



Healthy Food Environment Scoping Review

Physical Activity, Nutrition and Obesity Research Group (PANORG)

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Authors' Note

Dr Hector determined the final approach, structure and content of the review, the interpretation of the information, and the underpinning ideas contained therein; and as such is accountable.

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Preface

This work was conducted at the request of the Centre for Population Health at the NSW Ministry of Health, to inform implementation of the relevant strategic direction of the NSW Healthy Eating Active Living (HEAL) Strategy 2013–2018.

It is not intended to be an exhaustive review but rather to provide an indication of the rationale for intervening and the potential effectiveness of a broad range of policy options. It is also intended to inform ongoing stakeholder consultation regarding action with respect to the food environment. This consultation will necessarily take account of other evidence of effectiveness including likely reach and population impact, as well as implementation issues such as sustainability of effects, feasibility, acceptability, equity, and other factors affecting planning and investment decisions.

It is noted that no single action contained within this evidence synthesis will in itself be sufficient to affect weight status substantially at the population level. A portfolio of interventions within the food environment, alongside action to increase physical activity and reduce sedentary behaviours, is required to halt the progress of obesity and prevent chronic disease. This sentiment has been expressed many times previously but also recently in the McKinsey paper by Dobbs et al (November 2014) relating to an economic analysis for obesity prevention: "Existing evidence indicates that no single intervention is likely to have a significant overall impact. A systemic, sustained portfolio of initiatives, delivered at scale, is needed to reverse the health burden." Similarly, no individual sector in society can address obesity acting on its own — neither governments, retailers, consumer-goods companies, restaurants, employers, media organisations, educators, healthcare providers, or individuals. Achieving the full potential impact requires engagement from as many sectors as possible. Ideally such actions would be contained within an overarching National Nutrition Policy² in Australia.³

Finally, we would like to echo another sentiment of the McKinsey Global Institute discussion paper, that "... our analysis is by no means complete. Rather we see our work [on a potential program to address obesity] as the equivalent of the maps used by 16th-century navigators. Some islands were missing and some islands were misshapen in these maps, but they were helpful to the sailors of the era. We are sure that we have missed some interventions and over- or underestimated the impact of others. But we hope our work to be a useful guide...."

² A 'National Food & Nutrition Policy' is likely to be ideal as 'nutrition' needs to be considered as part of an overall policy for an environmentally, economically and socially sound and secure food system in Australia

³ http://www.health.gov.au/internet/main/publishing.nsf/Content/D309AF86C0D09DBDCA257F7F0077E0CE/\$File/1%20-%20Final%20Report%20-%20National%20Nutrition%20Policy%20Scoping%20 Study%20%28Report%20and%20Appendices%29.PDF

Executive Summary

Approach and methods

A scoping review and evidence synthesis was conducted during the period March 2014 to October 2015 to inform action in New South Wales (NSW), Australia, with regard to improving the food environment; essentially to inform the development of the "optimal portfolio of food policy options to focus on in the next 3–5 years that will create a healthier NSW Food Environment for all". Such a portfolio is being developed by the Centre for Population Health at the NSW Ministry of Health in consultation with various stakeholders. It is underpinned by the NSW Healthy Eating and Active Living Strategy 2013–2018, specifically Strategic Direction 1 'Environments to support healthy eating and active living'.

A scoping review was chosen as the approach. Scoping reviews are used to map out the distribution and characteristics of a broad knowledge area of issue. They are comprehensive reviews that generally do not appraise the quality of individual studies, and are concerned with contextualising knowledge in terms of identifying the current state of understanding, identifying the sorts of things we know and do not know, and setting this within the policy and practice context. Refined conceptual understanding of interventions and their proposed mechanisms of action is an intended output of the scoping process rather than its starting point. Accordingly this review and evidence synthesis used an iterative process for exploring, delimiting and describing the identified actions and associated evidence.

Modules within the INFORMAS (International Network for Food and Obesity Research, Monitoring and Action Support) Framework were chosen to broadly categorise the evidence. Evidence around the three broad modules or domains of retail, pricing and promotion was prioritised. 'Trade' was determined from the outset to be outside of scope, and the domains of composition, labelling and provision were considered to be a lesser priority in terms of scoping of the evidence due to existing action in these areas. Elements of action relating to the local food system were not comprehensively identified and included. Actions related to 'behaviour-change communication' — the 'ING" of the alternative 'NOURISHING' Framework — were outside of scope.

The evidence is presented in a format that is intended to enable the reader to interrogate the evidence with multiple research questions across the spectrum of this intervention sphere. A diverse range of publication types and study types were included to provide a more complete indication of the nature and extent of the evidence, including details about the relevance and implementation of various actions. A comprehensive range of actions is identified but these reflect the concentration of research and published literature rather than the full gamut of opportunity. Evidence from actions aiming to 'modify the food environment in order to make healthy food and beverage choices the easy choice' across the domains of retail, pricing and promotion, was classified as two broad types — 'Supporting evidence' and 'Evidence of effectiveness':

- Supporting evidence is derived primarily from: (i) descriptive and analytical observational studies which are hypothesis- and solution-generating and provide the intervention 'logic' but do not (individually) provide evidence of causality; (ii) experimental studies conducted under artificial, controlled conditions, the results of which indicate potential effectiveness of intervention; and, (iii) simulation modelling (predictive) studies and econometric studies, which provide additional evidence of the potential impact and effectiveness of intervention.
- Evidence of effectiveness is derived only from efficacy and intervention trials under real-world conditions and evaluation of implementation at an area-wide, population-scale.

Conventional search methods, particularly of systematic reviews, are reductionist. In this review search methods were used to identify the full extent of the literature according to the various potential and tried intervention options within the three domains of 'retail', 'pricing' and 'promotion' in the food environment. The review process was inclusive and did not use any pre-specified eligibility criteria, although these were applied as the search progressed.

Systematic searches using appropriate search terms, which were expanded to be as inclusive as possible as the evidence was uncovered, were made using standard databases including Scopus and PubMed. Snowball searches were conducted in parallel through scans of original papers, reviews, and forward and backward citation tracking using Scopus and Google Scholar. Supporting evidence was generally not specifically searched for; studies were included if they were identified during searches for evidence of effectiveness. Studies which contained indirect or parallel evidence were excluded as were expert opinions and overviews; although the latter were often used to identify primary studies for inclusion. The evidence from systematic and comprehensive narrative reviews in the literature was included where appropriate, noting the limitations of the traditional systematic review process when considering policy and environmental intervention.

No explicit restriction for publication status or year was applied in the searches, although more recent publications were included as priority. The final date for inclusion of studies is September 2015, although not all actions were researched up to this date. Emergent literature was included if considered significant. Australian and the most recent evidence were given precedence. Qualitative evidence relating to stakeholder acceptability, and barriers and enablers to implementation, was not systematically searched for, although studies relating to these elements of implementation were included where uncovered as part of the search processes.

A substantial number of evidence rating schemas exist in relation to programmatic public health and health promotion interventions, however many of these schemas and typologies have limitations, and are lengthy to apply to large bodies of diverse and diffuse evidence. In addition, due to the broad scope and extent of included literature, the quality of individual studies and reviews could not be explicitly appraised. Further, there is recognition that large-scale, innovative interventions of the sort considered in the realm of healthy food environments are rarely evaluated in ways that would satisfy 'hierarchy of evidence' criteria, and that often interventions with the largest potential for population impact have the least certainty of effectiveness.

These considerations, together with the overall scoping approach, necessitated a more flexible approach to considering the 'strength' of the evidence. The evidence for both the supportive evidence and evidence of effectiveness was therefore 'rated' or 'graded' in a simple, interpretive manner involving aspects of traffic light colour-coding.

The evidence is structured primarily in relation to identified areas for action and associated proximal and/or distal outcomes:

- Supporting evidence: Textual summary statements are included in the main text and which indicate whether the supporting evidence is supportive, mixed, or not supportive, of intervening in a particular area or via a particular means. These summary statements are communicated in the summary table for each domain through the use of limited text, coloured as green or grey to denote associations or experimental effect as follows:
 - Green the evidence of association or effect is supportive of intervening;
 - Grey the evidence is mixed, i.e. some studies support and some studies do not support (show an association or effect) intervening.

If no evidence was identified or the evidence showed no association or effect then it is not indicated in the summary table. This does not necessarily indicate that intervention is not needed, but rather might indicate methodological limitations to the identification of measures of association or experimental effect and/or a lack of research focus and funding in that particular area.

- Evidence of effectiveness: Evidence of effectiveness was categorised as follows according to relevant proximal and distal outcomes:
 - Dark green the evidence is 'highly supportive' of intervention; the action/intervention has been implemented in the real world setting at the population level and/or there are a substantial number of wellimplemented intervention trials in the real world indicating positive results
 - Light green the evidence is 'supportive' of intervention; the action/intervention has not been implemented at the broad-scale population level but there is positive evidence from real world intervention trials
 - Grey the evidence is 'mixed'; some studies indicate intervention effectiveness and others show no effect
 - Red there is evidence of ineffectiveness from realworld implementation
 - No colour there is a lack of evaluation evidence. This does not mean that there is a lack of evidence of effectiveness but indicates that there is either methodological limitations to the measurement of effectiveness for the various outcomes – particularly when linking intervention to more distal outcomes – and/or a lack of research focus and funding in that particular area.

Essentially, successful and effective implementation of intervention/action/policy under large-scale, real world conditions is deemed to provide the strongest evidence of effectiveness for the purposes of this review.

Elements of priority-setting and planning, including population impact, reach, equity, sustainability of intervention and/or sustainability of effect, and feasibility were not given systematic, explicit consideration in the review; however these elements are included where they have been prominently described in the literature.

Key Findings

As noted in the preface, no single action within this evidence review and literature synthesis will in itself be sufficient to affect weight status substantially at the population level. A portfolio of interventions within the food environment, alongside action to increase physical activity and reduce sedentary behaviours, is required to halt the progress of obesity and prevent chronic disease. Nevertheless, this review highlights those actions for which the supporting evidence is abundant and/or there is evidence of effectiveness under real-world implementation for actions to change the food environment to support healthier food and beverage choices and overall diet, and potentially overweight and obesity at the population level.

Further, although the evidence is presented for the three individual domains, there is overlap between the domains, and indeed, many multi-component interventions relate to the four 'Ps' of marketing, i.e. price, placement, product and promotion. Thus the evidence within each domain can often be crossreferenced to sections of the other domains.

Key Findings — Retail

Consumer Food Environment

- More research has been conducted in relation to increasing the availability of and access to healthier foods than to reduce the availability of and access to less healthy foods that are energy-dense and nutrient-poor (EDNP; high in fat, sugar and/or salt). Despite this, observational evidence indicates that substantially altering the ratio of healthier to less healthy items in-stores, i.e. reducing the proportional availability of EDNP foods, is likely to be necessary as an obesity prevention measure (as opposed to only increasing the consumption of fruit and vegetables (F&V)).
- Likewise, there has been more research conducted in relation to improving the healthiness of individual stores, i.e. changing the consumer food environment (in-store contents in grocery/corner stores) than in relation to changing the community food environment (density of 'healthy' and 'unhealthy' stores/food outlets).
- In addition to observational evidence supporting the need to increase the availability of healthier foods in-store, promising interventions are available to support grocery store owners to increase the availability of healthier produce and items. However, these interventions have usually addressed both supply and demand by including strategies to increase the visibility and point-of-purchase promotion of the healthier items in-store and/or pricing strategies. Thus increased availability may be a necessary but not sufficient part of the solution to increasing the purchase and consumption of healthier foods and beverages.

- A multi-pronged approach is therefore required in retail outlets, involving placement, pricing, promotion and increased proportional availability of healthier products and decreased availability of less healthy products. Different approaches may be more or less effective depending on the food category. There may be a 'threshold level' of impacts from a multi-pronged approach which tips the consumer into perceiving stores as healthier and making the healthier products more salient to the consumer.
- The scarcity of trialled intervention with respect to reducing the ubiquity of energy-dense, nutrient-poor foods and beverages in-store concurrently with the introduction of healthier foods and beverages, across a range of retail outlets, is a vital gap in the evidence.

Community Food Environment

- Observational evidence supports intervening to increase the proximity and density of healthier food stores in the community food environment, in addition to the in-store environment. Although often purported and likely to be a useful strategy to increase access to F&V and core food items, evaluation studies show that increasing the density of supermarkets also increases access to non-core foods/ beverages. Further, perceived availability of F&V may not be increased among shoppers of lower socio-economic status. The overall impact in terms of diet is not therefore likely to be positive, particularly for those whose diet is already lower in nutritional quality. The distinction between a 'healthy store/food outlet' (i.e. a store/food outlet with an overall high healthiness rating due to a proportionally large number and variety of healthy products) and a store/food outlet which contains some healthier items but a proportionally large number and/ or variety of EDNP items, is important when considering intervention options and intended outcomes.
- Increasing F&V availability via farmers' markets and market stands may lead to an overall reduction in the price of F&V in the neighbourhood environment, although this evidence was from one study only. There is no available evidence for the impact of farmers' markets on overall diet. No research studies were identified regarding the impact of the availability of/proximity to greengrocers on any dietary or health outcomes.

- Evidence of the association of fast food availability and of fast food consumption with diet, weight status and/or health is mixed. This may be due to measurement issues (including the categorisation of types of store, e.g. as fast food or takeaway, or sit-down restaurant) as well as the ubiquity of other takeaway food outlets (including bakeries and cafes) and other store types selling EDNP foods and beverages, such as convenience stores, corner stores, and service stations. The most robust associations that are supportive of intervention regarding the fast food environment are between: fast food consumption and lower diet quality; fast food consumption and energy intake; and neighbourhood fast food availability and diet quality.
- Evidence from real world implementation of a zoning regulation in the US on the density of fast food outlets indicates that the regulation must be sufficiently comprehensive to actually achieve reduced availability and access. Implementation evidence from zoning of F&V outlets/greengrocers emphasises the need for enforcement of the regulation.
- There is little observational evidence available to support reducing the density of fast food outlets near schools, probably because of the ubiquity of fast food outlets and/ or the substitution of fast food for EDNP foods from local takeaways and/or supermarkets/corner/convenience stores near schools.
- Changing the mix of the neighbourhood food environment to one that is healthier — through incentivising retail stores and prepared food outlets with a healthier overall profile to locate near schools and in lower socioeconomic status areas in particular — may have a larger impact than restricting the density of new fast food outlets. Targeting the community food environment around workplaces may offer particular gains in relation to adult obesity.

Key Findings — **Promotion**

- There is a vast literature relating to the advertising of less healthy foods and beverages, particularly to children and adolescents, across a wide variety of modes, contexts and settings.
- Children are affected by branding and persuasive elements of marketing. Although not all children are affected equally by advertising, those who are most susceptible are most likely to be overweight or obese. The magnitude of the effect is uncertain due to the

difficulty in disentangling the multitude of other factors affecting dietary behaviours and weight status from the pervasiveness of the promotion of food and beverages.

- Most of the observational evidence, mainly from crosssectional and longitudinal studies, relates to advertising on TV, as does much of the evidence from small-scale experimental studies largely conducted under artificial, controlled conditions. This body of evidence persuasively supports the negative impact on child and adolescent dietary preferences and behaviours, and weight status. It highlights the need to protect children from advertising of less healthy foods and beverages via TV. The experimental evidence suggests that the effect might be due less to exposure per se and more to the persuasive elements of the food and beverages advertisements. This finding is supported by the findings from a substantial number of experimental studies across a range of contexts and modes, including on packaged products.
- The experimental evidence indicates the negative effect of non-core food and beverage advertising via advergames and on social media, and that advertising via this medium has been higher among companies signed up to selfregulatory pledges than among non-signatories.
- The ineffectiveness of self-regulatory pledges and codes to reduce exposure to branding and food and beverage advertisements containing persuasive elements across a wide range of modes including advergames, TV advertising during commercial breaks particularly containing persuasive elements, promotional characters on packaged products and print media — suggests that there should be tighter regulations around food and beverage marketing across the breadth of exposure.
- Regulation of TV advertising of less healthy food and beverage products during children's viewing times is not sufficient to prevent exposure and needs to extend to family viewing times. Evidence from Canada showed that an overall reduction in exposure to TV advertising of EDNP foods and beverages across all viewing times led to reduced household expenditure on fast food.
- The negative impact of advertising of unhealthy foods and beverages on diet and weight status is observed in children and adolescents indicating that the upper age threshold for responsible food marketing to children should be increased to 14 years; as has recently been recommended by an expert panel.⁴

⁴ http://healthyeatingresearch.org/research/recommendations-for-responsible-food-marketing-to-children/

- Evidence from real world implementation of government and industry advertising regulations, including around toy ordinances, indicates that as well as the need for careful wording to ensure circumvention does not occur, there is also a need for compliance monitoring. Mandatory regulation of food and beverage advertising in schools, for example, indicates that monitoring is a necessary component of intervention to ensure compliance and hence reduced exposure.
- The impact of regulation of food and beverage advertising via other modes indicates the need for governmentapproved nutrition standards in order for packaged foods to carry a nutrient content claim.
- In the retail environment, in addition to reducing exposure of children to persuasive elements on less healthy packaged food and beverage products, evidence supports reducing exposure to these products via location on shelves, in particular restricting their placement in end-ofaisle bins, as well as at checkouts.

Key Findings – Pricing

- Evidence from simulation and predictive modelling studies is over-represented in this domain. There is a similar over-reliance on studies of observed demand and price elasticity. This scoping review attempts to integrate such studies with emerging experimental and implementation evidence of effectiveness: however this has been a difficult process. The difficulty of this process has been similarly highlighted in the recent briefing paper on 'Using price policies to promote healthier diets' by the World Health Organization (WHO; 2015). This paper points to the diversity of research methods, outcomes of interest, type and level of taxation or subsidy, and targeted food or nutrients, and suggests that "not only does this diversity present a challenge for interpreting the findings; it is also a challenge to link data on changes in consumption to the effects of a price policy".
- The price of healthy food and the price of a healthy diet in relation to healthier options and diets in Australia, and internationally, are disputed, and depend on the price metric used. There is, however, evidence that the price of less healthy foods and more energy-dense foods has risen evidence that the price of some less healthy foods and more energy dense foods has risen less than the price of some healthy foods, generating a growing gap between some relative prices. Fruit, vegetables and legumes remain expensive components of food baskets in Australia and are less available and more costly in rural areas. Healthy diets at a similar level of expenditure may not include currently socially-acceptable or familiar foods.

- Food overall, across countries, is considered to be relatively price inelastic, certainly across food groups/ categories; indicating that pricing strategies need to consider within-group substitution effects. There is some evidence of a positive association between food prices overall and/or the price of diets purchased, and body mass index (BMI). A study across 114 countries showed that a 10% increase in food prices leads to a 1.9% drop in expenditure on health care in high-income countries.
- There is mixed supporting (predictive) evidence as to whether a tax on less healthy foods or on 'negative' nutrients, such as saturated fat and sugar, would achieve the largest gains in terms of overall diet and health. However, there is evidence of effectiveness to support both these policy actions.
- Energy-dense, nutrient-poor foods play a considerable part in the social, cultural and emotional lives of people experiencing disadvantage. Therefore, a broad taxation of such foods, could lead to enhanced poverty particularly if taxation is not accompanied by subsidies for nutritious, core foods in the most vulnerable groups.
- Collectively the evidence suggests that taxing fast food might well affect consumption of fast food, overall energy intake and weight, among low income consumers, teenagers and those most overweight.
- There is a strong rationale for taxing sugar-sweetened beverages (SSBs), in addition to evidence of real world effectiveness. Evidence from implementation of a volumetric tax of only 10% in Mexico shows that this strategy is effective in terms of purchasing. Impact on overall diet and BMI is uncertain due to potential substitution effects. Among children there is evidence to indicate that substitution of SSBs with milk or water leads to less body fatness. The potential effectiveness for implementation of a graduated tax according to increasing volume (to reduce 'supersizing') has not been reported. Parallel evidence from alcohol taxes suggests that a tax on SSBs be dose-based, i.e. that the tax applies per kJ.
- There is much less evidence around subsidisation of healthier versions of products, e.g. low calorie beverages and bottled water (and there are environmental issues with bottled water although less so if they are replacing bottles or cans of soft drinks), and whole grain versus white bread, to make them relatively more affordable; however evidence and expert opinion suggests that fiscal measures (taxes and subsidies) which will shift consumers between close substitutes is likely to be more successful than shifting across food/beverage categories.

- Price promotions of healthier foods in discrete environments, e.g. cafeterias, vending machines, have been shown to be effective in shifting purchases towards healthier items; although overall impact on diet and long term-effects are unknown. Restricting price promotions on unhealthy items may be more effective than encouraging price promotions on healthier items in less discrete settings.
- There is sufficient evidence to intervene with regard to vouchers for free/subsidised F&V or cash-back rebates for healthier food. This could occur via farmers' markets, which might offer indirect support due to increased visibility and increased revenue, but could also be implemented in supermarkets and grocery stores. Low consumers of F&V and those on benefits should be targeted. Cash-back rebates of 25% on F&V and whole grain products have been shown to affect whole purchasing patterns (when combined with discouragement of less healthy options) and health outcomes, however such a scheme is very costly and no impact on obesity has been detected.
- The provision of free fruit, and where included, vegetables, in schools is associated with increased liking of, preferences for, attitudes towards, and consumption of, F&V. It may also be associated with reduced consumption of unhealthy snacks. There are likely to be positive outcomes with respect to equity, behaviour and learning at school. Impact on BMI is unknown. Such a scheme could be targeted at low SES schools and incorporated as part of the current Crunch & Sip[®] program in NSW.

Introduction

Physical Activity Nutrition and Obesity Research Group (PANORG)

The Physical Activity Nutrition and Obesity Research Group is part of the Prevention Research Collaboration at the University of Sydney. The group is funded by the Centre for Population Health at the NSW Ministry of Health (NSW Health) to undertake policy-relevant research to promote physical activity, nutrition, and obesity prevention. The funding and development of long-term research centres focusing on particular topics, or epistemic communities, are considered to be potentially the strongest ways a health system can take action to increase the possibilities of research being used to inform policy (Hector et al 2008).

NSW Healthy Eating Active Living Strategy 2013–2018

The NSW Healthy Eating and Active Living Strategy 2013–2018 provides a whole of government framework to promote and support healthy eating and active living in NSW and to reduce the impact of lifestyle-related chronic disease. The strategy is comprised of four strategic directions. Strategic direction 1 is **'Environments to support healthy eating and active living'**.

The food environment refers to what foods are available (via the local food supply and in food service and retail outlets), how much they cost and how they are marketed. The food environment affects the types and amounts of foods⁵ consumed. Access to affordable, healthy food and limited access to energy-dense, nutrient-poor foods⁴ are prerequisites for healthy eating.

Purpose

This scoping review and evidence synthesis was conducted in order to guide future action in NSW to promote and effect healthy food environments — to make healthy eating the default option and the easy choice. It was undertaken to inform the development of the 'optimal portfolio of food policy options to focus on in the next 3–5 years that will create a healthier NSW Food Environment for all⁶'. Such a portfolio is being developed by NSW Health through consultation with a large number of stakeholders. This literature review and evidence synthesis will inform these discussions.

The aim of the review and evidence synthesis was to provide a preliminary overview of intervention options that have been identified in the literature and for which there is evidence of effectiveness and/or potential actions for which few evaluation studies are identified but for which observational evidence is available and supports intervening to change the food environment. The identified intervention options — both tried and potential — will be subject to extensive dialogue with stakeholders and potentially, further review.

Initial research questions

Initial research questions proposed by NSW Health were:

- What is the evidence for the rationale for implementing known food policy and environmental interventions, especially in the NSW and Australian context?
- What is the evidence for the effectiveness of implementation of the known food policy and environmental interventions?

⁶'Energy-dense, nutrient-poor foods' is a collective term to describe unhealthy or less healthy foods. Other collective terms include: Foods 'high in saturated fat, added sugar and/or sodium (salt)' (HFSS) or foods that contribute little to meeting dietary recommendations. Such foods are identified as 'discretionary foods' in the Australian Dietary Guidelines as they are foods that contribute little to meeting the dietary guidelines; alternative terms include 'extra foods' and 'non-core foods'.

⁵Frequently throughout this overview, 'food' is used to denote 'food and beverages'. Wherever possible care has been taken to indicate where only one or the other is being considered, however there are likely to be many instances where the word food should also include the words 'and beverages'

Approach and Methods

Introduction

This review was designed to meet NSW Health's needs as a comprehensive review indicating the breadth, nature and extent of the evidence with respect to improving the food environment in NSW. The review encompasses evidence that supports intervening in a particular way and is hypothesis-generating, including the rationale for intervening and evidence of potential effectiveness (experimental studies not in the real world setting). It also includes evidence that is hypothesis-testing, i.e. evidence of effectiveness from intervention/efficacy trials and population-level implementation in the real world.

It includes a diverse range of publication types and study designs to offer a more complete indication of the evidence, including details about the relevance and implementation of various actions.

The evidence is presented in a format that is intended to enable the reader to interrogate the evidence with multiple research questions relating to: 'why' 'what' 'how' 'where', and 'to what' and 'to whom' (where appropriate and for where there is evidence), across the spectrum of this broad intervention area.

Common questions in decision-making are 'what works? ' (and 'what works best⁷?'), or 'does it work? ', yet the 'what', the 'it' and the 'works' in these questions are often not clearly defined or specified. The degree of specificity of the actions to achieve a change in the food environment and to affect consumer and dietary-behaviours within or across a particular context or setting varies depending on the content of the literature. Accordingly, the potential and tried intervention options — termed 'actions' within this review — were not predetermined but were identified in an iterative manner during the review process (see below). These actions remain 'varied' as to their specificity and discreteness in the text of this review to reflect the available literature, but the format of the content contained within the actions should enable the reader to further interrogate 'the action' to increase its specificity if required.

A comprehensive range of actions is identified but these mainly reflect the concentration of literature rather than the gamut of opportunity.

INFORMAS and NOURISHING frameworks

A number of frameworks were considered for structuring the evidence synthesis. The International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support (INFORMAS: Swinburn et al 2013) structure⁸ was chosen as it is concentrated on the food environment and. although global, is represented by a large body of researchers from the Australasian region, including one of the authors of this review. This global network of public-interest organisations and researchers aims to monitor, benchmark and support public and private sector policies and actions to create healthy food environments and reduce obesity, non-communicable diseases (NCDs) and their related inequalities. The INFORMAS structure is accepted internationally to provide a method for the collation and comparison of data — to benchmark and to identify improvements in food environments. One of its objectives is to 'use the results to strengthen public health efforts, particularly by supporting the translation of relevant evidence into public and private sector policies and actions'. This evidence synthesis is therefore intended to support the work of INFORMAS.

There are seven priority policy or impact domains within INFORMAS:

- composition
- labelling
- pricing
- promotion
- provision
- retail
- trade.

A series of papers relating to the rationale, framework and approach for each of these policy areas has been published in a special issue of Obesity Reviews (Issue 14, Supplement 1: 1–164 pp).

⁷Cf. Below section on priority-setting and planning frameworks ⁸Cf. Appendix 1 The INFORMAS framework is consistent with and complementary to the NOURISHING framework⁹, as developed by the World Cancer Research Fund International (WCRF) (Hawkes et al 2013). As with the INFORMAS framework, the NOURISHING framework has been developed to encourage action across a number of areas to promote healthier diets and reduce obesity. A list of regularly updated, comprehensive policy actions that are taking place around the world are recorded under this framework by the WCRF. The domains in the INFORMAS framework complement the policy areas within the food environment sections of the NOURISHING framework, while the 'ING' of the NOURISHING framework (i.e. the domain of 'behaviour change' within NOURISHING), is outside of the scope of this review.

Alternative frameworks were considered at the start of this scoping review process including the nutrition environments framework as detailed by Glanz et al (2005) and the Nutrition and Obesity Policy Research Network (NOPREN) — which was previously funded by the US Centers for Disease Control (Blanck & Kim 2012; Ascher et al 2012). The latter was considered to be too settings-based, more of a network, and is no longer funded; the former did not meet the need for full consideration of the body of evidence.

Three domains were considered priority areas for review with respect to the NSW situation. These are:

- retail
- pricing
- promotion.

There is naturally some overlap between the bodies of evidence contained under these broad headings. 'Portion size' as an action area was considered to be applicable across all of the domains and determined to be outside-of-scope for this publication (cf. Marteau et al 2015 and Hollands et al 2015; for recent reviews and policy options with regard to portion size).

Domains currently not included

Trade

The domain of food trade and investment, which assesses the risks of trade and investment agreements on food environments, is not included in this review. Swinburn et al (2013) placed this domain in the 'impacts' part of the INFORMAS framework alongside the other six domains, however it overlaps with the public sector domain and affects pricing, promotion, retail and provision. Within the INFORMAS framework the focus is on the direct impacts of trade policy-making processes and trade agreement provisions (multilateral, regional and bilateral) on the production, processing, distribution and retail of foods, and

subsequently on food availability, nutritional quality, price and promotion at the national level.

As this evidence review is intended to support action at the state and local level within NSW; the impact of trade agreements on food environments were excluded from the review. Friel et al (2013) provide a review of the evidence linking trade agreements and food environments as part of the INFORMAS overview.

Other papers of interest at the national and international level include:

- Thow et al (2015): Will the next generation of preferential trade and investment agreements undermine prevention of non-communicable diseases? A prospective policy analysis of the Trans Pacific Partnership Agreements
- Thow et al (2014): Protecting policy space for public health nutrition in an era of international investment agreements
- Baker et al (2014): Trade and investment liberalisation and Asia non-communicable disease epidemic: a synthesis of data and existing literature
- De Vogli et al (2014): The influence of market deregulation on fast food consumption and body mass index: a cross-national time series analysis
- Friel et al (2013): A new generation of trade policy: potential risks to diet-related health from the trans pacific partnership agreement
- Snowdon & Thow (2013): Trade policy and obesity prevention: challenges and innovation in the Pacific Islands
- Clark et al (2012): Exporting obesity US farm and trade policy and the transformation of the Mexican consumer food environment
- Thow et al (2011): Trade and the nutrition transition: strengthening policy for health in the Pacific
- Wallinga (2010): Agricultural policy and childhood obesity: A food systems and public health commentary

Trade and agriculture within NSW and Australia should ensure that policies and subsidies provide incentives for enhancing the production, distribution and consumption of fruit and vegetables (F&Vs), such as providing direct commodity subsidies for F&V production and subsidising transportation and revenue insurance policies for F&V farmers. Such policies can be considered alongside other local government policy and planning interventions (cf. Appendix 1; Retail Domain).

9° cf. Appendix 1' http://www.wcrf.org/int/policy/nourishing-framework. Note also that the INFORMAS network has developed a Government Healthy Food Environment Policy Index (Food-EPI) to assess the extent of government policy implementation against international best practice

Labelling

Mandatory kilojoule menu labelling in fast food restaurants and for ready-meals in supermarkets; and the voluntary federallysupported Health Star Rating are policies which are currently implemented in NSW hence this domain was not included. Menu labelling is regularly reviewed as part of the agreement between PANORG and the NSW Ministry of Health (MOH).

Provision and composition

Current actions in the realms of 'Provision' and 'Composition' nationally and state-wide rendered a review of these two domains as lesser priority than 'Retail', 'Pricing' and 'Promotion'.

The food supply chain and food system

The 'H' of the NOURISHING framework, i.e. the domain of 'Food System', is covered to some extent across the various INFORMAS domains within this evidence synthesis. Within the INFORMAS framework the retail domain is divided into two sections:

1. 'the consumer', which includes actions such as shelf-space ratios, and placement of F&Vs versus less healthy foods and beverages in-store

2. 'the community' relating to the relative density of F&V and fast food chain outlets and the proximity of food outlets to institutions such as schools.

The 'retail community' has been deemed to include local availability of F&Vs via farmers markets. However, a large section of the food system in relation to policy options was generally considered to be outside of scope. Examples include:

- land-use planning
- supply-chain incentives for production of F&Vs
- health-in-all policies
- governance structures for multi-sectoral engagement
- the built environment
- improved public transport options for access to healthier food
- urban and peri-urban agriculture
- school gardens
- other small-scale, local food supply and access options to improve local and household food security.

Minor consideration is given to some of these food access and availability options in Appendix 1 of the retail domain.

Note that in the INFORMAS overview paper, Swinburn et al (2013) suggested that domains such as food production and food waste could be included at a later stage.

Larger-scale, national-level policies and plans affecting the whole of food system and the food environment in Australia are not assessed in this review.

Methods

Review

The initial remit and scope of the review, as indicated by the preliminary research questions, was very broad. Various types of review (see, for example, Young et al 2014; civilservice.gov.uk) were considered in order to meet NSW Health needs , including:

- narrative review
- quick scoping review
- scoping review
- rapid evidence assessment
- structured rapid review
- (full) systematic review
- multi-arm systematic review
- review of reviews
- mixed-methods review

The methods and timeframes used within each of these types of review vary across publications and glossaries. Integrated findings from one or more of these methods can be used to inform policy and program development, to identify knowledge gaps and prioritise future research, and to inform risk and decision-analysis.

Systematic reviews

A rapid review across the gamut of potential and trialed actions was initially pursued. As the name suggests, a rapid review generally comprises a quick appraisal of the literature, including mainly systematic reviews and meta-analyses, to provide evidence of effectiveness (Young et al 2014). An initial search limited to systematic reviews in relation to 'food environments' quickly showed that systematic, and non-systematic, reviews rarely provide sufficient evidence in a format to guide action. This is an increasingly recognised phenomenon (Petticrew 2003; Wolfenden et al 2010).

Systematic reviews often include a specific research question that may not be especially relevant to the intention of the broader policy and environmental intervention. Systematic reviews also generally limit their findings to the inclusion of 'good quality' studies, which can often be difficult to find. Further, systematic reviews on the same topic and with similar research questions can produce vastly different findings due to different search periods, research questions, inclusion criteria and exclusion criteria, definitions and hence search terms used, and the extent of the search across databases. Finally, 'strength of evidence' grades reached by experienced systematic reviewers based on the same evidence can differ greatly, especially for complex bodies of evidence that do not lend themselves to meta-analysis (Berkman et al 2013). Mercer & Pignotti (2007) noted that it may not be appropriate simply to accept the conclusion reported by the researchers. For example, in one investigation of outcome studies, 70 per cent were found to have stated conclusions that were unjustified by their research design. These observations are supported by previous studies indicated by Rychetnik & Frommer (2002).

Woodman et al (2012) analysed eight reviews reporting evidence of the effectiveness of community interventions to promote physical activity. This research identified 28 included studies across the eight reviews, however little cross-citation between reviews was noted. Although studies that were cited in multiple reviews were generally consistently reported, this was not true for complex studies with multiple publications. Most reviews tended to have a narrow focus, making it difficult to gain an understanding of the field as a whole. In addition, in areas where evaluating impact is known to be difficult, review findings often relate to uncertainty of data and methodologies, rather than providing substantive findings for policy and practice.

The lack of applicability of findings from systematic reviews, particularly of complex interventions, has been highlighted by other authors, including Burford et al (2013). These researchers indicated that consensus on terminology is needed; that guidance should be developed about how the information within reviews should be implemented, and that reviewers' judgements of applicability should be documented.

Scoping review

The initial scan of the literature and the issues with both rapid reviews and systematic reviews across such a broad area of interest led to a change in approach to a scoping review. Arskey & O'Malley (2005) published the first methodological framework for conducting scoping studies and this framework was clarified and enhanced by Levac et al (2010)¹⁰.

Armstrong et al (2011) indicated that scoping reviews can be used to inform systematic reviews, that research questions are often broad, that inclusion/exclusion criteria can be developed post hoc, that quality is not an initial priority, it may or may not involve data extraction, the synthesis is more qualitative and typically not quantitative, and that it can be used to identify parameters and gaps in a body of evidence. Scoping reviews:

- are used to map out the distribution and characteristics of a broad knowledge area of issue; broad-scope, comprehensive reviews that do not appraise the quality of individual studies; commonly adopted for preparing overviews of a heterogenous literature on a wide-ranging topic (Young et al 2014).
- are used to explore, delimit and describe a broad evidence base whose boundaries are unclear at the outset (Shemilt et al 2013).
- are of particular use when the topic has not been reviewed extensively or is of a complex or heterogenous nature (Pham et al 2014).
- identify appropriate interventions and appropriate outcomes of a review.
- can reduce duplication of effort and guide future research, and can be used to inform systematic reviews. Also that research questions are often broad, that inclusion/exclusion criteria can be developed post hoc, that quality is not an initial priority, it may or may not involve data extraction, the synthesis is more qualitative and typically not quantitative, and that it can be used to identify parameters and gaps in a body of evidence (Armstrong et al 2011)
- summarise the state of knowledge on a particular issue, to identify research gaps, and to prioritise questions for a systematic review (Arskey & O'Malley 2005; Anderson et al 2008)
- provide greater conceptual clarity about a specific topic or field of evidence (Davis et al 2009)
- are an efficient way of identifying themes and trends in high-volume areas of scientific enquiry (Rumrill et al 2010)
- are concerned with contextualising knowledge in terms of identifying the current state of understanding, identifying the sorts of things we know and do not know, and then setting this within policy and practice context (Anderson et al 2008).

Shemilt et al (2013) indicated that scoping reviews are characterized by evidence synthesis strategies that focus on configuring or mapping evidence for effects, rather than aggregating such evidence as exemplified by the use of meta-analysis to estimate pooled effect sizes. Note that in these circumstances, 'refined conceptual understanding of interventions and their proposed mechanisms of action', becomes an intended output of the scoping process rather than its starting point. As such the current review process is an end-point of this iterative process rather than an answer to predetermined research questions.

¹⁰Clarifying and linking the purpose and research question (stage one); balancing feasibility with breadth and comprehensiveness of the scoping process (stage two); using an iterative team approach to selecting studies (stage three) and extracting data (stage four); incorporating a numerical summary and qualitative thematic analysis, reporting results, and considering the implications of study findings to policy, practice, or research (stage five); incorporating consultation with stakeholders as a required knowledge translation component of scoping study methodology (stage six).

Knowledge synthesis and mapping of the data

Knowledge synthesis is described by Young et al (2014) as a method of synthesising public policies that considers multiple effectiveness and contextual aspects and integrates data from logic modelling, literature reviews, and deliberative processes. Woodman et al (2012) indicate that systematic 'maps' of research can help identify where existing research is robust enough for multiple in-depth syntheses and also show where new reviews are needed.

There is an enormity of complex literature in relation to 'food environments' within the domains of 'retail', 'promotion' and 'pricing', as well across the other domains of the INFORMAS framework. Furthermore, the initial research questions were expansive.

Deciding on a system for appraising and synthesising the evidence as well as a format for presenting the evidence was therefore immensely challenging, and was determined in consultation with NSW Health colleagues in an iterative process¹¹. The final approach chosen for the knowledge synthesis and mapping of the evidence was designed to inform decision-making as much as possible.

Brennan and Brownson (2014) developed a review system to evaluate evidence of effectiveness and population impact among the growing literature on policy and environmental strategies to prevent childhood obesity. They identified 24 intervention strategies, which they grouped into 142 evaluation study groupings and 254 associational study groupings (n=396 groupings of 600 peer-reviewed studies). The detail and level of complexity of this review system and the associated evidence typology — which included planning elements such as reach, adoption, implementation and sustainability (see below) - was beyond the realm of our expansive scoping review. Further, the large review team required for the review system described by Brennan & Brownson (a team of researchers/experts took two years to produce the system and report on findings) and is required even for scoping reviews (e.g. Daudt et al 2013), was not available to conduct the current review.

As indicated by Kelly et al (2009, 2010), the original methods of evidence-based medicine were not designed to deal with multiple levels of analysis nor with highly diverse forms of evidence with different methods and underpinning epistemological differences. Longer public health causal chains add complexity. A conceptual map, logic model and theory can all be used to unravel the complexity that exists in public health practice. The process begins by identifying the sources of complexity across the food environments arena, and then mapping aspects of complexity in the intervention onto the appropriate sources of evidence, such as specific types of quantitative or qualitative study (Petticrew et al 2013).

Types of evidence and study groupings

Identified studies were scrutinised to determine whether they were indeed evaluation studies with evidence of effectiveness or whether they provided evidence that supported intervention but did not provide evidence of intervention (action) effectiveness; largely the associational study type as indicated by Brennan & Brownson (2014). This allocation of 'evidence' was complicated by the varied types of studies within and across domains, as well as the different data sources within individual studies. Issues in relation to categorisation of studies into 'study type' have been discussed in numerous reviews including that by Niebylski et al (2015; on food subsidies and taxation), for example; who identified overlap in study 'design or intent' and therefore categorisation by 'best-fit'.

Essentially evidence of effectiveness (from evaluation studies) was delineated from all other evidence which was grouped as supporting evidence and which provides an understanding of the pathways operating and theoretical underpinnings of the evidence of effectiveness¹². The supporting evidence can provide a rationale for intervening in situations where there is a lack of evaluation evidence. Threlfall et al (2014) indicates that there are many cases in public health where the combination of robust theory, causal understanding and observation are able to provide sufficient evidence of the direction of effect from an intervention such that current practice should be altered.

¹¹Publication of the considerations and outcomes of this iterative process of how best to synthesise, appraise, and present, the evidence to meet the needs of the decision-makers and other stakeholders is planned

¹²This clear delineation of studies according to whether they truly provide evidence of intervention effectiveness (from evaluation of field experiments or large-scale implementation) or whether they are 'association' studies (as per Brennan & Brownson 2014) or other study types listed as providing supporting evidence, is, the authors consider, a highly transparent presentation of the evidence to inform policy and practice.

Supporting evidence

Observational Evidence

Descriptive studies provide contextual information. Such evidence was not incorporated in a systematic or complete manner but was included where it was available for Australia and/or NSW, where there was a focus on the topic in the literature and particularly where there was a lack of evaluation evidence.

There were insufficient resources to identify the full rationale —for example the impact of various types of food and nutrients on weight gain and/or health — underpinning the many possible actions within the food environment. Instead, evidence of this type is restricted to selected prominent areas of focus in the literature that provide a background or situation analysis indicating the need to intervene and the potential impact of intervening according to changes in the food environment. Descriptive and ecological studies are generally hypothesisgenerating and hypothesis-supporting rather than hypothesistesting. They often describe elements of problem identification and solution generation: two stages of the framework describing the translation process to support evidence-based policy and practice (Nutbeam and Bauman 2006; Rychetnik et al 2012).

Analytical or epidemiological observational evidence includes cross-sectional, time-series and longitudinal studies which indicate an association between an exposure (aspects of the food environment) and an outcome (food preferences, purchases, consumption, weight, diet-related health). These do not generally confer causality; however a dose-response effect, strong association and temporality lend support to a causal association. These studies collectively can provide evidence of causality through consistency of association. Grimes and Schultz (2002) indicate that the differentiation between spurious, indirect and causal associations can be difficult in observational research. Such studies are considered to be hypothesis-supporting.

Simulation (predictive) modelling studies

There are many simulation modelling studies that relate to several areas of action across the food environment. Simulation modelling studies are only as robust as the input parameters and data. Consequently they are given relatively low priority within this review and do not provide evidence of intervention effectiveness, and are therefore not considered as such. Rather, they use effectiveness data together with other data to model and infer or predict overall population impact of intervention in terms of diet, health and weight outcomes.

Econometric studies

Econometric studies do not provide evidence of effectiveness but inform the likely effectiveness of intervention. They vary in whether they account for substitution and compensation effects: if they do, they provide a stronger indication of the potential effectiveness of intervention. These studies predominate under the domain of 'pricing', where they are often termed 'price elasticity of demand' studies. Various existing data sources provide varying degrees of support for the modelled outcomes.

Qualitative studies

Qualitative evidence, including from process evaluations, was incorporated if it provided evidence in relation to public support or acceptability for a particular or specific type of action and/ or barriers or enablers to such actions. Demonstrating the patterns of evidence drawn from different study designs may lead to the development of subsequent study designs to test the intervention. Studies generating qualitative data may also be relevant to other kinds of questions beyond effectiveness questions, including preferences of the likely recipients of the interventions, and the factors that constrain or facilitate the successful outcome of particular interventions.

Experimental studies under controlled or simulated conditions

A large number of small-scale experimental studies conducted under laboratory or virtual/simulated conditions are contained in the literature. These studies are not considered to provide evidence of effectiveness within this review because the potential for consumer choice and behaviour under experimental conditions to be replicated under real world situations, where a multitude of factors act, is likely to be minimal. Such studies are considered within this review to provide evidence of the potential effectiveness of intervening in a particular way under real-world conditions.

Evidence of effectiveness

In this review evidence of effectiveness is considered to be only from experimental studies conducted under real world conditions (field experiments), pilot and small-scale intervention trials in the real world, and large-scale area-wide implementation at the population level. Such studies provide evidence of 'hypothesis-testing' or 'intervention-testing'.

No exclusion criteria were applied according to study type as long as the aim of the study was to evaluate the impact of an intervention/policy action/environmental change.

Groupings

The studies are grouped and presented slightly differently depending on what is appropriate to the particular domain, action or group of sub-actions. Author(s), place of study and type of study and/or data are usually indicated for each included study. Studies are generally presented in chronological order, and, where appropriate, systematic and non-systematic reviews, and meta-analyses, are delineated from individual studies.

Search methods and inclusion criteria

A comprehensive review of the literature across the three domains of 'pricing', 'promotion' and 'retail' was undertaken.

Conventional search methods, particularly of systematic reviews, are reductionist. In this review, search methods were used in an attempt to identify the full nature and extent of the literature according to the various implemented and potential intervention options. Systematic searches using appropriate search terms were performed and were expanded to be as inclusive as possible, as the evidence was uncovered. Snowball searches were conducted in parallel through scans of original papers, reviews, and forward and backward citation tracking using, primarily, Scopus, PubMed, and Google Scholar. Google was used to search for non-peer reviewed (grey) literature.

Glasziou (2004) indicates that the criteria used to select studies should primarily reflect the question or questions being answered in the review, rather than any pre-determined hierarchy: *"It is therefore important to be able to distinguish situations in which natural experimental approaches are likely to be informative from those in which some form of fully experimental method such as an RCT is needed, and from those in which the research questions are genuinely intractable."*

The review process was inclusive. Pre-specified eligibility criteria in scoping reviews are provisional (Shemilt et al 2013) and it is accepted that they may be refined and re-applied iteratively during the review, based on emergent knowledge of the studies and evidence encountered. In the case of this review, initial consideration was given to contextual, related, indirect or parallel evidence but these were not included in the final review as the scope was unmanageable. Additionally, expert opinion and overviews were generally not included unless considered to be particularly pertinent, although such papers were often used to identify primary studies.

No explicit restriction for publication status or year was applied in the searches, although more recent publications were given priority. The final date for inclusion of studies is September 2015, although not all actions were researched up to this date. Emergent literature was included if considered pertinent.

Best available evidence was sourced wherever possible, with recency of studies playing an important, but not necessarily primary, role. Australian evidence was sourced wherever possible. Systematic reviews are often placed in chronological order within the listings of individual studies where it is more relevant to do so. A number of articles are included as citations by other authors (often reviews). These were not sighted by the author and are indicated as 'cited by' in the text.

Supporting evidence was generally not specifically searched for; these studies were included if they were identified during searches for evidence of effectiveness.

Final research questions

Complex interventions and the various interactions and interdependencies of the various actions need to be considered when formulating (systematic) review questions (e.g. Burford et al 2013). These authors indicate that 'specification of the intervention', i.e. developing a definition for the complex intervention, is an essential first step in formulating the review question.

Further, as indicated above, the research question is often not determined at the outset of a scoping review. Indeed, the scoping review can be used to indicate the potential research questions that need to be answered by more systematic reviews.

Therefore due to the broad extent and divergence in the evidence around multiple potential areas for action in the food environment and the choice of a scoping review method, we did not identify specific research questions in advance of the review. As indicated in the introduction to the overall approach taken, the evidence is presented in a format which is intended to enable the reader to interrogate the evidence with multiple research questions.

Appraisal of evidence

Rating typologies and schemas for bodies of evidence of effectiveness

Unlike evidence from clinical studies, where the NHMRC Levels of Evidence Criteria is accepted as the standard method for grading the evidence; there is no consensus on a system for synthesising and grading a body of evidence for public health interventions, especially when the evidence is considered as part of a scoping review and relates to policy and environmental intervention. In contrast to the evidence for clinical trials, meta-analyses are generally not possible and systematic reviews do not necessarily provide the optimal level of evidence of effectiveness — they may not even be useful in terms of policy and environmental interventions.

The highest level of evidence for policy and environmental intervention and action is considered in this review to be derived from evaluation of real-world implementation at the population level.

A substantial number of grading schemas for public health intervention exist in the peer-reviewed and grey literature. Several of these are indicated briefly in Appendix 2. Some of these schemas, sets of criteria, or frameworks, consider only evidence of efficacy and effectiveness, while others take a more expansive planning approach and consider quality of evidence against impact (e.g. reach, feasibility, sustainability).

A particular inconsistent aspect of the schemas is the descriptors used to communicate the strength of the evidence and the associated descriptions. Some of the sets of descriptors used include:

- strong / sufficient / some / limited(weak) / inconclusive/no evidence / evidence of ineffectiveness¹³
- proven / likely effective / promising / emerging / not recommended¹⁴

- strong/sufficient/insufficient/sufficient or strong evidence of ineffectiveness or harm/insufficient empirical evidence supported by expert opinion¹⁵
- weak/moderate/strong/rigorous
- excellent/good/moderate/limited/none¹⁶
- strong/sufficient/expert opinion/insufficient¹⁷
- scientifically-supported/ some evidence/ expert opinion/ insufficient evidence/ mixed evidence/ evidence of effectiveness.¹⁸

Different descriptors relate primarily to two different aspects of the evidence: the quality (incorporating elements of type of study) and the quantity. Some schemas combine a mixture of these descriptors – some of the descriptors within a schema relate to quality and some more to quantity. Many schemas are not explicit in choice of descriptors. In addition, some schemas provide individual quality of studies and then apply these collectively to indicate recommendations or overall evidence.

Many schemas explicitly include elements of the amount and type of evidence in addition to the quality of evidence but then do not indicate how these elements combine to provide an overall colour-coding or rating/grading. For example in the What works Wisconsin — research to practice series¹⁷ the description for the rating 'scientifically-supported' (coloured bright green) includes: one or more systematic reviews, or at least three experimental studies, or three guasi-experimental studies with matched concurrent comparisons, or six descriptive studies. The corresponding quality criterion, however, indicates that the studies must have 'strong designs', as well as statistically significant positive findings. The University of Wisconsin team emphasise that 'evidence of effectiveness' can mean different things to different people. Their approach to assessing evidence combines what is known from scientific study and the observations of unbiased experts.

¹³Haby & Bowen 2010; VIC Dept of Health categories for assessing the strength of evaluation and research evidence of health intervention effectiveness

¹⁴Brownson et al 2003; Kaplan et al 2013; Typology for classifying interventions/strategies by level of scientific evidence category

¹⁵Briss et al 2000; Relationship between strength of evidence and recommendations

¹⁶Spencer et al 2013 Conceptual framework for planning and improving evidence-based practices

¹⁷Preventive Services Task Force: Assessing the strength of a body of evidence on effectiveness of interventions

¹⁸University of Wisconsin; Nutrition, physical activity and obesity state plan strategies 'Strength of Evidence table'; https://www.dhs.wisconsin.gov/physical-activity/stateplan/evidencetable.pdf; adapted from the Robert Wood Johnson Foundation Program 'Rankings and Roadmaps' http://www.countyhealthrankings.org/roadmaps/what-works-for-health/our-methods

Outcome measures

Due to the heterogeneity of interventions, there is no onesize-fits-all metric for assessing their effectiveness. In addition, effectiveness is often not specified in terms of level of outcome, thus interventions may not be directly comparable in terms of effectiveness. Thus in this scoping review we provide a rating of the evidence according to different levels of outcome in relation to the intervention and population-level effects. This review is primarily structured around the types of evidence in relation to specific outcomes. Appropriate outcomes occur across a spectrum, and fiscal limitations often prevent the evaluation of a particular action with respect to more distal outcomes such as body weight and diet-related health, or it may not be feasible or relevant to link action to such distal outcomes. More proximal outcomes however, including successful modification of the food environment, are often insufficient to affect decisionmaking. Potential outcome measures searched for in the evidence were primarily:

- exposure to the intervention target for change (e.g. successful modification to food environment such as exposure to unhealthy food advertisements versus availability of healthy food)
- purchasing of food or non-alcoholic beverages
- food, energy or nutrient intake
- modifiable physiological or metabolic risk factors for NCDs, such as body weight, blood cholesterol, blood pressure, blood glucose.

SCHEMA to appraise evidence in this review

As indicated in the section above, study quality is not often included, at least as a primary criterion, when conducting a scoping review of a broad body of evidence.

There is a broad recognition that the traditional hierarchy of evidence is a difficult construct to apply in evidence-based medicine and even more so in public health. Petticrew & Roberts (2003) indicated that the debate is ongoing about the nature and use of evidence in public health decision-making, and there seems to be an emerging consensus that the hierarchy of evidence as used for grading the evidence in clinical trials, may be difficult to apply in other settings. Rychetnik et al (2002) noted that the levels of hierarchy are about the narrow concept of study design and not the broader concept of evidence; and Rychetnik & Frommer (2006) stated that 'study design alone is an inadequate marker of evidence quality in the evaluation of public health intervention'.

Kelly et al (2009) highlighted that, while the hierarchy of evidence explicates the degree of bias attributable to poor internal validity, internal validity is much less relevant in terms of some other forms of knowing, e.g. by virtue of theory or logic, or some other forms of empirical observation. Also, these authors indicate that we must have a good sense of the external validity of results and their transferability, and that the traditional hierarchy does not help much in this respect. Carter et al (2010) indicated that "Large-scale innovative social interventions, or those with controversial political and commercial implications such as the regulation of food manufacturing, marketing, and distribution, are rarely evaluated in ways that would satisfy 'hierarchy of evidence' criteria". Pettricrew et al (2013) indicate that the evidence hierarchy could indeed be turned upside down when evaluating the potential of public health interventions, i.e. RCTs¹⁹, could be placed at or towards the bottom of the pyramid.

Thus, and especially considering the extensive content, in this scoping review, individual study or review quality was not explicitly appraised; although details of the study design or data are frequently indicated.

Use of traffic light colour-coding

Traffic light colour-coding has been used in the expansive evidence reviews by the University of Wisconsin, as indicated above; however this schema was not used due to the degree of specificity and the ambiguity in relation to the relative contribution of the amount and quality of included studies for the various criteria. However, traffic light colour-coding was considered by the NSW Ministry of Health to be a useful tool for indicating the 'strength' of the evidence. In this review, colourcoding has been applied to the supporting evidence and to the evidence of intervention effectiveness within the summary of evidence tables for each of the three domains of effectiveness; with regard to the spectrum of outcomes relevant for each action area and domain.

As shown below, an estimated 'strength' of the evidence is based on the nature or type of studies and the number of studies available, plus the findings and outcomes of these studies: consistency in findings lends support to identified associations or effectiveness in relation to intervention studies.

¹⁹Too often studies are deemed to be 'RCTs' that are not 'trials' but are small-scale experimental studies conducted under artificial, controlled or virtual conditions, and as such should not be deemed in any way equivalent to an RCT involving an intervention under real world conditions

Supporting evidence

Textual summary statements²⁰ are included in the narrative and which indicate whether the evidence is supportive, mixed, or not supportive, of intervening in a particular area or via a particular means. These summary statements are communicated in the summary table for each domain through the use of two colours: 'green' which signifies that the evidence of association or effect is supportive of intervening; and, 'grey' which indicates that the evidence is mixed, i.e. some studies support and some studies do not support (show an association or an effect) intervening:

- Evidence of association/effect is supportive of intervening
- Mixed evidence of association/effect in support of intervening

If no evidence was identified or the evidence showed no association or effect then it is not indicated in the summary table, although it is indicated in the text. The latter situation does not necessarily mean that there is no need for intervention but rather might indicate methodological limitations to the identification of measures of association or experimental effect and/or a lack of research focus and funding in that particular area.

Evidence of effectiveness

Evidence of effectiveness was essentially categorised according to two shades of green, indicating different degrees of positive evidence. Evidence was considered to be highly supportive of intervention if the action/intervention has been implemented in a real world setting at the population level and/or there is a substantial number of well-implemented intervention trials in the real world indicating positive results. Fundamentally, successful and effective implementation of intervention/action/ policy under large-scale, real world conditions is deemed to provide the strongest evidence of effectiveness for the purpose of this review. A secondary level of positive effect, given the descriptor of 'supportive' of intervention and shaded light green, indicates that the evidence is lesser in nature, not being implemented at the broad-scale population level.

A colour-coding of grey is provided for actions and relevant outcomes for which there was indication of effectiveness from some evaluation studies but not from other studies. A colourcoding of red applies to evaluation evidence indicating a lack of effectiveness and applies predominantly to actions which have not achieved the necessary food environment modification to then impact on consumer attitudes or behaviour. A blank cell in the summary tables indicates a lack of evaluation evidence in the published literature, i.e. indicating a gap area.

- Evidence of effectiveness is **highly supportive** of intervention
- Evidence of effectiveness is **supportive** of intervention
- Mixed evidence of effectiveness of intervention
- Evidence of intervention ineffectiveness
- O **Lack of** evaluation evidence (gap area)

Priority-setting and planning frameworks

It is important to note that, although the evidence is graded in terms of rationale and effectiveness within the action area, this review does not explicitly consider the potential relative effectiveness of different actions within and across domains.

Determination of the 'level of promise' (Swinburn et al 2005) across the various options/interventions requires a separate process to that of evidence synthesis. It also requires consideration of more than evidence of effectiveness. Often interventions with the greatest potential for population health impact have the least certainty of effectiveness. It has been proposed that more flexible approaches should be developed that consider the uncertainty, risks, and potential benefits of promising obesity prevention programs.

Priority-setting and planning includes consideration of the degree of population impact, reach, equity, sustainability, and feasibility. Vast numbers of people and various tools are required to set priorities for action (e.g. Kaplan et al 2013). Although some schemas apply rating criteria that address some or all of these extraneous parameters, there is inevitably, but even more so than for the rating of evidence of effectiveness, an element of expert and other stakeholder judgement. For example, in the 'Promise table' approach proposed by Swinburn et al (2005) it is stated that "To classify interventions on their level of 'promise' will require a judgement on the quality of the available evidence and an estimation of population impact by considering the likely efficacy of an intervention as well as its reach and adoption/uptake". The strength of program logic is also a consideration.

²⁰As per the Robert Wood Johnson Foundation Program 'Healthy Eating Research: Building Evidence to prevent childhood obesity' (http://healthyeatingresearch.org/) – Research reviews indicate policy implications and future research needs. http://healthyeatingresearch.org/wp-content/uploads/2013/12/HER-RR-Menu-Labeling-FINAL-6-2013.pdf For these reasons, consideration of issues relating to population impact such as reach and equity, and implementation considerations such as feasibility and acceptability, were not explicitly considered in the review, however where these aspects were prominently described they are included in the evidence synthesis. Further, such aspects — particularly those relating to feasibility and stakeholder acceptability — can be determined through the stakeholder consultation process.

Sustainability is another element that is often considered when planning public health intervention. There are two aspects to sustainability: ability to sustain implementation of the intervention; and the likelihood of sustained effect/impact. Sustainability was considered where it was identified in the literature but was not given explicit consideration in terms of grading of the evidence.

Identification of gaps

The content of the literature review reflects the published literature rather than filling in all of the gaps. The gaps in the evidence of effectiveness with respect to the spectrum of outcomes have not been specifically identified, although the reader can quickly determine the areas where research has been concentrated. Similarly there are many potential actions that could be addressed — across a broad context/setting and more specific strategies for a particular context/setting —for which there is little to no evidence. Again, these are generally not explicitly indicated in the text although an expansive list of potential actions can be found in the literature, some of which are listed in Appendix 3.

Limitations

Due to the profusion of evidence it is inevitable that many studies have been missed²¹. In addition, there was not sufficient time to give due consideration to the findings of every individual study. For individual studies the abstracts were used wherever possible; however often there was insufficient detail in the abstract to determine the exact nature of the evidence, or if it really was evidence. In some cases the individual article was obtained and scanned for necessary detail. The findings of some studies were identified through review citation, particularly where they were cited by numerous analogous reviews. As indicated in the preface, such a process, and the sheer volume of studies considered, means that inevitably there will be inaccuracies in the reporting of some studies.

The limitations, or indeed the advantages, of not applying the traditional 'hierarchy of evidence' as per the NHMRC clinical guidelines with respect to broader, large-scale policy and environmental interventions in public health has been highlighted by numerous researchers and is discussed above.

²¹Some studies were excluded purposely if they were deemed to be not applicable in the overall context of this review

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Results - Pricing

Key findings

- Evidence from simulation and predictive modelling studies is over-represented in this Domain. There is a similar overreliance on studies of observed demand and price elasticity. This scoping review attempts to integrate such studies with emerging experimental and implementation evidence of effectiveness; however this has been a difficult process. The difficulty of this process has been similarly highlighted in the recent briefing paper on 'Using price policies to promote healthier diets' by the World Health Organization (WHO, 2015). This paper points to the diversity of research methods, outcomes of interest, type and level of taxation or subsidy, and targeted food or nutrients, and suggests that "not only does this diversity present a challenge for interpreting the findings; it is also a challenge to link data on changes in consumption to the effects of a price policy".
- The price of healthy food and the price of a healthy diet in relation to healthier options and diets in Australia, and internationally, are disputed, and depend on the price metric used. There is, however, irrefutable evidence that the price of less healthy foods and more energy-dense foods has risen less than the price of healthier foods, generating a growing gap between their relative price. Fruit, vegetables and legumes remain a pricier component of food baskets in Australia and are less available and more costly in rural areas. Healthy diets at a similar level of expenditure may not include currently socially-acceptable or familiar foods.
- Food overall, across countries, is considered to be relatively price inelastic, certainly across food groups/categories; indicating that pricing strategies need to considered within group substitution effects. There is some evidence of a positive association between food prices overall and/or the price of diets purchased, and body mass index (BMI). A study across 114 countries showed a 10% increase in food prices leads to a 1.9% drop in expenditure on health care in high-income countries.
- There is very mixed evidence as to whether a tax on less healthy foods or on 'negative' nutrients, such as saturated fat and sugar, would achieve the largest gains in terms of overall diet and health.

- Energy-dense, nutrient-poor foods play a considerable part in the social, cultural and emotional lives of people experiencing disadvantage, hence a broad taxation of such foods, if even feasible, could lead to enhanced poverty if such foods were taxed, unless equally palatable more nutritious foods are made socially-acceptable.
- Collectively the evidence suggests that taxing 'Fast Food' might well impact on consumption of fast food, overall energy intake and weight among low income consumers, teenagers and those most overweight.
- There is a strong rationale for taxing sugar-sweetened beverages (SSBs), in addition to evidence of real world effectiveness. Evidence from implementation of a volumetric tax of only 10% in Mexico shows that this strategy is effective in terms of purchasing. Impact on overall diet and BMI is uncertain due to potential substitution effects. Among children there is evidence to indicate that substitution of SSBs with milk or water leads to less body fatness. Parallel evidence from alcohol taxes suggest that a tax on SSBs be dose-based, i.e. that the tax applies per kJ.
- There is much less evidence around the subsidisation of other healthier 'versions' of products, e.g. low calorie beverages, bottled water (environmental issues but perhaps no more than cans/bottles soft drinks), whole grain bread (versus white etc.) to make them relatively more affordable; however expert opinion suggests that fiscal measures (taxes and subsidies) which will shift consumers between close substitutes is likely to be more successful than shifting across food/beverage categories. Subsidising reduced fat milk may be effective in increasing purchase of the healthier option in this product category and would likely lead to other health gains among children and adolescents.

- Price promotions of healthier foods in discrete environments, e.g. cafeterias, vending machines, have been shown to be effective in altering purchases towards healthier items; although overall impact on diet and long term-effects are unknown. Restricting price promotions on unhealthy items may be more effective than reduced price promotions on healthier items in less discrete settings.
- There is sufficient evidence to intervene with regard to vouchers for free/subsidised F&V or cash-back rebates for healthier food. This could occur via Farmers Markets which might offer indirect support due to increased visibility and increased revenue, but could also be implemented in supermarkets and grocery stores. Low consumers of F&V and healthier and those on benefits should be targeted. Cash-back rebates of 25% on F&V and whole-grain products have been shown to affect whole purchasing patterns (when combined with discouragement of less healthy options) and health outcomes but such a scheme is very costly and no impact on obesity has been detected.
- Free fruit, and in some studies where implemented, vegetables, in schools is associated with increased liking of, preferences for, attitudes towards, and consumption of F&V; it may be associated with reduced consumption of unhealthy snacks. There are likely to be positive outcomes with respect to equity, and behaviour and learning at school. Impact on BMI is unknown. Such a scheme could be targeted at low SES schools and incorporated as part of the current Crunch & Sip® program in NSW.

Summary of evidential support for intervention in the 'pricing' food domain

FOOD ENVIRONMENT OBJECTIVE	SUPPORTING EVIDENCE			INTERVENTION EVIDENCE Does it work in practice?					
	Observational / econometric studies	Simulation modelling studies	Experimental (laboratory) studies	Context/ Setting	"Action"/ Intervention	Purchases/ Consumption	Overall diet	BMI/ health	Comments
To increase the price of EDNP foods/negative nutrients	Sweets shown to be more price elastic than fats/oils/ sat fat but substitution effects with other high energy foods/nutrients	Price of unhealthy foods → Purchases unhealthy foods* Price sugar → Nutritive bundles* Price as nutrient- or food- based → Overall food/nutrient consumption Weight Morbidity/mortality	Price of unhealthy foods → Selection unhealthy foods	Retail	Taxation		\bigcirc		Substitution and compensatory effects uncertain Foods or nutrients? Regressiveness of tax debated
To increase the price of fast foods	Price of fast foods → Purchase and consumption of fast foods BMI in adolescents/low SES		Price of unhealthy menu items → Selection unhealthy items (men only)	Restaurant	Taxation	\bigcirc	\bigcirc	\bigcirc	Pricing interventions may need to be 'non-trivial' Single field experiment suggested taxation might need transparency about unhealthiness
To increase the price of EDNP beverages	Price of SSBs → Purchases of SSBs Energy intake from SSNs Daily/dietary energy intake Weight Welfare effect	Price of SSBs → purchases/consumption Energy intake Weight Revenue	Price of SSBs → Selection of SSBs and healthier beverages	Retail	Taxation				Substitution with whole milk in children/ adolescents may not increase overall energy intake
To decrease the price of healthier food/beverages	Temporary price discounts low fat yoghurt/fruit → Purchases (varies by consumer type) Price of F&V/healthier options → Purchases/ consumption Price of F&V → Diet quality* Child healthy weight	t → by Price F&V/diet SSB/healthy grain products/fibre → Diet, health, weight	Temporary price reductions healthier foods (low ED, F&V) → Purchases Calories purchased Price of healthy foods → Purchases/ consumption	Retail	Temporary price promotions healthier food		\bigcirc	\bigcirc	More money to spend on EDNP foods/drinks
				Retail	Cash-back rebates			\bigcirc	Very costly scheme
				Fast Food Outlets	Price discounts for healthier options		\bigcirc	\bigcirc	May increase revenue (very small field studies)
				Retail	Vouchers for free/ reduced price F&V – low-income			\bigcirc	May be associated with increased revenue
				Farmers' Markets	Vouchers for free F&V			\bigcirc	Particularly seniors and low SES youth
				Schools	Free F&V				Evidence of no effect on BMI (one study)

Key

Supporting evidence

- * One study
- \rightarrow "is associated with" / "had an effect on"

Evidence of association/effect is supportive of intervening Mixed evidence of association/effect to support intervening

Intervention evidence

- Evidence of effectiveness highly supportive of intervention
- Evidence of effectiveness supportive of intervention
- Mixed evidence to support intervention
- Evidence of intervention ineffectiveness
- Lack of evaluation evidence (gap area)

Background

The price²² of healthy food²³

- The price of food and the perception that healthy foods and healthy diets are pricier than less healthy foods and diets is debated extensively in the literature.
- The literature is complicated by the different metrics used to describe the price of food. The relative price of healthier versus less healthy foods depends on the price measure (or metric) used (i.e. price per unit energy; price per unit energy density (ED); price per serve/portion; price per nutrient density; price per edible weight).
- The notion of a linear negative relationship between the price of food and energy density of food is contested, primarily on the grounds that the relationship is statistically spurious when both sides of the ratio include the same parameter (unit energy).
- The price metric consumers use to choose foods within categories is unknown, but is most likely to be per unit weight/volume or per unit serve/package rather than price per unit energy; however there is some evidence to indicate that low income consumers instinctively know which foods will give them the most energy for their money.
- Both within food groups and across food categories, healthier options can be cheaper than less healthy options, particularly if home brand products are purchased; and the relative cost of healthier options of the same food varies depending on the food type.
- There is a substantial amount of evidence from all but one study (many data from Australia, and internationally) that the price of many less healthy foods and more energy-dense foods have risen less than the price of healthier foods, generating a growing gap between their relative prices.

Price of healthier foods using different metrics

Studies using multiple metrics

 Rao et al (2013; Systematic review and meta-analysis): This study included 27 studies from ten countries. Among food groups, meats/protein had the largest price differences: healthier options cost \$0.29/serving (95% CI \$0.19 to \$0.40) and \$0.47/200 kcal (\$0.42 to \$0.53) more than less healthy options. Price differences per serving for healthier versus less healthy foods were smaller among grains (\$0.03), dairy (-\$0.004), snacks/ sweets (\$0.12) and fats/oils (\$0.02; p<0.05 each) and not significant for soda/juice (\$0.11, p=0.64).

- Schimelt et al (2013; Scoping review): "It is important to note that different methods of measuring food prices in all of these studies can have a real impact on the results."
- Carlson & Frazão (2012; US): This study compared the prices of healthy and less healthy foods using three different price metrics: the price of food energy (\$/ calorie), the price of edible weight (\$/100 edible grams), and the price of an average portion (\$/average portion). They also calculated the cost of meeting the recommendations for each food group. For all metrics except the price of food energy, the authors found that healthy foods cost less than less healthy foods (foods high in saturated fat, added sugar, and/or sodium, or that contribute little to meeting dietary recommendations).
- Drewnowski (2010; US; nutrient composition and food prices data): For 1387 foods, key variables were as follows: energy density (kcal/g), serving size (g), unit price (\$/100 g), serving price (\$/serving), and energy cost (\$/ kcal). A regression model tested associations between nutrients and unit price (\$/100 g). Grains and fats food groups supplied the lowest-cost dietary energy. The energy cost for vegetables was higher than that for any other food group except for fruit.
- Connell et al (2012; US): For the Lower Mississippi Delta, ED was highest for fats/oils/sweets, whereas nutrient density was highest for vegetables.

Energy cost (price per unit energy)

- Jones et al (2014; UK): This study linked economic data for 94 foods and beverages in the UK Consumer Price Index to food and nutrient data from the national diet and nutrition survey for the period 2002–2012. Foods were classified as more or less healthy using a nutrient profiling model. The data showed that since 2002, healthier foods have been consistently more expensive (price per kilocalorie) than less healthy ones, with a growing gap between them.
- Lee et al (2013: *Review*): It was stated that *"it is not clear whether healthy foods and diets are generally more expensive than 'less healthy' foods and diets on the basis of price per calorie"* (cites: Cade et al 1999; Drewnowski 2004; Andrieu et al 2006; Waterlander et al 2010; Brinkman et al 2010; Lipsky 2009; Burns et al 2010; Carlson & Frazao 2012).

²²Note that "Price' is used rather than "cost" — price is the amount that the consumer pays for a product (in this case food or drink) whereas the cost is the amount spent by a business/manufacturer/producer making the product, or in this case relates primarily to the cost to the retailer in obtaining the product from the producer/manufacturer.
²³This section answers the question: 'Do healthier foods cost more than less healthy foods?'

Energy density and energy cost²⁴

- Wellard et al (2015; AUS: *store survey*): Price and kilojoule data were obtained from 20 Sydney fast food outlets (five largest chains) for 54 limited-time-only menu items and 67 standard menu items. There was a significant, although weak, inverse relationship between menu item energy density and energy cost. Salads had the highest energy cost, while value items, meals that included a dessert, and family meals, had the lowest. Limited-time-only items were significantly higher in ED and energy cost (EC) than standard items.
- Davis & Carlson (2014; US; *SR and MA*): This review and meta-analysis examined 4430 foods commonly consumed in the US, and noted the statistical anomalies²⁵ associated with consideration of a relationship between food price per unit ED and ED and hence the spurious nature of the relationship between the two measures. This meta-analysis found that the relationship is real for only two out of 25 food groups fish and poultry; i.e. for these two foods there was a real negative relationship between price per energy density and energy density.
- Bolaric & Satalic (2013; Croatia; *store survey*): Results from samples of 137 foods from supermarket, grocery and greengrocers showed that low ED foods are more expensive than high ED foods, e.g. the price of 1000 kcal from zucchini was 124.20 kN (15 kcal/100g) while the price of sour cream is 13.99 kN (138 kcal/100g). Food energy price was significantly different between food groups, with the highest price for vegetable products and raw vegetables and lowest for fats and cereal products. A negative correlation was observed for ED (kcal/100g) and price per 1000 kcal.
- Lee et al (2011; *SR*): Diets of higher ED were associated with lower diet cost. *"The literature examining* relationships between energy density and energy cost is extensive but its validity has been questioned after the finding that food category confounds the relationship between energy density and energy cost (Lipsky 2009). Around 96% of the variance in energy density can be explained by food category, suggesting that food category has a stronger influence on energy density than food price".

- Burns et al (2010; AUS; comment): Comment on Drewnowski (2009); "It is important for readers to be aware that graphs shown by Drewnowski in a recent commentary in this journal and previous publications carry a serious statistical artifact. At the supermarket, shoppers are likely to face the price signal of \$/g or \$/pack rather than \$/kcal. Nevertheless, it is certainly a plausible hypothesis that the 'cost per calorie' is an important reason that people, especially poorer people, make particular food choices."
- Landrigan & Pollard (2010; AUS; *observational data*): There was a strong correlation between the cost of foods and their ED across regions in and around Perth.
- Waterlander et al (2010; The Netherlands): In this crosssectional study using data from two Dutch cohort studies and recent food prices in The Netherlands, ED was inversely associated with energy costs (price/unit energy), implying that healthier diets cost more. However there were no differences in ED or EC between income levels.
- Lipsky (2009; US): This study was designed to show the methodological weakness of comparing ED (kcal/g) with energy cost²⁶ (price/kcal). The relation between ED (kcal/g) and energy cost (price/kcal) was shown to be driven by the algebraic properties of these variables. Food category was strongly correlated with both ED and food price measures. Energy cost was higher for produce than for snacks. However, total price and unit price were lower for produce. Serving price and serving size were greater for produce than for snacks. Within food categories, ED was uncorrelated with most measures of food price, except for a weak positive correlation with serving price within the produce category. The findings suggest the relation between ED and food price is confounded by food category and depends on which measure of price is used.
- Brimbelcombe & O'Dea (2009; AUS; remote Northern Australia; observational data): Among an Aboriginal population living in a remote region of northern Australia, foods with a high ED (MJ/kg) were associated with lower energy costs (\$/MJ) and contributed disproportionately to energy availability. The authors concluded that the energy cost differential between EDNP foods and energy-dilute, nutrient-rich foods influences the capacity of Australian Aboriginal people living in remote communities to attain a healthy diet.
- Lipsky (2009; US; cited in many of the reviews; *observational data*): Food category was strongly correlated with both ED and food price measures. Within

³⁶A similar methodological weakness to comparisons where there is the same measure on both sides of the ratio/equation was discussed by Davis & Carlson (2014) who considered the spurious nature of the relationship between food price per unit ED (price/unit weight * unit weight/unit energy = price per unit energy) and ED (unit energy/unit weight) - cf. 'price per energy density' sub-section.

²⁴Note that this association has been shown to be statistically spurious by a number of researchers, e.g. Davis & Carlson (2014), Burns et al (2010), and Lipsky (2007).
²⁵This statistical anomaly was also highlighted by Burns et al (2010) and Lipsky (2009); although it is challenged more formally by Davis & Carlson, who place this debate under the statistics literature pertaining to 'ratio analysis and spurious correlation'.

food categories, ED was uncorrelated with most measures of food price, except for a weak positive correlation with serving price within the produce category. The findings suggest the relation between ED and food price is confounded by food category and depends on which measure of price is used.

- Maillot et al (2007; France; cross-sectional data from seven-day food records and food cost data): Food costs were expressed in Euros per 100g edible portion. Diet cost was calculated for the whole diet as Euros per 10 MJ. Low ED diets were of higher nutritional quality but also cost more. For a given energy intake and energy density, each 10% increase in MAR (mean adequacy ratio = nutritional quality) led to a 13% increase in estimated diet costs per 10 MJ.
- Monsivais & Drewnowski (2009; US Seattle): In a study of 372 foods and beverages, it was found that the monetary cost of foods with the lowest ED was \$18.16/1000kcal compared to \$1.76/1000kcal for foods with the highest ED.

Price per serving

- Krukowski & West (2013; US): 75 full-service restaurants in US for children's menus. The mean (standard deviation) price of more healthful entrees (\$5.38 [\$2.01]) was not significantly different from the price of less healthful entrees (\$5.27 [\$2.04]).
- Connell et al (2012; US): Price per serving in 225 stores in 18 counties in the Lower Mississippi Delta was lowest for fats/oils/sweets and highest for meats.
- Drewnowski (2010; US): Examination of contemporary nutrient composition and food price data indicated that serving sizes increased with water content and varied inversely with energy density of foods. The highest prices per serving were for meats, poultry, and fish, and the lowest prices per serving were for the fats category. Although carbohydrates, sugar, and fat were associated with lower price per 100g, protein, fibre, vitamins, and minerals were associated with higher price per 100g, after adjustment for energy. Grains and sugar food groups were cheaper than fruit per serving.
- Lipsky (2009; US): Regressions on the relationship between serving price and ED for some observational data showed a weak positive relationship between serving price and ED within food categories.

Price per nutrient density

• Menard et al (2012; French Observatory): These data showed that, particularly for dairy products, cheaper products are not always more ED, saltier or sweeter.

"Too few studies have rigorously examined whether the nutritional quality of foods is associated with their prices within the same category."

- Connell et al (2012; US): For the Lower Mississippi Delta, ED was highest for fats/oils/sweets, whereas nutrient density was highest for vegetables.
- Drewnowski (2010; US): Although carbohydrates, sugar, and fat were associated with lower price per 100g, protein, fibre, vitamins, and minerals were associated with higher price per 100g, after adjustment for energy.

Price of branded versus home brand foods/ products/diets

- Faulkner et al (2014; UK): For 32 processed, commonlyconsumed foods, there were no differences in overall nutritional quality for own-brand versus market-brand products in 2010. However, the market-brand basket compared to the own-brand basket of these foods was higher in EC in 2010 and 2012. There was an inverse relationship between the ED and EC of the market-basket foods in 2010 and 2012. In summary, the market-brand food basket was higher in EC than the own-brand food basket in 2010 and 2012, but not superior in overall nutrient quality as determined using two methods.
- Chapman et al (2013; AUS): Examination of the cost of generic and branded food products in Sydney supermarkets showed that a cost saving of 44% was found by purchasing generic over branded products across all food categories. The most significant savings were for core foods, such as bread and cereals, and the smallest cost savings were for fruit products.
- Kettings et al (2009; AUS): Substituting generic brands for market brands reduced the weekly food cost of a healthy seven-day diet/meal plan by about 13%.
- Darmon et al (2009; US): Branded products cost 2.5 times more than low-cost products with equivalent energy and lipid contents; and had a slightly higher ingredient quality score (replacement of higher quality ingredients with lower-quality).
- Cooper et al (2003; UK): Prices of foods with similar nutrient contents (energy, fat, minerals, vitamins) in branded and economy line foods (canned tomatoes, orange juice, sliced bread, potatoes, sausages) and prices of foods with similar nutrient contents could differ fourfold.

Relative price of healthy foods over time

- Jones et al (2014; UK): Economic data for 94 foods and beverages in the UK Consumer Price Index were linked to food and nutrient data from the national diet and nutrition survey for the period 2002–2012. Foods were classified as more or less healthy using a nutrient profiling model. The data showed that since 2002, more healthy foods have been consistently more expensive (price/kcal) than less healthy ones, with a growing gap between them.
- Williams (2014; AUS): The Illawarra Healthy Food Basket (HFB) was developed in 2000. Consisting of 57 items, bi-annual costing from 2000–2009 has shown that the basket costs have increased by 38.4% in the 10-year period, [but that affordability has remained relatively constant at around 30% of average household incomes].
- Hawkes (2012; Review): "Some studies track changes in food prices over time, generally finding — but not always — that the prices of 'less healthy' foods have declined relatively faster than 'healthy foods" (Burns et al. 2008; Christian & Rashad 2009; Kuchler and Stewart 2008).
- Harrison et al (2012; AUS, Brisbane): 'Core' foods exhibited a non-significant increase in price compared to non-core foods from 1987 to 2007; however significant price increases were reported for nearly three-quarters of all food categories examined, including core and non-core foods.
- Lee et al (2011; *Review*): This review indicated that between 2000 and 2006 the price of healthy foods increased more than unhealthy foods.
- Harrison et al (2010; AUS, QLD): An examination of the cost of a HFB in 1998, 2000, 2001, 2004, and 2006 showed that the cost has increased over six years by around 50% (\$148.87) across Queensland. Where data were available, it was shown that HFB cost increased by more than the cost of less healthy alternatives. The

Consumer Price Index for food in Brisbane increased by 32.5% over the same period.

- Williams (2010; for the Illawarra HFB, AUS): Bi-annual costing from 2000–2009 has shown that the basket costs have increased by 38.4% in the 10-year period, but that affordability has remained relatively constant at around 30% of average household incomes (see above).
- Duffey et al (2010; US): Data from 20 years (of the CARDIA Study) showed that the real price of soda and pizza decreased over time, and the price of whole milk increased.
- Williams et al (2009; AUS, NSW): From 2000 to 2007, the price rise of a healthy food access basket (HFAB) (20.4%) was less than the rise in CPI (31.9%), maybe due to foods selected for CPI versus those included in HFAB. Nevertheless, over the study period, the price of F&V in the HFAB rose by 55.7% and 47.2%, respectively, while the price of 'extra foods' in the HFAB rose by only 22.7%.
- Monsivais & Drewnowski (2007; US Seattle): In a study of 372 foods and beverages, foods with higher ED were more resistant to inflation, with only a 1.8% increase in price over two years compared to an almost 20% increase in price for lower ED foods.
- Williams et al (2004; AUS, Illawarra): The average cost of the Illawarra HFB in 2003 was \$225.86. The largest increase in prices was for vegetables, which increased by 19.8%.

However:

 Kuchler & Stewart (2012; US) showed that for commonly consumed fresh F&V for which quality has remained fairly constant, analysis of price trends reveals a price decline similar to that of dessert and snack foods. This price trend evidence suggests that the price of a healthy diet has not changed relative to an unhealthy one, although a 'healthy diet' might not include every fresh F&V currently available.

Price of healthier options (within a food type)

- Remnant & Adams (2015; UK): In the UK, among 161 ready meals from 41 supermarkets one-fifth of meals were low in fat, saturated fat, sugar and salt, including two-thirds of 'healthier' meals. Meals that were low for three out of the four front-of-pack nutrients were the cheapest, hence there was little evidence that healthier ready meals necessarily cost more.
- Todd et al (2012; US): Not all healthy foods are more expensive than less healthy alternatives: skim and 1% milk are less expensive than whole and 2% milk and bottled water is generally less expensive than carbonated non-alcoholic drinks²⁷. They also found considerable geographic variation in the relative price²⁸ of healthy foods.
- Hawkes (2012; *narrative review*): 'Less healthy' versions of the same foods (e.g. white vs. wholemeal bread) are generally, but not always, more expensive than the healthier close substitute (cites e.g. Cooper & Nelson 2003; Ni Mhurchu & Ogra 2007 (see below); Ricciuto et al 2009; Temple et al 2011).
- Andreyeva et al (2008; US): Baked chips, lean meat and wholegrain pasta were 20–60% more costly than corresponding regular products. Exceptions included breakfast cereal, cheese and milk.
- Ni Mhurchu & Ogra (2007; NZ; supermarket survey of commonly-purchased items): Electronic sales data from supermarket (in Wellington) shoppers (n=882) from February 2004 to January 2005 were used to determine the 1000 top-selling food items. These items were categorised according to food type. Five regular items and five healthier options were selected per category to create two shopping baskets for which cost and nutrient data were then compared. Low fat alternatives were 44%, 27% and 19% more expensive for butter and margarine, for meat and poultry, and for cheese, respectively. Canned fish was an exception. Fruit or vegetables were not included as it is difficult to find an unhealthy alternative comparator.

Perceived price of healthy food (qualitative studies)

- Perceived price of healthy food may be as or more important than the real price of food among lowincome in terms of food choice.
- Bussey (2012; AUS; *qualitative*): For community stores in Aboriginal people living in Fitzroy Valley, the Kimberley, the price of F&V was significantly lower in stores with overall higher healthiness score. Participants who purchased foods from stores with higher scores felt they had enough money to purchase healthy food and they purchased significantly more vegetables, even though stores with higher scores were more expensive overall.
- Williams, Thornton et al (2012; AUS; *qualitative*): In Melbourne, results showed that irrespective of education, income and other key covariates, women who perceived poor availability and quality of F&V in their local neighbourhood were more likely to perceive F&V as expensive.
- Giskes et al (2007; AUS; *qualitative*): Study where consumers (in Brisbane) were asked about their perceptions of the price and availability of healthier foods in the supermarkets where they usually shopped, showed that perceived prices did not reflect actual prices and perceived price differences were not associated with food purchasing inequalities.
- Inglis et al (2005; AUS; *qualitative*): There was a perceived high cost of healthy eating in a qualitative study of women yet reported availability of and access to good quality healthy foods did not differ strikingly across SES groups in Melbourne.

²⁷This is generally not the case in Australia. ²⁸Price metric not stated in abstract.

Price of a healthy diet²⁹

- While Australian evidence indicates that a "healthy" food basket (HFB)²⁹ is available and accessible (same price) across levels of socioeconomic disadvantage in urban (metro) Australia, it is less available (reduced availability and variety of healthier items and higher price) in rural areas.
- Fruits, vegetables and legumes remain expensive components of HFBs in Australia.
- A HFB is considerably less affordable among low income families in Australia. Low income families would need to spend a significantly higher proportion of their income to obtain a HFB. The cost of a HFB ranges from 20–48% of welfare payments and 29–35% of average weekly earnings, compared to approximately 9% of the disposable income of families of high socioeconomic status.
- Diet optimisation modelling studies in Australia and internationally indicate that it may be possible to purchase a healthy diet at a relatively low cost, although such diets may not be familiar or meet social norms.
- Dietary intake data show that people who spend more on their diet tend to purchase healthier/more nutritious foods and people of lower socioeconomic status tend to purchase less healthy diets at a lower price.

"Healthy"³⁰ food basket studies

- Rossimel et al (2014; AUS, Melbourne): The median cost of the HFB for a family of four was not significantly different in 68 supermarkets across Melbourne, at \$456.27. The median price of a sample of F&V across 24 greengrocers was significantly cheaper than supermarkets.
- Chapman et al (2014; AUS, NSW): Trends in the cost of the HFB and F&V availability 2006–2009:
 - Mean price of the HFB increased by 3.4% between December 2006 and 2008 and was lowest in July 2009, decreasing by 6.2% from December 2006.
 - Variation between the cheapest and most expensive individual stores resulted in a \$221 price difference in 2009, \$148 in 2008 and \$182 in 2006.
 - Total food and F&V costs were more expensive in remote areas compared with highly accessible areas.

 The number of F&V varieties was influenced by increasing remoteness, low socioeconomic area and supermarket competition.

- Ward et al (2012; rural South Australia, AUS): Compared with metropolitan areas, healthy food is more expensive in rural areas; costs are even higher in more remote areas. However, the overall affordability³¹ of HFBs in rural areas was not significantly different from metro areas.
- Wong et al (2011; AUS, Adelaide): There were no differences in the cost, availability and quality of the HFB, as well as an assessment of food promotions in supermarkets, between high and low household income areas.
- Williams (2011, AUS; Review): In Australia, a number of different food baskets have been developed for a variety of different purposes in each of the States, including the Kimberley Market Basket in Western Australia; the Northern Territory Nutritionists Market Basket Survey; the Queensland Health Food Access Basket; the Victorian Healthy Food Basket; the Adelaide Healthy Food Basket in South Australia; the Illawarra Healthy Food Basket in NSW; and the Tasmanian Food Price Availability and Quality Survey. This diversity of approaches has led to calls for the development of one common national approach. Each of these baskets has slightly different objectives that illustrate the diverse ways that food basket information can inform nutrition surveillance. Although there is no difference in availability of healthy food or quality of F&V across Adelaide suburbs, it is a much different situation when comparing urban with rural or remote regions.
- McKluskey (2009; Moreland, AUS): Moreland Food Security and Food Access study showed that the HFB varied from 25% above to 18% below average cost across the area. Therefore those unable to travel to a cheaper supermarket are at a disadvantage.
- Landrigan & Pollard (2010; WA, AUS): In WA, the HFB cost on average 23.5% more in increasingly remote regions.
- Palermo et al (2008; rural VIC, AUS): The cost of the Victorian HFB varies in a manner that appears unrelated to remoteness, population, socioeconomic status or distance from metropolitan centre across rural areas of Victoria. Vegetables and legumes were the most expensive component of the Victorian HFB to purchase and this food group showed significantly greater variation in food price than cereals (p<0.05), non-core foods (p<0.05) and unhealthy foods (p<0.001).

²⁹This section answers the question 'Do healthy diets cost more than less healthy diets?'

³⁰Note that for many of the healthy food baskets used in these studies, the contents as a whole do not meet Australian Dietary Guidelines for a healthy diet. ³¹Not clear from the abstract if this refers to absolute costs or true affordability in relation to income.

- Renzaho (2008; VIC, AUS): Yarra, Richmond and Collingwood: The average cost of the Victorian HFB per fortnight for a family of six was significantly lower in Richmond (mean = \$419.26) than in Collingwood (mean = \$519.28) and in Fitzroy (mean = \$433.98). While costs for cereal groups, dairy, meats and alternatives, and non-core foods, were comparable across the suburbs, significant differences were noticed for fruit, legumes and vegetables.
- Winkler et al (2006; Brisbane, AUS): Fifty census collection districts were randomly sampled and all local (i.e. within 2.5km) supermarkets, greengrocers and convenience stores were observed. Little or no differences in price and availability of foods in the HFB were found on the basis of area socioeconomic characteristics.
- Sullivan et al (1987; AUS): For isolated NW Australia the basic food basket can cost >40% more than in the Perth metropolitan area.

Affordability (percentage of disposable income) of "healthy"³² food baskets in Australia and NZ

- Rossimel et al (2014; AUS): Study indicated that families in inner city Melbourne would use a lower proportion of their income to purchase the HFB (15%) compared to middle and outer suburbs (19%).
- Barosh et al (2014) and Ward et al (2013): In Greater Western Sydney, the Healthy & Sustainable Food Basket (H&SFB) cost more than the HFB in all five SES neighbourhoods, with most disadvantaged neighbourhoods spending proportionately more (30%) to buy the H&SFB; 48% of weekly income in lowest SES quintile to buy the H&SFB; 9% of weekly income among the highest income quintile.
- Lee et al (2013; *Review*): This review indicated that the cost of HFBs in Australia was equivalent to 20–40% of welfare payments and 29–35% of average weekly earnings.
- Ward et al (2013; AUS): In Adelaide low-income families would have to spend approximately 30% of household income on eating healthily, whereas high-income households needed to spend about 10%. The differential is explained by the cost of the HFB relative to household income (i.e., affordability). It is argued that families that spend more than 30% of household income on food could be experiencing 'food stress'.

- Williams (2011; AUS): The typical family of two adults and two children, relying entirely on welfare support, was estimated to need to spend 33% of household income to purchase an adequate HFB, compared with only nine percent in families with the highest average disposable income.
- Pattieson & Palermo (2011; VIC, AUS; grey literature): 20-40% of the income of a range of different family types, consisting of between one and six persons, is required to purchase a nutritious basket of food. Evidence from the latest Victorian HFB data suggests that an average family of four needs to spend \$417 per fortnight (or 33% of government pension) on a nutritious basket of food.
- Ward et al (2012; AUS): In South Australia the affordability of the HFB is significantly different between high and low SES areas, irrespective of whether they are in metro or rural areas. Low SES families need to spend between 27–32% of their equivalised disposable household income on the HFB compared to 9.5–9.6% among high SES families across levels of remoteness.
- Lee et al (2011; SR): This review indicated that families on welfare payments and low incomes would need to spend 28–34% of their income in order to be able to afford an Australian HFB.
- Davis (2010; VIC, grey literature): In a study of food security and community gardening in the Ashburton, Ashwood, and Chadstone neighbourhood renewal area in Victoria, the HFB was equivalent to 43% of income (family allowance).
- Kettings et al (2009; AUS): A seven-day meal plan comprising a healthy diet was determined to cost about 40% of the disposable income of welfare-dependent families; compared to families earning an average income who would spend only 20% of their disposable income to buy the same healthy food. Substituting generic brands for market brands reduced the weekly food cost by about 13%.
- Palermo et al (2008; rural VIC, AUS): The median cost of the Victorian HFB was most expensive for a typical family and single parent family (40% and 37% of welfare income) and least expensive for a single man (29% of income) and elderly pensioner (19% income).

³²Note that for many of the healthy food baskets used in these studies, the contents as a whole do not meet Australian Dietary Guidelines for a healthy diet.

Price of a healthy diet – optimisation modelling studies

- Wilson et al (2013; NZ): Scenario development and linear programming was used to model diets. Daily dietary patterns that met key nutrient requirements could be purchased for as little as a median of NZ\$3.17 per day; although including more familiar meals for New Zealanders increased the cost. Other optimised dietary patterns for reducing NCDs were low-cost and lowgreenhouse gas (GHG) emissions.
- Wilson et al (2013b; NZ): In this study eight optimised low-sodium daily diets (some with uncertainty) for New Zealanders or Mediterranean-, Asian-, and Pacific-style diets were modelled using nutrient recommendations for men and cost constraint of <NZ\$9 per day. Diets, excluding evening meal with sausages, were identified which were nutritious and affordable for men and women, particularly when the budget was increased to \$15/day (fruit was more expensive).
- Brimblecombe et al (2013; AUS): Optimisation modelling was used to assess the cost of dietary improvement in remote Aboriginal Australia. Simultaneous achievement of all nutrient goals was not feasible. The two most successful models (A & B) met all nutrient targets except sodium (146.2% and 148.9% of the respective target) and saturated fat (12.0% and 11.7% of energy). Model A was achieved with 3.2% lower cost than the baseline diet (which cost approximately AUD\$13.01/ person/day) and Model B achieved at 7.8% lower cost but with a reduction in energy of 4.4%. Both models required very large reductions in SSBs (-90%) and refined cereals (-90%) and an approximate four-fold increase in vegetables, fruit, dairy foods, eggs, fish and seafood, and wholegrain cereals. The modelling approach used was not able to meet all nutrient targets at less than current food expenditure.

- Monsivais et al (2011; France): "If populations were to follow dietary guidelines it would be more expensive."
- Maillot & Drewnowski (2011; US): Optimised food patterns were evaluated with respect to My Pyramid servings goals, energy density [kcal/g (1 kcal = 4.18 kJ)], and energy cost (US\$/2000 kcal). The optimised food patterns had more servings of vegetables and fruit, lower energy density, and higher cost compared with the observed diets. All nutrient goals were met. In contrast to the much lower USDA estimates, the two models placed SoFAS (solid fats and added sugars) allowances at between 17 and 33% of total energy, depending on energy needs.
- Katz et al (2011; US): Findings suggested that (price per item) it is possible to choose more nutritious foods within many common categories without spending more money, i.e. improving dietary choices does not invariably cost more. These authors point to the modelling of low-cost nutritious diets routinely used by USDA for Thrifty Food Plan.
- Maillot et al (2010; France): Several different 'healthy' market baskets of foods meeting different social norms in France at the lowest possible cost were designed. The study found that meeting social norms sharply increased the cost of the food basket without improving nutritional value, suggesting that minimising diet costs to take into account only nutrition standards led to a total diet that no one would want to eat.
Purchased diet prices – dietary intake data

- Rao et al (2013; systematic review and meta-analysis): This study included 27 studies³³ from ten countries. Comparing extremes (top versus bottom quantile) of food-based diet patterns, healthier diets cost \$1.48/day and \$1.54/2000 kcal more. Comparing nutrient-based patterns, price per day was not significantly different (top vs bottom quantile: \$0.04; p=0.916), whereas price per 2000 kcal was \$1.56 (\$0.61 to \$2.51) more. Adjustment for intensity of differences in healthfulness yielded similar results.
- Backholer et al (2015; AUS; *cross-sectional*): Although this study did not measure the price of diet purchased, data among 9,296 adults in the Australian Diabetes, Obesity and Lifestyle study showed that a higher level of socio-economic status (educational attainment, level of income, area-level disadvantage) was consistently associated with a higher level of diet quality.
- Marty et al (2015; France; prospective study for one month): Among 91 individuals in deprived social situations recruited as part of the Opticourses nutrition intervention 2012–2014, food-purchase receipts showed that Opticourse participants selected less expensive food options than the average French population, within a food group and for a given food item. Higher diet costs were associated with higher nutritional guality (lower mean adequacy ratio (MAR), and lower energy density), regardless of whether costs were calculated from actual expenditure or on the basis of standard food prices. Twenty-one 'positive deviants' (those with higher MAR and lower mean excess ratio) were identified. These positive deviants made significantly healthier purchases than did the other participants at higher estimated diet costs. Yet they did not spend more on food overall (having the same actual diet costs), which showed that they purchased food with a higher nutritional quality for the price. Thus this study showed that higher diet quality is not necessarily more costly.

- Morris et al (2014; UK): Cross-sectional analysis of data from the UK Women's Cohort Study (approximately 35,000 women recruited in the 1990s), showed a significant positive association between diet cost and healthiness of the diet. The healthiest dietary pattern was double the price of the least healthy: £6.63/day versus £3.39/day respectively. Dietary diversity was also shown to be associated with increased cost. Those with higher education and a professional or managerial occupation were more likely to consume a healthier diet.
- Aggarwal et al (2014; King County, US): Shopping at higher cost supermarkets was associated with higherquality diets — and findings persisted even when taking SES into account — but supermarket shoppers with positive attitudes toward healthy eating had equally higher-quality diets, even if they shopped at low-, medium- or high-cost supermarkets.
- Carlson & Frazao (2014; US): At any food spending level there are households that purchase healthy (and unhealthy) diets.
- Monsivais et al (2013; US; national dietary data): Using US national dietary data and food prices this study showed that accordance to the DASH (Dietary Approaches to Stop Hypertension) diet was generally more costly. However, some ethnic groups may have achieved both 'encouraged' and 'discouraged' components of DASH accordance at lower cost compared to other non-Hispanic adults, suggesting that ethnic eating patterns may hold a key to making healthful diets economically feasible.
- Lee et al (2013; *review*): Diets high in fats and sweets (Drewnowski et al 2004) or with high energy density (Andrieu et al 2006, Darmon et al 2002, Drewnowski et al 2007) are associated with lower diet cost, whereas diets with higher F&V intake (Drewnowski et al 2004) micronutrient intake, nutrient density (Andrieu et al 2006) and nutritional quality (Schroder et al 2006) were generally associated with higher diet cost. Higher diet cost was also associated with significantly higher biomarkerbased estimates of protein, potassium and sodium.

- Hawkes (2012; *Review*): Indicated that 'healthy' diets do not always cost more than 'less healthy' diets (e.g. Raynor et al 2002, Murakami et al 2007, Goulet et al 2008, Lenz et al 2009, Vlimas et al 2010). This reviewer indicates that "while specific foods in a 'healthy' diet may cost more than items in an 'unhealthy' diet, they are compensated for by less purchasing of more expensive 'unhealthy' foods, meaning that diet costs do not rise".
- Monsivais, Aggarwal et al (2012, France; usual dietary intakes): After controlling for energy and other covariates, high-cost diets were significantly higher in all seven nutrients and in overall nutrient density; "Socio-economic differences in nutrient intake can be substantially explained by the monetary cost of the diet. The higher cost of more nutritious diets may contribute to socioeconomic disparities in health and should be taken into account in the formulation of nutrition and public health policy."
- Aggarwal et al (2012; US; *longitudinal study*): In the Seattle Obesity Study, nutrients commonly associated with a lower risk of chronic disease were associated with higher diet costs. By contrast, nutrients associated with higher disease risk were associated with lower diet costs.
- Banks, Williams et al (2012; US): For many obese children, eating healthily would not necessarily incur prohibitive, additional financial cost, although a poor diet at a budget supermarket remains the cheapest of all options.
- Appelhans et al (2012; 69 shoppers in Pheonix, Arizona): Adjusting for covariates, the amount spent on 1000 kcal of food was \$0.26 larger for every multiple of the Federal Poverty Guideline (income); those with university education spent an additional \$1.05/1000 kcal compared to those with no college education. Lower energy cost was associated with higher total fat and less protein, dietary fibre, and vegetables per 1000 kcal. The authors concluded that low-SES supermarket shoppers purchase calories in inexpensive forms that are higher in fat and less nutrient-rich.

- Cleary et al (2012; Switzerland): A low-glycemic index diet did not cost more to follow during pregnancy.
- Ryden & Hagfors (2011; Sweden): Healthy eating is associated with higher dietary cost in Swedish children, in part because of price differences between healthy and less-healthy foods. Children who consumed the most healthy and/or expensive diets ate a more energy-dilute and varied diet compared with those who ate the least healthy and/or least expensive diets. The cheapest and most unhealthy diets were found among those children whose parents were the least educated and had manual, low-skill occupations.
- Lee et al (2011; *SR*): Eleven cross-sectional studies, one cohort study and one model analysis examined the relationship between diet quality (mainly from dietary surveys) and energy cost. Diets of higher nutrient density and nutrient quality were associated with higher diet cost. Diets high in fats, oils, sweets, salted snacks and caloric beverages, have a lower energy cost than diets high in F&V. Energy cost (\$/unit energy) was positively associated with nutrient intake, nutrient density, following a Mediterranean diet pattern, and meeting recommended intakes of micronutrients and fibre.
- Bernstein et al (2010; US): Data from the Nurses' Health Study (78,191 participants) showed that, although spending more money was associated with a healthier diet, large improvements in diet may be achieved without increased spending.
- Aggarwal, Monsivais et al (2011; US): Study showed that higher quality diets were associated with higher diet costs (kJ/g and mean adequacy ratio). Supermarket shoppers with positive attitudes toward healthy eating had equally higher-quality diets, even if they shopped at low-, medium-, or high-cost supermarkets, independent of SES and other covariates.

- Rehm et al (2011: US): Cross-sectional study using dietary intake data from NHANES in US (2001–2002) using national food price database indicated an association between diet cost and diet quality. Higher energy-adjusted diet costs were significantly associated with being older and non-Hispanic white, having a higher income and education, and living in a food-secure household. Higher diet costs were also associated with higher Healthy Eating Index (HEI) -2005 scores for both men and women. Women in the highest quintile of diet costs had a mean HEI-2005 score of 69.6 compared with 52.5 for women in the lowest-cost quintile. Higher diet cost was strongly associated with consuming more servings of F&V and fewer calories from solid fat, alcoholic beverages, and added sugars.
- Turrell et al (2002; AUS; Brisbane): Foods purchased by low SES were more likely to be lower in fibre, higher in fat, salt and sugar. The least educated, those employed in blue-collar (manual) occupations and residents of low income households purchased fewer types of F&V, and purchased them less regularly, than their higher status counterparts.
- Cade et al. (1999; UK): Data from a food frequency questionnaire from 15,191 women in the UK Women's Cohort Study and direct monetary cost of the diet using survey data and supermarket catalogue data (1995) and use of a healthy diet indicator (HDI) 0 (lowest) to 8 (highest); indicated that for direct costs, the difference between the most extreme HDI groups was 1.48 day-1 (equivalent to 540 year-1), with fruit and vegetable expenditure being the main items making a healthy diet more expensive. Forty-nine percent of the food budget was spent on fruit and vegetables in HDI group 8 compared to 29% in hdi group 0.
- Turrell (1996; AUS; Brisbane and Logan): Although significant differences were found between socioeconomic groups in terms of their foods purchased, most respondents from all socioeconomic groups shopped at large supermarkets where recommended food was readily available. Few reported difficulties obtaining access to these facilities, and the price difference between recommended and regular foods was, in most cases, small or nonexistent.

Supporting evidence

Price as a self-reported determinant of food choice

- Although price is frequently self-reported as a major determinant of food choice, many others factors affect food choice.
- Accumulating qualitative studies, including several in Australia, indicate that those on a low income and/or who are food insecure, purchase foods that will 'fill them up' (i.e. quantity per unit cost and energy-dense foods), that provide comfort from stress, and also meet social acceptability needs.

Australia

- Russell et al (2014; AUS): Among 371 parents of 2–5 year olds in two Australian cities, parents indicated that *health, nutrition and taste* were key motivators in terms of parents' food choice motives, whereas *price, political concerns and advertising* were among the motives considered *least important*.
- Harris (2014; PhD Thesis Deakin): "Thus, the different ways in which consumers prioritise the practical and moral concerns associated with both cost and nutrition to construct their perceptions of value, may be one mechanism that underpins the production and reproduction of socio-economic inequalities in diet."
- Burns et al (2013; AUS):
 - This study examined the role of expendable income and price in food choice by low income families, indicating that food choice is complex and has been discussed in the literature under a number of different lenses — individual, cultural, social or structural.
 - Price is identified as one of the main factors to have been determined from psychological research as being an important determinant of food choice, along with taste, health, convenience, mood, sensory appeal, natural content, weight control, familiarity and ethical concerns.
 - Two references are cited (Blanck et al 2009, Glanz et al 1998) as indicating that price has been shown to have precedence over other determinants of food choice for low income families. Burns et al (2013) indicates that other environmental and behavioural factors that influence low income families' food choices include: access to healthy food, psychological stress, difficulty

balancing work demands with feeding a family, and poor nutrition knowledge.

- Among 22 parents on low incomes (government pension) and who indicated they had experienced food insecurity in the previous year, four goals were identified when choosing food: getting enough food to fill you up, getting sufficient food when money runs out, getting food to compensate for feeling low, and getting food for comfort. The pathways to the first three goals involve triage strategies whereby participants described getting 'value for money' in which basic foods were prioritised in order to get sufficient food to satiate hunger. The fourth goal did not involve triage and was usually spontaneous purchasing. Acquiring comfort food occurred irrespective of whether there was sufficient money for other items; a weighing-up of attributes and values related to specific foods and food price in relation to available money. Four food categories are identified: basic, treat, emergency, comfort.
- Participants described the use of a rubric of quantity per unit cost to determine value for money, with the prioritisation of satiety in these value negotiations; food was 'fuel' and the need to be filling was highlighted — satiation value in terms of quantity and the provision of energy to 'do things'.
- Taste, family relationships and convenience were determinants of purchase other than price.
- The importance of food as a reflection or expression of social status and social identity is discussed in this paper. Participants put high value on branded foods which were perceived as mainstream. 'Sociallyprescribed tastes for luxury', or need for comfort from social exclusion, also drive purchases. Limited funds to spend on treats or comfort foods can reinforce a sense of social exclusion and may exacerbate further stress, as well as limiting healthy options and causing overeating. The use of food, particularly EDNP foods, to alleviate stress has been previously reported and may also have a physiological basis.
- Dixon & Isaacs (2013; AUS, Western Sydney): Food practices are essentially household budget and family nourishment practices rather than nutrition and sustainability practices.

- Mishra & Mishra (2011; AUS; *qualitative*): Consumers reported that they prefer bonus packs, as opposed to price discounts, for healthy foods, but they want a price discount rather than a bonus pack for indulgent foods.
- Law et al (2011; AUS; South Australia): Among single parents in SA who were exposed to food insecurity from subtle shifts in vulnerability, there was an indication that they needed to manage the appearance of poverty and guilt in relation to their children, so they bought food items accordingly, rather than based purely on price.
- Ramsey et al (2011; AUS): A narrative review of the literature indicated that, in studies involving mainly selfreport data, there was little evidence that food-insecure households are associated with higher consumption of foods high in ED, sugar, or fat; or processed food intake.
- Hunter & Worsley (2009; AUS, Melbourne): In a crosssectional survey of baby boomers who were asked what they would do on less money in retirement, nearly 50% responded that if they had reduced income they would make changes to their food purchasing habits including different types of foods and seeking out special offers or cheaper brands.
- Inglis et al (2009; AUS): In a hypothetical experimental/ laboratory study, when high- and low-income women were presented with a scenario where they had 25% more of their food budget to spend, low-income women chose to increase their spending on both healthy and unhealthy food to a greater extent than high-income women.
- Davis (2010; AUS; *grey literature*): study examining food security and community gardening in the Ashburton, Ashwood & Chadstone neighbourhood renewal area in Victoria. Participants reported 'feeling full' as most important.

- Crawford et al (2014; AUS): Homeless 15–25 year-olds indicated daily experiences of food insecurity, persistent hunger, anxiety, stress, and embarrassment. They also craved convenience and instant gratification of fast foods and to be socially connected through food.
- Cuesta-Briand et al (2011; AUS; Perth): examined diet among low income earners with Type 2 diabetes. Majority struggled to accommodate the price of healthy food within a limited budget "You get the quickest and cheapest stuff you can".

International

- Pula et al (2014; US): This study on regulatory focus and food choice, highlights that health, sensory appeal and price are typically rated as the most important motives in food choice. Compared with consumers who tend to be oriented toward the ideal self, aspirations, and accomplishments (i.e. promotion-focused), those who tend to be oriented toward the ought self, responsibilities, and safety (i.e. prevention-focused) reported that it was important for their food to help them with stress, coping, and mood; be easy to prepare; and be familiar. In general, consumers who placed high importance on sensory appeal also placed high importance on price, but this positive correlation was stronger in the prevention group than in the promotion group. One possible interpretation of this finding is that promotion-oriented consumers are more open to potential trade-offs between financial costs and sensory qualities.
- Faupel et al (2014; Germany): Parents have similar choice criteria independent of their social class, e.g. quality, price, brand and children's preferences.
- Alkon et al (2013; US): This study comprised five independently conducted qualitative studies from Oakland and Chicago that investigate how low-income people eat, where and how they shop, and what motivates their food choices. Their data reveal that cost, not lack of knowledge or physical distance, is the primary barrier to healthy food access, and that low-income people employ a wide variety of strategies to obtain the foods they prefer at prices they can afford.

- Konttinen et al (2013; Finland): Data from a populationbased survey indicated that socio-economically disadvantaged individuals considered price and/or familiarity more important in their food choices in both absolute and relative terms. A higher income was related to a greater relative importance of health considerations. Relative motives were more strongly associated with F&V and ED food consumption than absolute motives and the relative importance of price, familiarity and health partly mediated the effects of the SES indicators on the consumption of these food items. The study concluded that individual priorities in food choice motives, rather than the absolute importance of single motives, play a role in producing SES disparities in diet.
- Hawkes (2012; review): "The findings from these studies suggest a complex picture: consumers sometimes say that cost is a leading influence, sometimes not (e.g. Lennernäs et al 1997, Sonneville et al 2009). Without doubt, groups of lower socio-economic status say more consistently that price is a barrier to healthy eating, but even here, the significance of price over purchasing choices varies and may not be the most critical factor (e.g. Connors et al 2001, Dibsdall et al 2003, Inglis et al 2005, Barker et al 2008). "Breuning et al (2012): Several studies in Minnesota, US, among low-income and those that are food insecure at times, have indicated high rates of bingeeating, over-eating at mealtimes and eating snacks and highly-palatable foods as coping mechanisms.
- Darmon et al (2014) cites Lennernas et al (1997) as indicating that price is an important determinant of food choice among nationally-representative samples of adults in the European Union.
- Darmon et al (2004); Drewnowski & Spencer (2004) [cited in Lee et al 2013]: "Under times of economic stress, it has been postulated that socio-economically disadvantaged groups tend to choose cheaper foods that are energydense".

Overall price of food and purchases — price elasticity of demand³⁴ studies

- Own- and cross-price elasticities (PEs) are varied across countries and food groups and appear to be highly context (country and sub-group) dependent.
- Price elasticity of demand studies indicate that food is relatively price inelastic, i.e. changes in price have a relatively small effect on the quantity purchased; however some categories of food, particularly soft drinks and fast food are probably more price elastic; and a recent systematic review and meta-analysis of PE studies indicated that a tax on sugar, sweets and sugar-sweetened beverages could induce healthier alternatives such as F&V enhancing the direct effect of the tax.
- Own-PEs tend to be higher than cross-PEs; cross-PEs tend to be very small, indicating that consumers are not willing to shift consumption across food groups/ categories.
- Price-elasticity studies using food expenditure data indicate that low income and certain ethnic groups may be more susceptible to price changes.

Studies using national food expenditure data

Cross country comparisons

Cornelsen et al (2014; SR and MA); This review is similar to that by the same authors (Green et al 2013). The review and meta-analysis examined own-price elasticities (OPEs) and cross-price elasticities (CPEs)³⁵ for low-, middleand high-income countries. An increase in the price of F&V by 10% led to a reduction in their consumption by 5.3% and to a reduction in consumption of fish, dairy and cereals of 0.15%, 0.3%, and 0.2% respectively. A 10% price increase in dairy products, while reducing consumption of dairy products by 6%, was associated with a reduction in quantities purchased of F&V (0.3%), fish (0.32%), and cereals (0.39%). A price reduction in cereals led to a decrease in cereal consumption of 4.3%, however it was associated with more F&V consumption (0.48%), meat (0.45%), fish (0.75%), dairy (1%) and sweets (0.57%). These substitutions would replace approximately one third of the calories lost from cereal consumption.

A 10% increase in the price of fats and oils was associated with a 4.2% reduction in their consumption, indicating relatively inelastic demand. The same increase in the price of sweets (includes sweets, confectionery and SSBs) would lead to 5.6% reduction in consumption, but an increase in consumption of 3% for all other foods, apart from fats and oils. This indicates that a tax on sugar, sweets and SSBs could induce, among other things, more consumption of healthier alternatives such as F&V, reinforcing the direct effect of the tax. When combined with data on calorie availability, the reduction in calories from fats and oils due to the price increase was greater than for sweets, as half of the calories reduced from sweets were substituted with cereals, dairy, and F&V.

- Green et al (2013; *SR and MA*; 136 studies reporting 3495 OPEs): This systematic review and meta-analysis reports on OPE data from 162 countries. OPE values ranged from -0.36 to -0.77 in high-income countries compared with -0.54 to -0.95 in low-income countries. The highest OPEs were found for meat (-0.95, 95% CI: -1.07 to -0.82), fish (-1.01; -1.17 to -0.84), and other food (-1.06, -1.21 to -0.92) among low income households, and the lowest were found for cereals (-0.72; -0.85 to -0.59), sweets (-0.73; -0.91 to -0.55), and F&V (-0.73; -0.84 to -0.62) among high income households.
- Ngheim et al (2013, *Review*): This review examined CPEs across countries and food groups and indicates that data of the highest CPE (0.274) corresponds with a rise in the demand for fruit after an increase in the price of meat (UK study) however these effects aren't borne out in other countries and studies, reporting the CPE for meat (relative to fruit) was close to zero, or even negative. Indeed the general finding is that there are no patterns and that there is much variation across contexts (including time) (or they are too difficult to measure/unstable). The authors indicate that probabilistic analyses are not valid for food as PEs; so their findings are uncertain, and that scenario analyses are much more transparent/honest.
- Seale et al (2003; cited in Ni Mhurchu et al 2013; metaanalysis): Pooled data from 114 countries described a narrow range of PEs for high-income countries from -0.14 (meat) to -0.36 (bread and cereals). Demand response to food price changes was larger in poorer countries; however, comparable food PE ranges were -0.30 to -0.68 for middle-income countries, and -0.43 to -1.01 for low-income countries.

³⁵The authors indicate that they analysed uncompensated CPEs allowing for substitution and income effects and because these effects act in opposite directions, the elasticity estimates are more likely to tend towards zero. It is indicated that compensated elasticities would provide a better understanding of pure substitution effects within countries, unless price increases exceed income growth. Another explanation for the small CPEs is that nationally representative data were used, combining the preferences and tastes of various consumer populations with different levels of accessibility and affordability. Averaging across these groups leads to combining income, substitution and complementarity effects that act in opposite directions and could therefore lead to small overall values.

Within country

Australia

- Ulubasoglu et al (2010; AUS): Analysis of data from two Australian food expenditure surveys covering the period 1998 to 2004 reported OPEs that ranged from -0.23 (milk) to -2.66 (rice), with values approximating or exceeding -1.0 for 10 of the 15 food categories examined. Households with Australian-born heads had higher OPE for rice and more elastic demand for pork and dairy products compared to households whose heads were born overseas.
- AIHW (1992 data): In Australia little information is available on the influence of price on domestic consumption of food products. The Australian Bureau of Agricultural and Resource Economics has done some work on meat and seafood. Australian and international estimates of the price elasticity of demand for food products vary to a surprising extent, probably because of differences in periods over which the analyses are undertaken, the statistical procedures used, and the databases analysed. Nevertheless, there is a consistent pattern of price elasticity of many staple foods such as potatoes, bread, milk (both full fat and skim), sugar and many fresh vegetables, all with estimated price elasticities close to zero (0.30 \leq $|\eta|$. Very few consumer demand studies in the economic literature differentiate between the sensitivity of the various socioeconomic groups to price changes. Investigation of income elasticities of demand may be an important component of a monitoring strategy for food purchase behaviour. The Canadian data of Chang and Green suggest that demand is more responsive to changes in income than to changes in prices or advertising but that advertising tends to reduce consumer response to income changes. More research needs to be done to determine responses to food price changes, particularly within lower income groups.

New Zealand

 Ni Mhurchu et al (2013; NZ): Food expenditure data were used to indicate PEs for 24 food categories in NZ. OPE (percentage change in demand associated with 1% change in price of that good) ranged from -0.44 to -1.78. CPE estimates (1% change in price of another good) were generally smaller; only 31% of absolute values were >0.10, with an average absolute value of 0.11. Earlier PE estimates for NZ for seven food groups based on 1996 expenditure and price data spanned a narrow range from –0.22 (bread and cereals) to –0.47 (fish). The discussion section of this paper stated that *"our PE estimates are generally higher than those from comparable countries"*.

UK

- MAFF (2000; cited in Ni Mhurchu et al 2013): United Kingdom (UK) food PEs over the period 1988 to 2000 ranged from -0.17 to -0.94; cereals and cereal products, fresh fish, and sugar and preserves were most responsive to price changes.
- US
- Lin et al (2014; US): This analysis used a utility-theoretic censored demand system for 13 food groups among households that receive the Supplemental Nutrition Assistance Program (SNAP) benefits in the U.S. The demand system is estimated with a Bayesian procedure which otherwise would have been cumbersome with the classical approach. Results suggest that prices are significant determinants of food purchases, but that supermarket access has limited influence.
- Andreyeva et al (2010; *SR*): Identified the PE from 160 US-based studies between 1938 and 2007: Overall, their results are consistent with customary characterisations of the demand response to food prices as inelastic; all mean PE estimates were below 1.0 and ranged from 0.27 to 0.81. Estimates were relatively more elastic for soft drinks (0.79), juice (0.76), meats (0.68–0.75), fruit (0.70), and cereals (0.60) and most inelastic for eggs (0.27), sugars and sweets (0.34), cheese (0.44), and fats and oils (0.48).

Overall food price elasticity and socioeconomic status

Pieroni et al (2013; Italy; modelled household survey data): Cross-sections of the Italian Household Budget Survey (1997–2005) were examined to obtain the variables of the demand system, which accounts for regional price variability and modelled to examine the effect of different prices. The relative increase in healthy food prices was found to produce nontrivial elasticities of substitution towards higher relative consumption of unhealthy foods, with effects on weight outcomes. In addition, these changes were unevenly distributed among

individuals and were particularly significant for those who were poorer and had less education.

- Green et al (2013; *SR*: 136 studies reporting 3495 OPEs): The analysis identified that demand for food was more responsive to price changes among households with lower incomes.
- Ni Mhurchu et al (2013; NZ): Food expenditure data were used to indicate PEs for 24 food categories in NZ. Own-PE (percentage change in demand associated with 1% change in price of that good) ranged from -0.44 to -1.78. Cross-PE estimates (1% change in price of another good) were generally smaller; only 31% of absolute values were >0.10, with an average absolute value of 0.11. Differences were evident across income levels and ethnic groups. Excluding the outlier 'energy drinks', nine of 23 food groups had significantly stronger OPEs for the lowest versus highest income guintiles (average regression-based difference across food groups -0.30 (95% CI -0.62 to 0.02)). Six OPEs were significantly stronger among Maori; the average difference for Maori: non-Maori across food groups was -0.26 (95% CI -0.52 to 0.00). The OPE was 40% stronger among low- compared to high-income quintiles.
- Andreyeva et al (2010; *SR*; US-based studies only): This review did not identify consistent differences in estimated PEs between low-income consumers and consumers as a whole. One study focusing on milk demand showed that demand was more PE in low-income populations (1.2 versus 0.66), and a study on fast food depicted a large difference as well (2.09 versus 0.51). However, three studies including estimates for a broader group of foods reported essentially no difference, with average PEs of 0.62 for low-income populations and 0.64 for consumers as a whole.

Food prices and health expenditure

- A single study (across 114 countries) showed that a 10% increase in food prices leads to a 1.9% drop in expenditure on health care in high-income countries.
- Cornelsen et al (2014) cite Regmi & Seale (2010) as showing that a 10% increase in food prices leads to a 1.9% drop in expenditure on health care in high-income countries.

Food/diet price and weight status

- A small number of studies indicate that there is a positive association between food prices and diet prices and BMI.
- Xu et al (2014; US; *ecological data*): This study examined the impact of food price on obesity by exploring the co-occurrence of obesity growth with relative food price reduction between 1976 and 2001 in metropolitan areas. Analyses were controlled for female labour participation and metropolitan outlet densities that might affect body weight. Both the first-difference and fixed effects approaches provide consistent evidence suggesting that relative food prices have substantial impacts on obesity and such impacts were more pronounced among the low-educated. These findings imply that relative food price reductions during the time period could plausibly explain about 18% of the increase in obesity among the US adults in metropolitan areas.
- Lear et al (2013; US; *cross-sectional observational*): The price of a food basket (consisting of a mixture of several food items commonly consumed by residents and available in all supermarkets) was significantly inversely associated with BMI, after adjusting for age, sex, median individual income and car ownership.
- Drewnowski (2012; *narrative review*): Shopping in lowcost supermarkets was another powerful predictor of bodyweight.
- Murakami et al (2009; Japan; cross-sectional observational): Among 1136 Japanese dietetic students aged 18–22 years, after adjusting for potential confounding factors, monetary cost of dietary energy was significantly and negatively associated with BMI (P for trend = 0.0024). Monetary cost of dietary energy also showed a significant negative association with waist circumference independently of potential confounding factors, including BMI (P for trend = 0.0003). No significant associations were observed for other metabolic risk factors examined.

Food environment objective: increase price of EDNP foods/negative nutrients in food

ACTION:

Taxation of unhealthy foods/ negative nutrients³⁶

Background

Unhealthy foods/nutrients and health³⁷

- There is accumulating evidence to suggest highly palatable discretionary foods (high in fat, salt and sugar), including fast food, may be addictive; and that, as with other addictive activities and products they may respond to taxation.
- Fast food or foods high in sugar, salt and fat are highly palatable and may be addictive; and terms such as 'food addiction' and eating addiction' are increasing in the literature (e.g. Gearhardt et al 2012; Fortuna 2012; Hedebrand et al 2014; Pomeranz & Roberto 2014).
- Palatable foods activate brain reward circuitry in a similar fashion to many addictive drugs, and soaring obesity rates may be correlated to the increased availability and exposure to highly reinforcing comfort foods (Hedebrand et al 2014, Volkow & Wise 2005, Wang et al 2001).
- Weltens et al (2014): The effects of food on mood may occur independently from their exteroceptive sensory properties.
- Pomeranz & Roberto (2014): In light of potential for addiction, it is reasonable for governments to implement similar strategies to similarly addictive activities and products (casino gambling, alcohol, tobacco) without expecting any single intervention to remedy the state of obesity on its own.
- Richards et al. (2007; *cited by Miao et al 2013*) showed that the addiction (habit persistence) to carbohydrates is a significant determinant of consumption.

Unhealthy food tax and acceptability

- Findings are mixed regarding the public support in Australia for taxation on obesogenic foods with an indication of more support if combined with frontof-pack traffic light labeling and/or revenue spent on health care.
- Moretto et al (2014; AUS): A citizens' jury was conducted in Brisbane, May 2013, to answer the question: *Is taxation on food and drinks an acceptable strategy to the public in order to reduce rates of childhood obesity?* The jurors unanimously supported taxation on SSBs but generally did not support taxation on processed meats, snack foods and foods eaten/ purchased outside the home. They also supported taxation on snack foods on the condition that traffic light labelling was also introduced.
- Lee et al (2013; US and AUS): An online survey of 479 adults from the US (n=215) and Australia (n=264) indicated substantial support for the idea of food addiction. There was very little support for taxes on obesogenic foods; respondents saw obesity as primarily a result of personal choices.
- Morley et al (2012; AUS): A random sample of 1511 adults who were the main grocery buyer for their household in June—July 2010 showed that a clear majority of participants (80% or more) were in favour of traffic light front of pack labelling (FOPL) and kJ menu labelling, reformulation to reduce the fat, salt and sugar content of processed foods, and regulation of broadcast and non-broadcast avenues used to market unhealthy food and drinks to children. Relatively less support (twothirds or more), particularly among lower socioeconomic status participants, was shown for taxation policies (although 71% favoured a tax on unhealthy foods if funds were used to subsidise healthy foods rather than to fund health programs); and controls on food company sponsorship of sports and education programs.
- Worsley & Thomson et al (2011; AUS): In this survey, 511 respondents in Victoria were surveyed to ascertain their support for possible government F&V promotion policies. The findings suggest that there is a strong and widespread support for policies that encourage country of origin labelling, local and increased production, subsidies, bans and taxes, and communication campaigns. The respondents' universalism values (e.g. valuing nature, harmony and beauty) were more pervasive predictors of their opinions than their demographic characteristics.

³⁶Taxation of sugar-sweetened beverages is dealt with as a separate action

³⁷The rationale section for taxation of unhealthy foods in terms of the impact of 'unhealthy foods/nutrients' is limited to some recent evidence on one particular issue — that of the possible addictive nature of less healthy foods/drinks and the nature of the parallel evidence on taxation as a preventive measure in relation to other health behaviours that have a strong addictive component. The literature pertaining to the negative health effects associated with various foods and nutrients such as saturated fat, fat, sugar and salt, are not contained within this section of the review (although certain foods/ drinks/nutrients are considered within other sections of this domain and within other domains —notably composition (nutrients) and retail (fast food)). In addition, the reader is directed to the systematic reviews underpinning the recently revised Australian Dietary Guidelines.

Implementation examples

- Mexico: Since January 2014, there is an 8% tax on highcalorie snack foods, including chocolates, sweets, ice cream, chips, puddings, and processed foods based on cereals (Sturm & An 2014).
- Zheng et al (2013; <u>US</u>): Fourteen states in US apply sales tax to general food products (purchased in grocery stores and other retailers).
- In 2011, <u>Hungary</u> introduced taxes on manufactured goods that contain sugar: 10-forint (US\$0.04) tax on packaged products high in fat, salt, or sugar (Holt 2011; Villanueva 2011; Cheney 2011). Revenue used to improve health and social services.
- Holt (2010): "<u>Romania</u> mulls over fast food tax." Tax was not introduced.
- ³⁸Denmark introduced a tax on saturated fat and increased the tax on sugar products, soft drinks and alcohol in October 2011. The tax rate is 16 DKK/kg (E2.15) of saturated fat for selected product categories and only applies if the saturated fat content exceeds 2.3g/100g (Smed 2012; Jensen & Smed 2013). The fat tax in Denmark amounts to an additional 3%, for example, on the price of minced beef, 14.6% on whipped cream, 13–16% on rapeseed and sunflower oils, and 30% on butter (Smed & Robertson 2012). The impacts of the tax were considered controversial, and as a result, the tax was abandoned in November 2012. Vallgårda et al (2015; Denmark) conducted an analysis of parliamentary debates, expert reports and media coverage, as well as key informant interviews. The study indicated that the tax on saturated fat had been suggested by two expert committees and was introduced with a majority in parliament, as a part of a larger economic reform package. Many actors, including representatives from the food industry and nutrition researchers, opposed the tax both before and after its introduction, claiming that it harmed the economy and had no positive influence on health, rather the contrary. Few policy actors defended the tax. Public health had a prominent role in the politicians' arguments for introducing the tax but was barely mentioned in the debate about the repeal.

- Tax in <u>Nauru</u> was a 'sugar levy' of 30% on imported sugar, confectionery, carbonated soft drinks, cordials, flavoured milks and drink mixes (Nauru has no local production). It was primarily a health-promoting measure. It was raised by the Minister for Health and designed to shift consumption habits. However, the tax was also implemented in the context of the government seeking alternative sources of income, and significant revenue has been collected via the tax. (Thow et al 2011)
- In <u>French Polynesia</u>, taxes were implemented on sweetened drinks, confectionery, ice cream and beer, and were marketed as health measures. Their intent was not to lower consumption but to raise revenue for a prevention fund. The funding mechanism was subsequently modified so that the funds from the tax go to the general government budget, and 80% of these funds are then earmarked for the Ministry of Health's general budget. (Thow et al 2011)
- Franck et al (2013): Sales tax (VAT in Europe and Canada). In Canada and many US states, taxes are imposed on soft drinks, sweets, snack foods, but not on basic groceries. Also in Belgium, Germany, Ireland, Italy, UK have a sales taxes but the effect is unknown.

³⁸Refer to subsequent evaluation of effectiveness

Supporting evidence

Price of unhealthy foods and purchases/ consumption

Econometric/demand studies

- Cross-price elasticity studies across countries indicate relatively inelastic demand of fats and oils, and saturated fat, although there may be slightly larger elasticity for sweets; however a tax on the latter may result in the same or even higher calorific consumption through increases in consumption of other foods.
- Cornelsen et al³⁹ (2014; SR and MA): The review and meta-analysis examined OPEs and CPEs⁴⁰ for low-, middleand high-income countries. An increase in the price of fats and oils by 10% was associated with a reduction in their consumption of 4.2%, indicating relatively inelastic demand. The same increase in the price of sweets (includes sweets, confectionery and SSBs) would lead to 5.6% reduction in consumption, but a 3% increase in consumption of all other foods, apart from fats and oils. This indicates that a tax on sugar, sweets and SSBs could induce, among other things, more consumption of healthier alternatives such as F&V, reinforcing the direct effect of the tax. When combined with data on calorie availability, the reduction in calories from fats and oils due to the price increase was greater than for sweets, as half of the calories reduced from sweets were substituted with cereals, dairy, and F&V.
- McInnes and Ozturk (2011): Consumers weigh losses more heavily from the purchase of a taxed unhealthy product than equivalent gains from the purchase of a subsidised healthy product (cited in Papoukis 2012).
- Andreyeva et al (2010; *SR*): OPE from 160 US-based studies between 1938 and 2007: Mean PE estimates were below 1.0 and ranged from 0.27 to 0.81. Estimates were most inelastic for eggs (0.27), sugars and sweets (0.34), cheese (0.44), and fats and oils (0.48).
- MAFF (2000; UK; *cited in Ni Mhurchu et al 2013*): Food PEs over the period 1988 to 2000 ranged from -0.17 to -0.94; and cereals and cereal products, fresh fish, and sugar and preserves were most responsive to price changes.

Simulation modelling studies

- One modelling paper (Norway) indicates that a VAT on some unhealthy foods will reduce purchasing of unhealthy foods among high-purchasing households more than removing the VAT from healthy foods; another modelling paper (US) indicates that a sugar tax is a powerful tool to induce healthier nutritive bundles among consumers.
- Harding & Lovenheim (2015; US): This paper provides an analysis of the role of prices in determining food purchases and nutrition using very detailed transactionlevel observations for a large, nationally-representative sample of US consumers over the period 2002–2007. Using product-specific nutritional information, the authors develop a new method of partitioning the product space into relevant nutritional clusters that define a set of nutritionally-bundled goods, which parsimoniously characterise consumer choice sets. Estimation of a large utility-derived demand system over this joint product-nutrient space allowed the calculation of price and expenditure elasticities. Using structural demand estimates, the simulated role of product taxes on soda, sugar-sweetened beverages, packaged meals, and snacks, and nutrient taxes on fat, salt, and sugar, showed that a 20% nutrient tax has a significantly larger impact on nutrition than an equivalent product tax, due to the fact that these are broader-based taxes. The cost of these taxes in terms of consumer utility is only about 70 cents per household per day. Thus the study concluded that a sugar tax in particular is a powerful tool to induce healthier nutritive bundles among consumers.
- Gustavsen & Rickertsen (2013; Norway): The effects of an increase in the Norwegian VAT on some unhealthy foods and a removal of the VAT on some healthy foods are investigated. Using censored quantile regressions, the study rejects equality of the own-price elasticities for eight of nine food and beverage groups. The authors find that a VAT increase is more effective in reducing purchases of unhealthy foods among high-purchasing households than a VAT removal is in increasing the purchases of healthy foods among low-purchasing households.

³⁹There was an earlier similar review by the same authors (Green et al 2013).

⁴⁰The authors indicate that they analysed uncompensated CPEs allowing for substitution and income effects and because these effects act in opposite directions, the elasticity estimates are more likely to tend towards zero. It is indicated that compensated elasticities would provide a better understanding of pure substitution effects within countries, unless price increases exceed income growth. Another explanation for the small CPEs is that nationally representative data were used, combining the preferences and tastes of various consumer populations with different levels of accessibility and affordability. Averaging across these groups leads to combining income, substitution and complementarity effects that act in opposite directions and could therefore lead to small overall values.

Experimental studies41

- Experimental (laboratory) studies provide mixed results regarding the potential impact of a tax on unhealthy foods, and the relative effectiveness of a tax on unhealthy foods/nutrients compared to a subsidy on healthier foods in terms of purchases. Several studies indicate that impulsiveness and inhibitory control, may play a part in consumer response. One experimental study showed that consumers are more responsive to changes in price than to changes in package size in terms of purchasing indulgent food items.
- Epstein et al (2015; US): Among 199 female shoppers exposed to an experimental store, a tax of 12.5% or 25% on selected low nutrient dense foods (SSBs, candy, salted snacks) led to a reduction in calories 'purchased' of taxed foods. A subsidy of the same amount on fruits and vegetables and bottled water led to a decrease in the calories 'purchased' for subsidised foods, but there was no overall effect on total calories purchased.
- Streletskaya et al (2014; US): A laboratory experiment with 258 adult non-student participants, examined whether unhealthy foods taxes, healthy foods subsidies, anti-obesity advertising, and healthy foods advertising have an impact on changing consumers' choices of lunch items and the nutrient content of their choices for a selected meal. The results indicate that the unhealthy foods tax, healthy foods advertising, and unhealthy foods tax combined with anti-obesity advertising significantly reduced the content of some nutrients of concern, such as calories, calories from fat, carbohydrates, and cholesterol in meal selections.
- Nederkoorn et al (2014; The Netherlands): In a virtual online supermarket, 118 participants responded to temporary price promotions. In the sales promotion condition, advertisements for snack foods, including pizza, crisps, cookies, and candy were positioned on the bottom of the screen; those with less inhibitory control 'purchased' more calories than participants with more inhibitory control. In addition, sales promotion, weight status, and inhibitory control appeared to interact in their effect on snack food purchases: participants with less inhibitory control and overweight bought more calories of snacks in the sales promotions condition, but not in the control condition. For the other participants, with normal

weight and/or high inhibitory control, sales promotions had no effect on their purchases of calories of snacks. The authors concluded that it seems that especially the combination of low inhibitory control and overweight makes participants vulnerable for environmental cues. Note: this is the only experimental study in the retail environment to examine a price discount on less healthy foods.

Papoutsi et al (2013; Greece): Small-scale laboratory experiment. Since market prices between the three products differ, this experiment simulated the fiscal policy changes separately for each product (from their experimental data — chocolate milk beverage, cheese, and yogurt — for which there were healthy and less healthy choices). Results show that changing the food fiscal policy for the chocolate milk beverage from a basic level of market prices to imposing a 15% fat tax, increases choices of the healthier alternative by 6.8% and decreases choices of the unhealthier alternative by 7.07%. The effect is proportional to a 25% fat tax and results in an 11.25% increase in healthier choices and an 11.8% decrease in unhealthier choices. The results from a corresponding subsidy of the healthier alternative show that the effect is even stronger in increasing the incidence of healthier choices. For example, a 25% subsidisation of the price of the healthier cheese alternative results in a 19.6% increase in the healthier choice share while the equivalent fat tax imposed on the unhealthier alternative results in a 15.6% increase in the healthier choice share. This indicates that the implementation of a subsidy is more effective than the implementation of a fat tax in increasing healthier choices, at least in the context of our experiment. The combined effect of a fat tax and a subsidy is even more robust. The most prominent case is for the cheese product where a 25% fat tax on the unhealthier alternative and a 25% subsidy on the healthier alternative increase (decrease) the choice share of the healthier (unhealthier) alternative by 36% (38.5%).

⁴Note that many of these laboratory/virtual environment studies have examined the effects of a tax on unhealthy foods in addition to a subsidy on healthier foods.

- Huyghe & Van Kerckhove (2013): This study conceptually replicates and extends the finding of Mishra & Mishra (2011; qualitative) to show that consumers are more responsive to changes in price than to changes in package size for indulgent food options, whereas they are more responsive to changes in package size than to changes in price for healthy food options.
- Giesen, Havermans et al (2012): Laboratory experiment investigated the effect of taxing high-ED products and subsidising low-ED products on changes in calorie consumption. Contrary to the hypothesis, results showed that 'more impulsive' individuals adjusted their calorie consumption with regard to price changes whereas 'less impulsive' participants were less influenced by price changes. Furthermore, taxing high-ED products was more successful in reducing calorie consumption than subsidising low-ED products.

Price of unhealthy foods and diet/weight

Simulation modelling studies

- Simulation modelling studies of a fat tax implemented as either nutrient-based or foodbased indicate variable impacts on overall food and nutrient consumption and weight; some modelling results indicate only positive effects if combined with a thin-subsidy.
- Eyles et al (2012; SR): Systematic review of simulation studies provided pooled estimates for taxes on saturated fat: -0.02% (-0.01%, -0.04%) reduction in energy intake from saturated fat per 1% price increase (n=5 studies).
- Allais et al (2010; France; modelling study based on scanner data): Assesses the effects of a 'fat tax' on the nutrients purchased by French households across different income groups. This is done by making a preliminary estimation of price elasticities using a complete demand system on household scanner data, and by calculating nutrient elasticities using estimated price elasticities. The authors find that a fat tax has small and ambiguous effects on nutrients purchased by French households, and a slight effect on body weight in the short run, with a greater effect in the long run.

- Yaniv, Rosin et al. (2009; Israel): Paper addresses the fat tax and thin subsidy within a food-intake rational-choice model. Assuming that healthy meals are cooked at home with purchased ingredients and time input, the paper examines the effects on obesity of a tax on junk-food meals and a subsidy to cooking ingredients. The results show that for a non-weight conscious individual a fat tax will unambiguously reduce obesity, whereas a thin subsidy may increase obesity. However, for a weight-conscious individual, particularly one who is physically active, even a fat tax may increase obesity, as it may reduce not just the consumption of junk-food, but also the time devoted to physical activity.
- Allais et al⁴² (2008; France): A 10% VAT increase for cheese and butter products, sugar and fat products, and ready-made meals. All tax rises would decrease total energy and saturated fat intake; taxing both sugar and fat products and cheese and butter products increased polyunsaturated fat use; taxing all three food groups gave weight decrease of 1.3kg/year. Ready-made meal tax increased fat-soluble vitamin intake and decreased sodium, vitamin B and good fat intake; government revenue increased by 16%.
- Schroeter et al³ (2008; US): 10% tax on food away from home. Daily weight change was 0.196% increase. Tax on food away from home induces substitution for calorie-dense home food.
- Gelbach et al (2007; US): 100% tax on unhealthy foods. Decreased average BMI by around 1% and decreased incidence of overweight by 2% and obesity by 1%. Very small differences in price sensitivity with education, race and gender.
- Jensen & Smed (2007; Denmark): Used aggregate consumption data and examined different taxes and subsidies; found that best scenario was revenue-neutral subsidy on fibre and tax on saturated fats and sugar. Sugar consumption would decrease by 6.5%, fat by 2.5%, saturated fat by 3.6% and fibre consumption increased by 6.5%.

⁴²Details taken from Thow et al (2010)

- Smed et al (2007; Denmark): Using data on household purchases: price of meat, butter and fat increased by 5%; VAT on F&V halved. The following modelling scenarios were all scaled to have an equivalent effect on consumers as the above VAT reduction: fibre subsidy; taxes on fat, saturated fat and sugar; and revenue-neutral combinations. More effective to target nutrients than foods. Best scenario: saturated fat and sugar tax plus fibre subsidy resulted in a sugar consumption decrease of 16%, saturated fat consumption decrease of 8%, and increased fibre consumption of 15%.
- Chouinard et al (2007; US): HPs 10% and 50% tax on dairy products by fat content. Daily fat intake decreased by 23g with 50% tax; no noticeable effect on weight.
- Choinard, et al. (2005; US): Using supermarket scanner data, estimated an incomplete demand system to determine the effects of taxing the fat content of dairy products on various demographic groups. The OPEs of demand are relatively inelastic and vary little across demographic groups. As a consequence, a 10% tax on fat content has relatively little effect on the quantity of dairy products consumed of any group. More importantly, simulations suggest that such a tax has only a 1.4% reduction in average fat consumption. To have a substantial effect, the tax rate would have to be extremely high.
- Kuchler et al (2004, 2005; US): US Salty snack food excise taxes: 1 US cent/pound weight (i.e. 0.4%), 1% and 20%. 1 US cent/pound weight and 1% tax had no effect on consumption or body weight; 20% tax decreased body weight by 115–170g/person/year, equivalent to a reduction in energy intake of around 830 calories. 1 US cent/pound weight gave US\$40 million revenue; 1% tax gave US\$100 million; 20% gave US\$ 500–700 million.
- Santarossa & Mainland (2003; Scotland): Household consumption data: tax rates needed to change nutrient consumption to meet recommendations were meat by 1%, dairy products by 4%, eggs by 11%, and fats and oils by 24%.

Price of unhealthy foods and morbidity/ mortality

Simulation modelling studies

- Ni Mhurchu et al (2015; NZ): Using an econometricepidemiological (data from household expenditure, demand elasticities, and population impact fractions) simulation modelling study, a 20% tax on major dietary sources of saturated fat would result in 1500 deaths prevented or postponed (DPP), and a 20% tax on major dietary sources of sodium would result in 2000 DPP.
- Nnoaham et al (2009; US): Extend 17.5% VAT to: (i) sources of saturated fat; (ii) unhealthy foods (nutrient profiling); (iii) unhealthy foods, with 17.5% F&V subsidy; (iv) unhealthy foods, with all tax revenue going to a F&V subsidy. (i) no mortality reduction; (ii) CVD and cancer deaths increased by 35–1300 per year; (iii) up to 2900 CVD and cancer deaths averted per year; (iv) up to 6400 CVD and cancer deaths averted per year (regressive and positive health effects not necessarily greater in low income groups).
- Mytton et al (2007; UK): Extend 17.5% VAT to: (i) sources of saturated fat, (ii) unhealthy foods; (iii) modification of the above for the best health outcome: (i) increased CVD deaths due to increased salt intake; (ii) decreased CVD deaths by 1.2%; (iii) decreased CVD deaths by 1.7%.
- Marshall (2000; UK): Extend 17.5% VAT to main sources of saturated fat. Would decrease ischaemic heart disease by 1.8–2.6%, equivalent to 1800–2500 deaths/year, with 900–1000 deaths/year in people under 75 years.

Evidence of intervention effectiveness

Outcome: purchases/consumption

- A quasi-experimental study in a natural environment indicated that large taxes on unhealthy foods can be effective in reducing purchases of unhealthy items and stimulating purchases of healthier items.
- In Denmark, econometric analysis of real world implementation of a 'fat tax' suggests that the level of consumption of fats dropped by 10–15% but that not all of the tax was passed on to consumers, and perhaps passed on disproportionately to those who shopped in discount stores. There was some preliminary evidence indicating that Danish consumers do substitute with healthier products but they also substitute their usual unhealthy product with cheaper varieties of the same composition. More recently published data indicate a statistically significant total decrease in the intake of saturated fat from minced beef and regular cream but overall reductions in saturated fat intake were limited.

Field experiment

Elbel et al (2013; US): A new store at a large hospital selling healthier and less healthy options/foods and beverages. Baseline with no special labelling or taxation, a 30% tax, highlighting the phrase 'less healthy' on the price tag, and combinations of taxation and labelling. Purchases were analysed over a six-month period. Consumers were 11% more likely to purchase a healthier item under a 30% 'unhealthy' tax (p<0.001) and 6% more likely under labelling (p=0.04). By product type, consumers switched away from the purchase of lesshealthy food under taxation (9%, p<0.001) and into healthier beverages (6% increase, p=0.001); there were no effects for labelling. Conditions were associated with the purchase of 11–14 fewer calories (9–11% in relative terms) and two fewer grams of sugar. Results remained significant controlling for all items purchased in a single transaction.

Real world implementation

Denmark

- Bødker et al (2015): Comprehensive retail outlet data on the sale of 12 foodstuff categories targeted by the fat tax between January 2010 and July 2013 showed that the total sale of the included foodstuffs decreased by 0.9%. Modelling of these data suggested the impact of the fat tax was associated with an increased population risk of Ischaemic heart disease (IHD) by between 0.2–0.3%.
- Jensen et al (2015): Econometric analysis using data from one of the largest retail chains in Denmark between January 2010 to October 2012, and monthly records of sales volume, sales revenue and information about specific campaigns from 1923 stores revealed that the Danish fat tax had an insignificant or small negative effect on the price for low- and medium-fat varieties, and led to a 13–16% price increase for high-fat varieties of minced beef and cream products. The tax induced substitution effects, budget effects and preference change effects on consumption, yielding a total decrease of 4–6% in the intake of saturated fat from minced beef and regular cream, and a negligible effect on the intake from sour cream. The authors concluded that the Danish introduction of a tax on saturated fat in food in October 2011 had statistically significant effects on the sales of fat in minced beef and cream products, but the tax seems to have reduced the beyond-recommendation saturated fat intake to only a limited extent.
- Jensen & Smed (2013): Econometric analysis on weekly food purchase data from a large household panel dataset, spanning the period from January 2008 until July 2012 for food products in Denmark. The econometric analysis suggests that the introduction of the tax on saturated fat in food products has had some effects on the market for the considered products, in that the level of consumption of fats dropped by 10–15%. Furthermore, the analysis points at shifts in demand from high price supermarkets (who absorbed a lot of the cost) towards low-price discount stores — at least for some types of oils and fats, a shift that seems to have been utilised by discount chains to raise the prices of butter and margarine by more than the pure tax increase. Therefore there was evidence that not all of the tax was passed on to consumers, and perhaps disproportionately to those who shopped in discount stores.

- Stafford, N. (2012). "Denmark cancels 'fat tax' and shelves 'sugar tax' because of threat of job losses." BMJ 21(345): e7889.
- Smed & Robertson (2012): Preliminary evidence suggests that Danish consumers do substitute with healthier products but they also substitute their usual unhealthy product with cheaper varieties of the same composition. Anecdotal evidence also suggests that cross-border food shopping, which is a politically sensitive issue, is increasing. Purchased taxed items across the border in Germany and Sweden. It was estimated that the revenue from the Danish fat tax would be around 1.2bn Kr (£129m; €160m; \$206m) a year, equivalent to about €74 per household per year. Before the tax was implemented, a modelling exercise that took income and substitution effects into account predicted that the Danish fat tax would reduce the intake of saturated fats by about 8% (citations in Smed & Roberston 2012; Smed & Jensen 2007; Jensen & Smed 2007; Smed 2012). One year after its implementation (October 2011), the tax seemed to have been passed on to consumers in most cases and the revenue generated by the government was as expected (cited in Smed & Robertson 2012).

Outcome: obesity

An ecological study in the US indicated that US states without sales taxes on [soft drinks or] snack foods were four times as likely as states with a tax to have a relative increase in the prevalence of obesity. In addition, states that have repealed an existing [soft drink or] snack food tax were 13 times as likely other states to have an increase in obesity (note that causality cannot be determined as the data were ecological; although the study included states with/without real world implementation).

Real world implementation

United States

• Kim & Kawachi (2006; ecological data): As of 2003, US states without sales taxes on soft drinks or snack foods were four times as likely as states with a tax to have a relative increase in the prevalence of obesity. Similar results were found in states that had repealed an existing soft drink or snack food tax – making them 13 times as likely as other states to have an increase in obesity.

ACTION: Taxation of fast foods

Supporting evidence Price of fast foods and purchasing/ consumption

Observational studies

- Observational and econometric studies indicate that demand for fast food may be quite elastic (i.e. price sensitivity may be high); especially among lowincome consumers and adolescents.
- Richards and Mancino (2014; US): This study provides estimates of the PE of demand for four different types of food away from home (FAFH) using a new data set from NPD, Inc. and an econometric approach that accounts for the multiple-discrete-continuous nature of FAFH demand. We find that CPEs of demand are small, so consumers are unwilling to substitute between food-at-home and any type of FAFH or among types of FAFH. PE of demand for meals at fast food and various types of sit-down restaurants were between -0.5 and -0.9. Therefore, taxing fast food may be effective in reducing the number of fast food visits and shifting consumption to at-home meals.
- Meyer et al (2014; US): 25-year follow-up in the CARDIA (biracial US prospective cohort Coronary Artery Risk Development in Young Adults) study in the US; found greater fast food price sensitivity to fast food consumption among sociodemographic groups that have a disproportionate burden of chronic disease.
- Powell & Chriqui et al (2013; *SR* recent US studies): Based on the recent literature, the PED for fast food was estimated to be -0.52.
- Sturm & Datar (2011; US): An observational study using individual survey data of Grade 5 children and regional food in-store prices showed that there were no price effects on consumption frequency for fast food (or SSBs), indicating that either price variation is too small to affect children's consumption frequency, or the consumption of fast food (and SSBs) is less price sensitive (than for F&V and milk).

- Andreyeva et al (2010; SR) identified the PE from 160 US-based studies between 1938 and 2007: One study focusing on fast food depicted a large difference between low-income consumers and consumers as a whole (2.09 versus 0.51). FAFH was most responsive to changes in prices among other categories (0.81) and more elastic than demand for food at home (0.59).
- Powell & Bao (2009; US; *longitudinal survey and price data*): Data from the 1979 National Longitudinal Survey of Youth from 1998, 2000 and 2002, indicated fast food price elasticities of -0.26 among low-income children, and -0.13 among children with less educated mothers, with an overall PE of -0.12.
- Jekanowski et al. (2001; US; *market level data*): Demand for fast-food restaurants was much more price elastic than other food outlets (-1.02 in 1982 and -1.88 in 1992). The authors found very little evidence of substitution between fast food and other food establishments (i.e. grocery stores, inexpensive and expensive sit-down restaurants), and they found outlet density positively affected demand for fast food, while demographic characteristics of market areas had little impact on demand.

Experimental studies

- Three laboratory experiments in a single study showed that a surcharge of 17.5% alone to unhealthy menu items affected selection of those items by men but not women; and that the effect was observed across gender only when an 'unhealthy label' was added.
- Shah et al (2014; US): Three laboratory experiments involving a surcharge of 17.5% on unhealthy foods on a hypothetical menu taken from popular chain restaurants, with some experiments involving an explanation at the bottom of the menu that the surcharge was due to the item exceeding values for fat and/or sugar content or calorie and fat information; showed that an unhealthy surcharge - i.e. the combination of the price increase and the labeling as unhealthy – led to a reduced demand for the less healthy options among women and men but that neither a surcharge alone nor an unhealthy label is sufficient to reduce demand for unhealthy food across gender. Among men, a surcharge alone had some effect, but an unhealthy label had the opposite effect to that hypothesized, i.e. led to an increase in selection of unhealthy items.

Price of fast foods and health/weight

- There are mixed findings from a variety of studies with respect to a negative association between fast food prices and BMI (studies all from the US), although the majority of evidence supports the association among adolescents in particular.
- Morrissey et al (2014; US; *cohort data*): Early childhood longitudinal study-birth cohort (to 5 years) linked to local food price data: In fixed-effects models, higher-priced soft drinks were associated with a lower likelihood of being overweight; but surprisingly, higher fast food prices are associated with a greater likelihood of being overweight.
- Grossman et al (2014; US; *modelling using dietary survey data*): Using NHANES data; findings suggested that increases in the real price per calorie of food for home consumption and the real price of fast-food restaurant food lead to improvements in obesity outcomes among youths. Effect on percentage body fat as well as, and more than, BMI.
- Cotti & Tefft (2013; modelling using data on income, consumption, and BMI): "Although there is growing evidence for a negative association between fast food prices and weight among adolescents, less is known about adults. That any measured association is causal is unclear...". This study found little evidence that fast food price changes affect adult BMI or obesity prevalence.
- Han & Powell (2013; US; time-series): National longitudinal survey of youth 1979 in cross-sectional and longitudinal quantile regression models; ordinary least squares estimate for men underestimates the negative relationship of fast food prices with BMI at the 50th and upper quantiles in cross-sectional models, although the statistical significance disappears in the longitudinal individual fixed effects quantile regression. Among subpopulations, the study found that a 10% increase in the price of fast food is associated with 0.9% and 0.7% lower BMI for low-income women and women with any children, respectively, at the 90th quantile in a longitudinal individual fixed effects model. Results imply that fiscal pricing policies such as fast food taxes might have a greater impact on the weight outcomes of lowincome women or women with children in the upper tail of the conditional BMI distribution.

- Powell & Chriqui (2013; *SR*): Higher fast food prices were associated with lower weight outcomes, particularly among adolescents, suggesting that raising prices would potentially affect weight outcomes.
- Duffey et al (2010; US; modelled cohort data): Data from the 20-year longitudinal (CARDIA) study showed that a 10% increase in the price of soft drink or pizza was associated with a -7.2% or a -11.5% change in energy in the diet from these foods, respectively. A \$1.00 increase in the price of soft drinks was associated with lower daily energy intake (-124 kcal), lower weight (-1.05 kg) and lower insulin resistance score (-0.42). Similar results were found for pizza. A \$1.00 increase in the price of both soft drinks and pizza was associated with even larger changes (-181.49 kcal, -1.65 kg, and -0.45 respectively).
- Powell (2009; US; Data from four waves of the 1997 National Longitudinal Survey of Youth and external data): longitudinal individual-level fixed effects results confirm cross-sectional findings that the price of fast food but not the availability of fast food restaurants has a statistically significant effect on teen BMI with an estimated price elasticity of -0.08. The results suggest that the crosssectional model over-estimates the price of fast food BMI effect by about 25%. There is evidence that the weight of teens in low- to middle-socioeconomic status families is most sensitive to fast food prices. Therefore it is likely that price changes would impact low SES most.
- Powell & Chaloupka (2009; US; *empirical data*): Examined empirical evidence regarding the food and restaurant price sensitivity of weight outcomes. The studies reviewed showed that when statistically significant associations were found between food and restaurant prices (taxes) and weight outcomes, the effects were generally small in magnitude, although in some cases they were larger for low-socioeconomic status (SES) populations and for those at risk for overweight or obesity. *"Non-trivial pricing interventions may have some measurable effects on Americans' weight outcomes, particularly for children and adolescents, low-SES populations, and those most at risk for overweight."*
- Powell & Bao (2009; US; *longitudinal survey data*): Data from the 1979 National Longitudinal Survey of Youth from 1998, 2000 and 2002, combined with fast food

prices showed that fast food prices were not statistically significantly associated with BMI in the full sample (all children) but were weakly negatively associated with BMI among adolescents, with an estimated PE of -0.12. The associations were significantly stronger both economically and statistically among low- versus high-socioeconomic status children. The estimated PEs were, respectively, -0.26 and -0.13 among low-income and among children with less educated mothers.

- Powell et al (2007; US; longitudinal study): Using repeat cross-sectional data on adolescents from 1997-2003, results suggested that the price of a fast food meal is an important determinant of adolescents' body weight and eating habits: a 10% increase in the price of a fast food meal leads to a 3.0% increase in the probability of frequent F&V consumption, a 0.4% decrease in BMI, and a 5.9% decrease in probability of overweight. The price of F&V and restaurant outlet density are less important determinants, although these variables typically have the expected sign and are often statistically associated with the outcome measures. Despite these findings, changes in all observed economic and socio-demographic characteristics together only explain roughly one-quarter of the change in mean BMI and one-fifth of the change in overweight over the 1997–2003 sampling period.
- Beydoun et al (2008; US; *cross-sectional*): Using data from the USDA CSFII (Continuing Survey of Food Intakes by Individuals), the study showed that higher fast food price indices were associated with higher fibre intake, lower saturated fat, and better overall diet quality; although were not significantly related to weight outcomes.

Evidence of intervention effectiveness

A single RCT in a restaurant setting showed that a surcharge of 15.5% when combined with 'unhealthy' labeling decreased purchases and consumption of the less healthy items but a surcharge alone had no effect; an unhealthy label alone decreased purchases among women whereas increased purchases of unhealthy items among men.

Field experiment

Shah & Bettman (2014; US): A randomized controlled trial in the restaurant setting involved a 15.5% surcharge on main menu items (entrées) and/or an asterisk next to the menu item and an explanation at the bottom stating 'The marked items are above average for fat and/or sugar content in comparison to other entrée items'. Findings were as per the three laboratory experiments described above, in that the unhealthy surcharge (i.e. the price surcharge together with the unhealthy labeling) reduced the choice of an unhealthy menu item – although in the field experiment this condition was only directionally, not significantly, better than the unhealthy label alone⁴³. An unhealthy label alone again increased consumption under real world conditions for men. There was no significant impact of the surcharge alone.

Implementation considerations

Nutrient-based, within-category taxation versus food-based taxation and substitution effects

- Cornelsen et al (2014): "Studies usually consider substitution patterns within a limited set of foods or beverages rather than across the whole diet". Assumptions made about substitutions have real impacts about the predicted effect of food taxes on the total diet (Smith et al 2010; Fletcher 2011; Ford Runge et al 2011). One concern regarding food taxes and subsidies is that unintended compensatory or displacement impacts could undermine their health objectives.
- Requillart & Soler (2014; *review*): To be more successful, a nutritional policy should primarily target product substitution within food categories rather than between food categories, as demand at the product level is much more elastic than at the category level. Designing policies targeting substitutions within a food category rather than between food categories allows for: (i) easier

substitutions by consumers and (ii) greater incentives for food reformulation on the supply side. Although these changes may lead to smaller health benefits for some consumers (those who easily switch from one category to another), they induce greater benefits at the population level. As such, when taxation applies to food categories, most studies conclude with a statement regarding the difficulty of defining policies leading to an improvement in the intake of all nutrients (Irz and Niemi 2011; Eyles et al 2012; Mytton et al 2012). Recent works suggest that (i) focusing on intra-category taxation might be a better strategy, as the elasticity of demand within a category is larger than that across categories (e.g. Griffith et al 2010; Bonnet and Requillart 2013; Requillart and Soler 2013b); and, (ii) it is more efficient to define a nutrient-based tax/ subsidy rather than a food-based tax/subsidy (Miao et al 2012; Harding and Lovenheim 2014).

- Requillart & Soler (2014): An excise tax (tax imposed on the producer of specific goods, usually based on the weight or volume of the good) should be preferred to ad valorem (sales or value-added) taxes, as the former is likely to be transmitted into final consumer prices to a greater extent than the latter. Taxing the 'bad' products within a food category is sensible, as products within a category are highly substitutable. This militates for taxes that are based on the content of the bad nutrient. There are different ways to do so, but employing non-linear schemes might be attractive. In particular, defining a guality threshold should be favoured to allow substitution within the product category between taxed and untaxed products. In the example of soft drinks in France, which employs a per gram of sugar form of taxation, the main substitutions are between sugar-based (taxed) and diet products (untaxed) rather than between the sugar-based products (Bonnet and Requillart 2013b).
- Miao et al (2013):
 - The desired health outcome will be achieved only if a healthier substitute is affordable or cheaper — for example, if butter is easily and cheaply substituted with low fat spread. Thus taxing nutrients is preferable if there are many close substitutes. Cited Richards et al. (2007) who, through a simulated tax scenario, found that taxing pretzels did not reduce the carbohydrate intake and increased fat and calorie intake. Taxing nuts reduced fat intake but increased carbohydrate intake. Taxing potato chips reduced fat, carbohydrate, and calorie intake because there were few close substitutes. The authors argued that targeting the nutrients or food components is more effective than targeting foods because consumers can switch to other foods when the tax is targeted at the product level.

⁴³The authors indicate that this lack of statistical significance may have been due to the patrons being mostly female.

- Using modelling studies with respect to substitution, this study showed that under the added-sugar tax, the EVs per unit of calorie and sugar reduction are considerably overstated by the simpler approaches that overlook the consumers' ability to substitute within food groups. A similar logic holds for the tax on calories from fat, but the difference in EVs per calorie (without and with substitution) is moderate because fat is concentrated in fewer groups. This asymmetry brings a policy recommendation reversal. The tax on added sugar becomes the best instrument (i.e., lowest EV) with the substitution accounted for, whereas the tax on solid fat was the best instrument previously. With the proper substitution accounted for, estimated revenues from nutrient taxes are lower relative to the estimated revenues ignoring substitution possibilities because smaller tax rates are necessary to abate the targeted nutrients. In their calibration, tax revenues from the fat tax are overestimated by about 7% and those from the added-sugar tax by about 37%. The fat tax raises more revenue and has a lower deadweight loss per dollar of revenue than the sugar tax does.
- An important and often neglected aspect of the policy design is the possible trade-off between nutrients and in particular between sugar and fat and the related total effect on calorie intake when a tax is imposed. Any type of junk food tax has associated difficulties: a narrow tax (perhaps on saturated fat) may allow consumers to substitute the taxed food for another, equally unhealthy, untaxed food; whereas a more comprehensive system would be administratively difficult and costly.
- Hawkes (2012; narrative review): Evidence has shown that consumers are likely to be more responsive to taxes that seek to shift consumption habits between close substitutes (i.e. from full fat to skim milk, from white to wholemeal bread) rather than those that seek to simply eliminate certain foods from the diet without replacement — while this goal could be achieved, it would require a significant increase in price (Hawkes 2012).
- Block & Willett (2012) consider that substitution effects are small, not necessarily healthy and do not reverse overall reduction in calories from a tax (Lin et al 2011; Block et al 2010, Finkelstein et al 2013).
- Eyles et al (2012; SR of simulation studies): "Higher quality studies suggested unintended compensatory purchasing that could result in overall effects being counter to health."

- Maniadakis et al (2013; *SR*): A broader tax on foods high in fat, sugar, salt and saturated fats (HFSSFs) would possibly allow less substitution than narrow taxes (citing Fletcher 2011). However, a concern with taxing a wide range of products would be the fact that people should be encouraged to consume a wide range of food and beverage products, e.g. milk and olive oil; that would be difficult to include in the tax category. Furthermore, in some cases, taxing many food groups could possibly lead to nutrient deficiencies, in which case economic policies may have harmful nutritional and health effects. Taxing saturated fats is controversial partly because saturated fats are naturally present in many foods, and only consumption greater than 10% of total energy intake is considered unhealthy.
- Franck et al (2013; US):
 - Discusses the taxation of nutrients/composition; e.g. tax any food composed of >30% fat or >40% sugar. Ingredient tax, e.g. High-fructose corn syrup (HFCS) may encourage manufacturers to use fewer unhealthy ingredients. However, not all fats are unhealthy; may target some manufacturers disproportionately, e.g. specialist cheese vendors where a limited variety of products would be disproportionately taxed. Also production/government catch-up game.
 - This study suggests taxing snack foods as they do not constitute basic needs, and they are most legislatively feasible (citing Kuchler et al 2005). However, it is suggested this would be ineffective, e.g. 20% tax on potato chips: non-significant reduction of 830-calorie reduction per capita per year (less than 0.25 pound per year). Also categorisation is likely to be a grey area; for example, is a tax-free breakfast bar fundamentally healthier than a taxed chocolate bar?
- Powell & Chriqui (2011; review): "Selection of which food or category of food to tax is difficult."
- Cobiac et al (2010; AUS): "However, a potential problem with any tax on food is that many foods are themselves not good or bad, healthy or unhealthy: many have a mix of nutrients, and imposing a tax risks decreasing the consumption of good nutrients along with the bad."

Type of taxation

Kaplan & Thow (2013; AUS): A potential avenue for taxation is through item-specific taxes. The government currently imposes specific excise taxes on tobacco, fuel, petroleum products and alcoholic beverages (not including wine). The government has expressed a disinclination to use targeted excise taxes, saying that *"specific taxes should exist only where they improve social outcomes or market efficiency through better price signals"* (2011, Canberra). However, a tax on sugar-sweetened beverages or junk foods aims to achieve just that goal, and could be administered through the existing framework of either the excise or the wine equalisation taxes.

While the GST may not have been implemented as a fiscal tool to improve diets, it already exempts many healthy foods while requiring taxation on many unhealthy foods. However, it does not differentiate between healthy and less healthy foods in any given category: thus, healthy prepared salads or fruit platters are taxed alongside unhealthy burgers-and-fries, non-caloric beverages are taxed at the same rates as SSBs, and wholemeal breads are in the same category as white bread. Thus, food manufacturers have no incentive to improve the health profile of their products within any given food category.

In order to bring the GST into line with the best practices outlined above⁴⁴, the GST framework could remain and only small changes would be required:

- First, the categories of exempted and non-exempted food would need to be further refined to tax only unhealthy foods, and not healthy varieties of takeaway foods or savoury snacks, both to create incentives for manufacturers and to offer healthier options at lower prices to consumers.
- Second, the presence or absence of the tax should be prominently noted at retail outlets, to educate consumers about the health of their purchases and further influence their consumption habits.
- Third, the 10% flat rate is likely to be too low to significantly influence consumer behaviour; generally, tax rates of 20 to 50% have been recommended.

- Requillart & Soler (2014): An excise tax (tax imposed on the producer of specific goods, usually based on the weight or volume of the good) should be preferred to ad valorem (sales or value-added) taxes, as the former is likely to be transmitted into final consumer prices to a greater extent than the latter.
- Franck et al (2013; US): Sales taxes constitute a percentage of retail price (commonly used in the US). These are not the same as an excise tax which is levied at a fixed cost per unit of measure. Consumers can save on sales tax when buying in bulk; but not so in excise tax (cited Leicester & Windmeijer 2004; Gearhardt et al 2012; Jou & Techakehakij 2012).
- Thow et al (2011; AUS): "Proposals for public health nutrition taxation should (i) use existing types and rates of taxes where possible, (ii) use excise taxes that specifically address externalities, (iii) avoid differential VAT on foods, and, (iv) use import taxes in ways that comply with trade liberalisation priorities."

Arguments for/against taxation

- Madden et al (2015) This paper analyses the effect of such taxes on a range of poverty measures and also examines the effect of a revenue-neutral tax subsidy mixed with a tax on unhealthy food combined with a subsidy on more healthy food. Using Irish expenditure data, the results indicate that taxes on high fat/sugar goods on their own will be regressive but that a taxsubsidy combination can be broadly neutral with respect to poverty.
- Lusk et al (2014) provide an estimate of the value of choosing for one's self, in addition to investigating the choices of people assigned the role of paternalist. However, Buhler et al (2013) discuss the need for 'public stewardship' indicating that taxation seeks to provide conditions that allow people to be healthy, e.g. safe food supply.

⁴⁴Food makes up one of the large general categories of goods that are GST-free, and is defined such that food, beverages, food ingredients or food additives (spices, sweeteners, condiments) for human consumption are not taxable. Thus, fruit, vegetables, meat, fish, bread, cheese, eggs, milk, sugar, tea and coffee are generally not taxable. There are, however, exceptions to this exemption, i.e. foods that are not GST-free include all foods for consumption on the premises where they are supplied; hot foods for take-away; prepared foods, including sandwiches, pizza, platters, and burgers, but not including soup; confectionery, including muesli bars and popcom; savoury snacks including salted seeds or nuts, crisps, and other similar foods; bakery products including cakes, muffins and pies, but not including breads (unless they have a sweet filling or coating); ice cream and other frozen snacks; and foods consisting principally of biscuits, cookies, crackers, pretzels, cones or wafers. Similarly, certain beverages are also taxed, including carbonated drinks that are not made entirely of fruit or vegetable juices; juice drinks that contain less than 90% fruit or vegetable juice by volume; and ready-to-drink coffee, tea, chocolate, sports, or energy drinks. (From Kaplan & Thow 2013)

- Bogart (2013) indicates that revenue generated from such taxes can be used to subsidise the cost of healthy food and drinks such as fresh F&V. Such revenues can also be used to underwrite the cost of encouraging physical activity such as the building of bike paths and community recreational centres. Such subsidies and underwriting go a long way to meet arguments that excise taxes on junk food are regressive, i.e., that they are much more of a burden on the poor than they are on the affluent. Subsidies for healthy food should not be defeated by arguments against government intrusion and manipulation: governments have been subsidising the production of corn and soy for decades. Thus, underwriting the expense of nutritious foods should not be viewed as initiating controversial policies but, rather, modifying existing practices so as to promote the attractive goal of public health.
- Requillart & Soler (2014) discuss societal cost (caused by an item that is not borne by the buyer or seller, but by innocent third parties): the justification for intervention is related to beliefs regarding the negative externalities of unhealthy diets. Thus, it is observed that obesity and other food-related chronic diseases generate healthcare costs, which are borne collectively. However, debate persists concerning the size or even the existence of such negative externalities, as it has yet to have been proved that obese persons incur higher lifetime healthcare costs (cites Faulkner et al 2011). A second argument notes that there are long-term negative impacts of excessive consumption on individuals' own health (time-inconsistent preferences). In this context of delayed impact, O'Donoghue and Rabin (2006) demonstrated that, in an economy with heterogeneous agents and in which certain individuals have time-inconsistent preferences, a tax policy is welfareenhancing (cf. Griffith & O'Connell 2010)
- Ni Mhurchu et al (2014) dispute the regressiveness of the tax, as targeted taxes would affect households according to spending on individual items, not food spending overall. Regressivity is only a compelling argument if unhealthy foods are a necessity, which they are not. Also they are disproportionately eaten by lower SES. A real concern though is to ensure access to healthier, subsidised foods, else populations living in so-called food deserts might be doubly disadvantaged by price increases from 'sin taxes' and travel costs to far away supermarkets.

- Maniadakis et al (2013) and Allais et al (2010): such a tax generates substantial tax revenue but is highly regressive; and is more regressive towards the lowest income categories. A small tax may not measurably decrease consumption but would generate significant revenue for subsidies.
- Bogart (2013) considered that imperfect knowledge and time-inconsistent preferences impose significant externalities.
- Traill et al (2012; UK): Interventionist measures like taxes improve social welfare (according to the compensation principle) and reduce health inequalities but are regressive, like all sin taxes. Almost all interventions pass cost-effectiveness tests.
- A tax policy on food is generally regressive, as low-income consumers devote a larger share of their expenditures to food consumption than high-income consumers. Moreover, according to Tiffin and Salois (2012), the regressivity of a tax policy is particularly large when the tax is focused on products with high saturated fat contents. A policy that combines a fat tax with a subsidy on F&V is actually more regressive, as high-income consumers tend to consume more F&V than low-income consumers. For these reasons, measures that apply to the entire population may not reduce health inequalities. Conversely, approaches that target vulnerable populations that have a shared propensity to adopt unhealthy behaviours are more appropriate (e.g. Dallongeville et al 2011). Whereas many authors agree on the regressive impact of food taxes, there is no consensus on the impact of taxes on health inequalities. Thus, some studies have shown that the impact on consumption might be progressive (Smed et al 2007). As a consequence, the likely impact on health might also be progressive, thus reducing health inequalities. It has also been shown that, while heavy-consumption consumers may be less responsive to price changes, the impact of a tax on consumption is larger for heavy-consumption consumers, meaning that the health benefits could be higher for these consumers (Gustavsen and Rickersten 2011).

- Thow et al (2011): When a tax's goal is to change economic behaviours (not just collect revenue), the traditional efficiency requirement (that a tax or subsidy impact on economic behaviour as little as possible) is misplaced. Thus, in the case of tax policies geared to achieve health goals, the third dimension is the efficiency of consumer substitution, or whether the tax causes the desired changes in behaviour without causing other, undesirable changes. Of course, in addition to the risk of unforeseen changes in consumer behaviour, another risk is that the tax will not have the intended effect but will instead only provide windfall benefits to those already engaging in the desired behaviour.
- Salois and Tiffin (2010): It is ineffective because wealthy consumers are not very responsive to food prices and because of its regressive nature, which costs the poor relatively more than the rich. The argument is that taxing food would further reduce the disposable income of the poor as taxation is implemented on foods with high percentages of fats, sugar and calories, which are consumed disproportionately by low-income households (Frazao et al 2007). In addition, this policy is unfair because it punishes both those who are obese as well as those who are not.
- The income effect has been mentioned by a number of authors indicating that, if consumers choose to continue to purchase the same food they will have to spend more money, which implies that they may compensate by reducing the amount of healthy foods they buy, such as fish, fruit, and vegetables.

Food environment objective: increase price of EDNP beverages

ACTION:

Taxation of sugar sweetened beverages (SSBs)

Background

Consumption of SSBs & ill health^{45,46,47}

- SSBs lead to weight gain, type 2 diabetes, chronic disease risk factors and dental caries:
- There is sufficient and compelling scientific evidence from a large number of systematic reviews and meta-analyses of good quality prospective (and other) studies that decreasing SSB consumption will reduce the prevalence of obesity and obesityrelated diseases such as type 2 diabetes, and this evidence is for children, adolescents and adults. A dose-response relationship is found in many of the studies, lending support to causality. A number of studies indicate biological plausibility of the positive relationship between SSB consumption and weight as calories in liquid form are not satiating, hence there is a lack of compensation for them.
- There is a direct relationship, independent of body weight, between SSB consumption and coronary heart disease, elevated cholesterol and triglyceride levels, hypertension and metabolic syndrome.
- The association between non-alcoholic fatty liver disease and SSB consumption is so strong that SSB consumption is considered a predictor of this disease.
- Very recent evidence from NSW shows a significant relationship between severe dental caries and sugary drink consumption (soft drinks, fruit juices and sports drinks) among 12–17 year olds.

SSB consumption & weight status

Reviews

- Bes-Rastrollo et al (2013; *review*): Those reviews with conflicts of interest (such as by Forshee et al 2008 and whose data were queried as containing analytical errors by Malik et al (2008)) were five times more likely to present a conclusion of no positive association than those without them (relative risk: 5.0, 95% CI: 1.31–9.3). However, the best large randomised trials support a direct association between SSB consumption and weight gain or obesity.
- Hu et al (2013; *SR*): This review entitled "Resolved there is sufficient scientific evidence that decreasing SSB consumption will reduce the prevalence of obesity and obesity-related diseases" indicated that "taken together, the evidence that decreasing SSBs consumption will decrease the risk of obesity and related diseases such as type 2 diabetes, is compelling."
 - Findings from well-powered prospective cohorts have consistently shown a significant association, established temporality and demonstrated a direct dose-response relationship between SSB consumption and long-term weight gain and risk of type 2 diabetes.
 - A recently published meta-analysis of RCTs commissioned by the World Health Organization found that decreased intake of added sugars significantly reduced body weight (0.80 kg, 95% confidence interval [CI] 0.391–0.21; P < 0.001), whereas increased sugar intake led to a comparable weight increase (0.75 kg, 0.301–0.19; P = 0.001).
 - A parallel meta-analysis of cohort studies also found that higher intake of SSBs among children was associated with 55% (95% CI 32–82%) higher risk of being overweight or obese compared with those with lower intake.
 - Another meta-analysis of eight prospective cohort studies found that one to two servings per day of SSB intake was associated with a 26% (95% CI 12–41%) greater risk of developing T2D compared with occasional intake (less than one serving per month).
 - Recently, two large RCTs with a high degree of compliance provided convincing data that reducing consumption of SSBs significantly decreases weight gain and adiposity in children and adolescents.

⁴⁵The evidence for the relationship between SSBs and health and weight is included as SSBs are a particular "entity". This evidence has been systematically reviewed for the recently revised Australian Dietary Guidelines; more recent evidence is included in this scoping review to add to the findings of this earlier, systematic review. ⁴⁶The evidence for the relationship between SSBs and health and weight is included because SSBs are a particular 'entity'. This evidence has been systematically reviewed for the recently-revised Australian ⁴⁶The evidence for the relationship between SSBs and health and weight is included because SSBs are a particular 'entity'. This evidence has been systematically reviewed for the recently-revised Australian

⁴⁶The evidence for the relationship between SSBs and health and weight is included because SSBs are a particular 'entity'. This evidence has been systematically reviewed for the recently-revised Australia. Dietary Guidelines; more recent evidence is included in this scoping review to add to the findings of this earlier, systematic review.

⁴⁷Note that there is less evidence in the literature regarding the dietary impacts of water. A recent study in the US (Yang & Chun 2015) showed that plain water was beneficial in terms of micronutrient adequacy over other beverages

- Maniadakis et al (2013; *SR*): This systematic review was primarily concerned with the effects of taxes on nonalcoholic beverages but it reports a number of studies related to SSB consumption and weight gain.
 - This review cites two studies not supporting the link with weight gain: research published in 2010 from Queen Margaret University, Edinburgh, UK: SSBs consumed in moderate quantities do not promote short-term weight gain, do not trigger additional carbohydrate intake, and do not generate changes in the moods of overweight women.
 - In 2007, a similar study performed on average-weight women that reached similar conclusions.
 - However these studies were limited time-span experimental studies.
 - This SR suggests that, including the findings of two studies — one a meta-analysis (Forshee et al 2008⁴⁸) and the other a systematic review (Gibson 2008) the hypothetic contribution of SSBs on weight gain perhaps has been overestimated.
- Vartanian et al (2007; *SR and MA*): In a meta-analysis of 88 studies, the study found clear associations of soft drink intake with increased energy intake and body weight. Soft drink intake also was associated with lower intakes of milk, calcium, and other nutrients and with an increased risk of several medical problems (e.g., diabetes). Study design significantly influenced results: larger effect sizes were observed in studies with stronger methods (longitudinal and experimental versus cross-sectional studies). Several other factors also moderated effect sizes (e.g., gender, age, beverage type). Finally, studies funded by the food industry reported significantly smaller effects than did non–industry-funded studies.
- Malik et al (2013; *SR and MA*): Among 32 original articles (prospective cohort studies and RCTs; 20 in children, 12 in adults), this SR and MA provided evidence that SSB consumption promotes weight gain in children and adults.

Recent observational studies among children

- Zheng, Allman-Farinelli et al (2014; NSW, AUS; *longitudinal*): Data from 3 x 24-hour dietary recalls from the Childhood Asthma Prevention Study has shown that consumption of SSBs, in particular, are a significant predictor of childhood adiposity and that replacing SSBs with water, or diet drinks, can have long-term beneficial effects on childhood adiposity.
- Zheng, Rangan et al (2014a; Denmark; *longitudinal*): Data from the Danish part of the European Youth Heart Study (six-year and 12-year follow-up) have shown that SSB consumption in adolescence and changes in SSB consumption from childhood to adolescence are both significant predictors of change in body fat in early adulthood.
- Zheng, Rangan et al (2014b; Denmark; *longitudinal*): This study showed that SSB intake is associated with long term change in body fat in children, and replacing SSB with water or milk, but not 100% fruit juice, is inversely associated with body fat development.
- Bigornia et al (2015; UK; *longitudinal*): Data from the Avon Longitudinal Study of Parents and Children showed that higher consumption of SSBs from ages 10 to 13 years was associated with a larger waist circumference (WC) at age 13 years independent of differences in total adiposity. (Accounting for dietary reporting errors strengthened associations).
- Martin-Calvo et al (2014; Spain; matched casecontrol study): Among children and adolescents, high consumption of SSBs (>4 servings/week) was significantly associated with obesity (OR = 3.46; 95% CI 1.24, 9.62; P = 0.01). In addition, each additional daily serving of SSB was associated with a 69% relative increase in the risk of obesity (OR = 1.69; 95 % CI 1.04, 2.73; P = 0.03). Results suggest a monotonic dose-response linear shape for this association in children and adolescents (P for trend = 0.02).
- Shroff et al (2014; Colombia; cross-sectional): Among 5–12 year-olds, of the food items in the snacking pattern, soda intake was positively and significantly associated with change in BMI (P trend = 0.01) and waist circumference (P trend = 0.04) in multivariable analysis.

⁴⁸Note that this review was funded by the beverage industry and the meta-analysis by Forshee et al (2008) has been shown to contain analytical errors by Malik et al (2008) who showed that the results clearly show a positive association between SSB intake and BMI among children.

SSB consumption & chronic disease/risk factors

- Imamura et al (2015; US and UK; SR and MA): Data from 17 cohort studies showed that higher consumption of SSBs was associated with a greater incidence of type 2 diabetes, by 18% per one serving/day and 13% after adjustment for adiposity. For artificially-sweetened beverages and for fruit juice, percentages were 25% and 8%, and 5% and 7% respectively. Sources of heterogeneity or bias were not seen for SSBs but were seen for artificially-sweetened beverages. For fruit juice the finding was not significant in studies ascertaining type 2 diabetes objectively. The authors indicated that artificially-sweetened beverages and fruit juice were not likely to be healthy alternatives to SSBs for the prevention of type 2 diabetes. The study indicated that, under assumption of causality, among 20.9 million events of type 2 diabetes predicted to occur over 10 years in the USA, 1.8 million would be attributable to SSBs; and of 2.6 million events in the UK, 79 000 would be attributable to consumption of SSBs.
- Keller et al (2015; *SR*): All included studies examining vascular risk factors found direct associations between SSB consumption and change in blood pressure, blood lipid or blood sugar.
- Hernández-Cordero et al (2014; Mexico; *RCT*): This study among 240 women in Mexico showed that replacing SSB intake with water (only partial reduction in SSB intake achieved) was effective in reducing circulating triglycerides and the presence of metabolic syndrome in obese but not overweight women.
- Buhler et al (2013; *SR*): There is a direct relationship, independent of body weight, between SSB consumption and: coronary heart disease, elevated cholesterol and triglyceride levels, hypertension, metabolic syndrome, and type 2 diabetes.
- Abid et al (2009): "The association between fatty liver disease (nonalcoholic) and SSB consumption is so strong that SSB consumption is considered a predictor of this disease."

SSB consumption and dental caries

Skinner, Johnson et al (2014; NSW, AUS; cross-sectional *survey*) using data from the NSW Teen Dental Survey 2010 showed that severe dental caries was found to be significantly related to a variety of factors, including family income, fluoridation status, tooth brushing behaviour and sugary drink consumption. More than 50% of the respondents reported drinking four or more glasses of tap water per day. Eighteen per cent consumed five or more glasses of sugary drinks, and this behaviour was associated with higher levels of dental caries ($\chi 2=12.8$; 5 DF; p=0.02). An important risk factor for dental caries is the consumption of sugary drinks, fruit juices and sports drinks (Honkala et al 1991). The NSW Child Health Survey 2009–2010 reported that 34.8% of 9–15 year-olds drank six or more cups of sugary drinks, cordials or sports drinks per week. The NSW 2008 School Students Health Behaviours Survey found that 35% of males and 26.5% of females aged 12–17 years drank sugary drinks, energy drinks, fruit juice or cordial five or more times per week. Data in this paper show a significant relationship between severe caries and high consumption of sugary drinks, with a similar gender difference to the 2008 School Students Health Behaviours Survey, with males more likely than females to have a high consumption.

SSB consumption and mortality

• The Global Burden of Disease Study (2010) estimated that 300,000 deaths per year were attributable to diets high in SSBs, or about 0.6% of all deaths globally per year.

SSB tax and acceptability

There is generally strong public support for SSB taxation in Australia (and France) with higher support levels if funds are used to fund health programs/systems; there is less public support for taxation of SSBs in the United States.

Australia

- Moretto et al (2014; Brisbane): A citizens' jury conducted in May 2013 to answer the question: "Is taxation on food and drinks an acceptable strategy to the public in order to reduce rates of childhood obesity?" The jurors unanimously supported taxation on ssbs but generally did not support taxation on processed meats, snack foods and foods eaten/ purchased outside the home.
- Obesity Policy Coalition (2013): A survey of more than 1200 adults in 2012 found that 64% of those surveyed were in favour of a tax on soft drinks, and 42% of those surveyed were strongly in favour. In addition, more than half (57%) of respondents were in favour of a tax being raised if it was spent on health programs.⁴⁹
- Morley et al (2012): A random sample of 1511 adults who were the main grocery buyer for their household in June–July 2010 showed that a clear majority of participants (80% or more) were in favour of traffic light FOPL and kJ menu labelling, reformulation to reduce the fat, salt and sugar content of processed foods, and regulation of broadcast and non-broadcast avenues used to market unhealthy food and drinks to children. Relatively less support (two-thirds or more), particularly among lower socioeconomic status participants, was shown for taxation policies (although 71% favoured a tax on unhealthy foods if funds were used to subsidise healthy foods rather than to fund health programs); and controls on food company sponsorship of sports and education programs.
- Worsley & Thomson et al (2011): In this survey, 511
 respondents in Victoria were surveyed to ascertain
 their support for possible government F&V promotion
 policies. The findings suggest that there is a strong and
 widespread support for policies which encourage country
 of origin labelling, local and increased production,
 subsidies, bans and taxes, and communication campaigns.
 The respondents' universalism values (e.g. valuing nature,
 harmony and beauty) were more pervasive predictors of
 their opinions than their demographic characteristics.

United States

- Jou et al (2014; California): The pro-tax messages most frequently mentioned by respondents (18 semistructured interviews with key stakeholders) were reinvesting tax revenue into health-related programs and linking SSB consumption to health outcomes such as obesity and diabetes. The most frequently mentioned anti-tax messages addressed negative economic effects on businesses, and government restriction of personal choice. Factors contributing to perceived messaging success included clearly defining 'sugar-sweetened beverage' and earmarking funds for obesity prevention, incorporating cultural sensitivity into messaging, and providing education about the health effects of SSB consumption.
- Gollust et al (2014): In an internet-survey of 1319 adults, respondents showed the highest support for calorie labelling (65%) and removing drinks from schools (62%), and the lowest support for taxes (22%) or portion size restrictions (26%).
- Niederdeppe et al (2013): Media coverage from 2009–11 included more discrete pro-tax than anti-tax arguments on average. Supportive arguments about the health consequences and financial benefits of SSB taxes appeared most often. The most frequent opposing arguments focused on how SSB taxes would hurt the economy and how they constituted inappropriate governmental intrusion.
- Barry et al (2013): Findings indicated greater public agreement with anti- than pro-tax arguments. The most popular anti-tax argument was that a tax on sugarsweetened beverages is arbitrary because it does not affect consumption of other unhealthy foods (60%). A majority also agreed that such taxes were a guick way for politicians to fill budget holes (58%); an unacceptable intrusion of government into people's lives (53.8%); opposed by most Americans (53%); and harmful to the poor (51%). No pro-tax arguments were endorsed by a majority of the public. Respondents reported highest agreement with the argument that SSBs were the single largest contributor to obesity (49%) and would raise revenue for obesity prevention (41%). The study concluded that without bolstering public support for existing pro-tax messages or developing alternative pro-tax messages, enacting such policies will be difficult. Message-framing studies could be useful in identifying promising strategies for persuading Americans that taxes on sugar-sweetened beverages are warranted.

⁴⁹http://www.Foodprocessing.Com.Au/news/64141-australians-support-junk-food-tax-obesity-policy-coalition-says

France

 Julia Chantal et al (2015): Cross-sectional survey within a cohort study (n=1996) indicated that around 50% of the sample were generally supportive of the January 2012 excise tax on SSBs; and 57.7% perceived it as helpful in improving population health. Support for the tax was higher if the tax model used revenue for healthcare system improvement (72.7%) and if the tax was associated with a corresponding decrease in the prices of other foodstuffs (71.5%). Older persons and those with more formal education were more supportive of the tax. There was no association of level of SSB consumption with perceptions of the tax.

Implementation examples

- <u>US</u>: City of Berkeley, California Measure D applies a tax of US\$0.12 per 12 ounce can (AUD\$0.14 per 350mL). http://www.phrp.com.au/issues/vol2512014/soda-taxpops-staeside/ Ballot measure passed Nov 4, 2014.
- Mexico: 10% per litre October 2013; revenue (estimated at 15 B pesos) is intended for provision of drinking water in schools (from Sturm & An 2014). Since January 2014, SD are taxed at one peso per litre (approximately 8 cents).
- <u>Finland</u>: the excise tax on SD was raised from E0.045 to E0.075/l in 2011.
- France: an E0.0716/l tax on SD, sugar-based and diet, was introduced in January 2012. In 2011, took this approach and passed a beverage tax (1 euro cent per canned drink) that was expected to raise 280 million Euros (\$389 million) in 2012 alone, with one-half of the funds slated for obesity prevention and the remainder to lower social taxes on farm labour (Chriqui et al 2013).
- Zheng et al (2013; <u>US</u>) indicated that 32 states apply sales taxes to SD and eight states apply excise taxes to SD. [cf. Chriqui et al 2013 for more detail on US taxes]
- Fiji: in 2006 introduced an import excise duty of 5% on SD and an excise duty (on locally manufactured SD) of 5 cents/L. These taxes were developed by the Ministry of Finance to compensate for losses due to tariff reductions with trade liberalisation, and the domestic excise tax was subsequently removed due to local SD industry pressure. [in Thow et al 2011]

- Samoa: the excise and import excise taxes on SD were primarily for revenue raising and originated from within the Ministry of Finance. Despite this, there was also a stated aim of improving health, likely due to ongoing promotion of messages on healthy eating from the Ministry of Health. While evidence of impact on consumption is lacking, bottled water (which is not subject to the SD excise tax) is now cheaper than SD in the stores. (in Thow et al 2011)
- Nauru: In contrast, the tax in which was studied a 'sugar levy' of 30% on imported sugar, confectionery, carbonated SD, cordials, flavoured milks and drink mixes (Nauru has no local production) was primarily a health-promoting measure. It was raised by the Minister for Health and designed to shift consumption habits. However, the tax was also implemented in the context of the government seeking alternative sources of income, and significant revenue has been collected via the tax. The retail price of a 375 mL can of SD increased by 20%. (in Thow et al 2011)
- French Polynesia: taxes were implemented on sweetened drinks, confectionery, ice cream and beer, and were marketed as health measures. Their intent was not to lower consumption but to raise revenue for a prevention fund. The funding mechanism was subsequently modified so that the funds from the tax go to the general government budget, and 80% of these funds are then earmarked for the Ministry of Health's general budget. (in Thow et al 2011)
- Chriqui et al (2013; *review*):
 - United States Alabama, Arkansas, Rhode Island, Tennessee, Virginia, Washington, and West Virginia and the cities of Chicago and Baltimore apply excise and equivalent taxes/fees to a broad spectrum of SSB and ASB beverage bottles, syrups, and powders/mixes at the manufacturer, wholesaler, distributor, and/or retailer levels. No revenues have been dedicated to obesity prevention.
 - Several countries have adopted beverage excise or similar taxes/fees including, but not limited to Algeria, Samoa, Belgium, Denmark, Fiji, Finland, France, French Polynesia, Guatemala, Hungary, Latvia, Nauru and Norway. Some tax only SD, whereas others tax all sweetened beverages. They also vary by the type of tax applied (*specific* versus *ad valorem*). We do not know whether any country dedicates the revenues for obesity prevention.

- The second approach applies a sales tax as a percentage of the retail price. We are not aware of any government that applies a sales tax only to SSBs. Sales taxes are generally applied to both SSBs and ASBs as in states in the US that currently apply small taxes to sodas, SD, and other beverages (see Table 1; Appendix). These sales taxes use several approaches, including (i) sales taxes applying to all items sold; (ii) by not including SD (or similar beverages) in the sales taxe applying to a wide variety of beverages.
- We know of no government with a SSB-specific VAT, a VAT, or VAT-like tax (for example, GST or HST), but many tax a broad range of beverages (see Table 5; Appendix). Australia, Canada, Fiji Ireland, and other European Union countries all apply a VAT or VAT-like tax (for example, GST or HST) to beverages. These VAT and VAT-like taxes are applied AD VALOREM, like the excise and sales taxes, but no country currently restricts the VAT to SSBs. The European Union's VAT Directive requires member states to apply a standard rate of at least 15%, but allows a reduced rate for certain categories of goods and services (for example, nonalcoholic beverages are eligible for a reduced VAT). Data from 1 July 2012 indicate that VAT rates applied to SSBs such as lemonade and fruit juices (unspecified) vary greatly by European Union member countries ranging from a low of 3% in Luxembourg to a high of 27% in Hungary (with a mean and median VAT of 16% and 20%, respectively).

Supporting evidence

Price of SSBs and purchasing/consumption

- Price elasticity of demand studies support taxation of SSBs:
 - Price elasticity of demand studies indicate that SSBs or soft drinks have a much higher OPE than many other categories of food/drinks, particularly if diet and sugary versions are considered separately.
 - Various studies, including systematic reviews, indicate that the OPE for sugary soft drinks might be as high as -2.26; although most studies indicate it to be closer to 1.0, the latter indicating a 10% increase in price would reduce consumption by 10%.

- There is a lack of information on cross-price elasticity of SSBs; although one meta-analysis of four studies indicated that higher prices for SSBs were associated with increased demand for fruit juice, milk and diet drinks.
- There is mixed evidence, from simulation modelling studies, as to whether a tax would impact equally, in terms of purchasing/consumption, on higher consumers of SSBs, although recent data from Mexico indicate higher elasticities among households in rural areas, in more marginalised areas and with lower income.
- Two small experimental studies indicate that a tax on SSBs (in one study of 19%) is likely to lead to decreased purchasing of SSBs and substitution with healthier beverages.

Demand/simulation modelling studies

- Colchero et al (2015; Mexico; demand system modeling using survey data for daily food and beverage expenditures for one week): Data from 2006, 2008 and 2010 were used in an almost ideal demand system with linear approximation for beverages and high-energy food by simultaneous equations to derive the own- and cross-price elasticities for soft drinks and for all SSB (soft drinks, fruit juices, fruit drinks, flavoured water and energy drinks). Price elasticity for soft drinks was -1.06 and -1.16 for SSB, i.e., a 10% price increase was associated with a decrease in quantity of soft drinks consumed by 10.6% and 11.6% for SSB. A price increase in soft drinks is associated with larger quantity consumed of water, milk, snacks and sugar and a decrease in the consumption of other SSB, candies and traditional snacks. The same was found for SSB except that an increase in price of SSB was associated with a decrease in snacks. Higher elasticities were found among households living in rural areas (for soft drinks), in more marginalised areas and with lower income. Implementation of a tax on soft drinks or on SSB could decrease consumption, particularly among the poor. The authors indicated that substitutions and complementarities with other food and beverages should be evaluated to assess the potential impact on total calories consumed.
- Ni Mhurchu et al (2013; NZ): Taking into account magnitude of CPE values and their statistical and public health significance, CPEs of greatest potential importance include those between fruit and cakes/biscuits (–0.32 (SE 0.04)), fruit and ready-to-eat food (–0.22 (SE 0.04)), vegetables and cakes/biscuits (–0.24 (SE 0.02)), and cheese/cream and ready-to-eat food (–0.31 (SE 0.05)). Of note is that all these CPEs were less than zero, indicating

that the products are complements i.e. as the price of one rises, purchases of both decrease. Conversely, if the price of one product decreases, purchases of both will increase.

- Thow et al (2014; *SR*): Sixteen studies modelled the effect of price on consumption of SSB taxes that ranged from 5% to 30%:
 - All showed a reduction in consumption of these beverages, ranging from 5% to 48%, demonstrating overall a response in consumption that was proportional to the taxes applied.
 - Of these, four studies that modelled substitution between beverages in response to taxes of 5–20% suggested that consumers would reduce consumption of sugar-sweetened beverages, reducing caloric intake from these beverages by 10–48% in adults and by 5–8% in children, and increase consumption of a variety of other beverages, such as milk, low-calorie beverages, tea, and coffee (*Dharmasena & Capps* 2011; Lin et al 2011; Zhen et al 2011; Fletcher et al 2010). Three of these studies showed an overall reduction in calorie consumption from all beverages due to these taxes, while one study estimated that children will substitute whole milk for soft drinks and thus show no reduction in overall calorie consumption (*Fletcher et al 2010*).
 - Six studies that did not consider substitution with other beverages also found significant reductions in consumption of sugar-sweetened beverages or soft drinks of 10–25% in response to taxes of 10–30% (Bonnet & Requillart 2011; Claro et al 2012; Gustavsen et al 2011; Wang et al 2012; Andreyeva et al 2011; Lopez & Fantuzzi 2012).
- Zhen et al (2014b; US): In the fully modified model, a calorie-based beverage tax was estimated to cost \$1.40 less in compensating variation than an ounce-based tax per 3,500 beverage calories reduced. If applied to products purchased from all sources, a 0.04-cent per kcal tax on SSBs is predicted to reduce annual per capita beverage intake by 5,800 kcal.
- Okrent & MacEwan (2014; US): Estimated a demand system for ten non-alcoholic beverages to disentangle effects of prices, expenditures, advertising, and demographics on demand for non-alcoholic beverages for 1999 through 2010. These authors found that changes

in demographic composition of the population between 1999 and 2008 played a much bigger role in observed purchasing patterns for recently introduced beverages like soy, rice, and almond drinks, isotonic and energy drinks, and bottled water, whereas changes in prices and advertising expenditures largely explained declining demand for milk, regular carbonated soft drinks, and coffee and tea. Between 2008 and 2010, declining demand for most non-alcoholic beverages was largely driven by income-led decreases in expenditures.

- Nghiem et al (2013; US): Overall OPE for the overall category of SD (e.g. soda, fruit juice) has been estimated as -0.79 (Andreyeva et al 2010; SR); however separate calculations for regular and diet soft drinks indicated an OPE of -2.26 for regular SD and -1.27 for diet SD. The differences are attributable to the presence of more immediate substitutes, for example one can swap from sugary to diet SD if the price of (only) sugary drinks increases.
- Maniadakis et al (2013; *SR*): Among the demand studies, nine presented the association between prices and taxes with the consumption of SSBs. These studies indicated that the PE of demand for beverages is in the range of -0.5 to -1.6 depending on the beverage considered, with most of them falling below 1.0. This implies that the percentage changes in the quantities demanded were proportionally lower than the corresponding changes in prices.
- Cabrera Escobar et al (2013; *SR and MA*; own-PE): Articles published between Jan 2000 and Jan 2013 were identified which reported changes in diet or BMI, overweight or obesity, due to a tax on or price change of SSBs. Nine articles were included in the meta-analysis: six were from the US (*Pomeranz 2012, Finkelstein et al 2010, Fletcher et al 2010, Lin et al 2011, Smith et al*
- 2010, Gordon-Larsen et al 2011), and one each from Mexico (Barquera et al 2008), Brazil (Claro et al 2012) and France (Bonnet & Requillart 2011). All showed negative OPE, which means that higher prices are associated with a lower demand for SSBs. Pooled OPE was -1.3 (95% CI: -1.09 to -1.51. Four articles reported cross-PEs, three from the USA and one from Mexico. Higher prices for SSBs was associated with an increased demand for alternative beverages such as fruit juice (0.388; 0.009 to 0.767); milk (0.129; -0.085 to 0.342); and diet drinks (-0.423, -0.628 to -1.219).

- Powell et al (2013; *SR* of recent US studies): Based on the recent literature, the PED (OPE) for SSBs was estimated to be -1.21, i.e. a tax of 20% would reduce consumption by 24%.
- Ni Mhurchu et al (2013; NZ): OPE for carbonated soft drinks⁵⁰ was -1.11, -1.38 and -1.34 for Maori, non-Maori and non-Maori/non-Pacific, respectively; with a mean value of -1.27. The authors indicate that this value should be interpreted cautiously as there was a large standard error and relatively small changes in price over the measurement period. For energy drinks the values were -7.92, -0.93 and -1.04 respectively; i.e. showing an eight-fold difference in price elasticity for energy drinks between Indigenous and non-Indigenous New Zealanders.
- Eyles et al (2012; *SR*): Systematic review of simulation studies; pooled estimates: (1) taxes on carbonated SD: OPE (n= studies), -0.93 (range, -0.06, -2.43), and a modelled estimate of 0.02% (-0.01%, -0.04%) reduction in energy (calorie) intake for each 1% price increase (n = 3 studies; *Andreyeva et al 2011, Dharmasena & Capps 2011, Zhen et al 2011*).
- Andreyeva et al (2010; *SR*): Identified the PE from 160 US-based studies between 1938 and 2007: Overall their results are consistent with customary characterisations of the demand response to food prices as inelastic; all mean PE estimates were below 1.0 and ranged from 0.27 to 0.81. Estimates were relatively more elastic for soft drinks (0.79), i.e. a 10% increase in the price of soft drinks should reduce consumption by 8–10%.
- Wang et al (2012; US; *cited in Thow et al 2014; SR*): A study that used longitudinal data from the Nurses' Health Study to estimate the effect of modelled reductions in soft drink consumption found that a penny-per-ounce tax could reduce soft drink consumption by 15%.
- Sturm & Datar (2011; US): Using individual survey data of grade 5 children and regional food in-store prices (2004) showed that there were no price effects on consumption frequency for SSBs (or fast food), indicating that either price variation is too small to affect children's consumption frequency, or the consumption of SSBs (and fast food) is less price sensitive.
- Andreyeva et al (2011; US): Estimated that a 1 cent / ounce SSB tax could reduce daily caloric intake from 190–200 calories/day currently to 145–150 calories/day, *assuming no substitution* to other (caloric) beverages. Estimate that such a tax would reduce SSB consumption in the US by 24% and generate over \$79 billion in new revenue between 2010 and 2015.

- Gustavsen & Rickertsen (2011; Norway; *household purchasing data*): Using quantile regressions (modelling) on Norwegian household purchase data; showed that a VAT increase from 13 to 25% will have the highest percentage effect among low-purchasing households but the absolute effect is highest among high-purchasing households. Low-purchasing households will reduce their purchases by about five litres while the reduction is almost 20 litres among high-purchasing households. However, the effects among high-purchasing households are not statistically significant from zero. Other things being equal, a reduction of five litres corresponds to an annual reduction of about 0.3 kg of body weight.
- Duffy et al (2010; *cited in Thow et al 2014; SR*): A study based on data from the longitudinal USA Coronary Artery Risk Development in Young Adults found that a tax that increased the price of sugar-sweetened beverages by 10% could reduce consumption by 7%.
- Wilcox et al (2009; US; regression analysis of sales data vs. advertising expenditure, annual comparison 1984–2007): The Consumer Price Index for soft drinks was also significantly related to consumption, but the relationship was negative, indicating that increases in the CPI were associated with decreases in per capita soft drink consumption. Specifically, a unit increase in CPI resulted in a decrease in aggregate consumption by 74,282 gallons a year.
- Gabe (2008; grey lit; US; sales data; cited in Thow et al 2010): Excise tax: US\$0.42/gallon of bottled drinks and US\$4.00/gallon of SD syrup; equivalent to around a 10% tax. SD sales volume decreased by 4.8% and sports drink volume decreased by 3.2%.
- Gustavsen (2005; grey literature; Norway; household purchase data; cited in Thow et al 2010): Doubling of production tax and VAT on SD led to a price increase of 27%. Top 5% of SD consumers decreased consumption by around 44%, or 74 litres/year; lowest SD consumers decreased consumption by 17%, or 2 litres/year.

⁵⁰Included artificially-sweetened soft drinks. Understanding price elasticities for close substitutes is important for food policy analyses.

Experimental studies

- Waterlander et al (2014): The effects of a price increase on SSBs on beverage and snack purchases were examined using a randomised controlled design within a threedimensional web-based (virtual) supermarket (n=102). The trial contained two conditions: experimental condition with a 19% tax on SSBs (to reflect an increase in Dutch value added tax from 6% to 19%); and a control condition with regular prices. Participants in the price increase condition purchased significantly fewer SSBs than the control group (B = -0.90; 95% CI = -1.70 to -0.10L per household per week). There were no significant effects on purchases in other beverage or snack food categories. This means that the higher VAT rate was effective in reducing SSB purchases and had no negative side-effects.
- Yang & Chiou (2010; Taiwan): A small laboratory study involved 108 undergraduate students who were given a certain amount of money and allowed to purchase their choice of a healthy or unhealthy beverage. Increasing the price of a type of beverage was shown to reduce purchases of that beverage type and lead to substitution with the alternative type. There was also a more pronounced response when health-related claims were included on the beverages.

Outcome: energy intake

- Findings are mixed. Observational, longitudinal data in the US has shown that an increase in the price of SSBs is associated with fewer visits to FFOs and that a large increase in the cost of SSBs was associated with lower daily energy intake; however one study showed no association between price of SSBs and consumption frequency. In addition, multiple modelling studies using demand and econometric data generally find that a tax on SSBs would be effective at reducing energy intake from SSBs, but the findings are mixed with regard to substitution effects, hence overall energy intake.
- Data on the effects of SSB price on overall energy and dietary intake are lacking.

Observational/simulation studies

- Zhen et al (2014): A half-cent per ounce increase in SSB prices is predicted to reduce total calories from the 23 foods and beverages but increase sodium and fat intakes as a result of product substitution. "Neglecting price endogeneity or estimating a conditional demand model significantly overestimates the calorie reduction." The predicted decline in calories is larger for low-income households than for high-income households, although welfare loss is also higher for low-income households.
- Tiffin et al (2014; UK): Used a demand model estimated with household-level data on beverage purchases to investigate the effects of a tax on SD consumption. Separate models were estimated for low, moderate and high consumers to allow for a differential impact on consumption between these groups. Applying different hypothetical tax rates, they concluded that understanding the nature of substitute/complement relationships is crucial in designing an effective policy as these relationships differ between consumers depending on their consumption level. Estimated that the overall impact of a SD tax on calorie consumption is likely to be small.
- Finkelstein et al (2013; scanner data): Using the 2006 Homescan panel, estimated the changes in energy, fat and sodium purchases resulting from a tax that increases the price of SSBs by 20% and the effect of such a tax on body weight. In addition to substitutions that may arise with other beverages, the authors accounted for substitutions between SSBs and 12 major food categories. Main findings are that the tax would result in a decrease in store-bought energy of 24.3kcal per day per person. No evidence of substitution to sugary foods and show that complementary foods could contribute to decreasing energy purchases. Despite their significantly lower price elasticity, the tax has a similar effect on calories for the largest purchasers of SSBs. Salty snacks and ice-cream were complements to SSBs.
- Smith, Lin et al (2012; US; *household purchase data*): Estimated that a tax-induced 20% price increase on SSBs could cause an average reduction of 37 calories per day and an average of 43 calories per day for children.

- Eyles et al (2012; NZ; *SR of simulation studies*): Despite heterogeneity in tax rates and effect sizes, the pooled evidence suggests taxes on carbonated SSBs would be associated with beneficial dietary change, and potentially improved health.
- Gordon-Larsen et al (2011; US; *longitudinal*): Used nationally-representative, longitudinal data to examine how community-level food price variation was associated with individual-level dietary intake studies across a large number of counties in the US. Negative binomial regression models predicting the number of fast food meals per week show strong relationships between fast food consumption and prices of fast food and soda that varied by gender and race/ethnicity. The study found a relatively stronger association between food prices and fast food intake for males and relatively greater price sensitivity for soda versus burgers. In the group with strongest associations (black males), a 20% increase in the price of soda was associated with a decrease of 0.25 visits to a fast food restaurant per week.
- Andreyeva et al (2011; US): Estimated that a 1 cent/ounce SSB tax could reduce daily caloric intake from 190–200 calories/day currently to 145–150 calories/day, assuming no substitution to other (caloric) beverages. Estimate that such a tax would reduce US SSB consumption by 24% and generate over \$79 billion in new revenue between 2010 and 2015.
- Miao et al (2013) discusses the likelihood of substitution effects for SSBs citing Smith et al. (2010), Zhen et al. (2011), and Dharmasena and Capps (2011), who found complementarity between regular and diet sodas, evidence that would suggest that a tax on sweetened sodas would not cause substitution toward the low-calorie, diet soda drink. However, Bonnet and Requillart (2011) found that caloric and diet SD are substitutes.
- Zhen et al (2011; US): Suggested that the complementarity between regular and diet soda (i.e. they are not substitutes) stems from estimating household demand. For higher income groups, household size is positively correlated with the estimated cross-price elasticity (CPE). Large households may be buying both types of SD simultaneously.
- Dharmasena and Capps (2011; US): Showed that when both direct and indirect effects of a beverage tax are considered, the effectiveness of a tax on SSBs is reduced as consumers shift to other (caloric) beverages such as fruit juices.

 Duffey et al (2010; US; *cohort*): Using data from the 20year cohort (CARDIA) study, these authors showed that a 10% increase in the price of SD was associated with a -7.2% change in energy in the diet from these drinks. A \$1.00 increase in the price of SD was associated with lower daily energy intake (-124 kcal).

Outcome: health/weight

- Econometric studies using a variety of data including scanner data and household purchase data show mixed effects on weight status, however they do indicate that a volumetric excise tax of 20% is likely to produce the largest weight loss, of up to around 1kg per year, at least in the first year; but these positive weight outcomes are based on models that mainly do not consider substitution to other beverages or foods of high calorific value.
- Two longitudinal observational studies indicate that higher-priced SSBs are associated with a lower likelihood of being overweight.

Observational studies

- Long et al (2015; US): A cohort model used to simulate the impact of a SSB excise tax on BMI of \$0.01/ounce over 10 years, showed that implementing the tax nationally would cost \$51 billion in the first year. It would reduce SSB consumption by 20% and mean BMI by 0.16 units among youth and 0.08 units among adults in the second year, for a cost of \$3.16 per BMI unit reduced. From 2015–2025 the policy would avert 101,000 disability-adjusted life years (DALYs); gain 871,000 qualityadjusted life years (QUALYs) and result in \$23.6 billion in healthcare cost savings. The tax would generate \$12.5 billion in annual revenue.
- Morrissey et al (2014; US; *cohort study*): Early childhood longitudinal study-birth cohort (to five years) data were linked with local food price data in a fixed-effects model. Higher-priced SDs were associated with a lower likelihood of being overweight.
- Ni Mhurchu et al (2014; NZ; household food expenditure data): Used a macro-simulation model based on household food expenditure data and demand elasticity estimated that a 20% tax on SSBs would reduce daily energy intakes by 0.2% (20kJ/day) and avert or postpone 67 (95% uncertainty interval, 60 to 73) deaths from cardiovascular disease, diabetes and dietrelated cancers. This equates to 0.2% of all deaths in New Zealand per year, comparable to the number of annual deaths from cervical cancer (average 58 per year,

2001–10). Furthermore, the impact would likely be larger amongst Maori and Pacific consumers due to their greater responsiveness to changes in food prices, and amongst children and young people due to their higher consumption of such drinks. There would be parallel positive impacts on morbidity (i.e. diabetes, obesity).

- Kristensen et al (2014; US): used a Markov microsimulation model to determine the effect of a \$0.01/ ounce SSB excise tax over a 20-year implementation period. Effect size was determined from cross-sectional studies in the US. The modelling showed that the SSB excise tax would reduce obesity the most among adolescents aged 13–18 years (2.4%). This compared to a 1.8% reduction among children 6–12 years for after school physical activity programs; and 0.9% for a ban on child-directed fast food advertising.
- Sharma et al (2014; UK; scanner data): Demand system modelling and scanner data for different income groups showed that a 20% valorific (sales) tax and 20c/L volumetric tax; that the volumetric tax would result in more per capita weight loss (0.41kg vs. 0.29kg) however for low-income households of heavy purchasers, weight loss of 3.2 volumetric vs. 2.06kg for valoric. Thus the tax burden is lower, and weight reduction is higher under a volumetric tax.
- Finkelstein et al (2013; scanner data): Using the 2006 Homescan panel (scanner data at household level), estimated the changes in energy, fat and sodium purchases resulting from a tax that increases the price of sugar-sweetened beverages (SSBs) by 20% and the effect of such a tax on body weight. In addition to substitutions that may arise with other beverages, the authors accounted for substitutions between SSBs and 12 major food categories. Main findings are that the tax would result in a decrease in store-bought energy of 24.3kcal per day per person, which would translate into an average weight loss of 1.6 pounds during the first year and a cumulated weight loss of 2.9 pounds in the long run. Salty snacks and ice cream were complements to SSBs. Miao et al (2013) reported on Finkelstein et al (2010; US; modelling) indicating that their results show that expanding taxes from only carbonated beverages to all SSBs can reduce weight 60% more as consumers switch to healthier, lower calorie alternatives. This is because the expansion of the tax coverage limits the substitution effect with similar products.

- Maniadakis et al (2013; SR): Only a limited number of the identified studies — six studies and five studies respectively — indicated the association between beverage/food prices and taxes and energy outcomes and they all showed a very small impact. A 10% increase in prices/tax would produce changes of a maximum of 50 calories per day, 450 calories per month, or a weight change of 0.3kg per year.
- Briggs et al (2013; UK): econometric and comparative risk assessment modelling study; a 20% tax on SSBs would result in a 1.3% reduction in obesity, which, given that about 25% of the population are obese, corresponds to about 5% fewer obese people (180,000 people not obese). It would reduce the prevalence of overweight by a further 0.9% (285,000 not overweight).
- Smith, Lin et al (2012; US): Estimated that a tax-induced 20% price increase on SSBs could cause an average reduction of 37 calories per day, or 3.8 pounds of body weight over a year, for adults and an average of 43 calories per day, or 4.5 pounds over a year, for children. Given these reductions in calorie consumption, results show an estimated decline in adult overweight prevalence (66.9–62.4%) and obesity prevalence (33.4–30.4%), as well as the child at-risk-for-overweight prevalence (32.3–27.0%) and the overweight prevalence (16.6–13.7%). Actual impacts would depend on many factors (e.g. substitution effects).
- Lin et al (2011; US): Used different modelling strategies and showed that static model overestimates weight loss from reduced energy intake from taxation of SSBs.
- Duffey et al (2010; US; *longitudinal*): Using data from the 20-year cohort (CARDIA) study, these authors showed that a 10% increase in the price of SD was associated with a -7.2% change in energy in the diet from these drinks. A \$1.00 increase in the price of SD was associated with lower daily energy intake (-124 kcal), lower weight (-1.05 kg) and lower insulin resistance score (-0.42). A \$1.00 increase in the price of both SD and pizza was associated with even larger changes (-181 kcal, -1.65 kg, and -0.45 respectively). The large impact on weight in this study may have been because substitution effects could not be accounted for.

- Brownell & Frieden (2009; US): SSBs are thought to account for 10–15% of calorie intake of children/ adolescents. Estimates a decrease of just one quarter of calories from SSBs would lead to an estimated reduction of 8,000 calories per capita; just over 2 pounds per year for the average individual.
- Schroeter et al (2008; US; cited in Thow et al 2010): 10% tax on SD would lead to a daily weight change of 0.099% in men (0.086 kg) and 0.122% in women (0.091 kg).
 Offering a small subsidy on diet SD reduces calorie intake and weight but not as much as does the soda tax.
- Fantuzzi (2008; US; cited in Thow et al 2010; *household purchase data*): Modelling based on household purchases in US showed that 20% ad valorem tax and 10 US cent/ calorie tax on SD had insignificant impact on body weight, e.g. for Pepsi, 20% tax decreased energy intake by 4,258 calories/year and body weight by 1.22 lb/year; 10 US cent/calorie tax decreased energy intake by 3002 calories/year and body weight by 0.89 lb/year.
- Farra et al (2005; US; cited in Thow et al 2010): Modelling obesity prevalence used to examine effect of 10% excise tax on SSBs. Per capita consumption decreased by 23L (6 gallons)/year, equivalent to a weight loss of 1.4kg (3lb); 4% decrease in obesity prevalence.

Outcome: welfare effect/equity

There are mixed findings from a variety of econometric and simulation modelling studies as to whether a SSB tax is likely to have a negative impact on equity, although the effect is likely to be small.

Observational studies

Sharma et al (2014; UK): Demand system modelling and scanner data (2011) for different income groups in the UK showed that when comparing a 20% valorific (sales) tax and 20c/L volumetric tax, that the volumetric tax would result in more per capita weight loss (0.41kg vs. 0.29kg). However, for low income households of heavy purchasers, weight loss would be 3.2kg for volumetric vs. 2.06kg for valoric tax. Thus the tax burden is lower, and weight reduction is higher under a volumetric tax.

- Ni Mhurchu et al (2013, NZ): Estimated PE values for major commonly consumed food groups in New Zealand, by income and ethnicity. Excluding the outlier 'energy drinks', nine of 23 food groups had significantly stronger OPEs for the lowest versus highest income quintiles (average regression-based difference across food groups 20.3 (95% CI 20.6 to 0.02)). Six OPEs were significantly stronger among Maori; the average difference for Maori: non-Maori across food groups was 20.3 (95% CI 20.5 to 0.00).
- Backholer et al (2014; SR; conference abstract): Studies reporting a change in SSB price on purchases, energy intake, weight, prevalence of obesity and tax burden by socioeconomic position identified nine studies (UK, USA, NZ, Australia, Brazil). Five studies reported a significant effect on the outcome across all income groups with a greater magnitude of effect for lower income groups. Four studies reported equal benefits across socioeconomic status. Four out of the five described the tax as regressive, but the amount paid in tax was negligible for all income groups. One study reported the tax burden as progressive.
- Bonnet & Requillart (2013; France): Simulated the effect of a nine eurocents tax on sugar in SDs and indicated that, ignoring long-term health effects, the tax would have a small negative welfare effect of about 1 euro per person per year.
- Colantouni et al (2012): Indicated that sales taxes on SDs have been demonstrated to be regressive in previous studies (Wang 2010; Lin and Smith 2010; Chouinard et al 2006). In particular, it has been found that soda taxes generate a welfare loss not homogenously distributed across households of different income levels, with poorer consumers being more affected by such taxes (Wang 2010).
Outcome: revenue

Simulation modelling studies indicate that even a relatively small tax on SSBs would provide a large revenue.

Simulation modelling studies

- Basu et al (2014) indicated that the imposition of even small taxes, e.g. VAT (Europe and Canada) and sales tax (US) can generate high revenue. Estimated that national excise tax of 1% per 12-oz SD = US\$1.5B per year.
- Ni Mhurchu et al (2014; NZ): A macro-simulation model based on household food expenditure data and demand elasticity to show that a 20% tax on soft drinks could generate up to \$40 million revenue per year (even allowing for reductions in consumption due to tax) if applied to all carbonated drinks, or about \$30 million if applied only to sugar-sweetened varieties.
- Lin et al (2011; US): Used different modelling strategies and showed that static model overestimates weight loss from reduced energy intake from taxation of SSBs; although 20% tax would generate \$5.8 billion, be regressive, and would only represent about 1% of household food and beverage spending.
- Gabe (2008; grey literature; cited in Thow et al 2010): Modelling study using sales data US. Excise tax: US\$0.42/ gallon of bottled drinks and US\$4.00/gallon of SD syrup; equivalent to around a 10% tax. SD sales volume decreased by 4.8% and sports drink volume decreased by 3.2%. Revenue: US\$ 31.4 million; jobs lost with decreased production.

Evidence of intervention effectiveness

Outcome: purchases / consumption

Sales taxes:

- A field study in the US indicated that a tax of 10% for six months led to a short-term reduction in consumption of SSBs but there was substitution with less healthy options (beer).
- Two out of three studies in the US have indicated that state-level implementation of a very small sales tax on SSBs leads to a moderate reduction in SSB consumption, with one study showing that these were replaced in calorific value by whole milk among children and adolescents.

Volumetric excise taxes:

- One case study in Ireland showed that reducing the volumetric excise tax of SSBs led to an increase in their consumption.
- Preliminary results from implementation of the country-wide volumetric excise tax of approximately 10% of SSBs in Mexico has led to an approximately 10% decline in purchases of the taxed beverages with concomitant increases in purchases of some untaxed beverages and plain water. The effect was largest among lower-income households.

Field experiments

- Wansink, Hanks et al (2012; US): A six-month field experiment was conducted in a small American city where half of the households (of 113 households) faced a 10% tax and half did not. The 10% tax resulted in a short-term (one month) decrease in SD purchases, but there was no decrease in purchases over a three-month or six-month period. Moreover, in beer-purchasing households, this tax led to increased purchases of beer. Therefore, there is a need to investigate unexpected substitutions. Specifically, they found that households that frequently buy beer bought even more beer and households that frequently bought SD purchased even more. Even though they found evidence that the tax triggered sales of water, any health benefit was completely overridden by the additional calories purchased through SD.
- Ibel et al (2013; US): A new store at a large hospital selling healthier and less healthy options/foods and beverages. Baseline with no special labelling or taxation, a 30% tax, highlighting the phrase 'less healthy' on the price tag, and combinations of taxation and labelling. Purchases were analysed over a six-month period. Consumers were 11% more likely to purchase a healthier item under a 30% 'unhealthy' tax and 6% more likely under labelling. By product type, consumers switched away from the purchase of less-healthy food under taxation (9% decrease) and into healthier beverages (6% increase); there were no effects for labelling. Conditions were associated with the purchase of 11-14 fewer calories (9-11% in relative terms) and two fewer grams of sugar. Results remained significant, controlling for all items purchased in a single transaction.
- Block et al (2010; US): In a hospital cafeteria in Boston, Massachusetts; After posting existing prices of regular and diet SD and water during baseline, the authors imposed several interventions in series: a price increase of 35% on regular SD, a reversion to baseline prices (washout), an educational campaign, and a combination price and educational period. Sales of regular SD declined by 26%

during the price increase phase and an increase in sales of diet soda of 20%. This reduction in sales of regular soda persisted throughout the study period, with an additional decline of 18% during the combination phase compared with the washout period. Education had no independent effect on sales. Analysis of the comparison site showed no change in regular SD sales during the study period.

Real world implementation

- Instituto Nacional de Salud Pública (Mexican National Institute of Health) and the University of North Carolina (2015; Mexico; grey literature; preliminary results): The one peso per litre excise tax (approximately 10%) on sugar-sweetened beverages (non-dairy and non-alcoholic beverages) is estimated to have resulted in a 10% decline in purchases of taxed beverages in the first quarter of 2014 compared to the first quarter of 2013. Results also show roughly a 7% increase in purchases of untaxed beverages (such as diet sodas, sparkling and still plain water, 100% juices, flavoured water with non-caloric sweeteners, and milk without added sugar); with an approximately 13% increase in plain water purchases. Purchases of untaxed carbonated beverages (i.e. diet beverages and sparkling water) and other untaxed beverages (i.e. milks and 100% juices) did not change significantly. http://www.insp.mx/epppo/blog/preliminaresbebidas-azucaradas.html Note that other data on the internet indicate a drop in purchases of 6% across 2014, and by as much as 12% in the latter part of the year. The effect was greatest on lower-income households who cut their purchases by an average of 9% across the 12 months and by 17% in the later months. Note: Mexican consumer advocates are calling for a removal of sales tax on bottled water.
- Colantouni et al (2012; US): Used scanner data to examine the effect of two tax events: a 5.5% sales tax on SD imposed by the state of Maine in 1991, and a 5% sales tax on SD levied in Ohio in 2003, and summarised that the 'average' effect of the tax on consumption is nil.

- Sturm et al (2010; US; children): A study of existing statelevel taxes and population consumption data found no significant relationship between sales taxes on SDs and overall children's SD consumption. A stronger relationship was found among those with a high income and high BMI.
- Fletcher Frisvold & Tefft (2010; US; children and adolescents): Results based on state SD sales and excise tax information between 1989 and 2006 and national dietary survey (NHANES) data suggest that SD taxation, as currently practiced in the US (combined sales and excise tax), leads to a moderate reduction in SD consumption by children and adolescents; however this reduction is completely off-set by increases in consumption of other high-calorie drinks (whole milk).
- Tefft (2008; grey literature; cited by Block & Willett 2013): Household purchase data in US regarding state SD tax: SD tax increase of 10% decreased probability of SD expenditure by 0.7%.
- Bahl et al (2003; Ireland): Excise tax on SDs in Ireland reduced from IR£0.37/gallon (which it was from 1980 to 1990) to IR£0.29/gallon (from mid-1990 to Nov 1992 when tax was abolished completely): Case study indicated a 6.8% increase in consumption due to drop in excise tax (indicated that if whole tax reduction had been passed on (some taken up by VAT), increased consumption would have been 15%). Revenue lost was approx. IR£2M per year. The authors found that SD consumption is price elastic, income elastic, and sensitive to weather. However, the study was mainly concerned with losses to revenue.

Outcome: health/weight

Evidence of effects of taxation of SSBs on body weight from real world implementation comes from the US, where relatively low sales taxes have been shown to have a small, if any, impact on weight status. One study, however, showed that US states with no SSB tax and those that repealed a tax were substantially more likely to experience an increase in obesity.

Real world implementation

- Maniadakis et al (2013; SR): "There is no significant effect on obesity-related outcomes, i.e. weight, BMI, and obesity." They concluded that the effectiveness of a taxation policy to curb obesity is doubtful and available evidence in most studies is not very straightforward due to the multiple complexities in consumer behaviour and the underlying substitution effects. This is in accordance with the findings of many studies in the literature⁵¹ (cited Fletcher et al 2010; Waterlander et al 2012; Smith et al 2010; de Castro 1993; Hasselbalch 2010; Bell et al 2005).
- Powell et al (2013; SR): Indicated that, in the US, the studies that linked soda taxes to weight outcomes showed minimal impacts on weight; however, they were based on existing state-level sales taxes that were relatively low.
- Sturm et al (2010; US;): A study of existing state-level taxes and population consumption data found limited effects on BMI, although stronger effects for consumption and BMI were found among those with high income and high BMI.
- Fletcher et al (2010b; US; empirical study): Population data on BMI from the BRFSS (Behavioural Risk Factor Surveillance Survey) and total and incremental soft drink taxes at the state and quarter level from 1990 to 2006 were modelled to show that a 1% tax increase decreased BMI by 0.003 points; and a decrease in obesity and overweight of 0.01 and 0.02 percentage points, respectively. The largest impacts were in low and high income earners at the tails of the distribution and in Hispanic-Americans.

- Powell et al (2009; US; *empirical study*): State-level tax data and repeat, cross-sectional, individual-level data on adolescents showed a weak effect of vending machine soda tax rates on BMI among teens at risk for overweight. A 1% increase in tax was associated with a 0.006 kg/ m2 reduction in BMI among adolescents at risk of being overweight (p=0.09).
- Kim & Kawachi (2006; US; ecological study): This study examined the presence of state-level taxation on soft drinks between 1991 and 1996 and relative changes in obesity prevalence using data from a population survey. There was no association with obesity point prevalence between states with and without a ≥5% tax on SSBs; however, states with no tax were more than four times as likely to experience an increase in obesity. In addition, those that repealed the tax were more than 13 times as likely as other states to experience an increase in obesity.
- Oaks (2005; US; interrupted time series comparison group design): Used obesity prevalence data from national survey data (BRFSS) to show that a state tax of 5.5% (as was implemented in Maine from 1991 to 2001) on soft drinks and snacks was not related to obesity.

Outcome: employment

- There was no negative impact of taxation of SSBs on state-level unemployment in the US (one modelling study using real world data).
- Powell et al (2014; US): A macroeconomic simulation model was used to show that state-level sales taxes for SSBs do not have a negative impact on state-level employment, and industry claims of regional job losses are overstated and may mislead lawmakers and constituents. Declines in employment within the beverage industry occurred but were offset by new employment in nonbeverage industry and government sectors.

⁵¹Note that these studies may not be intervention studies or real world implementation

Implementation considerations — what type of tax?

- The vast majority of experts consider that a volumetric excise tax is the optimal fiscal policy in relation to SSBs. A dose-based tax on the kJ content of SSBs has also been proposed – based on parallel evidence of effectiveness from alcohol dose taxes in South Africa.
- Blecher (2015): Taxes on the dose of alcohol rather than the volume of the beverage may incentivize producers to reduce the volume of alcohol in beverages through the supply side. While specific taxes based on the volume of beverages are likely to reduce the demand for SSBs, policy makers should also consider taxes on alcohol and SSBs that tax the dose of the alcohol and calories in order to create supply-side incentives for producers to lower alcohol and calorie levels in existing products or promote products with lower levels of alcohol and calories.
- Lusk (2014; US): Economically, a tax will be effective only to the extent consumers see it reflected in the retail price. In the United States, where taxes are added at the cash register and are not posted on the shelf, the 'effective' OPE is something much smaller (and thus the anticipated weight impacts of a SSB tax are much smaller) than is suggested by an analysis of the conventional OPE.
- Kaplan & Thow (2013; AUS): A potential avenue for taxation in Australia is through item-specific taxes. The government currently imposes specific excise taxes on tobacco, fuel, petroleum products and alcoholic beverages (not including wine). The government has expressed a disinclination to use targeted excise taxes, saying that "specific taxes should exist only where they improve social outcomes or market efficiency through better price signals" (2011, Canberra). However, a tax on SSBs or junk foods aims to achieve just that goal, and could be administered through the existing framework of either the excise or the wine equalisation taxes.
- Zheng et al (2013): Consideration of SD, tobacco and alcohol, indicates that an excise tax is better than a sales tax. Sales taxes are not very effective in the US probably because the sales tax is not indicated at the shelf, hence consumers are unaware and focus on the posted price when shopping. The study showed that the NYC proposal

of 18% sales tax on SDs was not useful; whereas final proposal by NYC governor was a penny-per-ounce (excise) tax which Zheng et al (2013) showed would be five times more effective than a sales tax.

- Bonnet & Réquillart (2013; France): Taking into account the strategic response of both manufacturers and retailers, these authors simulated the impacts of ad valorem and excise taxes to SDs in France. An excise tax is over-shifted, while an ad valorem tax is undershifted, to consumer prices. An excise tax based on the sugar content of SD is the most effective at reducing SD consumption.
- Buhler et al (2010; Canada): Penny per ounce tax (US) would work out at approx. 3.5¢/100 mL in Canada. Therefore $5 \not c/100$ mL is recommended. With a per volume tax, percent price increase varies depending on the volume for any given product format. For example, a two litre bottle of a cola beverage currently priced at \$1.95 would see a price increase of \$1.00 (50¢/litre) representing a 51% increase in bottle price. In contrast, a 355 mL can of cola currently priced at \$1.10, would undergo a price increase of \$0.18, equivalent to a 16% rise in cost. Although both increases exceed the 10% estimated as necessary to reduce consumption, the added benefit of such a per volume tax is that the cost of the smaller portion size is increased less, potentially favouring purchase of smaller portions. At current consumption rates, a tax of 5¢ per litre would generate revenue of \$6.5 billion annually in Canada. Assuming a 10% decline in consumption, revenue would be closer to \$5.85 billion.
- Faulkner et al (2011; US): Stakeholders considered taxing sugar as an input to caloric sweetened drinks as an alternative strategy to consumer-facing taxes.

Food environment objective: decrease price of healthy food/beverage items

Description

The comprehensive review on fiscal policies by Kaplan & Thow (2013) indicates the following mechanisms or routes by which to make healthier foods cheaper: to farmers; to wholesalers; reduced prices at the point of sale; tax breaks or exemptions for certain goods or certain behaviours; income transfers to low-income families or individuals (income transfers can be either unrestricted, which is government funding for any use, or can be restricted, which is government funding for specific purposes, such as purchasing food and beverages⁵²; subsidies (e.g. vouchers, coupons, loyalty schemes) for healthier foods at retail outlets (particularly F&V, whether fresh, canned, or frozen) either aimed at the retailer creating immediate price reductions, or at the consumer, through later reimbursement; and, subsidised F&V (and potentially other healthy foods) at schools.

In this domain the focus is on:

- Temporary price reductions at point of sale (retail, cafeterias, vending machines)
- Price subsidies/taxes via taxation system
- Use of coupons/vouchers for free or reduced price fruit and vegetables
- Provision of subsidised or free fruit and vegetables in schools.

Supporting evidence

Price of healthy food and purchases/ consumption

There is mixed evidence from econometric studies on the effect of prices of healthier foods such as F&V and less-fatty foods on demand/consumption; although observational data indicate that at least some fruits may be price elastic. Price elasticity of demand studies for F&V indicate an OPE of between -0.35 (systematic review of simulation studies) to -0.32 (longitudinal study) to -0.53 (systematic review and meta-analysis).

Observational studies

Weatherspoon et al (2014a; *demand study*): Examined different methods of determining elasticities: Slutsky (compensated) elasticities represent pure substitution effects while Cournot (uncompensated) elasticities comprise both income and substitution effects. Slutsky OPEs of bananas, oranges and apples were negative and statistically significant; thus, a 1% increase in price would lead to a decrease in purchases by 0.33%, 0.54% and 0.28% respectively. Slutsky OPEs for lemons and all other fruit were very small and not statistically significant, indicating that their own price is not important in the purchasing decision. Slutsky CPE indicated that bananas and oranges, oranges and all other fruit, and apples and lemons, are net substitutes; while oranges and apples have a complementary relationship.

All Cournot OPEs were negative and all but the lemon OPE were statistically significant. Specifically, if their own price increased by 1%, banana purchases would decrease by 0.53%, orange purchases by 0.72%, apple purchases by 0.5% and purchases of all other fruits would decrease by 0.41%. The authors compared results of Durham & Eales (2010) who found an elastic response to price changes for apples, oranges, bananas and grapes in two stores in the Pacific Northwest; although Durham & Eales (2010) found substantially lower expenditure elasticities, particularly for apples and bananas (inelastic). This means that, within the fruit group, income (as determined by expenditures) plays a much more important role in the purchasing decisions of Detroit food desert residents than price compared with consumers more representative of the average American. Econometric estimation of the Rotterdam system of weekly purchase expenditures allowed the analysis of income and price effects at the community level. Expenditures (a proxy for income) play a significant role in determining the purchasing behaviour of consumers. Specifically, if expenditures on the fruit category increased by 1%, expenditures on bananas, oranges, apples and lemons would increase by more than 1%. The results overall indicate that increasing income and/or lowering price will increase the amount of fruit consumed.

- Cornelsen et al (2014; SR and MA; also Green et al 2013). The review and meta-analysis examined OPEs and CPEs⁵³ for low-, middle- and high-income countries. An increase in the price of F&V by 10% led to a reduction in their consumption by 5.3% and to a reduction in consumption of fish, dairy and cereals of 0.15%, 0.3%, and 0.2% respectively. A 10% price increase in dairy products, while reducing consumption of dairy products by 6%, was associated with a reduction in quantities purchased of F&V (0.3%), fish (0.32%), and cereals (0.39%). A price reduction in cereals led to a decrease in cereal consumption of 4.3%, however it was associated with more F&V consumption (0.48%), meat (0.45%), fish (0.75%), dairy (1%) and sweets (0.57%). These substitutions would replace approximately one third of the calories lost from cereal consumption. When combined with data on calorie availability, the reduction in calories from fats and oils due to the price increase was greater than for sweets, as half of the calories reduced from sweets were substituted with cereals, dairy, and F&V.
- Powell, Chriqui et al (2013; *SR*): This review of recent US studies on the price elasticity of demand for SSBs, fast food and F&V showed that PED for F&V was estimated to be -0.49 and -0.48 respectively.
- Juhl & Jensen (2014; Denmark; purchase patterns): Examined purchasing patterns and products' prices: observed discounts between 0% and 20% of the regular price; period 2010–2011. Interestingly, from a public health perspective the findings suggest that there is an asymmetric effect of discounts depending on the fat content of the product. Furthermore, the results point at two classes of consumers where the asymmetric effects go in different directions. The types of consumer differ along a number of dimensions, but in particular they differ on the effect of the discount depending on the type of product. Compared to the results in Talukdar & Lindsey (2013). Three classes have very different purchasing patterns: class 1 (richest) primarily buy fatty yoghurt with fruit; class 2 buy low fat products; class 3 buy cheapest. Interaction between fat content and discount price: no effect in class 3. Households in class 3 react to discounts but not differently for fat content — they buy cheapest in nearly all instances. For class 1, discounts on low-fat product may lead to switching. Class 2 is the opposite —

they typically purchase low-fat but a discount on full-fat product may tempt them to switch. The overall conclusion is that discounts have an immediate effect on brand choice, but the effect is different across sociodemographic classes 1 and 2. Results indicate that it is easier to change the consumption pattern from fatty products to low-fat ones than vice versa by changing the relative prices.

- Talukdar & Lindsey (2013; US; scanner data) presents a study based upon analysis of extensive scanner data and a controlled experiment in a supermarket. They focus on effects of price changes both for healthy and unhealthy products and allow for and find asymmetric responses to a price increase and decrease respectively. Their conclusion is that for unhealthy food (e.g. potato crisps, white bread), consumer's demand response sensitivity is greater for a price decrease than that for a price increase, relative to the last purchase price, and for healthy products (e.g. grapes, raisins) they find the opposite pattern. The analysis was based upon individual transaction data for 52 consecutive weeks. Eight categories were studied.
- Weatherspoon et al (2013; US; scanner data): Using register data from a non-profit greengrocer in Detroit one of America's largest and most severe food deserts — expenditure and price elasticities of fresh fruits were estimated; showed that cost was likely to play a major role in determining fruit demand; food desert consumers were found to be more price responsive than the average US consumer.
- Eyles et al (2012; SR): Systematic review of simulation studies showed that pooled estimates were possible for subsidies on F&V: OPE (n=3 studies), -0.35 (-0.21, -0.77).
- Sturm & Datar (2011; US; cross-sectional): An observational study using individual-level survey data of grade 5 children and regional in-store food prices. Study showed that lower real prices for F&V predict significantly higher intake frequency.

⁵³The authors indicate that they analysed uncompensated CPEs allowing for substitution and income effects and because these effects act in opposite directions, the elasticity estimates are more likely to tend towards zero. It is indicated that compensated elasticities would provide a better understanding of pure substitution effects within countries, unless price increases exceed income growth. Another explanation for the small CPEs is that nationally representative data were used, combining the preferences and tastes of various consumer populations with different levels of accessibility and affordability. Averaging across these groups leads to combining income, substitution and complementarity effects that act in opposite directions and could therefore lead to small overall values. Tiffin et al (2011; UK; grey literature): National Food Survey 2000 reports estimates of elasticities of demand using Family Food module of the Living Costs and Food Survey. The application of the dynamic Almost Ideal Demand System (DAIDS) to the seven main food groups including dairy & egg products, meat, fish, fats and starches, fruit, vegetables and alcohol, finds that expenditure shares for all food groups except meat are affected by seasonality. Furthermore, they found that if the prices of fruits and nuts, alcohol; and dairy and egg products increase, consumers appear to continue buying these products out of habit despite their higher prices and they only make the effort to look for cheaper alternatives in the long run. Another finding is that as food expenditure rises, demand for meat and alcohol rises, whereby the demand increase is stronger in the long run than in the short run. The converse is true in the case of the fish, fruits and nuts and vegetable group, demand for which increases more in the short run then in the long run if food expenditure rises.

In part II of the project the authors estimate the household level Almost Ideal Demand System (AIDS) using Family Food Module of the Living Costs and Food Survey data for the years 2001/02 to 2009. The household level AIDS measures the extent to which food price differences influence differences in food consumption between households that are identical in all respects other than the price they face or the food expenditure they have at their disposal. The authors find that differences in the own prices of fruits and vegetables tend to have a stronger effect on fruit consumption than on vegetable consumption. We find that the diet of households who face a lower price for fresh vegetables is better in terms of quantity of fresh vegetables consumed than that of identical households that face higher prices for fresh vegetables. The same applies but to a lesser extent to the price of fresh fruits and fruit consumption. Furthermore, households increase their consumption of fish and meat products at the expense of their fruit consumption: if faced with lower prices for fish and meat products. If faced with higher prices for fresh fruits, consumers substitute them with canned fruits and juice and likewise if faced with higher vegetable prices they substitute them with canned produce. The expenditure elasticities reveal that differences in income and therefore in food expenditure result in comparatively larger differences between households in terms of their consumption of vegetables and comparatively smaller differences between households in terms of their consumption of fruits. Overall, compared to other food groups income has a relatively small impact on the composition of households' diet with regard to F&V.

• Steenhuis et al (2011; The Netherlands): The study was carried out in POP settings, i.e. supermarkets, fast-food restaurants and sports canteens (adults n=159). This qualitative study indicated that price is an important factor in food choice, especially for low-income consumers. Low-income consumers were significantly more conscious of value and price than higher-income consumers. The most attractive strategies, according to the consumers, were discounting healthy food more often and applying a lower VAT rate on healthy food.

Experimental studies

- Four laboratory-based experimental studies in a simulated environment, and one 'willingness-topay' survey, examining the effect of price subsidies on healthier foods showed mixed findings in terms of purchasing, indicated effectiveness may differ according to socio-demographic factors such as age, income, and peer-pressure (and one study indicated that subsidies might increase socio-demographic inequalities in health).
- Nordström & Thunström (2015; Sweden): A study using the contingent valuation method (CVM) involving an internet-based guestionnaire and choice experiment (500 respondents) indicating willingness-to-pay for a Keyholelabelled healthy meal (low in fat, sugar, energy, salt and high in fibre; per portion) showed that to get the majority of individuals to choose the healthy option regularly it would be necessary to alter the relative price between healthy and less healthy meals. Generally groups of individuals with a poor nutritional intake require a larger compensation (subsidy) before they choose the healthy alternative. About one-third of respondents would choose the healthy option regularly if the prices for a healthy and less healthy meal were the same. The study showed that groups with a generally poor nutritional intake (men and individuals with lower education and lower income) would gain health benefits from a subsidy of Keyholelabelled meals.
- Darmon et al (2014; US; *experimental economics*): Women from low- (n=95) and medium-incomes (n=33) selected a daily food basket, first at current prices and then at manipulated prices. The redistributive effects of experimental conditions were assessed by comparing the extent of savings induced by subsidies and of costs generated by the tax on the two income groups. At baseline, low-income women selected less expensive and less healthy baskets than medium-income ones. After price manipulations, expenditures for both income groups decreased significantly, whereas the nutritional

quality improved (ED decreased and mean adequacy ratio increased). Additionally the redistributive effects were less favourable for low-income women and their nutritional quality improvements from baseline were significantly lower. In summary, low-income women derived fewer financial and nutritional benefits from implemented food subsidies and taxes than medium-income women; suggesting that food price policies may improve diet quality while increasing socio-economic inequalities in health.

- Streletskaya et al (2014; US): Using a laboratory experiment with 258 adult non-student participants, examined whether unhealthy foods taxes, healthy foods subsidies, anti-obesity advertising, and healthy foods advertising have an impact on changing consumers' choices of lunch items and the nutrient content of their choices for a selected meal. The results indicate that the unhealthy foods tax, healthy foods advertising, and unhealthy foods tax combined with anti-obesity advertising significantly reduced the content of some nutrients of concern, such as calories, calories from fat, carbohydrates, and cholesterol in meal selections. The authors also found that when combined with a healthy foods subsidy, the healthy foods advertising had very little effect on nutrient consumption; the anti-obesity advertising on its own is not efficient at changing dietary behavior.
- Giesen et al (2012): Laboratory experiment investigated the effect of taxing high-ED products and subsidising low-ED products on changes in calorie consumption. Contrary to the hypothesis, results showed that 'more impulsive' individuals adjusted their calorie consumption with regard to price changes whereas 'less impulsive' participants were less influenced by price changes. Furthermore, taxing high-ED products was more successful in reducing calorie consumption than subsidising low-ED products. Note that this study was among healthy weight undergraduates which have been shown to not be a representative group.
- Salvy et al (2012): Laboratory study to examine the influence of taxes and subsidies on youth's snack food purchases when alone and when with peers; 12–14 year olds. Changed price by 25% and 50%. In both experiments purchases of unhealthy snacks decreased and purchases of healthy snacks increased when the price of unhealthy snacks were taxed (increased). In experiment 1 (alone), participants did not purchase more healthy snacks when the prices of these snacks were subsidised (decreased). However, in experiment 2 (when participants were in the presence of a peer), participants purchased more healthy snacks when these snacks were subsidised.

Price of healthy food and weight/health

Abundant evidence from longitudinal studies and time series data in the US indicate positive associations between the price of F&V and a healthy weight among children: one study showed an association with improved diet quality and health outcomes.

Observational studies

- Morrissey et al (2014; US; *early childhood longitudinal study-birth cohort*): Higher-priced F&V are associated with higher child BMI, and this relationship is driven by the prices of fresh (versus frozen or canned) F&V. They also found that a rise in the real price of F&V leads to increased obesity. They concluded that policies that reduce the costs of fresh F&V may be effective in promoting healthy weight outcomes among young children.
- Powell et al (2013; *SR*): This review of recent US studies on the price elasticity of demand for SSBs, fast food and F&V showed that lower F&V prices were generally found to be associated with lower body weight outcomes among low income children and adults, suggesting that subsidies that would reduce the cost of F&V for lower socioeconomic populations may be effective at reducing obesity.
- Rahkovsky & Gregory (2013; US; not indicated): Prices of vegetables, processed foods, whole milk and whole grains are significantly associated with blood cholesterol levels. Having analysed the costs and benefits of government interventions, the authors found that a subsidy of vegetables and whole grains would be an efficient way to reduce cardiovascular disease expenditures.
- Powell & Bao (2009; US; *longitudinal data*): Using repeat cross-sectional data in 1998, 2000, and 2002 from the 1979 cohort of the National Longitudinal Survey of Youth and food price data, the authors showed that a 10% increase in the price of F&V was associated with a 0.7% increase in child BMI. The associations of F&V prices with BMI were significantly stronger both economically and statistically among low- versus high- socioeconomic status children. The estimated F&V price-elasticity was 0.14 and 0.09 among low-income children and among children with less educated mothers, respectively.

- Beydoun et al (2008; US; *longitudinal dietary survey data*): F&V price index was positively associated with improved dietary quality as well as in terms of lower cholesterol and sodium intakes, and lower BMI.
- Sturm & Datar (2008; US; *cited in Faulkner et al 2011*): *Early childhood longitudinal study data in the US*; followed up on 2005 study below by including fifth grade students. Found that one standard deviation increase in the price of F&V increased children's BMI by 0.09 units by third grade and 0.18 units by fifth grade. Their results suggest a consistent long-term effect of F&V prices on children's weight outcomes.
- Powell et al (2007; US; repeat cross-sectional data): Among adolescents from 1997–2003, the price of F&V (and restaurant outlet density) were less important determinants of adolescent body weight and eating habits than fast food prices, although these variables typically have the expected sign and are often statistically associated with the outcome measures.
- Sturm & Datar (2005; US; early childhood longitudinal study data): Over four years and merged individuallevel data on metropolitan data on food prices. Lower real prices for F&V were found to predict a significantly lower gain in BMI between kindergarten and third grade; half of that effect was found between kindergarten and first grade. Lower meat prices had the opposite effect, although this effect was generally smaller in magnitude and was insignificant for BMI gain over three years (by 0.11 by third grade). Differences across subgroups were not statistically significant due to smaller sample sizes in subgroup analyses, but the estimated effects were meaningfully larger for children in poverty, children already at risk for overweight or overweight in kindergarten, and Asian and Hispanic children. There were no significant effects for dairy or fast food prices, nor for outlet density. The geographic variation in F&V prices is large enough to explain a meaningful amount of the differential gain in BMI among elementary school children across metropolitan areas.

Modelling studies

- Modelling (largely predictive, simulation modelling) studies indicate improvements in various dietary, health and weight outcomes from tax subsidies of healthier foods.
- Ni Mhurchu et al (2015; NZ): Using an econometricepidemiological (data from household expenditure, demand elasticities, and population impact fractions) simulation modelling study, a 20% subsidy on fruit and vegetables would result in 560⁵⁴ deaths prevented or postponed (DPP) each year (1.9% all-cause mortality).
- Veerman & Cobiac (2013; AUS): From estimates of the PE of demand for fruits and vegetables in the United States, estimated that fruit consumption would decline by 4.9% (95% CI, 2.6%–8.1%) and vegetable consumption by 4.8% (95% CI, 2.6%–7.2%) with removal of the current 10% GST exemption. The model assumes a reduction in F&V consumption is associated with an increase in the incidence of ischaemic heart disease (IHD), ischaemic stroke, and cancer of the lung, oesophagus, stomach and colon. Calculated that adding GST to F&V could cost about 10,000 healthy life-years over the lifetime of the 2003 Australian adult population, due to an additional 90,000 cases of IHD, stroke and cancer. This extra disease burden could add a billion dollars in health care costs over the same period.
- Dong & Lin⁵⁵ (2009; US): 10% subsidy F&V for people on low incomes. Household fruit consumption increased by 2.1–5.2% and vegetable consumption, by 2.1–4.9%. Cost: US\$308 million for fruit subsidy, US\$274 million for vegetable subsidy.
- Nnoaham et al (2009; UK): Extend 17.5% VAT to (iii) unhealthy foods, with 17.5% F&V subsidy; (iv) unhealthy foods, with all tax revenue going to a F&V subsidy; results in (iii) up to 2900 CVD and cancer deaths averted per year; (iv) up to 6400 CVD and cancer deaths averted per year. All policies would be economically regressive and positive health effects would not necessarily be greater in lower income groups.
- Schroeter et al (2008; US): 10% (iii) subsidy for F&V; (iv) subsidy for diet soft drinks = daily weight changes (iii) 0.222% increase: 0.193kg in men and 0.166kg in women; (iv) 0.071% decrease.

⁵⁴Note that this is less one-third to a quarter fewer DPPs than for a simulated 20% tax on major sources of dietary fat and sodium, respectively (see same article referenced in taxation section). ⁵⁵Data from Thow et al (2010) review of the effect of fiscal policy on diet, obesity and chronic disease.

- Nordström & Thunström (2007; Sweden): Removal of VAT plus subsidy for healthy grain products. 50% subsidy required to increased fibre intake to recommended level; 114% tax on bakery and ready-to-eat products could fund this subsidy. Increased fat, salt and sugar intake.
- Jensen & Smed (2007; Denmark): Fibre subsidy: Small changes in targeted nutrient and food consumption. Best scenario: revenue-neutral subsidy on fibre and tax on saturated fats and sugar. Sugar consumption decreased 6.5%, fat consumption decreased 2.5%, saturated fat consumption decreased 3.6%, and fibre consumption increased 6.5%.
- Smed et al (2007; Denmark): VAT on F&V halved. The following modelling scenarios were all scaled to have an equivalent effect on consumers as the above VAT reduction: fibre subsidy; More effective to target nutrients than foods. Best scenario: saturated fat and sugar tax plus fibre subsidy resulted in a sugar consumption decrease of 16%, saturated fat consumption decrease of 8%, and increased fibre consumption of 15%. Younger consumers and lower income groups responded more, especially in saturated fat consumption.
- Cash et al (2005; US): Subsidy to decrease F&V prices by 1% would prevent 6,733 cases of coronary heart disease and 2946 cases of ischaemic stroke. Average cost per life saved would be US\$1.29 million.
- Asfaw⁵⁶ (2007; Egypt): Empirical-ecological study; Food subsidy program: 1% price increase in bread decreased BMI by 0.12%; 1% price increase in sugar decreased BMI by 0.11%; 1% price decrease in F&V decreased BMI by 0.09%; 1% price decrease in eggs and milk decreased BMI by 0.14%. Cost US\$1.1 billion in 1997 values. Estimated elasticities reveal that mothers' BMI is inversely related to the price of subsidised, energy-dense food and directly to the price of a high diet quality but with expensive food items suggesting that the program aggravates obesity by lowering the direct costs of becoming obese.

⁵⁶Cited by Thow et al (2010)

ACTION:

Temporary price promotions (discounts) to increase purchase and consumption of healthier foods

Background

- Ailawadi et al (2009; cited in Hamlin et al 2012): price promotion represents the industry's largest single marketing budget, with over double the expenditure relative to advertising. Price promotions in the shape of temporary price discounts are the majority of the promotional budget. The scale of this activity supports a very large body of research literature on price promotions and related consumer behaviours — heavily oriented towards the use of historical time series/scanner data.
- Basch et al (2012; US): In a descriptive study of popular fast food outlets in NYC, the authors indicate the healthiest meal item to be significantly higher in price than less nutritious meal items available for \$1.00, with the mean cost differential equal to \$4.33. Window promotions generally advertised less healthful menu items, which may aid in priming customers to purchase these versus more healthful options.
- Vermeer et al (2010): Marketers also reduce the relative price of food by offering quantity discounts with larger package sizes or multi-unit packs, which is a powerful driver of supersizing.
- Exum et al (2014; US): Buy one get one free (BOGOF) and meal deals likely to be largely composed of 'empty calories' and very low in vegetables, fruit, and dairy.
- Cameron et al (2014; ANZOS poster): A comparison of the content of catalogues of four Australian supermarket chains indicated that, of all foods advertised in the catalogues, 26.4% were from the five core food groups (AGHE), while 33.4% were discretionary foods. The remaining 40.1% of foods did not fall into the two defined categories.

Supporting evidence

Outcome: purchases/consumption

- Evidence from scanner data across a wide range of products indicate that sales (mainly price) promotions lead to increased category purchases (which may link to long-term increased consumption due to repeat purchasing); however the evidence from sales data is not specifically related to healthier foods.
- More recent observational data (two studies one population level in Great Britain, one small sample of low-income shoppers in the US) suggest that sales of some healthier foods such as low fat yoghurt and fruit, may be increased by price discounts; however the effect of price discounts on sales varies by food type and also depends on the type of consumer according to food/product-type.

Observational studies

Nakamura et al (2015; Great Britain; hierarchical regression analysis; scanner data): This study analysed data on purchases of 11,323 products within 135 food and beverage categories from 26,986 households in Great Britain during 2010. Healthiness of products was determined using a nutrient-profiling model. A total of 6,788 products (60%) were in healthier categories and 4,535 products (40%) were in less-healthy categories. There was no significant gap in the frequency of promotion by the healthiness of products neither within nor between categories. However, after controlling for the reference price, price discount rate, and brand-specific effects, the sales uplift arising from price promotions was larger in less-healthy than in healthier categories. A 1-SD point increase in the category mean NP score, implying the category becomes less healthy, was associated with an additional 7.7 percentage point increase in sales (from 27.3% to 35.0%; P < 0.01). The magnitude of the sales uplift from promotions was larger for highersocioeconomic status (SES) groups than for lower ones (34.6% for the high-SES group, 28.1% for the middle-SES group, and 23.1% for the low-SES group). Finally, there was no significant SES gap in the absolute volume of purchases of less-healthy foods made on promotion. It was concluded that attempts to limit promotions on less-healthy foods could improve the population diet but would be unlikely to reduce health inequalities arising from poorer diets in low-socioeconomic groups.

- Phipps et al (2014; US; purchase data): Among 82 low-income shoppers of primarily African-American background, supermarket purchase data showed that, in analyses of 6,493 food purchase transactions over 65 weeks, the odds of buying foods on sale versus at full price were higher for high-calorie foods, specifically grain-based snacks, sweet snacks, and sugar-sweetened beverages (OR: 6.6, 5.9, and 2.6, respectively; all P < .001) but not for savoury snacks. The odds of buying foods on sale versus full price were not higher for any of the low-calorie foods (F&V, low-fat milk) (P >/= .07). Without controlling for quantities purchased, the authors found that spending increased as percentage saved from the full price increased for all high calorie foods and for F&V (P < = .002). When shoppers bought foods on sale, the mean discount varied from 3.9% off the full price for sweet snacks to 37.9% for SSBs, and 43.8% for low-fat dairy, although low-fat dairy products were infrequently purchased. Shoppers spent more on average in a food category as the amount they saved in that category increased for F&V and for all HFC categories, suggesting a win-win situation for healthier products. However, the purchase data show that the response to sales of F&V was to spend more through purchasing larger quantities or more costly varieties that became affordable when on sale, than to increase purchase frequency. The study suggested that the price discounts for fruit, in particular, were not sufficient. Focus group participants emphasised the lure of sale items and took advantage of sales to stock up.
- Evidence of impact of sales promotions from studies of scanner data were reviewed by Hawkes (2009). She concluded that there is evidence that sales promotions - primarily, but not restricted to, price promotions - can encourage consumers to change their consumption⁵⁷ patterns. The evidence in the academic literature to support this theory remains somewhat limited: evidence is only available on the increased-category-consumption effect, and the studies do not measure the impact on actual dietary intake or dietary precursors, relying on analysis of sales data. There is also some ongoing debate in the literature regarding the extent of the categoryconsumption effect, and whether the effect persists over the longer term. But, overall, there does seem to be consensus that sales promotions can lead to increased category consumption over the short-term. Gaps in the evidence were summarised as follows:
 - Studies that explicitly aim to measure the effects of sales promotions on the consumption of EDNP foods, relative to more nutritious foods like F&V.

- Effects of the promotions often used to target EDNP foods to children and youth, such as collector and prize promotions.
- Effect of sales promotions on 'product substitution' between nutritious and less nutritious foods.
- Examination of whether people with unhealthy diets or overweight/obese people are more prone to respond to sales promotions.

Evidence from price promotions specifically was from the following cited studies:

- Bell et al (1999): examined a random sample of 250 participants shopping in three supermarkets for a range of food and non-food products; 78 weeks.
 25% of sales arising from price promotions were from increased category consumption. Consumers purchased greater quantities of the products when on promotion and consumed them faster. Note: Using a different method of measuring sales, van Heerde et al (2003) concluded that Bell et al (1999) underestimated the increased-category-consumption effect, suggesting that it explains 75% of the recorded sales increase, not 25%.
- Nijs et al (2001; The Netherlands): Price promotions led to increased category consumption for 58% of 560 products during an average period of 10 weeks; the study covered four years of data.
- van Heerde et al (2003, 2004): Approximately onethird of the sales increase caused by price promotions for peanut butter and tuna resulted from people purchasing more. Price promotions supported by feature and display promotions had a larger effect on increased category consumption than price promotions alone.
- Mela et al (1998) found that the greater exposure of consumers to price promotions made them less likely to expand their increased category consumption over the longer term.
- Martinez & Montaner (2006) and Huff & Alden 1998):
 Price-conscious consumers are the most 'deal-prone' and those that are more deal-prone are not necessarily those with lowest income; tending to be related to the impulsiveness and innovativeness of the shopper, how much they enjoy shopping, and whether the shopper uses a shopping list.
- Pauwels et al (2002; cited in Hawkes 2009): Sales promotions are expected to increase consumer price sensitivity and decrease brand equity over time. It leads to a negative relationship between sales promotions and brand loyalty.

⁵⁷Hawkes (2009) highlights that, although she uses the term 'consumption' in her review, the evidence from scanner data only relates to sales/purchases

• Neslin & Van Heerde (2009; cited in Hawkes 2009): However, it has now become clear that temporary sales promotions can lead to a significant increase in consumption.

Experimental studies

- Evidence from a substantial number of choice experiments in simulated / virtual shopping scenarios and online supermarkets indicate that temporary price reductions may increase purchases of F&V and other less energy dense foods.
- There is mixed evidence as to whether this effect was associated with an increase in overall calories purchased (with the evidence tending towards increased energy purchased).
- There is some evidence from choice experiments and small-scale pricing experiments in the laboratory that a thin subsidy combined with a fat tax is likely to be more effective than either alone.
- Epstein et al (2015; US): Among 199 female shoppers exposed to an experimental store, a tax of 12.5% or 25% on selected low nutrient dense foods (SSBs, candy, salted snacks) led to a reduction in calories 'purchased' of taxed foods and a subsidy of the same amount on fruits and vegetables and bottled water led to a decrease in the calories 'purchased' for subsidized foods, but there was no overall effect on total calories purchased.
- Disantis et al (2014; US): Choice experiments using hypothetical supermarket shopping scenarios among 65 low- and middle-income black women in US. Compared with a price that was 35% lower, the regular price was associated with a lesser propensity to purchase foods in all categories (frozen vegetables, bread, chips, soda, fruit drinks, chicken and cheese) (β = -0.33 to -0.82 points on a 1 to 5 scale). Other attributes, primarily calorie content/healthfulness, were more influential than price for four of seven foods. The moderating variable most often associated with propensity to pay the regular versus lower price was the reported use of nutrition labels. Price reductions alone may increase purchases of certain lowercalorie or more healthful foods by black female shoppers. In other cases, effects may depend on combining price changes with nutrition education or improvements in other valued attributes.

- Papoutsi et al (2013; Greece): Small-scale choice experiment in the laboratory and modelling: Experiment involved 25% increase/decrease on market price of three product categories: chocolate milk beverage, cheese and yogurt. For each of these there was a healthier and a less healthy choice. Information provided via descriptive label at top of screen. Examined pester power by involving/ not involving children in parent choices. Two different products of same brand (e.g. cheese) one healthier than the other. Three price levels. Real choice — had to buy at the end (deducted from participation fee).
 - Concluded that healthier choices can go up to 83% of all choices when a fat tax and a subsidy are combined, when subjects receive information about fiscal policies, and children cannot exercise pestering power.
 - When information about fiscal policies is provided and there is pestering power, healthier choices go down to 71%.
 - Even when information is not available and the child is present (the two factors that favour unhealthier purchases), the combination of a fat tax and a subsidy produce the largest percentage of healthier choices when compared with the other fiscal policies (28%).

Results from the lab experiment suggest that:

- implementing a fat tax and a subsidy simultaneously can nudge parents to choose healthier food products
- providing information regarding the food fiscal policies in place can further increase the impact of the intervention
- kid's pestering power is one of the causes of the policies' moderate effectiveness as it strongly affects parents in making unhealthier choices.
- Waterlander et al (2013: The Netherlands): An experiment with a 3x3 factorial design was conducted, including: three levels of price reduction (10%; 25%; and 50%) x three labels ('special offer', 'healthy choice' and 'special offer & healthy choice') on healthy foods defined following the Choices front-of-pack nutrition label. N=109 participants completed the experiment by conducting a typical weekly shop for their household at a three-dimensional web-based supermarket. Participants receiving a 50% price discount purchased significantly more healthy foods for their household in a typical weekly shop than the 10% discount (+8.7 items; 95%CI = 3.8-13.6) and the 25% discount group (+7.7 items; 95%CI = 2.74-12.6). However, the proportion of healthy foods was not significantly higher and the discounts led to an increased amount of energy purchased. No significant effects of the labels were found.

- Waterlander et al (2012a; The Netherlands): An RCT with two research conditions was conducted: a control condition with regular prices (n=52) and an experimental condition with a 25% discount on F&V (n=63). The experiment was carried out using a threedimensional web-based supermarket. Participants received a fixed budget and were asked to buy weekly household groceries at the web-based supermarket. The purchased amount of F&V was significantly higher in the experimental condition compared to the control condition (change of 984g / household / week, p=0.03) after appropriate adjustments. This corresponds to a 25% difference compared to the control group. Both groups had similar expenditures in unhealthier food categories, including desserts, soda, crisps, candy and chocolate. Furthermore, both groups purchased an equal number of food items and an equal amount of calories, indicating that participants in the discount condition did not spend the money they saved from the discounts on other foods than F&V.
- Waterlander et al (2012b; The Netherlands): An RCT with three levels of price reduction on healthy foods (no; 25%; 50%) x three levels of price increase on unhealthy foods (5%; 10%; 25%) factorial design was used. One hundred and fifty participants were randomised into one of nine conditions and were asked to purchase groceries at a web-based supermarket. Subjects receiving 50% discount purchased significantly more healthy foods than subjects receiving no discount (mean difference=6.62 items, p<0.01) or 25% discount (mean difference=4.87 items, p<0.05). Moreover, these subjects purchased more vegetables (mean difference=821 g; p<0.05 compared to no discount). However, participants with the highest discount also purchased significantly more calories. No significant effects of the price increases on unhealthy foods were found.
- Giesen et al (2012; The Netherlands; *internet supermarket choice experiment*): Contrary to the author's hypothesis, 'more impulsive' individuals adjusted their calorie consumption with regard to price changes whereas 'less impulsive' participants were less influenced by price changes. Impulsives buy more calories from energy dense food when low-energy dense food is subsidised. Low-impulsives buy more calories from low-energy dense food if these are subsidised. Taxing energy-dense products was more successful in reducing calorie consumption than subsidising low-energy dense products.

- Nederkoon, Havermans et al (2011; The Netherlands; internet supermarket choice experiment): study examined whether a high tax on energy-dense foods effectively reduces the purchased calories of energy-dense foods in a web based supermarket, and whether this effect is moderated by budget and weight status. Three hundred and six participants purchased groceries in a web based supermarket, with an individualised budget based on what they normally spend. Results showed that relative to the no tax condition, the participants in the tax condition bought fewer calories. The main reduction was found in energy-dense products and in calories from carbohydrates, but not in calories from fat. BMI and budget did not influence the effectiveness of the tax. The reduction in calories occurred regardless of budget or BMI implying that a food tax may be a beneficial tool, along with other measures, in promoting a diet with fewer calories.
- Epstein et al (2012; US): As well as studies conducted in the cafeteria setting and vending machine experiments (see below), this review included four experimental studies to simulate supermarkets (conducted by the main author of the review and colleagues). The authors concluded that experimental research suggests that price changes modify purchases of targeted foods, but research on the overall nutritional quality of purchases is mixed because of substitution effects. There is mixed support for combining price changes with adjunctive interventions, and there are no replicated findings on moderators to price sensitivity in experiments. The four studies cited by the above review involved small sample sizes and were not conducted in the actual supermarket setting, hence the findings should be interpreted with caution:
 - Epstein Dearing et al (2006) Epstein Handley et al (2006): In the first of two experiments, children aged 10–12 years could purchase a preferred energy dense snack food or a preferred fruit or vegetable. Prices ranged from \$0.50 to \$2.50 in \$0.50 increments. Results showed that price changes influenced purchases of healthier and less healthy foods, and the changes were very similar. Thus, reducing the price of healthier foods increased purchases, whereas increasing the price of less healthy foods decreased purchases. The OPEs of –1.01 and –0.921 for healthy and less healthy foods showed that the percentage increase in price was nearly exactly offset by a percentage decrease in quantity demanded.

- In another experiment, children were provided with \$1, \$3, or \$5 to shop. Price changes of 25% and 50% again influenced purchases of healthier foods (apples, pretzels, yogurt, skim milk; OPE = -1.65) and less healthy foods (cookies, potato chips, pudding, cola; own-price arc elasticity = -2.11), and children substituted healthier foods when the price of less healthy foods was increased (cross-price arc elasticity = 0.97). When the price of healthier foods was reduced, there was some reduction in purchases of less healthy food because children allocated more money for the healthy foods (cross-price arc elasticity = 0.49). The amount available interacted with food price to influence the purchase of substitute foods suggesting that the amount of money the child has to spend on food when shopping at a convenience store can influence whether they decide to substitute for other foods when the prices of favourite foods are increased.

Results showed both mothers and their children were sensitive to price changes in healthy and less healthy foods for the child: OPEs for healthy and less healthy foods were -0.58 and -0.50 respectively, for children and -0.74 and -0.58, respectively, for parents. There was a significant relation between own-price arc elasticity for healthy foods ($\beta = 0.46$, P< 0.001) and less healthy foods ($\beta = 0.12$, P = 0.036), because mothers and children responded in a similar fashion to price changes.

- Epstein Dearing et al (2007): Used an analog supermarket in which mothers shopped for their families from 68 common foods and beverages, which were equally distributed among high-caloriefor-nutrient and low-calorie-for-nutrient foods. The first study used a mixed design with price change ($\pm 25\%$) as a between factor; and study income and price manipulation as within factors. Price increases influenced purchases of less healthy foods (ownprice arc elasticity = -1.6) more than price decreases influenced purchases of healthier foods (own-price arc elasticity = -0.6). Once again, shoppers were more likely to substitute healthy foods when the price of less healthy foods increased (cross-price arc elasticity = 0.6), but they did not change purchases of less healthy foods when the price of healthy foods changed (crossprice arc elasticity = -0.06). In this study, mothers were provided with two levels of budgets for shopping, but neither level moderated the effects of the price changes. BMI did moderate the effects, because non-obese women were more sensitive to changes in prices of healthier foods and were also more likely to substitute healthy foods when the price of less healthy foods increased.

- Epstein Dearing et al (2010): In a subsequent shopping study using a within-subject design in which prices changed from $\pm 25\%$ of reference value, price changes influenced the purchase of less healthy foods (ownprice arc elasticity = -1.4) and healthier foods (ownprice arc elasticity = -1.0). In addition, shoppers substituted healthy foods for less healthy foods when the price of less healthy foods was increased (crossprice arc elasticity = 0.22) and increased purchases of less healthy foods when the price of healthier foods was reduced (cross-price arc elasticity = -0.68). In general, when healthier foods, as defined by calories per nutrient, were reduced in price, a significant increase in calories was observed, whereas when prices of less healthy foods increased, a significant decrease in calories was observed. Taxing less healthy foods resulted in a reduction in purchases of dietary fat and an increase in protein. These results suggest that when mothers saw lower prices for healthier options they increased their purchases of these foods, but they also used the savings to buy more unhealthy items. As a result, whereas price increases for less healthy foods result in reductions in calories, subsidising healthy foods may result in a net increase in calories. BMI did not moderate the effects of price changes. The study was limited by consumer encouragement to spend all or almost all money available to them.

Evidence of intervention effectiveness

Outcome: sales/purchases

- Reviews indicate that short-term monetary discounts are effective for increasing purchases of healthier foods across a range of discrete settings including retail, cafeterias, schools, and restaurants.
- There is mixed evidence from recent primary studies of the effectiveness of price discounts in increasing healthier food/F&V purchases across different settings.
- Several recent experimental studies in supermarkets have indicated a positive effect of temporary price discounts on purchase of healthier foods, including F&V, although there is insufficient evidence to determine the effect on nutrients purchased.

Reviews58

- Liberato et al (2014; review) included evidence on 'monetary incentives' (also taken to refer to financial incentives or monetary benefits) including food coupons or food vouchers of any value. In the current review coupons/vouchers are considered as a separate sub-action (the evidence indicates that the motivation for purchase may operate differently for direct price discounts versus coupons). From studies involving both sub-actions (based on the studies by Herman et al 2008, Ni Mhurchu et al 2010, Waterlander et al 2013, and Sturm et al 2013), the review conclusions were: "Monetary incentive alone involving short-term interventions seems to be effective in increasing purchase and/or intake of healthier food options when a relevant monetary incentive⁵⁹ is offered to customers. There was an insufficient number of studies to draw clear conclusions on long-term studies or on the mediating factors that might affect the primary outcome".
- Shemilt et al (2013; systematic scoping review of price discounts): The review included studies by: Bell 1999, Block 2010, Curhan 1974, French 1997a, French 1997b, French 2001a, French 2010, Harnack 2008, Ho 1998, Horgen 2002, Jeffery 1994, Michels 2008, Mishra 2011,

Ni Mhurchu 2010, Richards 2009, Schindler 1992. The specific type of price promotion studied most frequently was simple discounts applied to healthier foods in discrete settings (usually accompanied by minimal or no promotional signage), typically using quasi-experimental study designs. In some of these primary studies, simple discounts were implemented concurrently with other intervention components (e.g. calorie labelling, health messages, nutrition education). A finding reported consistently across this relatively homogenous cluster of studies was that reducing the unit retail prices of healthier foods relative to less healthy foods in discrete settings was independently associated with increased levels of purchasing of healthier foods. This finding was consistent across the range of discrete settings studied. It was also consistent with conclusions reported in reviews that included assessment of this cluster of primary studies. Few primary studies in this category assessed effects on food or nutrient intake alongside purchasing: those that did reported no association between price promotions and intake of healthy foods or nutrients. Few or no studies were located that assessed other specific types of price promotion (multi-buy deals, price-pack deals, price deals, introductory pricing, couponing or rebates).

An (2013; published online 2012; review): This review included field experiments examining the effectiveness of subsidies — coupons and vouchers — and price discounts in promoting healthy food purchases and consumption. Twenty interventions were identified, conducted in seven countries: the USA (n 14), Canada (n 1), France (n 1), Germany (n 1), Netherlands (n 1), South Africa (n 1) and the UK (n 1). Subsidies (i.e. price discounts and vouchers) applied to different types of foods such as fruits, vegetables and low-fat snacks, fruit juice, vegetable soup, low-fat milk, sold in supermarkets (n=6), cafeterias (n=5), vending machines (n=5), farmers' markets (n=2) or restaurants (n=1). The studies included in this review in terms of price discounts in supermarkets were Paine-Andrews et al (1996), Ni Mhurchu et al (2010), Blakely et al (2011), and An et al (2013). All but one study found subsidies on healthier foods to significantly increase the purchase and consumption of promoted products. Study limitations include small and convenience samples, short intervention and follow-up duration, and lack of costeffectiveness and overall diet assessment.

⁵⁸Various study types included in these reviews — the two most recent reviews included non-field based experimental studies. ⁵⁹Included coupons/vouchers

- Epstein et al (2012; comprehensive *review* of experimental research on the relation between food price changes and food purchasing patterns): Apart from laboratory settings, Epstein et al. discuss results from experiments done in a cafeteria setting, vending machine and supermarket:
 - Only one cafeteria study examined substitution effects and that study showed the substitution of healthier beverages when soda was taxed. French et al. (1997) found that reducing the price of low-fat items in vending machines by 50% led to an increase in the proportion of low-fat snack products purchased from 25% to 46% during a four-week baseline period. When prices returned to normal, the proportion of low-fat snacks purchased went back to 23% indicating that price does indeed influence decision-making.
 - Another study pointing in the same direction (Jeffery et al 1994) found that a three-week cafeteria intervention where prices of fruit and salad were reduced by 50% led to a threefold increase in sales of these items with the total number of items purchased remaining constant. Obviously, price changes have to be significant to create more long-term effects on choice, but the price changes in the studies referred to above are very dramatic.
 - A 25% reduction in the price of healthier food choices led to a 39% increase in the sale of these items (French et al 2002). A price reduction of 10%, 25% and 50% on lower-fat snacks relative to the higher-fat snacks led to increases in sales of lower-fat snacks by 9%, 39% and 93%, respectively.

The review summarised that experimental research suggests that price changes modify purchases of targeted foods, but research on the overall nutritional quality of purchases is mixed because of substitution effects. There is mixed support for combining price changes with adjunctive interventions, and there are no replicated findings on moderators to price sensitivity in experiments.

Salvy et al (2012; review): One factor that is known to influence consumption of different food items is to manipulate cost, as a consistent body of research has shown a strong relationship between cost and types of food purchases (Brownell & Horgen, 2003; Cinciripini, 1984; Faith et al 2007; Jacobson & Brownell, 2000). Subsidising, or decreasing, the price of healthy foods increases purchases of these foods, while taxing, or increasing, the price of unhealthy foods results in decreased purchases of these foods (Epstein et al 2007; Epstein et al 2006; Faith et al 2007; French 2003).

- Hawkes (2012; *review*): Over 10 oft-cited studies from the United States suggest that manipulating the prices of different foods (often, substitutes like low-fat relative to high-fat snacks, but also F&V) in discrete environments (e.g. vending machines, university cafeterias) can lead to large consumer responses to changes in price (e.g. French et al 2001, Michels et al 2008, French et al 2010).
- Jensen Hartmann et al (2011; *SR*): This was a review of economic incentives and nutritional behaviour of children in the school setting: 30 publications representing 28 studies fulfilled the criteria for inclusion. The studies addressing price incentives suggest that such incentives are effective for altering consumption in the school setting. Other types of economic incentives have been included in combined intervention schemes, but the inclusion of other intervention elements makes it difficult to draw conclusions about the effectiveness of the economic incentive instruments per se in these studies.

Field Experiments

Ball et al (2015; AUS): The Supermarket Eating for Life trial was an RCT conducted over a three-month period with a six-month follow-up time. Female primary household shoppers in Melbourne were randomly assigned to one of four groups: (1) skill-building (n=160); (2) price reduction (n=161); (3) combined skill-building and price reduction (n=160); or (4) control (n=161). Main study outcomes were fruit, vegetable and beverages purchases and self-reported F&V consumption. At three months (time 2), price reduction-alone participants purchased more total vegetables and frozen vegetables than did controls. Price reduction-alone and price reduction-plus-skill-building participants purchased more fruit than did controls. Relative to controls, in the price-reduction group, total vegetable consumption increased by 233g/wk (3.1 servings or 15% more than at baseline), and fruit purchases increased by 364g/wk (2.4 servings; 35% more than at baseline). Increases were not maintained six month post-intervention (time 3). Price reduction-alone participants showed a tendency for a slight increase in fruit consumption at time 2 (P = 0.09) that was maintained at time 3 (P = 0.014). No intervention improved purchases of bottled water or low-calorie beverages. The authors concluded that a 20% price reduction in fruit and vegetables resulted in increased purchasing per household of 35% for fruit and 15% for vegetables over the price-reduction period. These findings show that price modifications can directly increase produce purchases. Note that increases were not maintained post-intervention.60

- Wolfenden et al (2015; AUS): A multi-component intervention aimed to increase the availability and promotion (including price), of fruit and vegetable and non-sugar-sweetened drink products in community sporting club canteens. This RCT showed that among 85 sporting clubs, relative to the control group, clubs allocated to the intervention were significantly more likely to promote fruit and vegetable selection using reduced pricing and meal deals (OR = 34.48; 95% CI 4.18-250.00), as well as more likely to have F&V products available, and members of intervention clubs were more likely to report purchase of fruit and vegetables (OR = 2.58; 1.08-6.18) and non-sugar-sweetened drinks (OR = 1.56; 1.09-2.25).
- Phipps et al (2015; US): A four-phase prospective cohort study involved an eight week baseline of no rewards. It was followed by an intervention period of eight weeks with rewards involving a gift card for which, during the rebate phase, shoppers received a rebate of 50% of the dollar amount spent on fresh or frozen produce. In the tapering phase the amount fell to 25% rebate (four weeks). There was a follow-up of six weeks with no rewards. The study was conducted in a busy supermarket in Philadelphia in an area with predominantly African Americans who shopped there frequently and had a loyalty card (for data collection purposes). In the qualitative component of the study, 62% of 50 participants (88% response rate) indicated that they bought more F&V that were 'more nutritious', 50% bought more F&V 'than they usually did', 40% bought F&V 'that were not usually available in their household' and 34% bought F&V 'that were new to them'. Households assigned to the intervention purchased an average of eight more servings of vegetables and 2.5 more servings of fruit per week than did control households. In longitudinal price-adjusted analyses, when the incentive was reduced and then discontinued, the amounts purchased were similar to baseline.
- Cárdenas et al (2014; Peru): In a quasi-experimental pilot study in a University cafeteria in Lima, a 33% price reduction combined with displaying the fruit near the POP, with added health and price information, resulted in a significant increase in fruit purchases, among males and non-student adults.
- Olstad et al (2014; AUS; NSW): Assessed the comparative and additive efficacy of two nudges and an economic incentive in supporting healthy food purchases by patrons at a recreational swimming pool. An initial preintervention period was followed by three successive

and additive interventions that promoted sales of healthy items through: signage, taste testing, and 30% price reductions, concluding with a return to baseline conditions. Each period was eight days in length. Healthy items represented 41% of sales and were significantly lower than sales of unhealthy items. In the full sample, sales of healthy items did not differ across periods, whereas in the subsample, sales of healthy items increased by 30% when a signage plus taste testing intervention was implemented. This increase was maintained when prices of healthy items were reduced by 30%, and when all interventions were removed. When adults were alone they purchased more healthy items compared to when children were present during food purchases, however parental choices were not substantially better than choices made by children alone. In conclusion, this study found mixed evidence for the efficacy of nudging in cueing healthier dietary behaviours. Moreover, price reductions appeared ineffectual in this setting. Findings point to complex, context-specific patterns of effectiveness and suggest that nudging should not supplant the use of other strategies that have proven to promote healthier dietary behaviours.

- Waterlander et al (2013b; The Netherlands): A sixmonth RCT within Dutch supermarkets was conducted. Regular supermarket shoppers were randomly assigned to one of four conditions: 50% price discounts on F&V, nutrition education, 50% price discounts plus nutrition education, or no intervention. There were 151 (76%) shoppers included in the final analysis. Adjusted multilevel models showed significantly higher F&V purchases (per household/fortnight) as a result of the price discount (+3.9kg; 95% CI: 1.5, 6.3kg) and the discount plus education intervention (+5.6kg; 95% CI: 3.2, 7.9kg) at six months compared with control. Moreover, the percentage of participants who consumed recommended amounts of F&V (>/=400 g/day) increased from 42.5% at baseline to 61.3% at six months in both discount groups. Education alone had no significant effect. Discounting F&V is a promising intervention strategy because it resulted in substantially higher F&V purchases, and no adverse effects were observed.
- Geliebter et al (2013; US): This good quality study in Manhattan showed that an eight-week 50% reduction in F&V price resulted in significant increase in F&V purchasing and intake and was partially sustained four weeks after end of discount period. There was also an indication that the intervention may have affected body weight among the overweight/obese participants.

- Kottke et al (2013; US): Effect of a price reduction on salad bar purchases in a corporate cafeteria. The study involved reducing the price of salad bar purchases by 50% during March 2012 and analysing monthly sales data for February through June 2012. An anonymous survey was also conducted. Salad bar sales by weight more than tripled during the price reduction and returned to baseline afterward. Survey respondents reported that the high price of salad relative to other choices is a barrier to purchases.
- Jue et al (2012; US): Prospective interrupted time-series quasi-experiment included three sites in Philadelphia, PA, Evanston, IL, and Detroit, MI. Each site received five interventions: (1) a 10% price discount on zero-calorie beverages; (2) the 10% discount plus discount messaging; (3) messaging comparing calorie information of SSBs with zero-calorie beverages; (4) messaging comparing exercise equivalent information; and (5) messaging comparing both calorie and exercise equivalent information. Main outcome was daily sales of bottled zero-calorie and SSBs. The overall analysis failed to demonstrate a consistent effect across all interventions. Two treatments had statistically significant effects: the discount plus discount messaging, with an increase in purchases of zero calorie beverages; and the calorie messaging intervention, with an increase in purchases of SSBs Individual site analysis results were similar. The study concluded that the effects of price discounts and calorie messaging in different forms on beverage purchases were inconsistent and frequently small.
- Ni Mhurchu et al (2010; NZ); Blakely et al (2011; NZ): A 2x2 factorial RCT was conducted in eight NZ supermarkets. A total of 1104 shoppers were randomly assigned to one of the following four interventions over six months: price discounts (12.5%) on healthier foods, tailored nutrition education, discounts plus education, or control (no intervention). Outcomes were assessed by using electronic scanner sales data. At six months there were no differences in amount of saturated fat purchased by intervention arm. However, those subjects who were randomly assigned to receive price discounts bought significantly more (11%) predefined healthier foods at six months and 12 months (5% more). Education had no effect on food purchases. It was concluded that neither price discounts nor tailored nutrition education had a significant effect on nutrients purchased. However, the significant and sustained effect of discounts on food purchases suggests that pricing strategies hold promise as a means to improve population diets.

• Curhan (1972; US): A series of supermarket experiments examined the effect of a price promotion of at least 10% lower than prevailing 'normal' price as well as competitors' prevailing prices on hard fruit, cooking vegetables, salad vegetables and soft fruit. The impact of price reductions was not statistically significant except for soft fruit, although the author considered that this finding be interpreted with caution. Finding only for soft fruit may be due to its more discretionary character and relatively higher absolute price.

ACTION: Pricing discounts in prepared food outlets

Evidence of intervention effectiveness

Outcome: sales/purchases

There is a small amount of experimental evidence from two studies in the US that price discounts for more healthful meals in takeaway food outlets can increase sales (and possibly revenue).

Field experiments

- Gittelsohn et al (2013; SR): A systematic review of community-based interventions in prepared-food sources in the US identified four interventions which sought to reduce consumers' cost for more healthful items:
 - Steps to a Healthier Salinas: included coupons or discount cards
 - TrEAT Yourself: included coupons or discount cards
 - Baltimore Healthy Carryouts: focused on price reductions for combination meals as a strategy
 - Horgen and Brownell (2002) implemented a price reduction.

Two interventions showed positive results by reducing food prices (Baltimore Health Carryouts and the study detailed in Horgen and Brownell, 2002).

• Lee (2012): Baltimore Healthy Carryouts demonstrated that reducing the price of healthful foods not only increased sales of healthful foods but also increased total carryout revenue.

ACTION:

Quantity discounts

Evidence of intervention effectiveness

Outcome: sales/purchases

There is a lack of evidence around the effectiveness of quantity discounts for increasing purchases of healthier products, although marketing data indicate that such promotions increase purchasing (and probably consumption) of less healthy products.

Review

- Neslin & Van Heerde (2009) and Vermeer et al (2010b); cited in Chandon & Wansink (2012): "Although there are exceptions, most studies found that quantity discounts generally lead to stockpiling and increased consumption, especially for overweight consumers."
- Hawkes et al (2009; review; narrative): The UK's Competition Commission reported that sales promotions in British supermarkets typically lead to sales increases of 200%, and buy-one-get-one-free-type offers can lead to increases reaching 3000%. In the United States, a study in 2004 showed that sales promotions in drugstores typically increase the sale of candy by 29.8%, salty snacks by 19.5%, and soft drinks by 5.1%.
- IGD (2007; cited in Hawkes 2009): A recent survey conducted by the Institute of Grocery Distribution in the United Kingdom found that 25% of those interviewed identified buy-one-get-one-free offers (BOGOF) as particularly effective in encouraging product testing of a new brand. These promotions were most likely to influence sales of non-perishable products; for fresh products like fruits and vegetables, consumers said they would be more likely influenced by overall lower prices⁶¹.

Field experiments

- Chandon & Wansink (2002; cited in Chandon & Wansink 2012): One study found that during weeks in which multi-unit packages were purchased, consumption of orange juice increased by 100% and cookies by 92% The authors replicated this effect in a field experiment in which the quantity of food was randomly manipulated while keeping its price constant. They found that large purchase quantities influenced consumption by making the food salient in the pantry or fridge, and not just by reducing its price.
- Mishra & Mishra (2011; cited in Chandon & Wansink 2012): One study suggests that consumers prefer price discounts to bonus packs for guilt-inducing 'vice' foods, but preferred bonus packs to price discounts for 'virtue' foods because it is easy to justify buying them in larger quantity.

ACTION:

Use of coupons / vouchers for healthier food

Supporting evidence

- A select number of studies of varied type support the use of coupons or vouchers to increase purchases/consumption of healthier foods.
- Betty (2013: UK): cites evidence from Which? (2011) indicating that consumers report preferring simple, money-off coupons to multi-buy special offers in fresh produce categories such as F&V.
- Lopez & Seligman (2014; US): Consumers and retailers may both benefit from stronger incentives for purchasing perishable food items, due to resulting reduced food wastage. In a content analysis of online store coupons from six national grocery chains with 1,056 online store coupons available during the four-week study period: 25% were for processed snack foods, candies, and desserts (the largest category); prepared meals (14% of all online coupons); and cereals (11% of all online coupons). Approximately 12% of coupons were for beverages, more than half of which were for sodas, juices, and energy/ sports drinks. Few coupons were available for fruits (<1%), vegetables (3%), or unprocessed meats (1%).

- Waterlander, de Mul et al (2010; The Netherlands): A focus group study in The Netherlands indicated that pricing strategies focusing on encouraging healthy eating were valued to be more helpful than pricing strategies which focused on discouraging unhealthy eating.
 Suggested high reward strategies were: reducing the price of healthier options of comparable products (e.g., whole meal bread) compared to unhealthier options (e.g. white bread); providing a healthy food discount card for low-income groups; and combining price discounts on healthier foods with other marketing techniques such as displaying cheap and healthy foods at the cash desk.
- Inglis et al (2009; AUS): This hypothetical experimental/ laboratory study demonstrated that, when high- and low-income women were presented with a scenario where they had 25% more of their food budget to spend, low-income women chose to increase their spending on both healthy and unhealthy food to a greater extent than high-income women.
- Dong and Kaiser (2005; cited in Hawkes 2009; *ecological data*): The effect of coupon usage on cheese purchases in a sample of 30,000 American households between 1996 and 1999 showed that coupon usage was significantly associated with increases in cheese purchases over the four-year period. Coupon usage thus increased demand for cheese over the longer term.

Evidence of intervention effectiveness

Outcome: purchases / consumption

- There is mixed evidence from a substantial number of experimental studies of the effectiveness of discount vouchers and coupons for increasing purchases of healthier food.
- However, a large proportion of the studies, including a large intervention trial in a large supermarket chain in the UK, showed significant positive effects of vouchers for F&V on increased F&V purchases, particularly among low SES. Largescale implementation of vouchers in the US WIC scheme led to substantial increases in the purchase of vegetables and particularly fruit.

Reviews

• An (2013; *review*): effectiveness of subsidies in promoting healthy food purchases and consumption: review of field experiments (published online 2012); used coupons or vouchers for healthier foods and price discounts:

Interventions were conducted in seven countries: the USA (n 14), Canada (n 1), France (n 1), Germany (n 1), Netherlands (n 1), South Africa (n 1) and the UK (n 1). Subsidies (i.e. price discounts and vouchers) applied to different types of foods such as fruits, vegetables and low-fat snacks, fruit juice, vegetable soup, lowfat milk, sold in supermarkets (n=6), cafeterias (n=5), vending machines (n=5), farmers' markets (n=2) or restaurants (n=1). All but one study found subsidies on healthier foods to significantly increase the purchase and consumption of promoted products. The only null finding, reported in Kristal et al (1997), was likely due to its small financial incentive — a voucher worth \$US0.50 towards the purchase of any fruit or vegetable. Note: This was one of four studies included in the review examining the use of vouchers in supermarkets (or stores) — the other being Herman et al (2006) and the studies by Bihan et al (2010; 2012); these studies are detailed briefly below.

- Glanz et al (2012; *review*): Use of in-store coupons (pricing and promotion) raises consumer affect and purchasing and can also increase profits through incomplete redemption. This review indicated that in community research, price reductions and coupon programs are well-received but there is little evidence of effectiveness.
- Glanz & Yaroch (2004; *review*): There is some evidence that monetary incentives like coupons, price promotions or discounting of healthier options may provide one way to reduce the economic barrier to healthy choices.

Intervention studies

Klerman et al (2014): The USDA Food and Nutrition Service created the Healthy Incentives Pilot (HIP) to test the efficacy of providing a 30% incentive for purchases of targeted F&V (TFV). These TFV included the same fruits and vegetables that are eligible for WIC cash vouchers - fresh, canned, frozen, and dried fruits and vegetables without added sugars, fats, oils or salt, but excluding white potatoes and 100% fruit juice. After purchasing an eligible TFV in a retailer that participated in HIP, the 30% incentive was added back to the participant's electronic benefit transfer (EBT) card. Incentives were capped at \$60 per month, but in practice that cap was reached in less than 1% of household months. Four to six months after implementation, mean daily TFV intake for adult HIP participants was 0.22 cup-equivalents higher (24% higher) than for control-group SNAP participants. These impact estimates with a random-assignment research design generally agree with previously published nonexperimental elasticity estimates, which imply that a pure price reduction of F&V by 30% would increase F&V consumption by about 20%.

- Betty (2013; UK): The COOP supermarket group in UK has a commitment to Public Health Responsibility Deal, hence it piloted a coupon incentive scheme in July 2012 for low F&V spenders to see if making them more affordable would encourage purchases and facilitate increased consumption. Customers presented at the checkout with a maximum of one coupon/week for a £1 off a minimum £3 pound spend. Fresh, frozen, dried, canned (no sugar or salt) F&V were included. Accompanied by POP messages and menus etc. Sales of F&V increased by 23.2% during the four-week campaign (132,000 redemptions of the coupon by 90,000 members). Membership cards were used to identify low purchasers. Notably only around 8% of coupons were redeemed. Higher discounts were considered as maybe being necessary to increase participation. Post-campaign data showed F&V sales declined to levels prior to pilot.
- Smith et al (2013; NZ): n=214; 'SPend Study'; fourweek RCT; provided additional money in the form of supermarket vouchers mean value of NZ \$17 per week
 — to be spent on food or non-food items. Voucher group spent NZ\$15.20 more on food per week during the fourweek intervention phase. No differences in expenditure between voucher and control group for the food groups F&V, meat and poultry, and dairy. Cites evidence from Ni Mhurchu et al (2010; NZ supermarket Healthy Options Project), Herman et al (2008) and Weerts & Amoran (2011) indicating increases in healthier foods purchased due to vouchers (the latter two targeted for F&V).
- Gittelsohn et al (2010; US): In a process evaluation of the Baltimore Healthy Stores Program, this study showed that incentive cards and coupons were used to increase initial demand for healthier foods. Ten incentive cards (*"buy 3 of the BHS-promoted foods and get the fourth free"*) were provided during different phases. Of the 60 and 40 cards handed out to corner store owners in Phases 1 and 3, respectively, only 25% and 13% were returned by the store owners for reimbursement. In Phases 2, 4, and 5, 50 to 60 coupons per phase (offering 50 cents to a dollar off a promoted food) were distributed to corner store owners. However, store owners infrequently gave them to their customers, so dose received was low and less than 20% of the coupons were returned for reimbursement by store owners.
- Bihan et al (2012; France): In a 12-month trial, 302 lowincome adults 18–60 years old (defined by evaluation of deprivation and inequalities in health examination centres, a specific deprivation score) were randomised into two groups: dietary advice alone ('advice'), or dietary

advice plus F&V vouchers ('F&V vouchers') (10–40 Euros/ month) exchangeable for fresh fruits and vegetables. Between baseline and three-month follow-up, mean F&V consumption (self-reported) increased significantly in both the 'advice' (0.62 ± 1.29 times/day, P=0.0004) and 'F&V vouchers' groups (0.74 ± 1.90 , P=0.002), with no difference between groups. Subjects in the F&V vouchers group had a significantly decreased risk of low F&V consumption (<1 time/day) compared with those in the advice group (P=0.008).

- Herman et al (2008; US): Vouchers for F&V for low income women (WIC) had no effect on purchases, although they were found to be effective in motivating people of low SES to buy fresh F&V.
- Herman et al (2006; US): Vouchers for \$40 per month to low-income postpartum women exchangeable for fresh F&V in farmers' markets and supermarkets. There was no difference in F&V consumption for the supermarket arm of the study.
- Anderson (2001; US): In an RCT among five supermarkets in small towns in Virginia, targeted vouchers of \$8–10 per week (mean of \$34 per participant in coupons, across 15 weeks of intervention) plus intensive nutrition education (involving in-store kiosk), focused on increasing purchases and consumption of cruciferous vegetables, fruits, highfibre cereals, low fat dairy and lean protein sources as well as on decreasing consumption of fat from butter, beef and snacks. Shopper receipts and food frequency questionnaires showed improvements in percentage fat, and fibre, F&V purchased.
- Winett et al (1997; US): An intervention involved a video booth with educational videos plus discount coupons for healthier items which combined led to a reduction in purchased calories from fat, increased purchased dietary fibre, and increased likelihood of meeting F&V intake. Some indication from an earlier study that coupons stimulated purchasing of healthier items beyond education.
- Kristal et al (1997; US): In an intervention study among 960 shoppers across eight supermarkets — involving the provision of supermarket flyers identifying F&Vs on sale, recipes and menu ideas for using sale foods and a voucher of US\$0.50 for F&V purchases, plus store signage to identify F&V on flyer and consciousness raising activities (e.g. food demos and nutrition-related signage); there was no evidence of effectiveness. A larger financial incentive was suggested.

 Paine-Andrews et al (1996; US): A supermarket intervention consisted of prompting, product sampling and price reduction involving store coupons. Prompting/ demos to change to reduced fat options among milk, desserts, salad dressings, with coupons for 40% off. The largest increase in purchases was found for frozen desserts. Findings from this study suggest that prompting, product sampling, and price reduction can increase customer purchases of some lower-fat products.

Real world implementation

Andreyeva & Luedicke (2014; US): In 2009, the US Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) began to provide participants with cashvalue vouchers to purchase fruits and vegetables (US\$10 for women and US\$6 for children per month). Study using scanner data showed purchases of fresh and frozen vegetables increased in volume by 17.5% and 27.8%, respectively. The biggest improvements were observed for fresh fruit, an increase of 28.6%, adding almost a kilogram of fresh fruits per household per month. WIC households spent three times more of their WIC vouchers on purchasing fresh fruits than fresh vegetables. The magnitudes of substitution effects were relatively small: between 4% (fresh fruit) and 13% (canned vegetables) of the amounts purchased in 2009 with non-WIC funds were replaced by purchases made using WIC vouchers in 2010.

Outcome: cost-effectiveness

- A modeling study showed that fruit and vegetable vouchers may be cost-effective if lower income consumers are targeted.
- De Mouzon et al (2012; France): Quantified the economic and health effects of a F&V voucher policy designed to increase F&V consumption among low-income consumers. They found that targeted F&V voucher policies can be more cost-effective than non-targeted policies based on tax decreases, but only when the targeted policy is focused narrowly on the lowest income consumers.

ACTION: Loyalty programs

Supporting evidence

Outcome: sales/purchases

There is mixed evidence from empirical studies and field experiments as to whether consumers are equally responsive to price discounts and reward point-promotions under retail item-based loyalty programs. However, there is a lack of published evidence about how loyalty programs affect sales of healthier food/drink items.

Empirical studies

- Wei & Xiao (2013): Point-based frequency reward programs are widely used by retailers as a sales promotion strategy. To promote a specific product category, retailers offer more favorable Reward ratios so that members can earn extra points. The authors found that increasing the reward ratio in a category positively affected its choice probability and that the presence of rewards promotions also had a positive impact on the choice probability of a non-promoted but closely related category within the same category pair. As forms of sales promotion, price discounts and reward promotions were shown to substitute for each other, the authors constructed and computed a measure, the rate of substitution, to quantify the effects of substitution. The financial implications of holding reward promotions are computed and discussed.
- Zhang & Breugelmans (2012; US): The authors conducted an empirical investigation of a new retail loyalty program (LP), called an item-based loyalty program (IBLP), in which price discounts are replaced by reward point promotions that need to be accumulated and redeemed later. The main objective is to examine its impact on various aspects of consumer purchase behaviour and a retailer's sales revenue. They found that after a retailer switched from a conventional LP to the IBLP, consumers became more responsive to reward point promotions than to price discounts of the same monetary value, were no longer responsive to competitors' reward point promotions, and exhibited stronger cumulative reward point effects. In addition, the new LP had a significantly different impact on 'current' LP members and non-members (defined by their status right before the switch), resulting in decreased (increased) total spending by the former (latter) group, under the retailer's current promotion practice.

Furthermore, it is critically important for retailers to offer sufficient promotions under the new LP to achieve its full potential; otherwise, they risk alienating their loyal customers. Finally, the IBLP reduced attrition among existing customers and attracted more new customers, which contributed to most of the retailer's sales revenue gain after adopting the IBLP.

Evidence of intervention effectiveness

Field experiment

Hamlin Lindsay et al (2012; NZ): A search on retailer branded price promotions could only find literature on branded loyalty programs which are targeted at storewide behaviours, rather than the individual product level behaviours with which existing retailer brands are associated. The authors then described a field experiment (in Dunedin NZ, 2010) that compared the performance of a food retailer's branded price promotion system with that of a generic (manufacturer) price promotion. The research involved three experiments that covered two food categories (sliced bread and margarine) and two levels of discount (10% and 20%). The results indicate that food retailers are able to attach powerful brands to their price promotion systems, and these brand heuristics can significantly increase consumer purchase intent relative to an equivalent generic/manufacturer promotion; stable in both categories and for both levels of price discount studied. These results are consistent with the predictions of alternative, non-cognitive and heuristic based models of food consumer choice. Overall the authors indicate that a major retailer has succeeded in creating a brand and attaching it to a system of price promotion that is under their control — the brand operating by a visual cue at the POS, and the heuristics associated with it are capable of moderating consumer purchase intentions at a level at least commensurate to the leading supplier product brands. Category specific (in this case margarine) heuristics were powerful enough to create a negative response to a substantial generic promotional price discount; "If it's discounted here, then it's discounted for an undesirable reason". This research may not apply across all categories.

ACTION:

Use of vouchers⁶² as incentives to encourage F&V purchases at farmers' markets

Evidence of intervention effectiveness

Outcome: purchases / consumption

There is accumulating evidence from relatively large-scale implementation and pilot studies in the US that vouchers for free or reduced-priced F&V for use in farmers markets are effective in increasing self-reported F&V consumption, and can reach low income youth and seniors. They may be associated with increased revenue at the markets.

Implementation studies

- Olsho et al (2015; US): In the Farmers' Market incentive program 'Health Bucks' in New York City, repeat surveys pre- and post-intervention in 2002, 2004, 2008, 2009 and various surveys in 2010, showed that higher Health Bucks exposure was associated with greater awareness of farmers markets, increased frequency and amount of farmers market purchases, and a greater likelihood of a self-reported year-over-year increase in fruit and vegetable consumption. However a Community Health Survey did not detect impacts on consumption.
- Freedman et al (2014; US): Shop N Save (SNS) provided one \$5 monetary incentive per week to customers spending \$5 or more in food assistance at the farmers' markets (located at a federally-qualified health centre).
 SNS was available to any farmers' market customer using Supplemental Nutrition Assistance Program (SNAP), Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), and/or Senior or WIC
 Farmers' Market Nutrition Program (FMNP) vouchers. In total, the use of all forms of food assistance (SNAP, WIC, and FMNP) at the farmers markets increased significantly after the intervention (from 10% before, to 25% after, P=0.003). Senior FMNP vouchers and SNAP usage increased the most. Interventions that provide

⁶²Vouchers via Federal federal subsidy program for low-income families/pregnant women such as the Healthy Start programme in the UK (McFadden et al 2014) and the full description of the effectiveness of the US welfare programs such as SNAP and WIC, are outside of the scope of this evidence synthesis.

incentives to recipients of food assistance programs at farmers markets are a viable strategy for increasing food assistance usage and revenue.

- Dimitri et al (2014; US): Application of a federal policy of nutrition beneficiaries vouchers, for use at farmers' markets. A longitudinal pilot study examined vegetable consumption under the scheme among 300 economically disadvantaged women in five farmers' markets in three cities. Around half of the participants dropped out of the study, however among those remaining, those with low levels of education and low levels of fresh produce consumption were most likely to increase vegetable consumption.
- Young et al (2013): Philly Food Bucks, Pennsylvania 2011. Philly Food Bucks users were significantly more likely than nonusers to report increasing F&V consumption (OR, 2.4; 95% CI, 1.63–0.7) and to report trying new fruits or vegetables (OR 1.8; 95% CI, 1.22–0.7). At the market level, average SNAP sales more than doubled at farmers markets in low-income areas in the first two years of the Philly Food Bucks program. At the city's largest farmers market in a low-income area, the program was associated with an almost five-fold higher increase in annual SNAP sales compared with baseline. Therefore, a bonus incentive program tied to SNAP was associated with self-reported increases in F&V consumption and increased SNAP sales at participating farmers markets in low-income communities.
- Baronberg et al (2013): New York City's Health Bucks Program provides SNAP recipients with a \$2 coupon for every \$5 spent using SNAP benefits at participating farmers markets. When a \$2 financial incentive was distributed with EBT, use of SNAP benefits increased at participating New York City farmers markets. Considered worthy of continued funding. Process evaluation of the program (Payne et al 2013) indicated that respondents view Health Bucks as a positive program model.

- Lindsay et al (2013): Farmers' Market Fresh Fund Incentive Program San Diego. 7,298 eligible participants enrolled in Fresh Fund; most (82%) had previously never been to a farmers market. Among 252 participants with matched surveys at baseline and 12-month follow-up, the proportion who reported their diet to be 'healthy' or 'very healthy' increased from 4% to 63% (P < .001); nearly all (93%) stated that Fresh Fund was 'important' or 'very important' in their decision to shop at the farmers market. Vendors reported that 48% of all market revenue they received was through the FF program. Revenue increased by 74% and 63% at two markets over the 18-month period.
- Freedman et al (2013): Farmers' markets at a health centre. Marginally significant average increase of 1.6 servings F&V per day; odds increased if using the financial incentives and those frequenting the farmers market more often , i.e. dose response emphasising importance of addressing economic barriers to food access.
- Freedman et al (2011; US): the 'Veggie Project' increased access to healthy foods particularly for youth (outcome was 'use'/sales).
- Herman et al (2006): USA; vouchers for \$40 per month to low-income postpartum women exchangeable for fresh F&V in farmers markets and supermarkets. F&V consumption increased significantly among both the farmers' markets participants (0.33 servings/1000 kJ) and the voucher group (0.19 servings/1000 kJ).
- Kunkel et al (2003): Seniors Farmers' Market Nutrition Program (SFMNP) vouchers for low income seniors at farmers markets; 89% reported intention to eat F&V year round. Farmers reported benefits.
- Webber et al (1995; cited in Lee et al 2013): Massachusetts farmers' markets coupon program for low income elders, as well as vulnerable women, children and elders. F&V coupons increased purchases of F&V in around 30% of participants.

ACTION:

Cash-back rebates

Evidence of intervention effectiveness

Outcome: purchases / consumption

Results from a cash-back rebate program on healthier products across South Africa indicate that reducing the costs of healthy food products is likely to change purchasing, and consumption patterns in a meaningful (although costly) way.

Real world implementation

Sturm et al (2013): The Healthy Food Program (health insurer Discovery; health promotion program Vitality) provides a cash-back rebate of up to 25% for healthy food purchases in over 400 designated supermarkets across South Africa. Monthly household supermarket food purchase scanner data between 2009 and 2012 are linked to 170,000 households (60% eligible for the rebate) with Visa credit cards (used by one third of enrolled customers). Rebates of 10% (immediate) and 25% (after online health risk assessment) for healthy foods are associated with an increase in the ratio of healthy to total food expenditure by 6.0% (household fixed-effects model) and 9.3% (case-control differences in differences model); an increase in the ratio of fruit and vegetables to total food expenditure by 5.7% and 8.5%; and a decrease in the ratio of less desirable to total food expenditure by 5.6% and 7.2%. "The results from this rebate program suggest that reducing the costs of healthy food purchases is likely to change purchasing patterns in a meaningful way. However, it is not a cheap way to achieve major changes in population diets. Changes in purchases are commensurate with price changes, but even a large price change for healthy foods (e.g. 25%) can at best address a small part of the discrepancy between population dietary patterns and dietary quidelines." Note that in this program less-desirable items that are discouraged include cookies, candy, chips and soft drinks.

An et al (2013): This article indicates that the program is available in around 800 supermarkets in the Pick N Pay group across South Africa with 260,000 households enrolled. Program participation is associated with higher consumption of fruits/vegetables and whole-grain foods and less consumption of high sugar/salt foods, fried foods, processed meats, and fast food. There is no strong evidence that participation reduces obesity.

Food environment objective: increased access to F&V at school

ACTION:

Free or subsidised fruit & vegetables in schools

Evidence of intervention effectiveness

Outcome: preferences/consumption

- There is substantial evidence from implementation at the national level in several countries (Norway, The Netherlands, Canada, UK) that free F&V programs in schools are effective at increasing the consumption of fruit in children, particularly primary school children. There is less evidence — due mainly to lesser implementation — for high school children.
- There is evidence that subsidised F&V schemes are likely to be much less effective than free F&V schemes.
- Free F&V schemes in schools increase children's acceptance of new varieties of F&V with an increased willingness to try new varieties and improved preferences for fruit.

Review

- Delgado-Noguera et al (2011; *SR and MA*): School-based F&V promotion programs indicated that multi-component interventions and free/subsidised F&V interventions were not effective at increasing consumption. Three studies involving free/subsidized F&V were included:
 - Bere et al (2006; Norway; *RCT of moderate quality*): At the end of the second year there was an increase in consumption of +0.59 servings F&V per day.
 - Moore and Tapper (2008; UK; RCT of moderate quality): Established a subsidised fruit tuck shop for one year but was not effective.
 - Ransley et al (2007; cluster controlled trial of moderate quality): Intervention consisted of giving each student one piece of F&V daily for two years. Fruit intake increased by +0.2 servings after three months, but the effect dropped back to +0.1 servings at seven months, and to baseline in the second year.

Intervention trials & real world implementation

Norway

- Ovrum & Bere (2014; *quasi-experimental, cross-sectional*): Norwegian School Fruit Scheme using nationally representative data showed that children who receive free fruit consume on average 0.36 more portions (25%) more fruits than children who attend schools with no fruit arrangement (p=0.040). No significant associations were found between the NSFS and the vegetable intakes of children and their parents. In addition, parents of children who receive free school fruit eat on average 0.19 more fruit portions daily (12.5%).
- Bere et al (2010; *pre- post-*): A subscription program was initiated in 1996 and made nationwide in 2003; and a free program has been implemented nationwide since 2007. The increases in fruit intake at school were 0.49, 0.29 and 0.18 portions/school day, respectively, for the free fruit, subscription and no program schools (time x group P<0001), and 0.74, 0.39 and 0.16 portions/d for fruit intake all day (time x group P=004). No group effect was observed for vegetable intake. There has been an increase in pupils' fruit intake from 2001 to 2008 in Norway, and the school fruit programs seem to have been effective. A great challenge remains in increasing vegetable intake.
- Bere et al (2007; *RCT*): Evaluation of the Norwegian School Fruit program (NSFP) showed that the pupils in the free fruit group increased their F&V intake compared to pupils in the control group as a result of the intervention. Some of the effect was sustained three years later. The estimated long-term effects for F&V all day were 0.38 and 0.44 portion/day for boys and girls, respectively.
- Bere et al (2006; *RCT*): Free subscription to the NSFP combined with FVMM (F&V Make the Marks) educational program. At both follow-up 1 (six months) and follow-up 2 (18 months), strong intervention effects were observed for all-day F&V intake (effect sizes were 0.6 and 0.5 portions, respectively). Concluded that the effects observed are most likely due to the no-cost subscription and not due to the FVMM educational program, and that providing pupils with a piece of fruit or a vegetable at school at no cost for the parents is an effective strategy to increase school children's intake of F&V. The effect is also sustained one year after the end of the no-cost subscription.

The Netherlands

- Tak et al (2009; *RCT*): Schoolgruiten Project, Dutch primary school program providing free F&V. Both child and parent reports indicated that the intervention group had a significantly higher fruit intake at two-year follow-up (difference, servings/d: 0.15; 95 % CI 0.004, 0.286 for child reports; 0.19; 95 % CI 0.030, 0.340 for parent reports). No significant effects on vegetable intake were observed. Significant positive intervention effects were also found for knowledge of fruit recommendations among boys. Some evidence was found that appreciation of the project partly mediated the effects on fruit intake.
- Tak et al (2007; *controlled trial*): Children of non-Western ethnicity in the intervention group reported a significantly higher vegetable intake (difference = 20.7 g day-1, 95% confidence interval (CI) = 7.63–3.7). A significant positive intervention effect was also found for fruit intake for children of Dutch ethnicity (difference = 0.23 pieces day -1, 95% CI = 0.07–0.39). No significant effects in intake were observed based on parent reports. Significant positive intervention effects were also found for perceived accessibility among children of non-Western ethnicity, as well as for parent-reported taste preference of their child among children of non-Western ethnicity and boys of Dutch ethnicity. Authors concluded that providing children with free F&V had some positive effects on child-reported intakes.
- Reinaerts et al (2007; *RCT*): A pilot study in The Netherlands indicated that free F&V at primary school increased children's (n=939) fruit consumption by 0.2 servings per day; and increased vegetable intake among non-native children. It also led to an increased 24h fruit, juice and vegetable intake among the youngest and oldest age-groups.

North America and Canada

 He et al (2009; *cluster RCT*): The Northern F&V Pilot Program (NFVPP) in Ontario, Canada, consisting of a free F&V snack and, in intervention 2 – with enhanced nutrition education, resulted in students (in intervention F&V only) consuming more F&V at school than their control counterparts by 0.49 serving/d (P < 0.05). Similarly, intervention 2 students consumed more F&V at school than control students, by 0.42 servings/day, although this difference was not statistically significant. Among students in both intervention groups, preferences for certain F&V shifted from never tried it towards like it.

- Cullen et al (2009; *comparison group study*): A postintervention only study of the impact of free F&V among adolescents in Houston, showed that access to the program did not appear to improve high school student reported F&V exposure or preferences.
- Coyle et al (2009; one-group pre- post- study): During the 2004–2005 school year the Mississippi Department of Education, Child Nutrition Programs initiated a pilot program to distribute free F&V to students (kindergarten through 12th grade) during the school day. Data were collected in 2004–2005 within a one-group pretest/ posttest design using a self-report questionnaire (n=725) and 24-hour dietary recalls (n=207) with a sample of students from five schools in Mississippi. Results showed greater familiarity with F&V at all grade levels (p<0.05) and increased preferences for fruit among eighth- and 10th-grade students (p<0.01). Eighth-grade students also reported more positive attitudes toward eating F&V (p<0.01), increased perceived self-efficacy to eat more fruit (p<0.01), and increased willingness to try new fruit. Finally, results showed increased consumption of fruit, but not vegetables, among eighth- and 10th-grade students (p<0.001).
- Jamelske et al (2008; *RCT*): The free Fresh F&V Program (FFVP) in the USA (USDA, 2002) was evaluated in Wisconsin in 2006 (introduced 2005). Compared to controls, intervention students reported an increased willingness to try new fruits (24.8% versus 12.8%, P<0.01) and vegetables (25.1% versus 18.4%, P=0.01) at school.

UK

Fogarty et al (2007; UK; pre- post-comparison group): A large study of national implementation of the National Schools Fruit Scheme (NSFS) in the UK indicated that between 2003 and 2004, individual fruit consumption in the intervention region increased by more (from a median of 7.5 to 14.0 pieces/week) than in the control region (from a median of 9.21–1.0 pieces/week), resulting in a difference (P = 0.001) between the two regions in 2004. However, after ceasing to be eligible for the NSFS, fruit intake in children in the intervention region fell to a median of 12 pieces per week, lower than that in the control region (median value of 14 pieces per week, P=0.02).

Outcome: diet

One experimental study in Norway showed that school free fruit led to a larger reduction in unhealthy snack consumption than nutrition education alone.

Real world implementation

Norway

Øverby et al (2012; Norway; pre- post- comparison groups): During the period 2001 to 2008, in the 'Fruits and Vegetables Make the Marks' project the frequency of unhealthy snack consumption decreased across all 27 schools in the study; from 6.9 to 4.6 times/week (p<0.001). The difference was larger in the schools that participated in the national school free fruit program (-2.8 times/week). The effect of the school fruit programs was significant in reducing the frequency of unhealthy snack consumption in children of parents without higher education (from 7.8 to 4.0 times/wek; P=0.004).

Outcome: BMI / weight status

- A single field experimental study in Norway showed no effect of free fruit at school on BMI.
- Bere et al (2014; Norway; *RCT*): The long-term impact of free school fruit in two areas of Norway in 2001/2002 (10–12 year=old children) on weight status in 2005 and 2009 was studied. Intervention versus control children (large loss to follow-up and not matched) indicated no difference in BMI between free fruit group and control group regarding weight status but in 2009 a significant difference in overweight was observed: 15% vs. 25% (p=0.04). The crude OR was 0.52 (0.28–0.97). However, when adjusting for school, sex, grade level and parental education, the association was no longer statistically significant.

Outcome: well-being/learning/behavioural

There is unpublished evidence from implementation among low decile schools in NZ that free fruit was associated with marked improvements in children's well-being and learning.

New Zealand

 Internet report: The Fruit in Schools program began in 2006 in NZ after a review found that only 40% of children ate two pieces of fruit per day. Health Minister Tony Ryall said the scheme would provide about 18 million pieces of free fruit to around 473 primary and intermediate (low decile) schools throughout the academic year. The scheme was designed to run for three years but it was expanded after research showed that children were more active, better behaved and had improved oral health through eating fruit. Among the 33 types of fruit delivered to schools were peacharines, tomatoberries and prince melons, giving children the opportunity to try new types of fruit. *"The Decile 2 Mt Roskill schools inclusion in the scheme had led to a tangible difference in children's wellbeing and learning"*

(http://www.nzherald.co.nz/nz/news/article.cfm?c_ id=1&objectid=11196719: sighted 10.08.14).

Barriers/enablers

- Aarstrup et al (2014; gualitative): School-based BOOST study in Denmark examined implementation of the F&V program using focus groups (teachers), class observations and telephone interviews (suppliers). F&V suppliers affected the implementation of the FV program at schools and thereby pupils' intake through their timing of delivery and through the quality, quantity and variety of the delivered F&V. Teachers influenced the accessibility and appearance of F&V by deciding if and when the pupils could eat F&V and whether F&V were cut up. Different aspects of time acted as barriers for teachers' implementation of the F&V program: time spent on having a F&V break during lessons, time needed to prepare F&V and time spent on pupils' misbehaviour and not being able to handle getting F&V. Teacher timing of cutting up and serving F&V could turn into a barrier for pupils F&V intake due to enzymatic browning. The appearance of F&V was important for pupils' intake, especially for girls. F&V that did not appeal to the pupils, e.g. had turned brown after being cut up were thrown around as part of a game by the pupils, especially boys. Girls appreciated the social dimension of eating F&V together to a larger extent than boys.
- He et al (2012; *qualitative*): Study of the Northern F&V Program in Ontario, Canada, a free, school-based F&V snack program, 139 students from grades 5–8 perceived (focus groups) that the program was valuable in allowing them to try new F&V. Children stated that they would now eat more F&V at home and at school. These students indicated that they would like the program offered more frequently and with more variety.

- Bouck et al (2011; *qualitative, teacher survey*): In the Northern F&V Pilot Program (NFVPP) in Canada, schoollevel stakeholders saw the NFVPP as a valuable program. Key facilitators included teacher role-modelling and sufficient funding for supplies and personnel. Key challenges included produce delivery, quality, wastage, and variety. The enhanced nutrition education component was minimally implemented.
- Potter et al (2011; *gualitative*; interviews, logs, focus groups, guestionnaires, various stakeholders): In the Mississippi F&V pilot program, which involved the distribution of free F&V snacks to students at school during 2004–2005; the process evaluation indicated that the F&V snacks were well-received by staff and students. Most schools distributed them at morning break in classrooms or in a central courtyard. Twenty-two types of fresh fruit, four types of dried fruit, and seven types of vegetables were served to students during the program year. Commonly distributed fruit included apples, oranges, pears, bananas, and tangerines. Carrots were the staple vegetable, followed by celery. Key challenges included getting students to try new foods and receiving the produce in a timely manner without spoiling. Main successes included seeing students try new F&V snacks, having the program run smoothly, and teacher support.

Discussion

Nature of the evidence

This review was initiated in late 2013 and although articles have been included as they were published during the review process, including some very recent publications, some of the recent larger reviews have not been fully absorbed, particularly in relation to the various study and included data types. These reviews describe the different types of studies in the evidence base and apportion the various studies according to their type:

- Thow et al (2014): 'A systematic review of the effectiveness of food taxes and subsidies to improve diets: understanding the recent evidence'. This review specifically provided a framework for assessing the different types of evidence available, to better equip policy advisors and decision-makers to interpret the evidence available. The review concludes that "the evidence base is far from conclusive and remains heavily dependent on modelling studies and extrapolated or surveyed — rather than observed — outcomes". In terms of specifics the review discussed the evidence as strongest for soft drink taxes and subsidies on healthier food, although the possibility of overall increased calorie consumption as a result of subsidies was indicated. This review also makes mention of consistent effects across taxes in the range of 10-20%.
- Maniadakis et al (2015): 'A systematic review of the effectiveness of taxes on non-alcoholic beverages and high-in-fat foods as a means to prevent obesity trends'. The paper concludes that "The effectiveness of a taxation policy to curb obesity is doubtful, and available evidence in most studies is not very straightforward due to the multiple complexities in human behaviour and the underlying substation effects. There is a need to investigate in-depth the potential underlying mechanisms and the relationship between price-increase policies, obesity and public health outcomes."
- Niebylski et al (2015): 'Healthy food subsidies and unhealthy food taxation: a systematic review of the evidence' – the study discussion begins by indicating that "When taken as a whole, the breadth of articles included in this review provide moderately strong evidence that taxation and subsidy policies can be effective for improving population dietary behaviours."

The current scoping review, in accordance with the above publications, indicates that much of the evidence regarding the potential or likely impact of fiscal policy on consumption, diet, health or weight status comes from demand and price elasticity studies, and simulation or predictive modelling studies which depend heavily on varied underlying assumptions. Limited evidence for the effectiveness of fiscal policy comes from experiments in closed (laboratory) environments; experimental studies using simple price discounts in discrete settings; and very limited larger experimental studies and generally limited real-world implementation (although there are some exceptions, including taxation of soft drinks in Mexico, cash-back rebates for healthier food in South Africa, and free F&V schemes). Some of these different types of data have been derived from very different study types, and the findings from very different study types have been conflated in the literature, notably from modelling studies using observational data and simulation modelling studies, particularly in several reviews.

The recent briefing publication by the WHO Regional Office for Europe (2015) on 'Using price policies to promote healthier diets' succinctly describes the part that the various types of study play in this particular (and related) policy arena. The WHO publication highlights the significant amount of research published in this area, particularly in recent years. This growing body of evidence is diverse in terms of research methods, outcome of interest, type and level of taxation or subsidy, and target food or nutrients. "Not only does this diversity present a challenge for interpreting the findings; it is also a challenge to link data on changes in consumption to the effects of a price policy." The report particularly highlights the extensiveness of evidence from simulation studies or modelling⁶³ — in some cases the predictive value of modelling is limited by the quality of available dietary, health and economic data. These studies do bridge the gap between economic theory and experimental settings to forecast potential outcomes in real-world settings and can highlight key considerations for policy design.

A relatively recent systematic review on simulation modelling studies is presented by Eyles et al (2012). Shemilt et al (2015) further highlight the necessary role that such studies play in the formulation of policy in this area but also indicate that they are insufficient and advise caution in placing excessive reliance on evidence from such studies, instead pointing to the need for integration with empirical studies of the effects of food tax and subsidy policies in practice.

⁶³The current review has attempted to be as specific as possible with regard to the study type (although there is overlap within studies, for example some studies use observational, empirical data to predictively model distal outcomes. This overlap in study type was highlighted by Niebylski et al 2015). It was not always clear in the abstract, however, as to what the data were and what the study type was, hence there may be some misclassification of study type between observational, demand and predictive/simulation modelling studies The WHO briefing publication provides a very user-friendly format to communicate the evidence around pricing policies and the reader is directed to this report as a highly accessible overall evidence summary. It provides information on the use of price policies to promote healthy diets and explores policy developments from around the WHO European Region. It examines the economic theory underpinning the use of subsidies and taxation and explores the currently available evidence. The publication includes several case studies from WHO European member states where price policies have been introduced and it concludes with some observations about the design of more effective price policies.

A large number of other reviews and reports have indicated that many limitations to the evidence base remain (e.g. Lee et al 2013). A major limitation in much of the evidence is that many of the studies have been unable to account for substitution and compensation effects and therefore do not provide a complete picture of how price changes affect the total diet or how sustainable any effects might be (Lee et al 2013). In an observational study by Dellava et al (2010) based on data from a Russian longitudinal study covering the years 1994–2005, involving observations from more than 4000 households, the main conclusion is that "permanent price changes are inadequate for producing long-term dietary change".

Cornelsen et al (2014) highlight findings from reviews that point to a lack of knowledge and consideration of the crossprice elasticity that explain substitution and complementarity (income) effects. Hawkes (2012) indicated that "we do not really know how a population would respond to a tax on foods. The evidence suggests that — if we are talking about shifting consumer behaviour away from whole categories of foods or nutrients, price changes would have to be very large to have an effect and even then would be very much dependent on policy design. But if we are talking about shifting consumers between close substitutes, or in very discrete environments, consumers are far more likely to be responsive".

Moodie et al (2013) highlighted, in Australia, "[However,] Uncertainty and gaps in the effectiveness evidence base need to be addressed first: more studies are needed that collect 'real-world' empirical data, and larger studies with more robust designs and longer follow-up timeframes are required. Reliability of cross-price elasticity data needs to be investigated; and greater consideration given to moderators of intervention effects and the sustainability of outcomes." These authors indicated though, that "as in other public health areas such as alcohol and tobacco, early indications are that population-level fiscal policies are likely to be potentially effective and costsaving".

The lack of cohesion in the evidence due to the very varied types of evidence and the focus of that evidence has meant that recommendations have often come from empirical evidence and expert opinion (Sturm & An 2014). These authors considered that there is currently insufficient solid evidence to support a tax on SSB (unless price increases were very large) and the impact of F&V subsidies for children and low-income households on overall diet is uncertain and the impact on obesity is likely to be minimal. The latter statement highlights an issue to come out of this series of scoping reviews for the NSW Ministry of Health, i.e. that the choice of strategy depends on the desired behavioural/health outcome. As indicated, F&V vouchers are likely to be an optimal strategy for increasing fruit and vegetable consumption, as is free fruit and vegetables in schools, but such strategies are unlikely, by themselves, to lead to a reduction in the prevalence of obesity.

A recent, although not peer-reviewed, evidence review by Finkelstein et al (2014) examined the link between food or beverage price changes and energy intake or weight outcomes among US consumers. They concluded that current evidence indicates that, by themselves, targeted food taxes and subsidies as considered to date are unlikely to have a major effect on individual weight or obesity prevalence. However, the authors considered that "While research suggests that the effects are modest, food taxes and subsidies may play an important role in a multifaceted approach to reducing obesity incidence". Similarly, other authors such as Dellava et al (2010) and Allemanno & Carreno (2013) indicate that price changes would make a difference by complementing other nutritional policy tools. Other authors indicate that large taxes of >20% may lead to measureable decreases in obesity if combined with additional interventions (Powell et al 2010, Andreyeva et al 2010, Gorden-Larson et al 2011, Mytton et al 2012).

In addition, a glaring gap in the evidence base, as indicated by Hawkes (2012), is any sense of how the food supply would respond to a tax on unhealthy foods, beverages or nutrients. Hawkes considered that the real question that policy makers needed to engage with was how fiscal intervention would affect the choices made by food producers, manufacturers and retailers about the inputs they use and the outputs they produce.

Maniadakis et al (2013) cites the Organization for Economic Co-operation and Development in 2010: *"the impact of fiscal measures aiming to change behaviours may be unpredictable;* because the price-elasticity of demand (PED) varies across individuals and population groups". Nonetheless, the evidence presented in this synthesis suggests that taxation policies would not be inequitable; and might benefit more disadvantaged groups.

Certainly there is evidence of 'market failure' — the freer an economy is, the more obese its people are (De Vogli 2014), a necessary situation for taxation policy to be considered (Kaplan & Thow 2013). Likewise, Duvaleix-Tréguer et al (2012) show that taxation may be efficient and even necessary to correct the potential negative effects induced by population heterogeneity in nutrition and health sensitivity.

In the systematic review by Kaplan & Thow (2013), the authors indicate that "Taxes have the potential to achieve health policy objectives because it is widely recognised that taxes can be used not only to collect revenue but also to incentivise consumer behaviour in line with specific policy goals. Moreover, taxes and subsidies may work to educate consumers, encouraging healthier purchase decisions based not only on the monetary incentive but also on the knowledge of the reason for the tax or subsidy. For example, consumers may substitute away from goods which are subject to an 'unhealthy food tax' for entirely non-monetary reasons perhaps because they were previously unaware such goods were unhealthy". Thus price changes combined with public education campaigns and other regulations affecting the food environment in institutional and home settings may have a multiplicative effect that could significantly improve diets, particularly among at-risk population groups. Although demand for food is relatively inelastic, the power of small price changes, especially applied to foods most responsive to such changes, should not be underestimated given that their effects accumulate across a population.

The price of food in Australia

The price of healthy food in Australia

In 2003 the WHO proposed that the cost and pricing of healthy foods were key considerations in the prevention of obesity (Franck et al 2013). The inexpensiveness of unhealthy foods relative to fresh produce is thought to be an important contributor to the over-consumption of junk food. However, the rationale behind using fiscal policies and pricing/cost strategies to encourage the purchase and consumption of healthier foods and discourage the purchase and consumption of less healthy⁶⁴ foods and drinks is mixed.

There are a large number of studies, including systematic reviews and meta-analyses, reporting on the price of healthier versus less healthy food and how it varies depending on the measure used. The most recent systematic review indicated that healthier options/foods cost more per serving and per calorie and that healthier diets cost more than less healthy diets. However another review has found that for all metrics except the price of food energy, that healthy foods cost less than unhealthy foods. The relationship between energy density and food price is likely confounded by food category and depends on which measure of price is used. The often stated relationship between energy density (unit energy per unit weight) and energy cost (\$/unit energy) is statistically spurious. Davis & Carlson (2014) examined the often indicated inverse relationship between food price and energy density and concluded that "Obviously settling this debate is important ... if the inverse relationship ... is real ... then the higher obesity rates in lowincome groups has a simple economic story: low income groups eat more high energy-dense foods because these foods are cheaper, so addressing income inequality should significantly ease the problem. Alternatively, if the inverse relationship is 'spurious', the economic story relating lower income to higher obesity rates must become more sophisticated and requires more work". They concluded that the inverse relationship was indeed, at least for most foods, spurious.

A large study in the UK recently indicated that more healthy foods (price per kilojoule) are consistently more expensive; although a review did not support these data, instead indicating mixed findings. It's important to note that consumers will not face price per kilojoule in the retail environment, instead they are more likely being faced with price per unit volume or weight, or price per pack or product. Price per serving is lowest for fats. Less healthy versions of the same foods (e.g. low fat milk, wholegrain bread) are generally, but not always, more expensive. One reviewer considered that too few studies have rigorously examined whether the nutritional quality of foods is associated with their prices within the same category. Healthier options can be cheaper than less healthy options, particularly if home brand products are purchased.

There is substantial evidence, including from Australia, that the price of many healthy foods and more energy-dense foods has risen less than the price of healthier foods, generating a growing gap between their relative price.

^{ea}Defined for this study as foods that are high in saturated fat, added sugar, and/or sodium, or that contribute little to meeting dietary recommendations.

The price of a healthy diet in Australia

The cost and affordability of healthy foods has not been investigated systematically in Australia due to lack of standardised methodology (NHMRC 2013, WHO 2013, Lee et al 2013)⁶⁵. Many different approaches to monitoring food prices and affordability have been applied; in particular several groups have assessed the price of a diversity of food baskets (non-comparable) at State, regional or local levels over the last 15 years. However, the foods ('diet') contained in these food baskets do not reflect current NHMRC dietary guidelines, e.g. most include a disproportionate amount of discretionary foods and less healthy options of particular foods. Nevertheless, these baskets do contain a wide variety of foods that make up the diet of Australians and provide insight into the costs of such foods across Australia and over time. The data indicate that while the 'HFB' is available and accessible (i.e. same price) across levels of socioeconomic disadvantage in urban Australia, it is less accessible (reduced availability and variety of healthier items and higher price) in rural and remote areas of Australia. Fruits, vegetables and legumes remain a high price component of these baskets in Australia.

Such 'baskets' are also substantially less affordable among low-income families in Australia. Various studies indicate that the HFB would cost 20–48% of a family's welfare payments, and 29–35% of average weekly earnings, compared to approximately 9% of the disposable income of families of the highest socioeconomic class.

Diet optimisation modelling studies in NZ, in remote Aboriginal Australia, in France and in the US, generally show that healthy diets can be purchased without spending more money (not in remote Aboriginal Australia). However these diets may not meet all of the nutrient targets for all population groups and several studies indicated that these nutritionally-optimised diets were not necessarily 'acceptable' or 'familiar'. For example one study in France indicated that minimising diet price to take into account only nutrition standards led to a diet that no one would want to eat. Qualitative data indicate that low-income and food insecure individuals see branded products and luxury food items as more socially-inclusive.

As indicated above, individual healthy foods can be purchased at a lower price by purchasing home brand versions and shopping at cheaper supermarkets, at least in urban Australia. Dietary intake data indicate that people who spend more on their diet tend to purchase healthier foods and more nutritious diets and people of lower socioeconomic status tend to purchase less healthy diets at a lower price. Price is reported by many to be an important determinant of food choice; however findings from recent qualitative studies, including many in Australia, do not necessarily support this statement. There are clearly a large number of factors affecting food choice. Among those who are food-insecure and/or on low-incomes, it seems likely that price is a factor but is also considered in light of a large number of other factors. The most recent qualitative study in Australia highlighted the complexity of factors affecting food choice and how it has been discussed in the literature under a number of different lenses — individual, cultural, social and structural. Those on low incomes are likely to be more price-sensitive. Food needs to be filling (provide satiety) and provide enough energy to 'do things'; with an underlying goal of obtaining food with 'value for money'. Price per serve and price per energy density are therefore likely to be important metrics for the food insecure and low-income consumers. Parents report that acquiring 'comfort foods' such as fast food and EDNP foods, occurred irrespective of whether there was sufficient money for other items. These foods alleviate stress through activation of a hedonic (reward) pathway and memory; such that within a very short timeframe humans learn that high-fat, high-sugar foods are rewards that dampen the stress response.

A substantial number of price elasticity (PE) studies, including a large number of studies not explicitly reported as PE studies, are reported and reviewed in the literature. Price elasticity refers to the percentage change in guantity demanded (purchased) in response to a unit change in price. There are two types of PE reported — own-PE, i.e. how much the consumption of a particular good changes with a change in the price of the good itself; and cross-PE, i.e. how much consumption of a good changes with a change in another good's price, holding everything else constant. The net health impact of any tax or subsidy on food is a delicate balance of OPEs and CPEs, the baseline distribution of foods consumed, assumptions about whether total expenditures on food remain the same, and other factors (Ngheim et al 2013). Cross-PEs for food/drinks signify that consumers are not very willing to shift consumption across food groups/categories, indicating that pricing strategies need to consider within-group substitution effects, i.e. strategies should be aimed at shifting consumption to healthier close substitutes. Price-elasticity studies, including a significant study in New Zealand, using food expenditure data, indicate that low income and certain ethnic groups may be more susceptible to price changes. Price elasticity studies also suggest that sugarsweetened beverages and fast food may be more price elastic than other foods/drinks.

⁶⁵Healthy Diet ASAP (Australian Standardised Affordability and Pricing) methods have now been developed by Professor Lee and colleagues http://preventioncentre.org.au/our-work/research-projects/isprice-a-barrier-to-eating-healthy-food/ and recent publication by Lee et al (2016) One study which accessed data across 114 countries showed that a 10% increase in food prices leads to a 1.9% drop in expenditure on health care in high-income countries.

A small number of studies of different types in the US and Japan indicate that there is a positive association between food prices and/or the price of diets purchased and BMI. One of these studies was a large ecological study which explored the cooccurrence of obesity growth with relative food price reduction between 1976 and 2001 in metropolitan areas in the US. The findings indicated that relative food price reductions during the time period could plausibly explain about 18% of the increase in obesity among US adults in these areas.

Taxation of obesogenic foods/ nutrients

this scoping review has not considered the direct and relative health impacts of the various 'negative' nutrients and the different food types/groups that could be a focus of fiscal policy, beyond sugar-sweetened beverages and fast food. There is vast and debated literature in relation to these associations which is beyond the scope of the current review and literature synthesis. The reader is directed towards the systematic reviews underpinning the current Australian Dietary Guidelines as well as the multiple systematic reviews and meta-analyses since these underpinning reviews.

The vast and highly debated literature pertaining to the obesogenic and other negative health impacts of nutrients that could be the focus of fiscal policy, such as saturated fat and sugar, is not considered within this review. The health and obesogenic impacts of sugar-sweetened beverages⁶⁶ are discussed in some detail as they are a 'discrete' item for which the negative health impacts when consumed in excessive amounts are irrefutable (see below). The health and obesogenic impact of fast foods, a potential specific food category for taxation, is discussed in the 'Retail' and 'Promotion' domains. The emerging evidence indicating the addictive nature of HFSS and fast foods is mentioned briefly in this domain, suggesting the potential for fiscal policy to be effective as it has for other addictive substances such as tobacco.

The concept of 'food addiction' has public support in the US and Australia (one study). This study, and another three surveys conducted in Australia report mixed findings with respect to public support for taxation of obesogenic foods, with an indication of more support if combined with traffic light front-of-pack labelling (on snack foods; one study); and/or if the revenue is spent on health care.

Despite the most recent reviews indicating relatively low price elasticities for fats, oils and sweets (-0.34 to -0.48); the most recent review of cross-PEs across multiple countries indicated that a tax on sugar, sweets and SSBs could induce, among others, more consumption of healthier alternatives such as F&V, reinforcing the effect of the tax. Data on calorie availability indicate that a tax on fats/oils would lead to a larger reduction in calories overall, than a tax on sweets.

A simulation modelling study in Norway indicates that a VAT on some unhealthy foods will reduce purchasing of unhealthy foods among high-purchasing households more than VAT removal from healthy foods; and this is borne out by other studies, which indicate that consumers weigh losses more heavily from the purchase of a taxed unhealthy product than equivalent gains from the purchase of a subsidised healthy product. Another modelling study using detailed transactionlevel observations across a large, nationally-representative sample of US consumers over the period 2002–2007 showed that a sugar tax is a particularly powerful tool to induce healthier nutritive bundles among consumers. Simulation modelling studies of a fat tax implemented as either nutrientbased or food-based indicate variable impacts on overall food and nutrient consumption and weight; some modelling results indicate only positive effects if combined with a thin-subsidy. Three simulation studies were identified which predicted the effect of a 17.5% VAT on sources of saturated fat, unhealthy foods and combined with a subsidy on F&V; indicating reductions in mortality due to CVD and ischaemic heart disease. Simulation modelling studies are limited by the data sources and assumptions hence the mixed findings of the impact of either a nutrient-based or food-based fat tax on consumption and weight outcomes should be interpreted with caution. Extrapolation models can use static or dynamic models of weight change, and use self-reported or measured weight status/changes; and the degree of allowance for substitution effects are of particular concern. Generally the impact of a fat tax, particularly a food-based tax, is simulated to be small.

Mixed results are observed among five laboratory-based experimental studies simulating the purchasing environment with respect to the potential impact of a tax on unhealthy foods, and whether a tax on unhealthy foods/nutrients is more or less effective than a subsidy on healthier foods, in terms of 'virtual' purchases. A fat tax may affect different population groups differently, with some evidence from a short-term price discount study on less healthy foods, suggesting that a combination of low inhibitory control and overweight status made consumers more susceptible to lower priced unhealthy foods. Similarly. other studies (not cited). have indicated that obese individuals often find food more reinforcing than lean individuals; therefore they may be less likely to respond to small price increase. There is some indication that consumers are more responsive to changes in price than package size for indulgent food items, and the opposite is true for healthier items.

A quasi-experimental trial in a large hospital in the US showed that a 30% tax on unhealthy foods was effective in reducing purchases of unhealthy items and stimulating purchases of healthier items, particularly beverages, resulting in fewer calories and grams of sugar being purchased.

Impacts of the national implementation of the 'fat tax' in Denmark (tax on saturated fat for selected product categories with higher than threshold levels of saturated fat⁶⁷) were considered controversial with cross-border purchasing, concurrent threats of job losses, abuse of the tax to add additional retail prices and substitution of usual versions of the taxed product to cheaper varieties with the same composition. Published data from implementation of the tax on fat in Denmark indicate that consumption of fats dropped by 10-15%, but that not all of the tax was passed on to consumers, and it may have been passed on disproportionately to those who shopped at discount stores. There was some preliminary evidence indicating that Danish consumers do substitute with healthier products but they also substitute their usual unhealthy product with cheaper varieties of the same composition. More recently published data indicate a statistically significant total decrease in the intake of saturated fat from minced beef and regular cream but overall reductions in saturated fat intake were limited.

An ecological study in the US (for which causality cannot be assumed) examined the effect of sales taxes on snack foods and SSBs and obesity across states. The findings are combined for the two products in the abstract, but indicate that US states without sales taxes on (soft drinks or) snack foods were four times as likely as states with a tax to have a relative increase in the prevalence of obesity. Similar results were found in states that had repealed an existing (soft drink or) snack food tax, making them 13 times as likely as other states to have an increase in obesity.

Data in relation to the taxation of fast food, possibly in combination with SSBs, indicate the potential of fiscal policy on these products to affect diet and weight status. A number of longitudinal and demand studies and two systematic reviews in the US indicate that demand for fast food may be quite elastic — with estimates ranging from -0.5 to -1.88, i.e. that sensitivity

to price in terms of purchasing may be quite high, especially among low income consumers and adolescents, indicating the potential for taxation of such foods to influence purchase and consumption. In terms of the effect of price of fast food on health and weight outcomes, the evidence, primarily from longitudinal studies, is more mixed. The majority of evidence, however, supports a negative association between the price of fast foods and BMI, again particularly among low income women and adolescents. For example, data from the 1979 National Longitudinal Survey of Youth showed that a 10% increase in the price of fast foods is associated with 0.9% and 0.7% lower BMI for low-income women and women with any children, respectively, and data from the 20-year CARDIA study showed that a 10% increase in the price of pizza is associated with a 11.5% decrease in energy from pizza in the diet, lower daily energy intake (-124 kcal), lower weight (-1.05 kg) and lower insulin resistance scores. This study noted the combined larger effects of a \$1.00 increase in the price of both soft drinks and pizza.

There is thus considerable debate in the literature about which foods to tax, or whether to tax nutrients instead of food. There are challenges in classifying foods that are often complex many foods have a mix of nutrients, hence a tax risks decreasing the consumption of good nutrients along with the bad. Unintended compensatory purchasing could result in overall effects being counter to health, decreasing the consumption of good nutrients along with the bad. Broader taxes on foods high in sodium, saturated fat and sugars would possibly allow less substitution than narrow taxes; however a concern of taxing a wide range of products would be the fact that people should be encouraged to consume a wide variety of foods and beverages, e.g. milk and olive oil, that would be difficult to include in the tax category. In some cases, taxing many food groups could lead to nutrient deficiencies. Taxing snack foods is likely to be ineffective as there are many close substitutes, and categorisation as 'unhealthy/healthy' is considered to be a grey area — although nutrient profiling in concordance with the Health Star Rating could be used. Taxing fast food is a more appealing option, although the issue of healthier versus less healthy foods/nutrients remains.

Although it is suggested by many researchers that taxing nutrients is preferable if there are many close substitutes, even when a tax is targeted at the product level, taxing nutrients is equally problematic as they are not a problem in small amounts (e.g. not all fats are unhealthy, saturated fat is only considered unhealthy above a certain amount) and there may

⁶⁷The fat tax in Denmark amounts to an additional 3%, for example, on the price of minced beef, 14.6% on whipped cream, 13–6% on rapeseed and sunflower oils, and 30% on butter (Smed & Robertson 2012).
be a trade-off in nutrients. Both strategies risk targeting some manufacturers disproportionately and may lead to substitutions with equally unhealthy alternatives. Price elasticity of demand studies indicate they should primarily target product substitution within food categories (at the product level) as it is easier to shift consumers to close substitutes, e.g. from whole milk to low fat milk (for which there is evidence), or from white bread to wholegrain bread (for which there is a lack of evidence).

It is considered that only small changes would be required to the current GST framework in Australia to tax unhealthy foods, making sure that healthy varieties of take-away foods or savoury snacks, for example, are exempted, thereby creating incentives for manufacturers to reformulate and to offer healthier options at lower prices to consumers.

Although the regressivity argument is not compelling in some respects (as unhealthy foods are not a necessity), a real concern is to ensure access to healthier, subsidised foods otherwise those living in so-called food deserts may be doubly disadvantaged. In addition, although EDNP foods are not a necessity; as indicated in the introductory sections of this review, they do play a considerable part in the social, cultural and emotional (to alleviate stress) lives of people experiencing disadvantage. Thus, taxation could lead to enhanced poverty if such foods were taxed unless equally palatable more nutritious foods are made socially-available.

Nevertheless, the existence of externalities and welfareenhancement is supported by a number of pieces of information: imperfect knowledge (among those that consume more) and time-inconsistent preferences (the long-term negative impacts of excessive consumption on individuals' own health —such as with tobacco) impose significant externalities. The potential 'income effect' is discussed in the literature, whereby high consumers of these goods pre-taxation continue to purchase them post-taxation and therefore have less money to spend on healthier food items. Also, while heavy-consumers may be less responsive to price changes, the impact of a tax on consumption is larger for heavy-consumption consumers, meaning that the health benefits could be higher for these consumers. Conversely, a tax on unhealthy foods would be welfare-enhancing or progressive rather than regressive (if effective).

Limitations to the current knowledge base, particularly in Australia, are exemplified by an Australian study protocol by Comans et al (2013). Their study aims to develop an economic model to assess the lifetime benefits and costs to a cohort of Australian children by reducing energy-dense nutrient-poor food consumption through taxation mechanisms. The model inputs will be derived from a series of smaller studies. Food options for taxation will be derived from literature and expert opinion, the acceptability and impact of price changes will be explored through a citizen's jury and a discrete choice experiment, and price elasticities will be derived from the discrete choice experiment and consumption data.

Taxation of sugar-sweetened beverages

As indicated above, the evidence regarding the negative impact of sugar-sweetened beverages on health and weight is included in this report in some detail. Sugar-sweetened beverages (SSBs) provide nutrient-poor calories in a non-satiating form⁶⁸. There is sufficient and compelling evidence from a large number of reviews, meta-analyses and good quality prospective (and other) studies that consumption of SSBs is causally linked to obesity among children, adolescents and adults. Consumption of these beverages is also associated with obesity-related diseases including type 2 diabetes, and, independent of body weight, to coronary heart disease, elevated cholesterol and triglyceride levels, hypertension and metabolic syndrome; as well as nonalcoholic fatty liver disease. Their consumption is linked to severe dental caries in adolescents in NSW, and they may be linked to a range of child and adolescent behavioural issues⁶⁹.

There is generally strong public support for SSB taxation in Australia and in France, but not in the US, with higher support levels reported if funds where the revenue is used to fund health programs or the health system.

The evidence regarding price elasticity of demand for SSBs/ soft drinks is variable, although various studies, including systematic reviews, indicate that the own-PE for soft drinks might be as high as -2.26; although most studies indicate a value closer to 1.0 — indicating a 10% increase in price would reduce consumption by 10%. Higher values indicating large price sensitivity are indicated if diet and sugary soft drinks are considered separately. Recent data from Mexico give evidence for higher elasticities of demand among households in rural areas, in more marginalised areas, and among those with lower incomes. There is a lack of information on cross-price elasticity of SSBs, with one meta-analysis of four studies indicating that higher prices for SSBs were associated with increased demand for fruit juice, milk and diet drinks⁷⁰.

⁶⁸The mechanism by which SSBs are linked to weight gain is through low satiety and therefore lack of compensation for the liquid calories (DiMeglio & Mattes 2000; Mourao et al 2007).

⁶⁹Although the latter evidence relates to SSB consumption in the US, where high-fructose corn syrup is used to sweeten the beverages. ⁷⁰The reader is directed to the very recently published studies by Zheng et al (a, b, c) using data from Denmark and Australia indicating that replacing SSBs with water or milk, but not 100% fruit juice, is

inversely associated with body fatness development.

Observational, longitudinal data in the US has shown that an increase in the price of SSBs is associated with fewer visits to fast food outlets and that a large increase in the cost of SSBs was associated with lower daily energy intake. However, one study showed no association between price of SSBs and consumption frequency. In addition, multiple modelling studies using demand and econometric data generally find that a tax on SSBs — frequently used values are around 20–30% volumetric tax — would be effective at reducing energy intake from SSBs, but the findings are mixed with regard to substitution effects, hence overall energy intake.

Econometric studies using a variety of data, including scanner data and household purchase data, show mixed effects on weight status, however they do indicate that a volumetric excise tax of 20% is likely to produce the largest weight loss, of up to around 1kg per year, at least in the first year; but these positive weight outcomes are based on models that mainly do not consider substitution to other beverages or foods of high calorific value. Two longitudinal, observational studies indicate that higher-priced SSBs are associated with a lower likelihood of being overweight.

Two small experimental studies conducted under virtual conditions indicate that a tax on SSBs (in one study of 19%) is likely to lead to decreased purchasing of SSBs and substitution with healthier beverages. However a six-month field experiment in the US across 113 households showed that a 10% tax on soft drinks led to an increase in soft drink consumption and beer consumption (among beer-purchasing households).

Volumetric excise taxes have been shown to be more effective than sales taxes in terms of reducing the purchase of SSBs. In Ireland a repeal of a volumetric excise tax on SSBs led to a decrease in consumption (6.8%) that could have been larger if some of the repeal was not taken up by VAT. Preliminary data from implementation of the country-wide volumetric excise tax of approximately 10% in Mexico indicate that there has been a 10% decline in the purchase of the taxed beverages with concomitant increases in purchases of some untaxed beverages and plain water. The effect was largest among lower-income households.

The various studies in the US relate to small sales taxes which are applied at the register hence are not visible to consumers and consequently the evidence overall does not indicate changes in purchasing behaviours. Neither does this evidence indicate any significant changes in weight status; although one study showed very small reductions in BMI and relatively larger changes in BMI among some population groups, including those at the tails of the BMI distribution. One study showed that SSBs were replaced in calorific value by whole milk among children and adolescents. However, an ecological study (indicated above with respect to taxation of fast foods) examined the presence of US state-level taxation on soft drinks and fast foods between 1991 and 1996 and relative changes in obesity prevalence using data from a population survey. There was no association with obesity point prevalence between states with and without a \geq 5% tax on SSBs; however, states with no tax were more than four times as likely to experience an increase in obesity. In addition, those that repealed the tax were more than 13 times as likely as other states to experience an increase in obesity.

Substitution effects from household survey data and demand studies are mixed but several studies indicate that SSBs and diet soft drinks are complementary, i.e. that they are not substitutes for each other. A modelling study indicated an increase in fat and sodium intakes as a result of substitution. A study of the impact of state sales data and excise tax information between 1989 and 2006 showed a reduction in soft drink consumption by children and adolescents, but there was no impact on weight due to increases in consumption of whole milk. As reduced-fat milk is price elastic (cf. below), a combined strategy of a tax on SSBs and a subsidy on reduced-fat milk could lead to an overall decrease in calories and improved health. Overall, the data are mixed regarding what substitutions would occur in response to a soft drink tax — consumers have been shown to switch to milk, fruit juice, diet drinks, water, or beer. Evidence indicates substitution with sugary foods is unlikely — one study indicated that there would not be any increases in calories consumed from 12 other food groups. The context of SSB consumption may be important — it is often consumed in conjunction with less healthy foods, such as fast foods.

One study used a macroeconomic simulation model and showed that SSB taxes do not have a negative impact on statelevel employment; and industry claims of regional job losses are overstated, in the US. The evidence suggests that a tax on SSBs in Australia should be a volumetric tax administered through the existing framework of either the excise or the wine equalisation taxes.

In summary, SSBs are probably relatively price elastic compared to a number of other foods and beverages, hence, particularly as they are linked causally to a number of morbidities including weight status, and are of little nutritional value, they are a prime target for taxation. Most of the arguments against taxation have been adequately refuted. Overall the body of evidence suggests that, if large enough, such a volumetric excise tax could lead to substantial reductions in consumption, and, provided that it is implemented in association with other appropriate taxation/subsidies, such as including sports drinks and other non-carbonated beverages with added sugars, and subsidising reduced-fat milk; may lead to reductions in weight. Other health outcomes (e.g. improved nutrition through consumption of milk, reduction in dental caries, less diabetes) are likely even if substitution effects maintain energy intake. Effects are likely to be largest among adolescents (who are large consumers of SSBs and have less disposable income) and young children. The equity effects remain uncertain, although one review involving six studies on soft drinks indicated that 11 of 14 studies estimated that food pricing strategies would be associated with pro-health outcomes within lower socioeconomic groups and have the potential to reduce disparities in health. Barnhill & King (2013) examined the suggested exclusion of soft drinks from the SNAP assistance (welfare) program and concluded that two equity-based ethical objections were not decisive, and that the proposed exclusion of SSBs is not a violation of either distributive or social equality.

A recent study showed that the pairing of SSBs with calorie dense food was favourable to consumers but pairing SSBs with vegetables was not favoured. Results suggest simple consumer strategies that might be employed to change dietary patterns (e.g. drink water with meals), and hold straightforward policy implications (e.g. increase water as the default option in meal deals).

Subsidies for healthy food

there is mixed evidence from econometric studies on the effect of price of healthier foods such as F&V and less-fatty foods on the demand/consumption of those foods. Price elasticity of demand studies for F&V indicate an own-PE of between -0.35 (systematic review of simulation studies) to -0.32 (longitudinal study) to -0.53 (systematic review and meta-analysis). Household purchasing data indicate that it is easier to change consumption from fatty products to low-fat ones through price discounting. Expenditure elasticities, i.e. accounting for income, suggest that income may play a more important role in purchasing than price among disadvantaged consumers, although price is considered to play a role, at least for some fruits. Sturm & An (2014) considered that, although subsidising healthier foods can increase their purchase and consumption, inelastic demand means that changes in consumption will be smaller than price changes.

There are a large number of studies, including cross-sectional and cohort studies of household purchasing and dietary intake in relation to price indices, indicating a positive relationship between the price of healthier foods, reduced diet quality and weight and health outcomes. The evidence is particularly abundant from longitudinal studies and time series data in the US, indicating positive associations between the price of F&V and a healthy weight among children. For example, in a large study in Italy, the relative increase in healthy food prices was found to produce non-trivial elasticities of substitution towards higher relative consumption of unhealthy foods, with effects on weight outcomes. These differences were distributed unevenly, and were particularly significant among those of lower SES. Prices of healthier foods have also been significantly associated with lower sodium intakes and blood cholesterol levels.

Four experimental studies conducted under laboratory or simulated retail environment conditions were identified which examined the effect of price subsidies on purchasing. Findings were mixed and indicate that effectiveness may differ according to socio-demographic factors such as age, income and peer pressure. One of the studies examined the selection of food baskets with contents containing different-priced foods. The price manipulations indicated that subsidies might increase socio-economic inequalities in health. A subsidy on healthier foods including F&V has been generally criticised as risking bestowing a windfall to those already purchasing a healthy diet, often the wealthy; i.e. it risks being inequitable and regressive.

Modelling studies indicate that a subsidy for F&V, healthy grain products, fibre, or diet soft drinks will have modest effects on weight. In Australia it has been estimated (using PE estimates from the US) that adding GST to F&V could cost about 10,000 life years and add a billion dollars in health care costs over the lifetime of the 2003 Australian adult population.

Data from econometric studies and one empirical study indicate that within-category demand for milk may be highly elastic, suggesting promise in terms of effectiveness of a pricing discount for lower-fat milks: although it should be noted that any intervention should not affect the giving of whole milk to 1–2 year-olds. A longitudinal study in Denmark has shown that the consumption of milk instead of SSBs has been shown to result in favourable body fatness outcomes in children.

Data not included in the main text indicate that reducing the price of healthier oils (reduced saturated fat content) in Singapore so that prices were commensurate with the less healthy palm oil led to an increase in use of the healthier cooking oils by roadside food 'hawkers'⁷¹.

⁷¹Hawkes et al (2014) cited by the report on 'Using price policies to promote healthier diets' by the World Health Organisation (2015)..

Temporary price promotions/discounts

Scanner and purchase data across a wide range of products indicate that sales (mainly price) promotions lead to increased category purchases, which may lead to long-term increased consumption due to repeat purchasing) but this evidence has mainly concentrated on less healthy food and beverage products. More recent observational data from two studies, one at the population level in Great Britain and one among a small sample of low income shoppers in the US, suggest that sales of some healthier foods such as low fat yoghurt and fruit may be increased by price discounts. The effect of price discounts on sales appears to vary depending on food type and also the type of consumer according to food type/product.

The evidence from experimental studies including choice experiments under laboratory conditions and in simulated shopping environments supports reducing the price of F&V and other less energy-dense foods. One laboratory study found that taxing high-ED products was more successful in reducing calorie consumption than subsidising low-ED products. Findings are mixed, however, as to whether there is an increase in overall energy purchased, with the evidence tending towards this being increased.

A number of the studies indicate that a thin subsidy combined with a fat tax is likely to be more effective than either alone. Three recent reviews of field experiments across a range of settings including supermarkets, cafeterias, vending machines, farmers markets and restaurants indicated that there is consistency in findings across a relatively large number of studies that reducing the unit retail price of healthier foods relative to less healthy foods is effective in increasing purchase of those foods. However several recent primary studies of the effectiveness of price discounts in increasing healthier food/F&V purchases across different settings have provided mixed results. Nevertheless, a number of recent experimental studies in supermarkets have indicated a positive effect of temporary price discounts on purchase of healthier foods, including F&V, although there is not enough evidence to ascertain the effect on nutrients purchased. Subsidies may allow lowincome consumers to purchase healthy food that they could not previously afford: they may use the money they 'saved' to purchase more of the less healthy options; and there is some evidence to show that more food (energy) is purchased overall.

In terms of implementing price controls on F&V, Shill et al (2012) indicated that "set a maximum allowable mark up on F&V for retailers based on the price at the farm gate" was supported by representatives from state government.

Pricing discounts in prepared food outlets

Two intervention trials in the US, one of them the Baltimore Healthy Carryouts intervention, which focused on price reductions for combination meals as part of an overall strategy, provide some limited evidence that sales of these products increased as a result of the price discounts.

Quantity discounts

There is a lack of evidence around the effectiveness of quantity discounts for increasing purchases of healthier products, although marketing studies and data indicate that such promotions increase purchasing, and probably consumption, of less healthy products.

Use of coupons/vouchers for healthier food

Although the evidence is somewhat mixed, a large proportion of intervention studies, including a large trial in a large supermarket chain in the UK, showed significant positive effects of vouchers for subsidised F&V on increased F&V purchases, particularly among low SES. Notably in this latter study only about 8% of coupons were redeemed. The coupons offered a discount of UK£1 for a minimum UK£3 spend . The author indicated that higher discounts may be necessary to increase participation. Membership cards were used in this study to identify customers with low F&V purchases who were to be targeted by the scheme. A larger financial incentive was suggested as being necessary in an earlier small intervention trial in the US where a discount of 50¢ was offered. Cash-value vouchers for F&V (US\$10 for women and US\$6 for children per month) issued as part of the US Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) led to large increases in purchases of fresh and frozen vegetables as indicated by scanner data, with the biggest improvements being for fresh fruits, with an increase of 28.6% adding almost a kilogram of fresh fruits per household per month. A single modelling study in France guantified the economic and health effects of a F&V policy and showed that targeted voucher policies will be more cost-effective than non-targeted policies but only when the targeted policy is focused narrowly on the lowest income consumers.

With regard to subsidies, Pomeranz et al (2014) indicate that policy makers should consider two complementary laws: minimum price laws, and prohibitions and coupons and discounting, to accomplish the intended price increase.

Loyalty programs

There is mixed evidence from empirical studies and field experiments as to whether consumers are equally responsive to price discounts and reward point-promotions under retail itembased loyalty programs; however there is a lack of published evidence of the impact of loyalty programs on sales of healthier food/drink items. Literature mainly relates to branded loyalty programs targeted at store-wide behaviours rather than the individual product-level behaviours.

Use of vouchers in famers markets

All of the evidence around farmers markets (FMs) and the use of incentives to promote F&V purchase and consumption are from the US, where the use of incentives (vouchers for F&V) have been implemented for recipients of SNAP or WIC welfare programs, among low-income adults and seniors, and among disadvantaged youth. Evaluation of these programs involve predominantly self-reported purchasing and consumption but they collectively indicate that vouchers can be effective in increasing purchase and consumption of F&V, particularly among the vulnerable groups targeted. Farmers also report benefits, including increased revenue. Data are lacking with respect to impact on overall diet, energy intake and weight status.

Cash-back rebates

The Healthy Food Program in South Africa, provided by health insurer Discovery and within the health program 'Vitality' provides a cash-back rebate of up to 25% (after online risk assessment) for healthy food purchases in over 400 designated supermarkets. Two articles have been published in the peerreviewed literature and both indicate higher consumption of F&V and whole-grain foods and lower consumption of high sugar/salt foods, fried foods, processed meats, and fast food, which are 'discouraged'. The results indicate that these changes are meaningful in terms of purchase behaviours, although there are no data to support any changes in obesity prevalence, despite the large rebate, and the program is very costly.

Free or subsidised F&V in schools

There is substantial evidence from pilot studies and subsequent large scale implementation at the national level in Norway, The Netherlands, Canada and the UK, that free F&V programs lead to increased consumption of fruit in primary-school-aged children. The impact on vegetable intake is generally lower, but this is likely due to a much larger focus on fruit, with some schemes such as that in the UK, only involving fruit. The programs have not been extensively trialled and implemented in high schools. Subsidised schemes have been shown to be much less effective than free F&V schemes. The schemes also increase children's acceptance of new varieties of F&V, their willingness to try new varieties, and preferences for fruit.

The effect on overall diet hasn't been studied extensively, however the one experimental study that did investigate this outcome showed that the school free fruit scheme in Norway led to a larger reduction in unhealthy snack consumption than nutrition education alone. Another study in Norway, a randomised-controlled trial, did not find a statistically significant effect of free fruit at school on BMI when data were adjusted for school, sex, grade level and parental education.

Unpublished evidence from implementation among low-decile schools in New Zealand indicates that free fruit is associated with marked improvements in children's well-being and learning. Free F&V schemes have been identified as being highly acceptable to teachers and children, although a number of barriers exist, including delivery, quality, wastage, and spoilage after cutting in the classroom.

The provision of free vegetables in schools has been implemented substantially less as part of these programs (some were only free fruit); and increasing intake of vegetables in children (and adults) remains a challenge.

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Results - Retail

Key findings

Consumer food environment

- More research has been conducted in relation to increasing the availability of and access to healthier foods than to reducing the availability of and access to less healthy foods and beverages that are energy-dense and nutrient-poor (EDNP; high in fat, sugar and/or salt). Despite this, observational evidence indicates that substantially altering the ratio of healthier to less healthy items in-stores, i.e. reducing the proportional availability of EDNP foods, is likely to be necessary as an obesity prevention measure (as opposed to only increasing the consumption of fruit and vegetables (F&V)).
- There has also been more research conducted in relation to improving the healthiness of individual stores, i.e. changing the consumer food environment (in-store contents in grocery/corner stores) than in relation to changing the community food environment (density of 'healthy' and 'unhealthy' stores/food outlets; cf. below).
- In addition to observational evidence supporting the need to increase the availability of healthier foods instore, promising interventions are available to support grocery store owners to increase the availability of healthier produce. However, these interventions have usually addressed both supply and demand by including strategies to increase the visibility and point-of-purchase promotion of the healthier items in-store and/or pricing strategies. Thus increased availability may be a necessary but not sufficient part of the solution to increasing the purchase and consumption of healthier foods and beverages.
- A multi-pronged approach is therefore required involving placement, pricing, promotion and increased proportional availability of healthier foods and decreased availability of less healthy foods. Different approaches may be more or less effective depending on the food category. There may be a 'threshold level' of impacts from a multi-pronged approach that tips the consumer into perceiving stores as healthier and making the healthier products more appealing to the consumer.

The scarcity of trialled intervention with respect to reducing the ubiquity of energy-dense, nutrient-poor foods and beverages in-store concurrently with the introduction of healthier foods and beverages, across a range of retail outlets, is a vital gap in the evidence.

Community food environment

- Observational evidence supports intervening to increase the proximity and density of healthier food stores in the community food environment in addition to the in-store environment. Although often purported and likely to be a useful strategy to increase access to F&V and core food items, evaluation studies show that increasing the density of supermarkets also increases access to non-core foods/ beverages. Further, perceived availability of F&V may not be increased among shoppers of lower socio-economic status. The overall impact in terms of diet is not therefore likely to be positive, particularly for those whose diet is already lower in nutritional quality. The distinction between a healthy store/food outlet (i.e. a store/food outlet with an overall high healthiness rating due to a proportionally large number and variety of healthy products) and a store/food outlet which contains some healthier items but a proportionally large number and/ or variety of EDNP items, is important when considering intervention options and intended outcomes.
- Increasing F&V availability via farmers' markets and market stands may lead to an overall reduction in the price of F&V in the neighbourhood environment, although this evidence is from one study only. There is no available evidence for the impact of farmers' markets on overall diet. No research studies were identified regarding the impact of the availability of/proximity to greengrocers on any dietary or health outcomes.

- Evidence of the association of fast food availability and of fast food consumption with diet, weight status and/or health is mixed. This may be due to measurement issues (including the categorisation of types of store, e.g. as fast food, takeaway, or sit-down restaurant) as well as the ubiquity of other takeaway food outlets (including bakeries and cafes) and other store types selling EDNP foods and beverages, such as convenience stores, corner stores, and service stations. The most robust associations that are supportive of intervention regarding the fast food environment are between: fast food consumption and lower diet quality, fast food consumption and energy intake, and neighbourhood fast food availability and diet quality.
- Evidence from real world implementation of a zoning regulation in the US on the density of fast food outlets indicates that the regulation must be sufficiently comprehensive to actually achieve reduced availability and access. Implementation evidence from zoning of F&V outlets/greengrocers in the US emphasises the need for enforcement of the regulation.

- There is little observational evidence available to support reducing the density of fast food outlets near schools, probably due to the ubiquity of fast food outlets and/or the substitution of fast food for EDNP foods from local takeaways and/or supermarkets/corner/convenience stores near schools.
- Changing the mix of the neighbourhood food environment to one that is healthier – through incentivising retail stores and prepared food outlets with a healthier overall profile to locate near schools and in lower socioeconomic status areas in particular – may have a larger impact than restricting the density of new fast food outlets. Targeting the community food environment around workplaces may offer particular gains in relation to adult obesity.

Summary of evidential support for intervention in the retail food domain

FOOD ENVIRONMENT OBJECTIVE		SUPPORTING EVIDENCE (OBSERVATIONAL STUDIES)	ACTIONS IMPLEMENTED			INTERVENTION EVIDENCE Does it work in practice?
				Purchases/ Consumption	Overall diet	BMI/ health
CONSUMER FOOD ENVIRONMENT	Increase availability of healthier items in-store	Objective healthy food availability → Purchases healthier foods Perceived healthy food availability → Purchases & consumption healthier foods	Support to local grocery stores (small grants, equipment, training, etc) ¹			
	Decrease availability of less healthy items in-store	Shelf space availability non-core items → Weight/BMI*	Support and/or local nutrition policy – local grocery stores			\bigcirc
COMMUNITY FOOD ENVIRONMENT	Increase access to/ geographic availability of healthier stores	Supermarket proximity/ density → Diet quality → Weight/BMI	New supermarkets established (in underserved areas)			\bigcirc
		Purchases & consumption of healthier foods Proximity to healthy food stores → Purchases & consumption of healthier foode Weight/BMI	New farmers' markets established	\bigcirc		\bigcirc
		BMI* Density/proximity to greengrocers → No associations published	Zoning for new greengrocers	\bigcirc	\bigcirc	\bigcirc
	Decrease access to/ geographic availability of less healthy stores	Overall Fast food availability → of ast food consumption Energy intake Diet quality Health Weight/BMI Fast food consumption → Dietary practices/quality Weight/BMI	Zoning to restrict density of fast food outlets	\bigcirc	\bigcirc	\bigcirc
		Among children Fast food consumption → Diet quality Health Weight/BMI Fast food availability near schools → Fast food consumption Diet quality Fast food availability near schools → Weight/BMI	Zoning to restrict fast food outlets near schools	\bigcirc	\bigcirc	\bigcirc

Key

Supporting evidence

- * One study
- \rightarrow "is associated with" / "had an effect on"

Evidence of association/effect is supportive of intervening

Mixed evidence of association/effect to support intervening

Intervention evidence

- Evidence of effectiveness highly supportive of intervention
- Evidence of effectiveness supportive of intervention
- Mixed evidence to support intervention
- Evidence of intervention ineffectiveness
- Lack of evaluation evidence (gap area)

Comments

Large number of evaluation studies. Support of shop owners led to increased availability F&V/healthier options

All were multi-component interventions — i.e. increased availability combined with increased visibility/promotion and/ or pricing

Very small number of evaluation studies.

Support/policy in Aboriginal stores in Australia led to decreased availability of EDNP foods

All studies led to higher availability of/improved access to F&V and other core foods but also to less healthy foods

Evaluation studies of relatively poor quality using self-reported F&V consumption and not randomised

A farmers' market was associated with decrease in overall neighbourhood grocery prices (one intervention study)

Single evaluation study identified (US): enforcement of zoning regulations allowing use of F&V outlets in ordinances was strongly positively correlated with number of F&V outlets in 13 US counties

Single evaluation identified (Los Angeles): zoning regulation only covered new outlets in open areas (not malls) therefore density of FFOs not reduced (obesity increased)

Implementation examples but no evaluations identified

Introduction

Overview of the retail domain

Retail food environments are considered influential in determining dietary behaviours and health outcomes (Ni Mhurchu et al 2013; Caspsi et al 2012). The retail food environment domain can be divided into the consumer food environment (the availability, prices, promotions and nutritional quality of products within stores) and the community food environment (the type, availability and accessibility of food outlets). In this domain we have concentrated on an examination of evidence regarding the availability of foods and beverages in-store and the density and proximity to various types of food outlets in the neighbourhood environment.

Food accessibility includes issues relating to food price and transport, the former of which is included as a separate domain (Pricing), and the consideration of improved transport options to access healthier foods is outside of the scope of this review.

Ni Mhurchu et al (2013) have concluded that aspects of the food environments that may be important to monitor include:

- food source/outlet type
- relative outlet density of healthy and unhealthy stores
- availability of healthy and unhealthy foods and beverages in-store
- shelf space allocated to specific foods/beverages
- product placement (e.g. end-of-aisle, checkouts, number of locations) and displays.

Ni Mhurchu (pers. comm.) has since indicated that product placement is a form of marketing and as such might be better placed within the INFORMAS Promotion domain. Short-term pricing promotions are included as part of the Pricing domain. This document synthesises information about the nature of the food environment relating largely to the availability of healthy and less healthy food within the retail environment. A descriptive background to the retail domain is provided, as is the observation of associations between the retail food environment and obesity-related outcomes, providing a rationale for intervention.

As indicated above, within the INFORMAS framework the Retail domain is divided into two sections:

- 'the consumer', which includes actions such as shelfspace ratios, and placement of F&V versus less healthy foods and beverages in-store.
- 'the community' relating to the relative density of F&V and fast food chain outlets and the proximity of food outlets to schools, for example.

In this review 'the retail community' has included local availability of F&V via farmers' markets.

Several aspects of the food system were generally considered to be out of scope for this review in relation to policy options. These exclusions include land-use planning; structural mechanisms for improved distribution networks; supply-chain incentives for production of fruit and vegetables; health-in-all policies; governance structures for multi-sectoral engagement; the built environment; improved public transport options for access to healthier food; urban and peri-urban agriculture; school gardens; and other small-scale, local food supply and access options to improve local and household food security for fresh produce. However, some literature for these types of actions relating to the local fresh food system was identified and is included in the Appendices (1 and 2) to illustrate the nature of information and evidence for such actions.

Brief background: retail food environment

Availability of healthier food and beverage items in Australian stores

- In contrast to evidence from the US, availability of healthier food and beverages is not different in low SES urban areas of Australia (and the UK), however there may be less variety and a lower quality of healthier options in these areas.
- Millichamp & Gallegos (2013; AUS): In a multisite crosssectional study of farmers' markets, supermarkets and independent F&V retailers in SE QLD, availability, variety and quality did not differ significantly across levels of socio-economic position. However, the areas with the greatest socio-economic disadvantage scored poorest for quality and variety.
- Williams et al (2010; 2012b; AUS): Actual access to healthier food tends to be similar across levels of SES.
- Thornton et al (2010; AUS): Poorer diets were found among women living in disadvantaged neighbourhoods in Melbourne, however the differences were not attributable to less supportive nutrition environments in these neighbourhoods.
- Winkler et al (2006; AUS): In the Brisbane Food Study, little or no differences in availability of healthy food were found on the basis of area SES characteristics.
- Woodward et al (1999; AUS): A study in Tasmania showed no differences in foods available according to level of disadvantage.

- Cannuscio et al (2013; US): Supermarket offerings varied, with significantly fewer healthful foods at supermarkets closest to the homes of disadvantaged residents.
- Black et al (2012; UK): A survey in Southampton showed no difference in availability across neighbourhoods. However, the poorest neighbourhoods had less variety of healthy products and poorer quality F&V than more affluent neighbourhoods.
- Gustafson et al (2012; SR; mainly US studies): This review identified 6/10 studies which reported lower availability of healthy food in retail outlets in low SES areas; 4/10 reported no difference in availability.
- Sharkey et al (2012; US): Convenience stores provided a greater assortment of less healthy food than healthier foods and beverages.
- Bodor et al (2010; US): African-American neighbourhoods had fewer supermarkets and the aggregate availability of fresh F&V was lower than in other neighbourhoods. There were no differences in snack food availability. The authors concluded that other store types did not offset the relative lack of supermarkets in African-American neighbourhoods in the provision of fresh produce, though they did for snack foods. Altering the mix of foods offered in such stores might mitigate these inequities.

Availability of non-core foods

- Energy-dense, nutrient-poor foods are ubiquitous in many retail outlets.
- Wright et al (2015; UK): Among 205 non-food stores in a large indoor shopping mall in Gateshead, 15.6% displayed food at the checkout. All displayed less healthy foods, and 43.8% also had healthier foods. Overall 5,911 checkouts were identified. Of these 80.6% were classified as 'less healthy'.
- Innes-Hughes et al (2012; AUS): An audit of all types of retail outlets including pharmacies in three towns in rural NSW showed that EDNP foods were highly available across all types of outlets.
- Walker et al (2008; AUS): In a large supermarket in Melbourne, a consumer could choose from 1070 different snack foods and 863 different drinks. Flavour variety was more common in snacks (maximum thirteen per product) while variation in container size was more common for drinks (up to ten per product). Depending on the nutrient profile system selected, only 9–22% of snack foods presented for sale could be deemed 'nutritious' by multiple criteria. Similarly, only 14–27% of beverages met 'healthy' criteria.
- O'Malley et al (2013; US): In New Orleans, supermarkets were the primary food source but people who shopped at corner stores typically purchased prepared foods and/or beverages, making up nearly one-third of energy intake.

- A large amount of shelf space is devoted to noncore foods and beverages in Australian (and international) supermarkets.
- Thornton et al (2012; 2013; international including AUS): In a study comparing supermarket shelf space dedicated to different foods and drinks across Australia, Canada, Denmark, Netherlands, Sweden and the UK, the greatest aisle length dedicated to soft drinks was in Australian supermarkets. High levels of snack food and soft drink displays were identified within supermarkets across all of the eight countries.
- Farley et al (2009; US; cross-sectional): In LA, although supermarkets offer far more shelf space for F&V than other retail outlets, they also devoted more shelf space to unhealthy snacks than to F&V.
- There is mixed descriptive evidence (from two studies in Australia) as to whether shelf space allocation to non-core foods and beverages differs according to SES area.
- Cameron et al (2013; AUS): In supermarkets in Melbourne it was shown that exposure to energy-dense snack foods (crisps, chocolate) and soft drinks, as determined by shelf space, was greater in low SES neighbourhoods.
- Vinkeles Melchers et al (2009; AUS): There was no difference in the shelf space dedicated to non-core foods in either low or high SES areas across metropolitan Sydney.

Ratio of healthy to less healthy items in-store

- Descriptive evidence and informed opinion indicates that it is increasingly important to concurrently decrease unhealthy food and beverage items in retail while increasing availability of healthier items.
- Nutrition Team and Queensland Government; RIST Evaluation Report (2010; AUS): Evaluation of the Remote Indigenous Stores and Takeaways (RIST) project showed that it is important to address unhealthy foods and drinks in concordance with increasing healthier options in remote stores (reduce ratio of EDNP foods to core foods), as unhealthy foods and drinks are sold in large quantities.
- Sharkey et al (2012; US): Convenience stores in low SES areas provide a greater assortment of less-healthy foods compared with healthier foods and beverages. There are opportunities to influence consumer food choice through programs that alter the balance between healthier and less-healthy foods and beverages in existing convenience stores that serve rural and underserved neighbourhoods and communities.
- 'Food swamps' areas in which relatively large amounts of energy-dense snack foods inundate healthy food options, may be more important than 'food deserts' where there is limited access to healthy food, especially F&V. [Rose et al (2009); Cohen et al (2010); Fielding & Simon (2011)]
- Ver Ploeg et al (2009; US): Easy access to all food rather than lack of access to specific healthy foods may be a more important factor in explaining increases in BMI and obesity.

- Non-core foods and beverages are purchased more by low than high SES shoppers and purchases are high in remote Aboriginal communities in Australia.
- Brimblecomb et al (2013a; AUS): In remote Aboriginal stores a large proportion of total food expenditure is on SSBs, sweets and ice cream and very little on F&V (includes trend data showing situation hasn't changed).
- Brimblecombe et al (2013b; AUS): In remote Aboriginal stores, one-quarter of total food expenditure was on non-alcoholic beverages; 15.6% was on sugar-sweetened drinks. 2.2% was spent on fruit and 5.4% on vegetables. Sugars contributed 25.7%–34.3% of dietary energy, 71% of which was table sugar and sugar-sweetened beverages. F&V sales comprised 10.4% on average. Relatively few foods were major sources of nutrients.
- Vinkeles Melchers et al (2009; AUS): Study in Sydney metro showed that, after adjusting for number of people shopped for, low SES shoppers purchased significantly more non-core foods than high SES shoppers, especially chips, SSBs and cordials.

Density of different retail outlets in Australia

- Availability and access to supermarkets is not universal and the density of greengrocers is low in parts of Australia.
- Stirrat (2012; AUS): A food security needs assessment in the City of Greater Geelong (in December 2011) showed there were 1792 registered food premises of which 21% were takeaway food outlets, while supermarkets and green grocers accounted for 2.4% and 1.4% of these premises respectively. The socio-economically disadvantaged northern suburbs of Geelong had the highest number of takeaway shops per 1000 population (with the exception of the CBD) and the lowest number of fresh food outlets. The northern Bellarine had no green grocers. With one supermarket and no green grocers in the Geelong CBD and numerous takeaway options there were limited healthy food options.
- McCluskey (2009; AUS): In Moreland, there were 1.59 takeaway stores per 1000 persons compared with 0.49 fresh food stores per 1000 persons (30% greengrocers) and 0.13 supermarkets/1000 persons; the same study showed far greater access to takeaways on foot than fresh food outlets.

Foods purchased from retail outlets

- Corner stores and convenience stores primarily stock high-energy foods and beverages and these are the foods predominantly purchased from these outlets.
- Lent et al (2015; US): The most common corner store purchases were beverages, chips, prepared food items, pastries and candy. Beverage purchases occurred during 65.9% of intercepts and accounted for 39.2% of all items with regular soda being the most popular beverage purchased.

The consumer food environment

Food environment objective: increase availability of healthier food/beverage items in-store

ACTION:

Support grocery stores to increase overall availability of healthier items

Supporting evidence

Availability of healthier foods and purchasing/consumption of healthier foods

- Cross-sectional and ecological data indicate that people are more likely to shop at stores with healthier scores. They tend to buy more F&V and less SSBs.
- Bussey et al (2012; AUS; *cross-sectional*): A cross-sectional study among 401 Aboriginal people in the Fitzroy region of the Kimberley showed that community stores with healthier scores (sold more vegetables and wholegrain foods, for example) were positively associated with higher purchases of vegetables, as well as self-assessed health status and individual triglyceride levels. The cost of F&V was significantly lower in stores with higher scores, however the overall cost of foods was significantly higher in these stores (participants felt they had enough money to purchase healthier food in these stores).
- Gustafson et al (2013b; US; *survey*): In a study of food venue choice among 121 shoppers in Kentucky, those who shopped in supermarkets with higher availability of healthy foods were less likely to consume SSBs (OR=0.65; 0.14-0.83). [Note: Shopping frequently at a supermarket was associated with greater likelihood of consuming SSBs (OR=1.39, 1.08-2.23).]

- Cannuscio et al (2013; US; *mapping*): In multivariate analyses of food shopping among 373 retail stores in Philadelphia, participants were significantly more likely to shop at supermarkets closest to home if those supermarkets had higher healthiness scores.
- Martin et al (2012; US; cross-sectional): Among 19 corner stores in Hartford, greater availability of F&V in the store was associated with greater likelihood of purchasing F&V. For each additional variety of fruit there was a 12% increase in odds of purchasing and for vegetables there was a 15% increase in odds of purchasing. Greater availability of reduced-fat milk was not associated with greater likelihood of customers purchasing it.
- Bodor et al (2008; US; *cross-sectional*): In New Orleans, each additional metre of shelf space allocated to vegetables was associated with 0.35 servings per day of increased intake. Shelf space allocation to fresh fruit was not associated with increased intake.
- Fisher and Strogratz (1999; cited in Rose 2010; ecological): A positive correlation was found between the proportion of low-fat milk in area stores (by zip code area) and the prevalence of low-fat milk consumption in households (self-reported, telephone survey).
- Cheadle et al (1991; cited in Rose et al 2010; US; survey): Among 12 communities/counties in Hawaii and California, there were significant correlations between relative shelf space (in-store survey) devoted to red meat, reduced-fat milk, and non-white bread in community stores, and individuals' consumption (in catchment area of those stores) (self-reported, telephone survey, FFQ). Correlations of changes in the two measures over time, however, were weaker and non-significant.

Availability of healthier foods and purchase of less healthy foods and beverages

- One recent study from the US showed that lower amounts and varieties of fresh produce were associated with a higher likelihood of SSB purchases in small convenience stores.
- Ruff et al (2015; US; *cross-sectional*): Cross-sectional analysis of data from 171 bodegas (small convenience stores) in New York involving a sample of 2118 shoppers showed that lower amounts of available produce were significantly and independently associated with a higher likelihood of SSB purchases. Further data analysis showed that the likelihood of purchasing an SSB increased with decreasing varieties of produce when produce was located at the front of the store.

Availability of healthier foods and health/ BMI

- A small amount of cross-sectional data indicates a positive association between availability of healthier foods and health status but has no relationship with BMI.
- Bussey et al (2012; AUS; cross-sectional): A cross-sectional study among 401 Aboriginal people in the Fitzroy region of the Kimberley showed that community stores with healthier scores (contained more vegetables and wholegrain foods, for example) were positively associated with higher purchases of vegetables, as well as selfassessed health status and individual triglyceride levels.
- Rose et al (2009; US; cross-sectional): Measurement of the lineal shelf space allocated to fruits, vegetables and EDNP snack foods in 207 food stores in Louisiana showed that F&V shelf space was not significantly related to BMI.

Perceived availability of healthier items⁷² and purchases/ consumption of healthier items

- Cross-sectional survey data generally indicate that perceived availability of healthier items in the local neighbourhood may be as important as actual availability in terms of purchases and consumption.
- Williams et al (2012; AUS; *survey*): In Melbourne, women who perceived poor availability and quality of F&V in the local neighbourhood were more likely to perceive F&V as expensive.

- Lucan et al (2014; US; *survey*): In Philadelphia, a phone survey indicated that perceptions of neighbourhood food environments (supermarket accessibility, produce availability, grocery quality) were strongly associated with each other but were not consistently or significantly associated with objective measures of the neighbourhood food environment; nor was F&V consumption.
- Flint et al (2013; US; *cross-sectional/mapping*): Data from the Philadelphia Neighbourhood Food Environment Study showed that measured dimensions of the perceived neighbourhood food environment did not predict F&V consumption.
- Minaker et al (2013; Canada; *cross-sectional survey and environment audit*): Self-reported data indicate that residents' perceptions did not mediate the relationship between objective measures of the food environment and diet-related outcomes. Results indicated instead a direct effect of food access and relative food affordability on outcomes. Perceptions generally were not associated with diet-related outcomes.
- Lucan & Mitra (2012; US; *cross-sectional survey*): Crosssectional analysis using a large population survey found that perceived difficulty finding or accessing produce and high-quality groceries may support the consumption of more fast food, but did not affect F&V consumption. Thus, neighbourhoods where food-environment perceptions are worst might benefit from interventions to improve availability, accessibility, and quality of healthy foods, towards shifting consumption away from fast foods.
- Caspi et al (2012; US; *cross-sectional*): People (in Greater Boston) who did not report a supermarket within walking distance from home despite the objective presence of one, consumed significantly fewer F&V than those with a supermarket who reported one.
- Caldwell et al (2009; US; cross-sectional): Greater perceived access to F&V was significantly associated with higher increases in F&V consumption. Greater availability was also associated with larger increases in F&V consumption during the health promotion period; indicating that community interventions to increase F&V consumption should consider focusing on increasing access and availability to F&V in the community.

¹²This section includes studies which examined either or both of density of healthier stores and in-store availability of healthier items (store healthiness rating)

Experimental studies

- One small laboratory experiment showed that offering a higher proportion of healthier options favoured the purchase of healthier options: two short-term marketing studies in supermarkets in the 1970s showed that increasing shelf-space for some fruits and vegetables increased sales of those F&V.
- Aschemann-Witzel et al (2013; Poland, Germany; *laboratory experiment*): Evidence to support the need to manipulate choice sets by including healthier options, i.e. more choice but higher proportion of healthier options, is provided in a study among 1000 German and Polish consumers. In this choice experiment of snack products and different labelling formats, offering an additional set of more healthful products triggered consumers to reconsider their initial choice in a significant manner. Labelling was shown to have a low impact on choice.
- Curhan (1974; experiment in-store) indicated that not all F&V are the same with regards to purchasing decisions. Hard fruit and cooking vegetables, within season, are considered almost 'staples', whereas salad vegetables and soft fruit generally are more discretionary because they are more perishable, vary more in day-to-day quality, availability and price, and require more care in handling and refrigeration. The author used a factorial design to examine the effect of an doubling the space allocation for F&V items. The findings for display space indicated that bonus space increases sales for all categories of F&V products. Doubling space from normal (i.e. 100% increase) for hard fruit increased sales by an average of 44%. Overall unit sales increased by approximately 8% in response to a 40% increase in shelf space. Curhan points to other studies which indicate that space increases must

be noticeable before they will stimulate significant sales change, and that sooner or later sales reach an upper limit beyond which they no longer respond to incremental change. Slow-selling items may be more prone to the effects of changes in display space than fast-selling items.

Curhan (1972; model-testing with experiment in-store): In this study a hypothesised model was compared against unit sales observed for five to twelve weeks before and after changes to shelf space. In four supermarkets of a regional chain, shelf space was allocated according to recommendations of (a) store management and (b) COSMOS, a computerised management information system which monitors the profitability of grocery items per unit shelf space and calculates shelf space allocations using programmed heuristics. Twenty-four other supermarkets were used as controls. Findings were mixed, although an overall space elasticity of 0.212 was indicated, suggesting that an average 40% change in shelf space produced an average of 8% increased sales. However not all products have been found to be shelfspace elastic. The author concluded that the impact of shelf space on unit sales was very small relative to the effects of other variables.
Evidence of intervention effectiveness

Outcome: availability

A substantial number of intervention trials among small grocery store owners in the UK, US and among Australian Aboriginal community stores have indicated that support to stock more fresh produce and healthier packaged items — in the form of small grants, equipment, training and policy — are effective in increasing the availability and variety of healthier items.

Reviews

Langellier et al (2013; Structured review⁷³): This review (up to September 2010) found eight descriptive studies and six distinct corner store evaluated intervention studies (10 articles) in US cities (Bolen & Hecht, 2003; Gittelsohn, Song, et al., 2010; Gittelsohn et al., 2009; Gittelsohn, Vijayadeva, et al., 2010; Song et al., 2009), the Marshall Islands (Gittelsohn et al., 2007; Gittelsohn et al., 2006), and Native American communities in Arizona (Curran et al., 2005; Gittelsohn et al., 2008) and Canada (Ho et al., 2008). Three common strategies were: (1) partnering with an existing store, (2) stocking healthy foods (fresh produce, canned and frozen fruit and vegetables, lowfat milk, healthy grains, healthier cooking oils), and (3) social marketing and nutrition education. The types of foods stocked included not only fresh produce, but also canned and frozen fruits and vegetables, lowfat milk, healthy grains, and healthier cooking oils. In most cases, intervention staff used community surveys

to identify commonly consumed unhealthy foods and encouraged stores to expand their inventory and stock healthier alternatives (Curran et al., 2005; Gittelsohn et al., 2006; Gittelsohn et al., 2007; Gittelsohn et al., 2008; Gittelsohn et al., 2009; Gittelsohn, Song, et al., 2010; Gittelsohn, Vijayadeva, et al., 2010; Ho et al., 2008; Song et al., 2009). In addition to stocking healthier foods, store layouts were rearranged to increase the visibility of healthier products to consumers. Interventions often provided staff and owners with training, information and equipment.

Gittelsohn et al (2012; Review)74 included three studies (out of 16 included studies up to September 2010) which emphasised stocking and providing display stands to sell fresh produce (Scottish Grocers Federation Healthy Living Neighbourhood Shop project and Vida Sana Hoy y Mañana) and indicated that most of the 16 trials (eight peer-reviewed; eight grey literature) aimed to increase the availability and variety of healthy foods. The review also indicated that most trials used multipronged strategies. The overall availability of promoted foods increased in all of the trials, yet some trials varied in food availability, such as certain low-fat snacks (e.g. Baltimore Healthy Stores). Trials did not report impact on the quantity of foods, but five trials that focused on produce availability did report an increased number of varieties: Zhiwaapenewin Akino'maagewin trials (Ho et al 2008), the Apache Healthy Stores (Curran et al 2005), Baltimore Healthy Stores (Gittelsohn Song et al 2010), Steps to a Healthier New Orleans Corner Store Initiative (Bodor et al 2010), and Romano's Grocery Store Renovation (Morgan et al 2008; Grey Literature).

⁷³Corner store inventories, purchases and strategies for intervention: a review of the literature (Langellier et al 2013)
⁷⁴Interventions in small food stores to change the food environment, improve diet, and reduce risk of chronic disease (Gittelsohn et al 2012)

Intervention/Implementation studies

Australia

- Lee et al (1996; AUS; NT Aboriginal Communities): The Aboriginal board of directors of the Arnhem Land Progress Association (ALPA; a retailing cooperative owned by the Aboriginal residents of five communities in Arnhem Land in the Northern Territory) introduced a corporate nutrition policy in 1990. It aims to increase the variety of 'healthy' foods available at all times and to help promote consumption of these recommended foods. In 1993, compliance with the policy varied among stores with recommended healthier foods being regularly available in most but not all communities.
- Lee et al (1994; AUS; NT single Aboriginal Store): The Minjilang Health and Nutrition Project was conducted in Minjilang, an Aboriginal community 240 km northeast of Darwin. The program involved support of the single community store owner to provide and promote a wide variety of nutritious foods. Evaluation indicated that the program was effective in increasing availability of healthier items including fresh produce, wholemeal bread and less fatty meat. Longer-term evaluation of this intervention by Lee et al (1995) indicated sustained availability of these healthier items in-store.

United States

- Paek et al (2014; US): FIT Store program in Michigan: Improvement plans offered several specific advancements for the store, including: (i) small grants for equipment to enhance their capacity to sell fresh and/or healthy foods, such as refrigeration units, scales, and so forth; (ii) assistance with identifying sources of fresh/healthy foods; (iii) training for store owners/managers to increase their confidence in identifying healthy foods; (iv) help with marketing to increase the local demand for healthy foods; and, (v) nutrition information materials to place on site. Three out of four stores improved in healthiness rating.
- Cavanagh et al (2014; US): Philadelphia Corner Store intervention: Interventions aimed at increasing healthy food availability are associated with improvements in the availability of low-fat milk, fruits (apples, oranges, grapes), and some vegetables (broccoli), especially when infrastructure changes, such as refrigeration and shelving enhancements, were offered (211 stores).
- Havens et al (2012;US): US Special Supplemental Nutrition Program for Women, Infants and Children (WIC) program in 2009 revised food package requires certified stores to stock fresh produce, whole grains, and lower-fat milk. The program led to an increase in the composite score of

healthy food supply in stores (16% in higher income areas to 39% in lower income areas), mainly due to increase in whole-grain products (Andreyeva et al 2011). Similarly Havens et al (2012) and Hillier et al (2012) indicated that the 2009 WIC revisions increased availability of healthy foods (more varieties of fresh fruit; a greater proportion of lower-fat milk; and had greater availability of whole grain bread and brown rice) among WIC-certified vendors compared to those without WIC authorisation in Hartford CT. In addition, the program led to an increase in the number of varieties of fresh fruits and shelf length for vegetables (Rose et al 2014).

United Kingdom

- Change4Life Convenience Stores Program (2010; England): Following the success of the Scottish pilots, the Change4Life program was developed to increase access to and availability of fresh F&V in deprived areas with little or no access in order to help reduce health inequalities. The program involved substantial branding and promotional/point-of-sale materials. By the end of June 2009, there were 15 Development stores and 85 Roll-out stores (the latter with no chiller funding and less intensive support from the project coordinator). Customers' perceptions of the stores were positively changed (although these changes were higher in Development Stores where positioning of the F&V at the front of the store had a particular impact; cf. PROMOTION Domain). The evaluation report indicates that the project led to the stores: (i) offering a wide range of good quality F&V; (ii) displaying F&V in an appealing/hard-to-miss way; and, (iii) stocking F&V that customers wanted to buy; and 'as a place to buy F&V'.
- Scottish Healthy Living Neighbourhood Shops Project (2007; cited in Change4Life Convenience Stores Evaluation Report, 2010): This project was established by a small group of suppliers and retailers in Scotland to increase the availability of healthier items throughout Scotland, in both deprived and affluent areas, where little or no option existed to buy. The program received funding from the Scottish Executive and worked closely with the Scottish Grocers' Federation, which represents convenience stores throughout Scotland. Through a number of different trials, the program established clear criteria for increasing sales and also developed bespoke equipment/point of sale (POS) materials which were given to participating retailers free of charge. The initiative led to around 600 stores across Scotland improving their range, guality and stock of fresh F&V and other healthier eating/beverage products.

Outcome: sales/purchases

The intervention evidence from Australia, the UK, and the US, involving increased availability of healthier items in-store, is supportive of intervention effectiveness in increasing sales/ purchases of healthier products in grocery stores; although effectiveness is likely dependent on associated promotional, positional and labelling activities (in addition to full implementation of increased availability).

Intervention/Implementation studies

Review

Escaron et al (2013; SR)⁷⁵: indicated that there was sufficient evidence for the effectiveness of increased availability of healthful foods in terms of increased sales/ purchases, but this evidence was for interventions where increased availability was combined with combinations of point-of-purchase (POP)⁷⁶, promotion and advertising, or with POP, promotion, advertising and pricing. On average, of 3 three points possible, the intervention categories scored 2.6 for study design, 1.1 for effectiveness, 0.3 for reach, and 2 for availability of evidence. POP, increased availability of healthful foods, and promotion and advertising (n = 3 – Apache Healthy Stores (Gittelsohn et al 2010); Zhiiwaapenewin Akino'maagewin (Ho et al 2008); Marshall Islands Healthy Stores (Gittelsohn et al 2007; 2006)); Level of evidence was determined as 'sufficient'. POP, pricing, increased availability of healthful foods, and promotion and advertising (n = 2 - Healthy)Foods Hawaii (Gittelsohn, Vijayadeva et al 2010); Baltimore Healthy Stores (Gittelsohn Song et al 2010; Song, Gittelsohn et al 2010)); Level of evidence was determined as 'sufficient'.

Australia

• Lee et al (1994; AUS; NT Aboriginal community store; see above): Evaluation of the Minjilang Health and Nutrition Project to support the single community store owner to provide and promote a wide variety of nutritious foods, involved use of the store turnover method to indicate 'apparent dietary intake'. Data collected across threemonthly intervals during the intervention and compared with a control community showed that, compared to pre-intervention, the turnover of F&V more than doubled during the intervention period compared to remaining relatively constant in the comparison community. There were also significant increases in sales of wholemeal bread (from 8% to 24%), and sales of diet drinks and fruit juices increased from 1% and 6% to 12% and 17% as a percentage of total beverage turnover, respectively. The turnover of hot takeaway foods decreased (as sandwiches were provided) and turnover of sugar decreased. These changes were associated with an increase in store profits.

United Kingdom

- Change4Life Convenience Stores Program (2010; England; cited in Change4Life Evaluation Report (Department of Health [UK]; 2010): Sales data indicated increases in F&V sales from 6%-480%, with an average increase of 143% in the Development stores, although the positive effect was smaller and less consistent across Roll-out stores. Crucially, the increase in F&V sales did not appear to be replacing other sales hence retailers were not suffering financial losses due to the change in purchasing behaviour. The evaluation determined selfreported purchases as well as actual sales. The different measurement methods produced different results, with self-reported purchasing of fresh F&V falling off over time whereas sales data indicated a general increase over time. One explanation suggests that this may reflect a change in the profile of shoppers rather than changes in existing customers' purchasing patterns.
- Scottish Healthy Living Neighbourhood Shops Initiative (2007; Scotland; see above): The program resulted in increasing the range of fruit drinks and decreasing the range of carbonated drinks available in-store which led to a 14.6% increase in total soft drink sales and a 21% increase in cash profit.

⁷⁵Supermarket and grocery store-based interventions to promote healthful food choices and eating practices — a systematic review (Escaron et al 2013)
⁷⁶POP typically entail the use of food demonstrations, taste testing, signs, labels, and either printed materials highlighting health food choices or describing recipes with the goal of influencing purchasing

of healthful options.

United States

- Dannefer et al (2012): New York City 'Healthy Bodegas' initiative: Department of Health staff work with shop owners to sell more low-fat milk, low-salt, and no-sugaradded canned goods; and to improve the quantity, quality, and display of fresh foods. They also collaborate with distributors and suppliers to facilitate wholesale purchases. The percentage of customers surveyed who purchased items for which a healthier option was stocked and promoted (such as low-sodium canned goods, low-fat milk, whole-grain bread, healthier snacks and sandwiches), increased from 5% to 16%.
- Gittelsohn, Song et al (2010); Song, Gittelsohn et al (2010; US): Baltimore Healthy Stores: Two intervention supermarkets and seven Korean corner stores in East Baltimore (low income, African American district) were compared to two control supermarkets and six Korean corner stores in West Baltimore. The intervention that involved an environmental component to increase stocks of more nutritious foods and POP promotions, including signage for healthy choices and interactive nutrition education sessions, resulted in increased weekly sales of promoted foods when stocking improved. [Note - Escaron et al (2013) indicated that the intervention involved POP, pricing, increased availability of healthful foods, promotion, advertising] Exposure to intervention materials was modest in the intervention area, and there were no significant improvements in overall healthy food purchasing scores, food knowledge, and self-efficacy. [Note: more likely to report purchasing promoted foods because of the presence of a BHS shelf label; cf. Labelling Domain].

Outcome: diet / health

The interventions to increase availability of healthier items in-store among Aboriginal stores in Australia and small grocery stores in the UK and US from healthier stocking practices are promising in terms of impact on healthier diet (and possibly health and BMI); however increased availability was generally only one component of these interventions, which nearly all involved placement and other promotional and educational strategies.

Intervention/implementation studies

Australia

- Rowley et al (2000, 2001; AUS; WA Aboriginal Community): The Looma Healthy Lifestyle project included various strategies to improve diet (such as the promotion of traditional cooking methods, store management policy changes, and nutrition education) and to increase physical activity. Key aspects of the project included the appointment by the community council of a store manager with a mandate to improve food supply, and council policies regarding smoking, food availability and physical activity. Evaluations concluded that the project resulted in improvements to a range of coronary heart disease risk factors related to diet. However, no significant changes were found in the prevalence of obesity or diabetes.
- Lee et al (1996; AUS; NT Aboriginal Communities; see above): In the 1990 nutrition policy program implemented by The Aboriginal board of directors of the Arnhem Land Progress Association (ALPA); evaluation in 1993 showed that dietary improvements were evident in those communities which most complied with the policy. The authors concluded that some aspects of the ALPA nutrition policy required modification, and that renewed commitment to the policy was likely to further improve the diet in the Aboriginal communities involved. The ALPA nutrition policy is a potential model for the development of other local food and nutrition policies in remote Aboriginal communities.

- Lee et al (1995; AUS; NT Aboriginal Store): Assessment of the sustainability of the intervention described by Lee et al (1994) over the next four years showed that the dietary intake of most healthier foods (including fruits, vegetables and wholemeal bread) and nutrients (including folate, ascorbic acid and thiamine) was sustained in the subsequent years, and was higher than in the comparison community. The control community implemented some aspects of the program with assistance from members of the Minjilang community and the Arnhem Land Progress Association (ALPA) stores, and sugar intake fell in both communities, but the additional decrease in sugar consumption observed at Minjilang rebounded in the final year, returning to the level achieved during the original intervention.
- Lee et al (1994; AUS; NT Aboriginal Store): The 'dietary turnover method' and objective biomedical measures of health and nutritional status were used in the evaluation of the Minjilang Health and Nutrition Project. Data collected in three-monthly intervals during the intervention and compared with a control community showed that, compared to pre-intervention, there was a significant decrease in dietary intake of sugar and saturated fat and a doubling of fruit and vegetable turnover, post-intervention. Biochemical indices supported the evidence of dietary improvements (e.g. 12% decrease in mean serum cholesterol, increases in serum and red cell folate, serum vitamin B6, and ascorbic acid). There were also decreases in mean systolic and diastolic blood pressures and a normalisation of body mass index.

United Kingdom

 Change4Life Convenience Stores Program (2010; England; see above): Evaluation of the Development store in this Program showed self-reported increases (from 57% to 73% at seven months) in 'eating fruit or vegetables most or every day' and increases (23% to 34%) in the numbers claiming to 'eat five-a-day'. This was a small-scale evaluation (one store) and an associated evaluation of a Roll-out store indicated smaller but noted improvements in self-reported consumption of F&V.

United States

- Paek et al (2014; US): In the FIT Store program in Michigan, the plan led to a higher awareness of the FIT program and higher monthly nut and bean consumption was reported. Improvement plans also offered several specific advancements for the store, including: (i) small grants for equipment to enhance their capacity to sell fresh and/or healthy foods, such as refrigeration units, scales, and so forth; (ii) assistance with identifying sources of fresh/healthy foods, (iii) training for store owners/ managers to increase their confidence in identifying healthy foods; (iv) help with marketing to increase the local demand for healthy foods; and, (v) nutrition information materials to place on site.
- Gittelsohn et al (2013; US): Navajo Healthy Stores trial 10 regions: 14-month intervention trial to increase availability of healthier foods in local food stores and to promote these foods at POP and through community media. Greater exposure to the intervention was associated with significantly reduced BMI and improved healthy food intentions, healthy cooking methods, and healthy food getting. With increasing exposure, the odds of improving overweight or obese status was 5.02 times the odds of maintaining or worsening overweight or obese status. Case study analysis of this program (Gittelsohn et al 2014) also indicated evidence of effectiveness.
- Gittelsohn Vijayadeva et al (2010; Hawaii; comparison study; five intervention and two comparison stores): Healthy Foods Hawaii intervention involved an environmental component to increase stocking of nutritious foods, POP promotions, interactive sessions, and involved local producers and distributors. [Note Escaron et al (2013; SR) indicated that this intervention was POP, pricing, increased availability of healthful foods, promotion and advertising]. The Healthy Eating Index in children increased, mainly due to increased serves of whole grain and water, as well as increased caregivers' knowledge and perception that healthy foods are convenient (see above rationale regarding perceptions of healthy food availability).

Implementation examples

- Multiple examples in urban areas in the US (e.g. FoodFitPhilly-HCS; LEJ-Good Neighbor; Healthy Corner Stores Network/Initiative); Pennsylvania FFFI (Fresh Food Financing Initiative); Good Neighbor Program (stores agree to increase F&V stock and decrease advertising tobacco and alcohol in return for free resources/training).
- Harries et al (2014; US): Healthy Food Financing Projects such as New Orleans Fresh Food Retailer Initiative and the New York Healthy Food Healthy Communities Fund.
- Karpyn et al (2010; US) report on a five-step framework developed by the Pennsylvania Food Trust, for increasing access to fresh, healthy food in other locales.

Implementation enablers/ barriers

- Gardiner et al (2013; AUS; rural VIC): An initiative in rural Victoria, based on the 'Change 4 Life Convenience Store Program' in the United Kingdom (UK) offered financial and material incentives to small store owners (13/18 of those approached participated) to stock F&V and also ran a social media campaign promoting the 'Go for 2&5' message. Semi-structured interviews with store owners found that effective leadership and communication from project workers, a range of retail incentives and the capacity of the store to promote, stock and sell fresh F&V influenced perceived success.
- Charaktis et al (date not indicated; AUS, rural VIC): A similar project⁷⁶ involved a process evaluation of the retail fresh fruit and vegetable pilot project 'Go Fresh Go Local' and 'Buy Fresh Local' implemented in the Bass Coast and East Gippsland shires. Results indicate key project enablers included project management facilitated by the project officers and tailoring of retail incentives to the stores' needs. Furthermore, engaging the community facilitated capacity building among stakeholders to sustain their involvement in the program. Barriers to effective retailing of FFV included: geographic location; sourcing producers; time constraints; limited space; wastage; and qualitymaintenance. Key recommendations for the future of this project include developing a tool kit for retailers outlining time and waste management strategies and identifying local suppliers to strengthen retailer-producer networks.

- Harris & Palermo (2014; AUS; rural VIC): The publication in the grey literature relating to this intervention indicates that substantial in-store retailer support, using only one social marketing message and collaborating with other community projects were strategies that enhance success. The initiative built the retailers capacity to do business development. It was also found that small stores often provide a community service supporting access to F&V where there are no other retailers. Retailers identified geographical distance to wholesalers, time, and lack of available floor space as barriers to stocking and selling F&V.
- Aboriginal Community Stores and Outback Stores: (AUS; WA): qualitative evidence of effectiveness of management by company 'Outback Stores' which has an emphasis on stocking fresh produce, e.g. http://www.abc.net.au/ news/2013-12-09/jigalong-shop/5141674
- Gudzune et al (2015; US): A case study among lowincome neighbourhoods showed that pairing corner stores with urban farms for produce distribution may be feasible. Strong community backing may be vital to support produce sales.
- Larson et al (2013; US): Major barriers to retailing healthful options identified by community members are mistrust of store owners, history of poor-quality produce, and limited familiarity with healthful options. Store owners identified neighbourhood crime as the major barrier.
- O'Malley et al (2013; US): Store operators' perceptions about cost, infrastructure, and customer demand, plus produce wholesalers' hesitation to invest in small-scale business opportunities can be barriers.
- In 'What Works For Health' (2014; US; http:// whatworksforhealth.wisc.edu/factor.php?id=12), engaging community residents and understanding neighbourhood context while planning changes to corner store offerings (Larson et al 2013), coordinating changes at many corner stores (Widener et al 2013) and working closely with store owners to design and implement culturally-sensitive programs may increase the likelihood of success (Moore et al 2013; Gittelsohn et al 2014).
- Langellier et al (2013; Structured review): This review highlights a number of barriers and facilitators to corner store programs.

⁷⁷Possibly the same project

- Adams et al (2012; UK): In the Change4Life convenience store program in the UK, retailers were appreciative of part-funding for chill cabinets and free POS materials. However the intervention suffered from poor initial and on-going communication between the intervention delivery team and retailers, poor availability of replacement POS materials, and failure to cement intended links with health workers and community organisations. Intervention fidelity was low.
- Scottish Grocers Federation 'Healthy Living Program' aims to improve the range, quality and availability of fruit and vegetables in convenience stores across Scotland. This program includes a 'Train the Trainer' component. http://www.fhascot.org.uk/Event/scottish-grocersfederation-healthy-living-program-training-the-trainers
- Dannefer et al (2012; US): Healthy Bodegas intervention: barriers included lack of consumer demand and lack of space and refrigeration. Owners requested more cooking demonstrations and a greater range of in-store promotional material. The intervention also expanded to include fruit salad starter kits, produce storage shelves and baskets, blenders, small fridges.
- Bodor et al (2010; US): Greater percentage of corner stores' profits come from snack foods and SSBs hence altering the mix of foods may be difficult without financial incentives to store owners.
- Jetter and Cassady (2010; US): Fixed costs are one barrier to stocking more fresh F&V for store owners; and although the consumer response is sufficient to cover the direct costs of operating the produce case, it is not enough to cover variable management costs. Consequently, alternative management paradigms or venues may offer a better method to meet the demand for fresh produce by low-income consumers to promote better health through healthier diets in low-income communities.

Food environment objective: decrease availability of less-healthy food/beverage items in-store

Supporting evidence

Variety of snack foods and purchasing

- One study in Melbourne showed that variety of (EDNP) snack foods in supermarkets was not associated with purchases.
- Thornton et al (2012; AUS; *cross-sectional*): No association between variety of snack foods and purchases among women in Melbourne.

Shelf-space availability of non-core foods and purchasing

- One study in Melbourne showed that shelf space availability of (EDNP) snack foods in supermarkets was not associated with purchases.
- Vinkeles Melchers et al (2009; AUS; cross-sectional): Although low SES shoppers in metropolitan Sydney purchased significantly more non-core foods than high SES shoppers, especially chips and sugar-sweetened carbonated beverages and cordials, there was no difference between the volume of non-core foods purchased and the proportion of shelf space they occupied in either low or high SES areas.

Shelf space availability of non-core foods and BMI

- One study in the US showed that cumulative shelf space of EDNP snack foods was positively associated with BMI.
- Rose et al (2009; US; *cross-sectional*): Measurement of the lineal shelf space allocated to fruits, vegetables and EDNP snack foods in 207 food stores in Louisiana showed that cumulative shelf space of EDNP snack foods was positively associated with BMI. An additional 100m in shelf space of these foods within one kilometre of a participant's residence was associated with an additional 0.1 BMI points.

ACTION:

Support retail stores to decrease the availability of less healthy items

Evidence of intervention effectiveness

Outcome: purchases/consumption

Few interventions have sought to decrease the availability of less healthy items in-store. There is a small amount of evidence from intervention studies in Australian Aboriginal community stores and implementation in Scotland which shows that reducing the availability of less-healthy food and, particularly, less-healthy beverage items, leads to a reduction in purchases/consumption of these items.

Intervention studies

- Butler et al (2011; AUS): An Aboriginal communitydeveloped store nutrition policy was effective in implementing changes to product lines of SSBs sold in a remote Aboriginal store — the top three selling SSBs were removed. This change did not affect the total volume of all beverages sold but did result in a shift in purchasing trends towards beverages with lower or zero sugar content, resulting in a reduction in sugar and kilojoules consumed through water-based beverages.
- Gittelsohn et al (2010; *Review*): In this review of interventions to change the food environment in small food stores, the authors indicated that two of the 16 included trials sought to reduce the availability of unhealthy foods, however the primary articles weren't specifically referenced.
- Scottish Healthy Living Neighbourhood Shops Initiative (2007; Scotland; see above): The program resulted in increasing the range of fruit drinks and decreasing the range of carbonated drinks available in-store, which led to a 14.6% increase in total soft drink sales ('healthier' beverages) and a 21% increase in cash profit.
- Lee et al (1995; AUS; NT Aboriginal Store): In the Minjilang Health and Nutrition Project (see above; Lee et al 1994; 1995) the turnover of take-away foods remained relatively low after intervention; however the authors noted that this should be seen against the unusually high turn-over beforehand, which followed the upgrade of take-away facilities in May 1998.

The community food environment

Food environment objective: increase access to/geographic availability of healthy food & beverage retail outlets

Supporting evidence Density of 'healthy' food stores and purchases / consumption of healthier items

- Areas with a higher density (proportion) of healthier stores⁷⁸ are associated with purchases and consumption of healthier items, particularly vegetables.
- Rossimel et al (2014; AUS; Melbourne; *mapping*): This study examined the overall neighbourhood mix of shops in Melbourne. It measured the ratio of healthy stores (supermarkets and grocery stores) to unhealthy stores (fast food and takeaway outlets). Accessibility to healthy food stores decreased significantly between inner (ratio = 3.4), middle (ratio = 2.5) and outer suburbs (ratio = 0.91) of Melbourne. (Note: Median price of a sample of F&V across 24 greengrocers was significantly cheaper than supermarkets.)
- Mason et al (2013; AUS; Melbourne; cross-sectional): The VicLANES study provides evidence of healthier F&V purchasing in households located in areas where there were more healthy food stores. Compared to households in areas where healthy food stores made up no more than 10% of all healthy and unhealthy stores, households in areas with 10.1–15.0% healthy food stores and >15% healthy stores were more likely to purchase healthier items; OR=1.48 and OR=1.45, respectively. There was less evidence of an association between absolute numbers of healthy or unhealthy stores and F&V purchasing. Policies aimed at improving the balance between healthy and unhealthy stores within areas may therefore be effective in promoting greater consumption of F&V.
- Jaime et al (2011; Brazil; ecological study): After controlling for area-level SES in Sao Paulo, data showed a positive correlation between F&V intake and density of F&V specialised food markets.
- Bonanno & Goetz (2012; US; *modelling Study*): Using descriptive data indicated that, even after controlling for omitted variable, endogeneity bias and the lagged F&V consumption incidence, the density of F&V stores is associated with adults consuming more F&V regularly, and therefore lower obesity rates.

Density of 'healthy' food stores and weight status

- A single recent study among children in Canada showed that the density of healthy food outlets (and proximity to a supermarket) was associated with lower odds of being overweight or obese.
- Larsen et al (2015; Canada; *cross-sectional*): Using measured data for BMI and location of food outlets in Toronto, it was shown that living in an area with a higher density of healthy food outlets and in close proximity to a supermarket decreased the odds of being overweight or obese.

Proximity to 'healthy' food stores and purchases / consumption of healthier items

- A number of observational cross-sectional studies, including one longitudinal study, in the US show that proximity to stores with healthier scores (or to F&V stores), are associated with healthier purchases and consumption, particularly for vegetables.
- Wedick et al (2015; US; *longitudinal intervention*): In a long-term study involving a dietary behavioural intervention among obese adults in Massachusetts, a shorter distance to a healthy food store (at least one item available in each of 20 healthy food categories) was associated with greater improvements in consumption of fibre (b=-1.07 g/day per mile; p<0.01) and F&V (b=-0.19 servings/day per mile, p=0.03), with and without covariate adjustment, suggesting that the effectiveness of dietary interventions is significantly influenced by the presence of a supportive community nutrition environment.
- Gustafson et al (2013; US; *cross-sectional*): Supplemental Nutrition Assistance Program (SNAP) participants living closer to stores receiving healthier scores had higher odds of consuming at least one serve of vegetables daily.
- Ollberding et al (2012; Hawaii; *ecological*): Residing in an area with a greater density of total food outlets or healthy food outlets was associated with a higher mean intake of F&V at 0.5 km; but no differences were noted beyond 0.5 km.

⁷⁸Healthfulness of stores is measured using different scales in different studies (e.g. Black et al 2014 used a nine-point score based on: variety, price, quality, promotions, shelf placement, store placement, nutrition information, healthier alternatives and single fruit sale).

• Bodor et al (2008; US; *cross-sectional mapping*): From a sample of 102 households across four contiguous census tracts in central-city New Orleans, each additional metre of shelf space of vegetables within 100 m of residence was associated with 0.35 servings per day of increased vegetable intake. Fresh fruit availability was not associated with intake, although having a small food store within this same distance was a marginal predictor of fruit consumption.

ACTION:

New supermarkets/grocery stores in underserved areas

Supporting evidence

Supermarkets and diet

- Observational data in Australia suggest that supermarkets contribute to the purchase and consumption of SSBs; however there is overall mixed evidence, in Australia and the US, of an association between the availability of supermarkets and other grocery stores, and diet.
- Bond et al (2012; AUS; *cross-sectional*): Supermarket design and strategy encourages shoppers to buy large quantities of high profit-margin products.
- Hafekost et al (2011; AUS; cross-sectional): Data from the 2007 Australian National Children's Nutrition and Physical Activity Survey indicated that, for Australian children aged 2–16 years, over 77% of SSBs were purchased via the supermarket (<17% sourced from school canteens and FFOs).
- Aggarwal et al (2014; US): In the Seattle Obesity Study, only one third of the respondents shopped at their nearest supermarket for their primary food supply. Those who shopped at low-cost supermarkets were more likely to travel beyond their nearest supermarket. F&V consumption was not associated with physical distance but with supermarket choice, after adjusting for covariates.

- Liese et al (2014; South Carolina, eight counties, US; cross-sectional): This cross-sectional study measured F&V intake (self-reported phone survey) and found that frequency of grocery shopping at a primary food store was the only factor that independently directly affected F&V intake. Increased supermarket availability was significantly and positively associated with perceived healthy food availability in the neighbourhood and ease of shopping access, but not with F&V intake.
- Gustafson et al (2013; US; *cross-sectional*): Shopping frequently at a supermarket was associated with higher intake of SSBs.
- Boone-Heinonen et al (2011; US; *cohort study*): In the Coronary Artery Risk Development in Young Adults (CARDIA) 15-year cohort study in the US; greater supermarket availability was generally unrelated to diet quality and F&V intake, and relationships between grocery store availability and diet outcomes were mixed.
- Dean & Sharkey (2011; US; *cross-sectional*): In Texas, proximity to a supermarket was significant in its effect on F&V intake in rural but not in urban areas.
- Hawkes (2008; *Review*) '*Dietary implication of* supermarket development: a global perspective' indicates that the dietary implications can be positive and negative but that the most universally applicable dietary implication is that supermarkets encourage consumers to eat more, whatever the food.
- Morland et al (2002; US; cross-sectional): In a large population-based cross-sectional study (Atherosclerosis Risk in Communities Study), Black Americans' F&V intake increased by 32% for each additional supermarket in the census tract. White Americans' F&V intake increased by 11% with the presence of one or more supermarkets.

Supermarkets and obesity

There is mixed evidence (US data only) on the association between proximity to and/or density of supermarkets and obesity, although the majority of evidence from the US suggests that supermarkets are linked to lower obesity.

Proximity

- Larsen et al (2015; Canada; *cross-sectional study*): In Toronto, children in Grades 5 and 6 had lower odds of being overweight or obese if they lived within close proximity (within 1 km walk) of a supermarket.
- Fiechtner et al (2015; US; ecological study): GIS software was used to determine proximity from 49,770 paediatric patients' residences to six types of food establishments. Living closer to supermarkets and further away from fast food and full-service restaurants was associated with lower BMI z-score; neighbourhood median income was an effect modifier. Convenience stores and full-service restaurants had a stronger adverse effect on BMI z-score in lower-income neighbourhoods.
- Dubowitz et al (2015; US; cross-sectional): In a study in Pittsburgh; although the nearest full service supermarket was an average of 2.6 km from their home, respondents (n=1372) shopped an average of 6.0 km from home. Those who made longer trips had access to cars, shopped less often, and spent less money per person. Those who travelled further when they shopped had higher BMI, but most residents already shopped where healthy foods were available, and physical distance from full-service supermarkets was unrelated to weight or dietary quality.
- Fiechtner et al (2013; US; *ecological study*): Living closer to a large supermarket was associated with higher BMI among 438 preschool-age children who were overweight or obese in Massachusetts.
- Michimi & Wimberly (2010; US; *ecological study*): Obesity prevalence increased and F&V consumption decreased with increasing distance to supermarkets in metropolitan areas, but not in nonmetropolitan areas. These results suggest that there may be a threshold distance in nonmetropolitan areas beyond which distance

to supermarket no longer affects obesity and F&V consumption. In addition, obesity and food environments in non-metropolitan areas are likely to be driven by a more complex set of social, cultural, and physical factors than a single measure of supermarket accessibility.

Density

- Boone-Heinonen et al (2013; US; *cohort study*): In the CARDIA cohort study, BMI data over five years was linked with time-varying geographic information and system-derived neighbourhood environment measures. Modelled time-lagged BMI as a function of food resource density showed that an increase in supermarket density predicted reduction in BMI of 0.09 kg/m2.
- Bodor et al (2010; US; *ecological study*) mapping data and self-reported body weight data showed that, in New Orleans between 2004–2005, after adjusting for individual characteristics, each additional supermarket was associated with a reduced likelihood of obesity (OR 0.93; 0.88–0.99) and access to a FFO and convenience store were associated with greater odds of obesity (1.01; 1.00–1.02) and (1.01; 1.00–1.02) respectively.
- Morland et al (2006; US; *cross-sectional*): A crosssectional study of men and women participating in the third visit of the Atherosclerosis Risk in Communities Study, showed that the presence of a supermarket in an area or neighbourhood was associated with lower prevalence of obesity. In contrast, neighbourhoods without a supermarket had the highest prevalence of obesity.
- Bonanno & Goetz (2012; US; *modelling*): Showed that the presence of Wal-Mart Supercenters, in contrast with supermarkets, is associated with lower percentages of individuals consuming F&V regularly and, as a consequence, with higher levels of obesity.

Evidence of intervention effectiveness

Outcome: food availability/accessibility

- New supermarkets or grocery stores result in improved availability of and access to a variety of healthy foods.
- Cummins et al (2014; US; *case study*): The Pennsylvania Fresh Food Financing Initiative in the US (public-private partnership for new supermarkets and refurbish or replace equipment in existing stores, 2004) has funded 83 projects, created 5000 jobs, and created 1.4 M feet of retail space. This case study indicated that a supermarket in an underserved area resulted in improved availability of a variety of healthy foods, although residents' perceived food availability was only moderately improved.
- Gill & Rudkin (2014; UK; Intervention study): A new Tesco store (a large retailer with low prices and wide product ranges) was opened in a poor access area of the UK, 'Seacroft'. Rather than using 'as the crow flies' distance, road network distance was used as measure of access. The new store led to improved access for consumers without a car.
- Sadler et al (2013; US; *Intervention study*): This study examined the effect of the opening of two new grocery stores in a former food desert in Flint, Michigan, and indicated substantial improvement in both geographic and economic food accessibility. There was no statistical difference between prices at average grocery stores and the new stores.

Outcome: food purchases/diet

- The majority of implementation studies (four intervention studies and two natural experiments in the US and UK) indicate that new supermarkets or grocery stores in food deserts have no impact on F&V consumption and may even lead to a poorer diet, increased energy intake and an inequitable effect; although two intervention studies indicated a modest positive impact on F&V purchases and dietary intake.
- Dubowitz et al (2015; US; *pre- post-study with comparison group*): In this study, households in two neighbourhoods in Pittsburgh, Pennslyvania, one of which received a new supermarket in 2013, were surveyed in 2011 and 2014. In the neighbourhood that had a new supermarket, there were net positive changes in overall diet quality, average daily consumption of kilocalories and added sugars, and percentage of kilocalories from solid fats, added sugars and alcohol. The only positive outcome in the recipient neighbourhood specifically associated with regular use of the new supermarket was improved perceived access to healthy food. No differential improvement between the neighbourhoods in fruit and vegetable intake, whole grain or body mass index was observed.
- Elbel et al (2015; US; *difference-in-difference intervention study*): A new supermarket was opened in Morrisania (low-income) in the Bronx, NYC. A comparison community in the Bronx was Highbridge. Analysis of 2,172 street-intercept surveys and 363 dietary recalls of parents/caregivers of children aged 3–10 years showed that there were small, inconsistent changes pre- and post-intervention. There were no appreciable differences in availability of healthy or unhealthy foods at home or in child dietary intake, one year after the supermarket opening.
- Gill & Rudkin (2014; ENGLAND; Intervention study): A new Tesco store (a large retailer with low prices and wide product ranges) was opened in a poor access area of the UK 'Seacroft'. For residents with easy access to the new store, a significant average increase in F&V of half a portion per day was found. However, there was an inequitable impact where shopping at the new store was significant only for those at the top end of the distribution, i.e. for those with initial larger intakes, not for those whose diets were previously poor. Attitudes to healthy eating, relative cost of F&V, and deprivation are shown to be key factors at lower intake levels.

- Cummins et al (2014; US; *Intervention study*): An evaluation of the Pennsylvania Fresh Food Financing Initiative resulting in a new grocery store in one area in Philadelphia did not lead to changes in reported F&V intake or BMI. These authors indicated that complementary policy changes may be needed to help consumers to bridge the gap between perception and action.
- Weatherspoon et al (2013; US; *Intervention study*): A non-profit greengrocer (Peaches & Greens) was opened in a food desert in downtown Detroit (the existing single food retail outlet was a low quality corner store, plus one store with some F&V offerings further north, and over an hour to a supermarket). Sales indicated overall F&V consumption (mainly easy to store/consume fruit) of 1–2 servings per person per day, consistent with national trends. Regular transaction activities at the store and the upward purchasing trend over a two-year period showed that food desert residents will purchase fresh produce if it is made available at affordable prices.
- Sadler et al (2012; US; *Intervention study*): The opening of two new grocery stores in a former food desert in Flint did not have a significant impact on F&V consumption, and the intervention population actually purchased prepared meals more frequently. Only 8% of respondents overall regularly consumed enough F&V and 34% were food insecure. The new grocery store closed after 17 months of operation due to economic failure.
- Cummins et al (2005; SCOTLAND; Natural experiment): A new supermarket in Glasgow showed no evidence of effect on F&V consumption.
- Wrigley et al (2003; ENGLAND; *Intervention study*): A before-and-after evaluation of a new retail outlet in a highly deprived area in the UK (Leeds) indicated a positive but modest impact on diet.

Implementation examples

- Healthy Food Financing Initiative (HFFI); through the US Department of Health and Human Services and the Department of Agriculture to provide funding to help attract grocery stores and supermarkets to food deserts. The HFFI is modelled on the Pennsylvania Fresh Food Financing Initiative that supported 88 projects in urban and rural areas across the state. Pennsylvania's program has also inspired similar programs in Arizona, Colorado, Illinois, Louisiana, Maryland, Massachusetts, Minnesota, Mississippi, New Jersey, New York, Tennessee, and Texas. As of 2011, 11 states and Washington DC had enacted healthy food retail legislation: in nine cases this legislation focuses on attracting grocery stores and supermarkets to underserved areas. (CDC State Initiatives, Healthy Food; Cited by University of Wisconsin, May 2014).
- In 2009, New York City established the Food Retail Expansion to Support Health Program (FRESH). Under the program, financial and zoning incentives are offered to promote neighbourhood grocery stores offering fresh meat, fruit and vegetables in underserved communities. The financial incentives consist of an exemption or reduction of certain taxes. The zoning incentives consist of providing additional floor area in mixed buildings, reducing the amount of required parking, and permitting larger grocery stores as-of-right in light manufacturing districts. (cited in WCRF International Nourishing Framework; updated 24.06.14).

ACTION:

Farmers' markets⁷⁹

Supporting evidence

Farmers' markets and F&V consumption

- Several cross-sectional studies in the US have shown that use of farmers' markets is positively associated with F&V consumption, with some evidence of a dose response relationship; and one study showed that proximity to a farmers' market was positively associated with consumption.
- Jilcott Pitts et al (2014; US; cross-sectional survey): A survey was conducted among a purposive sample of farmers' market customers and among a representative sample of primary household food shoppers in two geographically and racially diverse rural areas: eastern North Carolina (NC) and the Appalachian region of Kentucky (KY), respectively. In NC farmers' market customers, there was no association between F&V consumption and farmers market use, nor were there any associations between BMI and either farmers market use and F&V consumption. Among KY farmers' market customers, F&V consumption was positively associated with farmers market use: those who visited a farmers' market at least two to three times per month consumed on average 0.8 servings of F&V more than those who visited a farmers market once a month or less. Among the representative samples, there were significant associations between F&V consumption and farmers market use: those who visited a farmers market at least two to three times per month consumed on average 1.3 and 1.0 servings of F&V more than those who visited a farmers market once a month or less, in NC and KY respectively. Overall, higher use of farmers' markets was associated with higher F&V consumption.
- Jilcott Pitts et al (2013; US; cross-sectional survey): Among a sample of 400 low-income women in Eastern North Carolina, over a quarter reported ever shopping at farmers' markets. A significantly larger proportion of women who shopped at farmers' markets consumed five or more F&Vs daily (42.1%) than those who did not (24.0%; p<0.001)).

- Gustafson, Lewis et al (2013; US; cross-sectional): SNAP participants living within 0.5 miles of at least one farmers' market or produce stand were more likely to consume one serving or more of vegetables, five servings or more of grains, and one serving or more of milk.
- Gustafson, Christian et al (2013; US; cross-sectional survey): Among 121 shoppers in Kentucky, people shopping at farmers' markets or specialty grocery stores were more likely to consume F&V (OR 1.60 95% CI [1.21, 2.79]). People who shopped at farmers' markets and specialty stores at least once a week had higher consumption of F&V (OR 1.55 95% CI [1.08, 2.23]).

Farmers' markets and obesity

- There is evidence from ecological data in Italy and non-metro US that the density of farmers' markets is negatively associated with BMI, but overall the evidence is mixed.
- Bimbo et al (2015; Italy; *ecological study*): The relationship between the presence of farmers' markets and adult Italians' Body Mass Index (BMI) was assessed by applying quantile regression on a cross-sectional, individual-level database, matched with regional farmers' markets density figures. Findings illustrate that for most adult Italians, a higher density of farmers' markets is associated with lower BMIs and that this relationship becomes more marked for individuals with higher BMIs facing limited supermarket access.
- Jilcott Pitts et al (2014; US; *cross-sectional survey*): In the study detailed above, there were no associations between farmers' market use and BMI.
- Jilcott et al (2011; US; *ecological study*): In a large ecological study using national data across the US, farmers' markets were not significantly associated with BMI for combined (metro and non-metro) or for metro counties alone, but were significantly inversely related to obesity rates in the model for non-metro counties.

⁷⁹Farmers markets are defined as recurrent markets at fixed locations where farm products are sold by farmers (McCormack et al 2010). They offer direct access to a wide range of produce from local farmers. Some states in the US provide tax relief for vendors at farmers' markets, e.g. Mississippi exempted food grown or processed in-state and sold at farmers markets from the state sales tax in 2010 (Shinkle 2013)

Evidence of intervention effectiveness

There is evidence from small-scale studies indicating that farmers' markets lead to increases in selfreported F&V consumption: one study indicated that they led to a reduction in nearby grocery prices.

Outcome: retail grocery prices

• Larsen & Gilliland (2009; US; *quasi-experimental study*): The farmers' market had a major effect on retail grocery prices in the neighbourhood, which decreased by almost 12% in three years.

Outcome: F&V consumption

- Evans et al (2012; US; *experimental pilot study*): Farm stands were placed in two low-income communities with limited access to fresh and quality F&V one day a week for 12-weeks. Significant increases were found for participants' self-reported consumption of fruit, fruit juice, tomatoes, green salad, and other vegetables. Participants also reported increases in mediating variables of F&V consumption.
- McCormack et al (2010; *Review*): This review was confined to studies conducted in the US and revealed that few well-designed research studies (e.g. those incorporating control groups) using valid and reliable dietary assessment methods to evaluate the influence of farmers' markets and community gardens on nutritionrelated outcomes have been completed.
- Payet et al (2005; AUS; *cross-sectional survey; post-only evaluation*): In a random structured intercept survey and focus group interviews regarding the Gascoyne Growers Market in Carnarvon (100 consumers and 28 market stallholders), over two-thirds of respondents (71%) reported that, since starting shopping at the markets, they were eating more F&V. Twenty-seven percent of shoppers increased consumption by more than 40%.

ACTION:

Zoning to increase greengrocer/ F&V outlet density

Evidence of intervention effectiveness

One cross-sectional study in North Carolina showed that enforcement of zoning regulations which allowed use of F&V outlets in council and municipality ordinances was strongly positively correlated with the number of F&V outlets in 13 counties.

Outcome: density of F&V outlets

 Mayo et al (2013; US; cross-sectional evaluation): In rural north-eastern North Carolina, a healthful food zoning score (allowed use of F&V outlets in council and municipality zoning ordinances) was strongly positively correlated with the number of F&V outlets in 13 counties. Major themes in implementation and enforcement of zoning to support F&V outlets included strict enforcement versus lack of enforcement of zoning regulations.

Food environment objective: decrease access to/geographic availability of less healthy food & beverage retail outlets

ACTION:

Regulation of fast food outlets

Supporting evidence Fast food consumption and diet quality

- Many studies in Australia and internationally, including one systematic review of 29 studies, indicate that consumption of fast food is associated with poorer dietary practices and quality.
- Barnes et al (2015; US): Among 200 adults aged 18–60 years, frequency of fast food consumption was significantly associated with higher energy intake, and poorer diet quality. However changes in consumption over six months was not significantly associated with energy intake, BMI or overall diet quality but was significantly negatively associated with intake of vegetables.
- Miura et al (2011, 2012; AUS; *cross-sectional survey*): In a postal survey of 903 adults in Brisbane, 'less healthy' takeaway items were generally purchased by lower SES groups. Regular consumption of 'less healthy' take-out items may contribute to socioeconomic differences in F&V intake, possibly by displacing these foods.
- Miura et al (2009; AUS; National Nutrition Survey 2005): In Australia, the total and types of takeaway foods consumed may contribute to socioeconomic inequalities in intakes of energy, total and saturated fats. However, takeaway consumption is unlikely to be a factor contributing to the lower F&V intakes among socioeconomically disadvantaged groups.
- Turrell & Giskes (2008; AUS; *cross-sectional*): Consumers that purchase less healthy takeaway options have lower F&V intakes.

- Smith et al (2009; AUS): Data from a national Australian study showed eating takeaway food twice a week or more was associated with poorer diet quality.
- Simmons et al (2005; rural AUS; *cross-sectional*): In rural Australia obesity exists where there is no significant consumption or availability of takeaway foods. In a setting of easy availability of food, increased takeaway consumption was associated with increased consumption of higher fat preparations of dairy and meat products.
- Malouf et al (1995; AUS; *modelling study* based on National Nutrition Survey data): The effect of three takeaway meals from McDonalds, Pizza Hut and KFC on dietary intake was examined from national dietary intake data. The data showed that intake of these meals increased average kJ consumption and the percentage energy contribution of fat; and decreased the P/S ratio and fibre intake.
- Deierlein et al (2014; US; *cohort study*): For girls aged six to eight years, frequency of use of local snack-food outlets increased with the number of available types of outlets and was associated with greater daily intakes of energy and servings of SSB and snack foods/sweets.
- Wilcox et al (2013; US; cross-sectional): Among overweight and obese women in low SES neighbourhoods, fast food consumption was associated with more negative dietary practices, although significant associations disappeared when controlling for total caloric intakes.
- Lachat et al (2012; <u>SR</u>): Included 29 studies with population data across many countries to examine the nutritional characteristics of eating out-of-home and dietary quality. Although the studies were cross-sectional and heterogeneous in the way they classified eating out-of-home, the authors concluded that eating out-of-home is a risk factor for higher energy and fat intake and lower micronutrient intake.

Fast food consumption and energy intake

- A number of studies, including a recent US cohort study, the findings from a systematic review of 29 studies, and two Australian studies, indicate that consumption of fast food is associated with higher energy intakes.
- An (2015; US; cross-sectional): Among nationally representative data for 18,098 adults from the NHANES 2003–2010, fast food and full-service restaurant consumption, respectively, were associated with a net increase in: (i) daily total energy intake of 190.29 and 186.74 kcal; (ii) total fat of 10.61 and 9.58 g; (iii) saturated fat of 3.49 and 2.46 g; (iv) cholesterol of 10.34 and 57.90 mg; and (v) sodium of 297.47 and 411.92 mg. Increased total energy, total fat, cholesterol and sodium intake were substantially larger when full-service restaurant food was consumed away from home than at home. The authors considered that a holistic policy intervention is warranted to target American's overall dining-out behaviour rather than fast-food consumption alone.
- Brindal et al (2014; AUS; cross-sectional survey): In a survey of 523 Australian adolescents and adults who had purchased items from McDonald's, Hungry Jack's, KFC, Domino's or Red Rooster in Australia within the previous six months, total energy consumed on one visit was positively associated with frequency of fast food consumption.
- Deierlein et al (2014; US; cohort study): For girls aged six to eight years, frequency of use of local snack-food outlets increased with the number of available types of outlets and was associated with greater daily intakes of energy and servings of SSB and snack foods/sweets.
- Lachat et al (2012; *SR*): Included 29 studies with population data across many countries to examine the nutritional characteristics of eating out-of-home and dietary quality. Although the studies were cross-sectional and heterogeneous in the way they classified eating out-of-home, the authors concluded that eating out-of-home is a risk factor for higher energy and fat intake and lower micronutrient intake.
- Satia et al (2004; US; *cross-sectional*): Among 658 adult African Americans in North Carolina, frequency of eating in FFOs was positively associated with total fat and saturated fat intakes and fat-related dietary behaviours

and inversely associated with vegetable intake. Frequency of eating at FFOs was not associated with ability to purchase healthy foods.

• Malouf et al (1995; AUS; *modelled intakes based on National Nutrition Survey data*): The effect of three takeaway meals from McDonalds, Pizza Hut and KFC on dietary intake was examined from national dietary intake data. The data showed that intake of these meals increased average kJ consumption and the percentage energy contribution of fat and decreased the P/S ratio and fibre intake.

Fast food consumption and weight outcomes

- There is mixed evidence from several systematic reviews and more recent cross-sectional and timeseries studies (including two from Australia which both support intervention), regarding a positive association between fast food consumption and BMI/obesity.
- Miura & Turrell (2014; AUS; *cross-sectional survey*): In a cross-sectional postal survey among 903 adults in Brisbane among women (but not men), the consumption of 'less healthy' takeaway food mediated BMI differences between the least and most educated, and between those employed in blue collar occupations and their higher status counterparts.
- Smith et al (2009; AUS; *national cross-sectional*): Data from national Australian study showed eating takeaway food twice a week or more was associated with a higher prevalence of moderate abdominal obesity in young men and women.
- De Vogli et al (2014; cross-country time-series analysis): In high-income countries, time series analysis data on fast food consumption and age-standardised BMI showed a strong positive relationship. The study also noted that market deregulation was a strong predictor of high fast food consumption. Nations that adopted more stringent market regulations experienced slower increases in fast food consumption and BMI. However, the intake of animal fats and total caloric intake did not appear to be significant mediators in the association.

- Hanks et al (2013; US; *national cross-sectional*): Data from the 2007–2008 NHANES indicated that calorie source, including number of times eating in FFOs or traditional restaurants or at home, was not associated with BMI.
- Mesas et al (2012; *SR*): Selected eating behaviours and excess body weight: Found only small or inconsistent evidence of a relationship between eating away from home, consumption of fast food, or takeaway food intake, and excess weight in the general population.
- Rosenheck (2008; SR): A systematic review of the association between fast food consumption and weight gain included 16 studies (six cross-sectional, seven prospective cohort studies and three experimental studies). The authors summarised that the 'findings from this review suggest that while a causal relationship cannot be stated, an unequivocal association exists between increased fast food consumption and increased caloric intake making individuals much more susceptible to weight gain and obesity'. They further cited expert panel findings of the World Cancer Research Fund and American Institute for Cancer Research that the 'current (2007) literature regarding fast food consumption as a cause of weight gain, overweight and obesity is strong and consistent'; and conclude that 'sufficient evidence exists for public health recommendations to limit fast food consumption' and facilitate healthier menu selection.

Neighbourhood fast food availability and fast food purchasing/ consumption

- Evidence (including three large cohort studies among children and young adults and among data mainly for adolescents in cross-sectional studies) from North America supports a positive association between the availability of FFOs and fast food consumption. However, in Australia, three out of four identified studies do not support an association and one study showed that access to a wider variety of FFOs is associated with fast food consumption.
- Thornton & Kavanagh (2012; AUS; *cross-sectional*): Examined fast food purchasing habits of 2547 individuals in Australia according to a 'food environment score' based on density of FFOs, green grocers and supermarkets. Respondents living in areas with a higher unhealthy FES than healthy FES were more likely to purchase fast food infrequently (OR 1.35; 1.00-1.82), however no association was found for frequent purchasing.

- Thornton et al (2009; AUS; *cross-sectional*): An independent association was identified between fast food purchasing and access to a wider variety of fast food restaurants in the VicLANES study; however density and proximity to FFOs were not significant predictors of fast food consumption.
- Timperio et al (2009; AUS; *cross-sectional*): In Melbourne and Geelong, access to outlets where takeaway or fast food could be purchased did not predict frequency of consumption of takeaway or fast food in the expected direction. Such relationships appear to be complex and may not be adequately captured by the measures of access included in the current study.
- Turrell & Giskes (2008; AUS; *cross-sectional*): In Brisbane, the number of takeaway shops in the local food environment, and road distance to the closest takeaway shop were largely unrelated to the purchase of takeaway food.
- Deierlein et al (2014; US; *cohort study*): Among girls aged six to eight years, frequency of use of local snack-food outlets increases with the number of available types of outlets and is associated with greater daily intakes of energy and servings of SSB and snack foods/sweets.
- Longacre et al (2012; US; cross-sectional): Cross-sectional data in New Hampshire and Vermont communities indicated that adolescents and parents who lived in towns with more than four FFOs were about 30% more likely to eat fast food compared to those in towns with no FFOs (aRR 1.29 and 1.33 respectively). The influence of in-town FFOs on fast food consumption was strongest among families with low motor vehicle access.
- He et al (2012; Canada; cross-sectional): Indicated that, in Canada, approximately 65% of adolescents reported self-purchasing foods from FFOs and convenience stores and close proximity to home increased probability of purchasing at least once per week.
- Khan et al (2012; US; *large population cohort study*): Greater availability of FFOs measured as outlets per capita was associated with higher frequency of fast food consumption among fifth and eighth graders.
- Boone-Heinonen et al (2011; US; large cohort study): Fifteen years of longitudinal data from the Coronary Artery Risk Development in Young Adults (CARDIA) study, a cohort of US young adults (aged 18–30 years at baseline) (n = 5115), with linked time-varying GIS-

derived food resource measures) showed that fast food consumption was related to fast food availability among low-income respondents, particularly within 1.00 to 2.99 km of home among men. The data provide some evidence for zoning restrictions on fast food restaurants within three kilometres of low-income residents but suggest that increased access to food stores may require complementary or alternative strategies to promote dietary behaviour change.

Neighbourhood fast food availability and diet quality

- Some evidence (including from a review) exists indicating that availability of FFOs may be associated with low F&V intakes, particularly among children.
- Timperio et al (2008; AUS; *cross-sectional*): In 12-year-old Australian children, availability of FFOs and convenience stores close to home may have a negative effect on their F&V intake.
- Ledoux et al (2014; US; *cross-sectional*): Among 162
 predominantly overweight or obese African American
 women in Texas, there were no significant interactions
 between neighbourhood FFOs and total energy or fat
 intake. However, the association between neighbourhood
 FFO availability and weight status was complicated by
 binge eating status, which is related to diet. Binge eaters
 with one or more neighbourhood FFO had higher BMI
 than non-binge eaters or binge eaters with no FFO.
- Svastisalee et al (2012; US; *cross-sectional*): High FFO exposure was marginally significant for low fruit intake in low SES children only.
- Hickson et al (2011; US; *cross-sectional*): Fast food availability was associated with increased energy (calorie) intake among African Americans.
- Fraser et al (2010; *Review*): Identified some evidence that fast food availability is associated with lower F&V intake, e.g. the likelihood of consuming vegetables three or more times per day was greater the further children lived from a supermarket or a FFO.

Neighbourhood fast food availability and health/weight outcomes

- There is mixed evidence of an association between exposure to fast food and BMI (or other health outcomes) internationally from a substantial number of observational studies; however three studies in Australia (including one longitudinal study) did not find an association between fast food availability and BMI or cardio-metabolic risk.
- Kepper et al (2015; US): Among 78 pre-school children, the ratio of fast food outlets to grocery stores in a two-mile concentric area around the child's residence was positively (P = 0.05) associated to BMI z-score after applying best model regression analysis.
- Carroll et al (2014; AUS; ANZOS Poster; cohort study): Data from a population-based biomedical cohort in Adelaide over three waves of follow-up (2000–2010) showed fast food availability was not related to cardiometabolic risk; however a greater local-area proportion of residents who were overweight or obese, and/or not meeting recommended daily fruit intake (i.e. area compositional norms) predicted 10-year worsening of cardio-metabolic risk.
- Simmons et al (2005; AUS; *cross-sectional*): In rural Australia obesity exists among those without significant consumption of or availability to takeaway foods. In a setting of easy availability of food, increased takeaway consumption was associated with increased consumption of higher fat preparations of dairy and meat products; but takeaway consumption was unrelated to BMI.
- Reidpath et al (2002; AUS; *cross-sectional*) showed that, in Australia, there was 2.5 times greater exposure to FFOs between wealthiest and poorest areas (in a doseresponse relationship) but no relationship with frequency of consumption or obesity.
- Bodicoat et al (2015; UK; cross-sectional screening studies): Data from three UK-based diabetes screening studies (10,461 participants), showed that, after adjustment for covariates, a higher density of FFOs within 500 m of home postcode was associated with significantly increased odds for diabetes. Assuming causality the data indicate that, for every additional two outlets per neighbourhood, one additional case of diabetes and obesity would be expected (OR = 1.02).

- Burgoine et al (2014; UK; cross-sectional/mapping): Among working adults exposure to takeaway food outlets in home, work, and commuting environments combined was associated with marginally higher consumption of takeaway food, greater BMI, and greater odds of obesity. 'Government strategies to promote healthier diets through planning restrictions for takeaway food could be most effective if focused around the workplace'.
- Pieroni & Salmasi (2014; UK; *cross-sectional*): Data from two recent waves of the British Household Panel Survey showed that BMI was found to be highly correlated with restaurant and FFO density for women.
- Hollands et al (2014; Canada; *ecological*): Canadian census data indicated a positive association between FFO density and BMI.
- Du et al (2014: China; *cross-sectional analytical*): Associations between number of western FFOs and weight status may vary by gender.
- Xu et al (2013; China; *cross-sectional analytical*): Associations between number of western FFOs and weight status are temporally dynamic rather than static.
- Ledoux et al (2014; US; *cross-sectional*): Among 162 predominantly overweight or obese African American women in Texas, the association between neighbourhood FFO availability and weight status was complicated by binge eating status, which is related to diet. Binge eaters with one or more neighbourhood FFO had higher BMIs than non-binge eaters or binge eaters with no FFO.
- Viola (2013; US): FFO density was not associated with overweight and obesity in New York City.

- Dunn et al (2012; US); *cross-sectional*: Greater availability of fast food was positively associated with both the number of meals consumed for non-white rural residents and their obesity, but there was no relationship for whites. Further, the effect of availability on weight outcomes was noticeably weaker when indirectly calculated from the implied relationship between consumption and caloric intake.
- Fleischhacker et al (2011; *SR*): This systematic review indicated that in 6/10 studies FFO exposure was related to higher BMI; however 4/10 studies found no association.
- Jaime et al (2011; Brazil; *ecological study*): In Sao Paolo, there was no relationship between FFO density and prevalence of overweight.
- Fraser et al (2010; *Review*): Identified 13 studies showing conflicting results with weight status and FFO availability.
- Bodor et al (2010; US; cross-sectional/mapping): Mapping data and self-reported body weight data showed that, in New Orleans between 2004–2005, after adjusting for individual characteristics, access to a FFO and convenience store were associated with greater odds of obesity (1.01; 1.00-1.02) and (1.01; 1.00-1.02) respectively.
- Inagami et al (2009; US; *modelling/ecological data*): Multilevel modelling from 63 neighbourhoods in LA County, USA, showed that higher restaurant density is associated with higher BMI; and that the local fast food environment has a stronger association with BMI for local residents who do not have cars.

Evidence of intervention effectiveness

One real world evaluation study in the US was identified regarding regulation of the density of fast food outlets, for which the zoning regulation was inadequate and as such did not lead to a reduction in density of fast food outlets (nor consumption or obesity).

Outcome: implementation / consumption / BMI

Sturm & Hattori (2015; US; Real World Implementation): These authors evaluated the impact of the 'Los Angeles Fast-Food Ban', a zoning regulation that restricted opening/remodelling of standalone fast-food restaurants in South Los Angeles since 2008. Food retail permits issued after the ban were more often for small food/ convenience stores and less often for larger restaurants not part of a chain. In South Los Angeles compared to other areas; there were no significant differences in the share of new fast-food chain outlets, other chain restaurants, or large food markets. About 10% of food outlets were new since the regulation, but there is little evidence that the composition has changed differentially across areas. Data from the California Health Interview Survey show that fast-food consumption and overweight/obesity rates have increased from 2007 to 2011/2012 in all areas. The increase in the combined prevalence of overweight and obesity since the ban has been significantly larger in South Los Angeles than elsewhere. The lack of impact on fast food consumption and overweight/obesity is attributed to the nature of the ban, which only blocked new construction or expansion of 'stand-alone fast food' restaurants - yet free-standing FFOs were relatively uncommon in South LA anyway. Such outlets are far outnumbered by FFOs in strip malls and small food shops such as corner stores.

Evidence of acceptability

- Shill et al (2012; AUS) indicated in their paper 'Government regulation to promote healthy food environments: a view from inside state government', which included interviews with representatives from state governments across Australia, that there was support for 'restrict retail hours of FFOs⁸⁰ and restaurants'.
- The ban on FFOs in South LA was considered unfair as there was a higher density of FFOs in other areas of LA (Sturm & Cohen 2009); however Cohen L (2010) considered that the conclusion of Sturm & Cohen (2009) was questionable and indicates that the full impact of such policies will be realised in time and was supported by community.

Implementation examples

- Several local authorities in the UK restrict the development of hot food takeaways in local centres, and exclude them from areas that children and youth often frequent. Examples include:
 - Local Borough of Waltham Forest 2009 (included none within 10 minutes' walk from schools, parks or other youth centres)
 - Barking and Dagenham's Local Borough Council (London; 2010) restricted clustering of hot food takeaways and banned them entirely from exclusion zones around schools (400 m)
 - In 2012, City of Birmingham adopted a restriction on hot food takeaways to 10% of units of towns, districts and neighbourhood centres (WCRF Nourishing Framework website).

⁸⁰Note that the support is for action around hours of opening rather than density

ACTION:

Regulate proximity of fast food outlets⁸¹ near schools

Supporting evidence

Consumption of fast foods and diet, health and weight status among children

- There is a small amount of mixed evidence of an association between consumption of takeaway foods and obesity in children, although data from a recent large, multi-country cross-sectional study indicated that children aged 6–7 years support intervention.
- Braithwaite et al (2014; multi-country cross-sectional): A large, multicentre, multi country cross-sectional study (ISAAC Phase 3) showed that children aged 6–7 years (parental report) who had frequent or very frequent fast food consumption had a BMI that was 0.15 and 0.22 kg/ m² higher than those in the infrequent group.
- Poti et al (2014; US; cross-sectional national survey): Data from the NHANES 2007–2010 among US children 2–18 years showed that half of US children consumed fast food: 39.5% were low consumers (≤30% of energy from FF) and 10.5% were high consumers (>30% of energy). Consuming a Western dietary pattern for the remainder of intake was more likely among low consumers of fast food (OR: 1.51) and high-consumers (OR: 2.21) than among non-consumers (i.e. dose-response). The remainder of diet was independently associated with overweight/obesity, whereas fast food consumption was not, and the remainder of diet had stronger associations with poor total intake than did fast food consumption. Therefore, overall consumption including diet outside of fast food intake, rather than fast food intake itself, is associated with BMI.

- Deierlein et al (2014; US; *cohort study*): Among girls aged six to eight years, frequency of use of local snack-food outlets increased with the number of available types of outlets and was associated with greater daily intakes of energy and servings of SSB and snack foods/sweets.
- Jaworowska et al (2013; *Review*): Review of nutritional characteristics of takeaway and fast food items, reports on the association of consumption of such foods on health outcomes but notes a lack of evidence for the latter.

Fast food availability near schools and fast food consumption/diet among children

- There is mixed evidence for an association between the availability of FFOs around schools and fast food purchasing / overall diet.
- Timperio et al (2009; AUS; cross-sectional): No associations between availability en route to school and the likelihood of consuming takeaway or fast food at least once weekly among children 5-6 years and 10-12 years in Geelong/Melbourne. [Only one measure of availability of outlets close to home was associated with consumption; each additional outlet within 800 m of home was associated with 3 % lower odds of consuming takeaway or fast food at least once weekly (OR = 0.97, 95 % CI 0.95, 1.00).]
- Deierlein et al (2014; US; *cohort study*): A cohort study of girls aged six to eight years showed that frequency of use of local snack-food outlets increases with the number of available types of outlets and is associated with greater daily intakes of energy and servings of SSB and snack foods/sweets.
- Williams et al (2014; *SR*): This systematic review of the influence of the retail environment around schools on obesity-related outcomes found very little evidence for an effect of the retail food environment surrounding schools on food purchases and consumption. Most of the included studies did not consider individual children's journeys through the food environment, suggesting that predominant exposure measures may not account for what individual children actually experience.

⁸¹/Fast Food' food' can include other hot food takeaway outlets. Zoning policies to prevent Fast Food Outlets (FFOs) and possibly other hot food takeaway outlets within a certain distance of schools (Note: accessible distance may be more important than actual distance as the crow flies) of schools. An alternative policy being considered in the UK is to restrict opening times to after 5 pm.

- He et al (2012; Canada; cross-sectional): High FFO density in school neighbourhoods was associated with increased fast food purchasing. Within adolescents' school environments, close proximity to convenience and FFOs and a high density of FFOs are associated with low healthy eating index.
- Forsyth et al (2012; US; adolescent males; cross-sectional): FFO proximity to schools is associated with increased fast food purchases.
- Smith et al (2013; UK; *cross-sectional*): There was some evidence that the local food environment around secondary schools may influence adolescent diet, though the effects were small.
- Brighton and Hove City Council (2011; UK; *impact study*): An impact study which examined school pupils' movements and behaviours at lunchtimes in relation to availability of food outside school premises in Brighton district in UK showed that large volumes of pupils leave the school premises at lunchtime and purchase a variety of 'unhealthy' foods including chips, soft drinks (including energy drinks), and chocolate/sweets. This study considered that hot food takeaways, newsagents, and supermarkets were all equally influential on the unhealthy food choices. In addition, the catchment area appeared to be defined by time not distance, hence the zoning distance needs to be considered on a time/access basis rather than a one-size-fits-all distance policy.

Fast food availability near schools and children's weight status

- There is mixed evidence of an association between FFO availability near schools and weight status in children/adolescents from several systematic reviews and recent international cross-sectional, longitudinal and ecological studies.
- Williams et al (2014; *SR*): This systematic review of the influence of the retail environment around schools on obesity-related outcomes found some evidence of an effect on body weight. Most of the included studies did not consider individual children's journeys through the food environment, suggesting that predominant exposure measures may not account for what individual children actually experience.

- Griffiths et al (2014; UK; cross-sectional): A cross-sectional study of over 13,000 children in Leeds, UK, showed no evidence of an association between the number of food outlets (supermarkets, takeaway and retail) or proximity to these outlets and childhood obesity in any of the environments (home, school, commute).
- Newman et al (2014; US; cross-sectional county-level): This cross-sectional, county-level analysis showed that higher levels of FFO saturation are associated with increased levels of childhood obesity in both urban and poor areas, with the largest negative effect of fast food availability on obesity occurring in more economically disadvantaged, urban areas.
- Alviola et al (2014; US; *cross-sectional*): The number of FFOs within a mile of school significantly affected school obesity rates in Arkansas.
- Ohri et al (2013; US; *cross-sectional*): A study among 702 children in New Jersey showed that proximity to fast food outlets was not associated with parent-measured child overweight and obesity, but that proximity to convenience stores was associated with nearly double the risk of being overweight or obese.
- Lee (2012; US; *longitudinal study*): Differential exposure to FFOs did not explain weight gain over time among elementary school children in a US national longitudinal study. There was a link between density of FFOs and convenience stores and low SES/minority groups but they also had good access to larger retail stores.
- Héroux et al (2012; Canada, Scotland, US; *ecological study*): Data from 26,778 students 13–15 years old from 687 schools across Canada, Scotland and the US showed no relationships between chain food retailer density and obesity.
- Currie et al (2010; US; *ecological/modelling study*): Proximity of FFOs to schools has been related to obesity rates among adolescents in the US. Among ninth graders, a FFO within 0.1 miles of a school results in a 5.2% increase in obesity rates.

Evidence of intervention effectiveness

No evaluation studies were identified

Implementation examples

- Various local councils in USA (e.g. Detroit Zoning)
- Various local councils in UK (400–800 m from schools);
 e.g. 'Tackling the takeaways: a new policy to address FFOs in Tower Hamlets' (Cavill & Rutter 2013; briefing paper; UK).
- Other councils in the UK are considering restricting opening hours until after 5 pm.
- Hillingdon Council passed a resolution banning ice cream vans from the vicinity of schools and nurseries. One of the reasons cited for the ban was that ice cream trading near schools contradicted dietary recommendations and the aims of the Healthy Hillingdon Schools Scheme (cited in Cavill & Rutter 2013).
- Several local authorities in the UK restrict the development of hot food takeaways in local centres, and exclude them from areas that children and youth often frequent. For example:
 - Local Borough of Waltham Forest 2009 included none within 10 mins walks from schools, parks or other youth centres.
 - Barking and Dagenham's Local Borough Council (London; 2010) restricted clustering of hot food takeaways and banned them entirely from exclusion zones around schools (400 m). (INFORMAS website).
- Detroit's zoning ordinance (1998) requires a distance of at least 500 feet between elementary, junior and senior high schools and restaurants, including carry-out, fast food and drive-through restaurants (INFORMAS website).

Discussion

Retail consumer food environment

There is abundant evidence from observational, cross-sectional studies that availability of healthier food is not different across levels of socioeconomic status in urban Australia, and probably also in the UK, although healthier items are less likely to be available in-store in less affluent areas in the US. Despite no differences in availability, there are socioeconomic differences in variety and quality of healthier options in-store. This is likely to have an effect on purchasing because, where possible, shoppers choose supermarkets that offer more variety and more healthful foods — as long as the choice is not too overwhelming. Some evidence also indicates that offering a choice set expansion of healthier foods — increasing the variety and proportional choice of healthier products among the choice mix — may 'nudge' consumers towards healthier choices.

Cross-sectional studies in Australia and the US show that areas with stores with an overall healthier 'score', i.e. higher availability of healthier items in proportion to unhealthy items, are associated with an increased likelihood of purchasing healthier items.

Conversely, there is some evidence that even if more F&V were made available in stores, consumers would not necessarily purchase more. Indeed, it may be that perceived healthy food availability is more important to some consumers than actual availability. Therefore it seems likely that neighbourhoods where food-environment perceptions are worst may benefit most from increased availability, accessibility and quality of healthy foods.

A substantial number of intervention trials, mainly involving stores in Aboriginal communities and grocery/corner stores in the US and UK, have shown that increasing availability of healthier options, including F&V, is highly feasible particularly with appropriate support for infrastructure changes. Foods that have been included in these studies include: F&V, lower-fat milk, low-salt options, no-sugar canned goods, nuts, legumes, and wholegrain products including bread and brown rice, healthier snacks and sandwiches, water and low-energy drinks.

The vast majority of the intervention trials were successful in terms of increased sales/purchases of healthier options and in dietary intake. In the successful interventions in terms of increased purchases, review articles and single studies indicate that increased availability needs to be combined with point-ofpurchase (POP) promotions, and probably pricing, to achieve and enhance effectiveness. One study, the Navajo Healthy Stores trial, showed that increased availability of healthier foods and POP and media promotion in local stores was effective in reducing the prevalence of overweight/obesity.

A cited barrier is that customer demand is not sufficient to warrant changes towards healthier products. However, the descriptive evidence suggests that consumer demand could be increased with sufficient promotion and hence improved perceived availability. This could also include placement (cf. Promotion domain) and pricing (cf. pricing domain). A number of other barriers to implementation were identified in these studies, including cost, infrastructure, history of poor-quality produce and limited familiarity with healthful options. The latter could be improved with store manager training.

There were many fewer intervention trials that examined reducing the availability and/or proportional availability of noncore foods and beverages, generally energy-dense foods of low nutritional value, in-store. Yet it is easy access to all food and beverages, and food and beverages that are predominantly energy-dense and nutrient-poor, rather than lack of access to specific healthy foods, that is likely to be more important in explaining increases in obesity. The ubiquity of EDNP foods and beverages in many retail food outlets, including supermarkets, corner stores, convenience stores, pharmacies, and petrol stations, means that addressing the imbalance between healthier and less healthy options within stores of many types may be crucial to overall success in terms of purchasing and dietary patterns.

The inclusion of healthier items in fast food outlets was not included in this domain; however there are several studies in Australia⁸² and internationally indicating that these items are not purchased, or not likely to be purchased, if they are included in fast food outlet menus. It seems likely that it is the dominance of the less healthy items that is the issue. Reformulating these items and making the overall menu healthier is likely to be more effective in terms of overall dietary purchases and consumption (see below). Large variability in the reported energy, total fat and saturated fat content in fast food products internationally⁸³ indicates considerable scope for reformulation.

⁸²E.g. Wellard et al 2012; Yoong et al (2015).
 ⁸³Ziauddeen et al (2015); Hobin et al (2014).

Retail community food environment

There are varied definitions in the literature of what constitutes a 'healthy' neighbourhood food environment. Supermarkets and grocery stores/corner stores are often deemed to be healthy, or at least healthier than fast food outlets and takeaways. However, EDNP foods are ubiquitous across store types in Australia and internationally, possibly accounting for the mixed evidence of an association between proximity to supermarkets and diet; with several studies showing no relationship, suggesting that there are other, more important, factors affecting dietary intake.

As indicated above, cross-sectional studies show that areas with stores with healthier scores (higher proportion/variety of healthier products) are associated with healthier purchases and consumption, particularly for vegetables. In the community food environment an increased ratio of healthier to less healthy retail outlets is also associated with higher consumption of F&V, and it is likely that it is the ratio rather than absolute numbers of stores that is more important. Consequently there is significant overlap between the rationale for improving the in-store balance between healthy and less healthy items and options, and the rationale for improving the neighbourhood mix of retail outlets.

Supermarkets are certainly a source of F&V but they are also a source of EDNP foods, and may be a particular source of SSBs: a national nutrition survey of children in Australia showed that the majority of SSBs are purchased at the supermarket. Despite some cross-sectional evidence of supermarkets being linked to poorer diet, the majority of cross-sectional studies (all from the US) show that proximity to supermarkets is associated with lower prevalence of obesity, suggesting mediating factors in the relationship. Location, e.g. rural versus metropolitan, may affect the association.

Intervention studies examining the effect of new retail on diet indicate that new supermarkets or grocery stores do result in improved availability of and access to a variety of healthier foods, particularly F&V, but they also provide access to all types of food. Consequently, although two intervention studies showed a modest positive impact on F&V purchases and intake, other intervention evidence indicates that new retail may have a negative effect on overall diet. This evidence, together with a suggestion that new retail does not necessarily result in improved perceived availability of healthier food, suggests the importance of making the healthier foods more predominant and salient, in these stores. In addition, new large stores such as supermarkets may cause small stores to close. A recent analysis of food policies in New York City from 2005 to 2012 and qualitative and geographic data collected from individual eaters living or working in NYC⁸⁴ indicated that policy incentives should address the high price of healthier food, and the consumer environment within stores (see above), not the number of supermarkets in their area. The study also indicated that geographically-targeted food and nutrition policies in lowincome areas miss the opportunity for city-wide interventions and have the potential for unintended negative consequences of promoting gentrification.

No observational or intervention trials were identified examining the effect of proximity to or density of greengrocers alone on purchases and diet. One study in the US showed that enforcement of a zoning ordinance was associated with a higher density of greengrocers. Density of greengrocers is low in Australia. Farmers' markets have become popular in many countries and their numbers are increasing. Shopping at a farmers' market has been associated with higher F&V consumption in a number of observational studies in the US, and there is mixed evidence as to whether farmers' markets are associated with levels of obesity. There is a lack of good quality evidence about the effectiveness of farmers' markets, although a number of small studies indicate higher self-reported F&V intake. One study in the US showed that farmers' markets had a major impact on retail grocery prices in the neighbourhood.

Among fast food consumers, those that purchase fast food less often live in areas with a higher healthy environment score (HES — based on density of FFOs, green grocers and supermarkets), although high frequency of consumption of fast food does not appear to be associated with HES. Similarly, although the density of FFOs and other less healthy takeaway outlets is higher in more socio-economically disadvantaged areas in Australia, and proximity to FFOs and/or consumption of fast food is associated with poorer overall diet, increased calorific intake and higher BMI, there are mixed findings from studies examining the link between neighbourhood FFO density/proximity and fast food consumption. Cross-sectional data from Australia and some studies internationally do not support an association between the density of FFOs and BMI or with other health outcomes (e.g. cardio-metabolic risk), although most data support an association between proximity to FFOs and BMI. Conversely, data support lower SES consumers purchasing less healthy fast food options and purchasing fast food more frequently. Also data from other countries – particularly cohort data – indicate that greater fast food availability is linked to fast food consumption, and to increased calorific intake. Time-series data from the US indicate that BMI was found to be highly correlated with FFO density among women but not men, suggesting a gender differential effect.

In summary, the data are mixed regarding neighbourhood availability of FFOs and fast food consumption and BMI in terms of likely causality. This is possibly due to methodological limitations in the many studies (varying definitions of the term 'neighbourhood', differences in exposure metrics and food outlet type (e.g. fast food versus takeaway), and differences in assessment of dietary intakes). A scoping review is not sufficient to explore the intricacies of the current, extensive evidence, possible relationships and causal pathways.

There has only been one evaluated study examining regulations on the density of FFOs. The 'Los Angeles Fast Food Ban' involved a restriction on the opening of new or remodelling of existing stand-alone fast-food restaurants since 2008. However, food retail permits issued after the ban were more often for small food/convenience stores and for larger restaurants not part of a chain. Free-standing fast food outlets were relatively uncommon in South LA anyway, as most were situated within shopping malls and complexes. Consequently there was no significant difference in the share of new fast food outlets, other chain restaurants, or large food markets resulting from the ban. Since the ban took effect there was a larger increase in the combined prevalence of overweight and obesity in South Los Angeles compared to elsewhere.

Among children there is mixed observational evidence of an association between consumption of take-away foods and diet and obesity; and between the availability of fast food outlets around schools and fast food purchasing, overall diet and weight status. As for the neighbourhood studies, many of the studies of fast food near schools have substantial methodological differences that must be considered when interpreting the findings. The most recent systematic review on the influence of the retail environment around school on obesity-related outcomes found very little evidence for an effect on food purchases and consumption (although some evidence of an effect on weight) but noted that most of the studies did not consider individual children's journeys through the food environment, suggesting that predominant exposure measures may not account for what individual children actually experience.

There is growing acknowledgement of 'activity spaces' — the environments used by individuals to fulfil tasks and move between locations — however there is limited information regarding the extent to which individuals actually encounter the different food outlets. Observational evidence from the UK suggests that limiting fast food outlets or improving the quality of fast food outlets around workplaces might be a particularly important priority for action.

No evaluation studies were identified, although zoning ordinances around schools have been implemented in the UK and the US. Evidence from the UK indicates that the ubiquity of EDNP foods in other outlets close to schools, including petrol stations, other hot food takeaways, convenience and corner stores, and supermarkets, have an equal effect on food choices.

The evidence overall leads to the likelihood that a more effective approach would be to concentrate on improving the food composition and the overall number and proportion of healthier menu items in fast food outlets and other takeaway outlets (cf. composition domain); and/or introducing incentives for fast food and other takeaway outlets with an overall 'healthier score', to locate near schools and in areas of socio-economic disadvantage (in addition to actions to improve the overall healthiness scores of other types of stores as per the consumer environment discussed above).

The ubiquity of FFOs on journeys to and from school, the ubiquity of EDNP foods and drinks available in multiple retail outlets (e.g. other hot food takeaways, supermarkets, corner stores, convenience stores, garage shops), and the mixed evidence relating consumption of fast food with obesity, suggests that increasing the proportionate availability of fresh foods and healthier takeaway options in existing local takeaways and FFOs and/or providing incentives to increase the type of these outlets to ones that have an overall healthier profile may offer more gains than banning FFOs near schools. Researchers (e.g. An 2015) have begun to indicate that an holistic policy intervention is warranted (at least in America) to target overall dining-out behaviour rather than fast-food consumption alone.

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Findings - Promotion

Key findings

- There is a vast literature relating to the advertising of less healthy foods and beverages, particularly to children, across a wide variety of modes, contexts and settings: such promotion is pervasive.
- Children are affected by branding and persuasive elements of marketing. Although not all children are affected equally by advertising, those who are most susceptible are most likely to be overweight or obese. The magnitude of the effect is uncertain due to the difficulty in disentangling the multitude of other factors affecting dietary behaviours and weight status from the pervasiveness of the promotion of food and beverages.
- Most of the observational evidence, mainly from crosssectional and longitudinal studies, relates to advertising on television (TV), as does much of the evidence from small-scale experimental studies largely conducted under artificial, controlled conditions. This body of evidence persuasively supports the negative impact on child and adolescent dietary preferences and behaviours, and on weight status. It highlights the need to protect children from TV advertising of less healthy foods and beverages. The experimental evidence suggests that the effect might be due less to exposure per se and due more to the persuasive elements of the food and beverage advertisements. This finding is supported by the findings from a substantial number of experimental studies across a range of contexts and modes, including studies of packaged products.
- The experimental evidence indicates the negative effect of non-core food and beverage advertising via advergames and on social media, and that advertising via this medium has been higher among companies signed up to selfregulatory pledges than among non-signatories.
- The ineffectiveness of self-regulatory pledges and codes to reduce exposure to less healthy branding and food and beverage advertisements containing persuasive elements — across a wide range of modes including advergames, TV advertising during commercial breaks particularly containing persuasive elements, promotional characters on packaged products and print media — suggests that there should be tighter regulations around food and beverage marketing across the breadth of exposure.

- Regulation of TV advertising of unhealthy food and beverage products during children's viewing times is not sufficient to prevent exposure and needs to extend to family viewing times. Evidence from Canada showed that an overall reduction in exposure to TV advertising of EDNP foods and beverages across all viewing times led to reduced household expenditure on fast food.
- The negative impact of advertising of unhealthy foods and beverages on diet and weight status is observed in children and adolescents, indicating that the upper age threshold for responsible food marketing to children should be increased to 14 years; as has recently been recommended by an expert panel.⁸⁵
- Evidence from real world implementation of government and industry advertising regulations, including toy ordinances, indicates that as well as the need for careful wording to ensure circumvention does not occur, there is also a need for compliance monitoring. Mandatory regulation of food and beverage advertising in schools, for example, indicates that monitoring is a necessary component of intervention to ensure compliance and hence reduced exposure.
- The impact of regulation of food and beverage advertising via other modes indicates the need for governmentapproved nutrition standards in order for packaged foods to carry a nutrient content claim.
- In the retail environment, in addition to reducing children's exposure to persuasive elements on less healthy packaged food and beverage products, evidence supports reducing exposure to these products via location on shelves; in particular restricting their placement in end-ofaisle bins as well as at checkouts.

⁸⁵http://healthyeatingresearch.org/research/recommendations-for-responsible-food-marketing-to-children/

Summary of evidential support for intervention in the promotion food domain⁺

FOOD ENVIRONMENT OBJECTIVE	SETTING/ CONTEXT	SUPPORTING EVIDENCE		SPECIFIC	INTERVENTION EFFECTIVENESS Does it work in practice?					
		Observational Studies	Experimental Studies	SETTING/ CONTEXT	"Action"/ intervention	Impact on food environment (exposure)	Awareness, Attitudes, Brand equity, Purchase intent	Food/Menu composition	Purchasing (including purchase request)/ Consumption	Comments
Reduce exposure to advertising directed at children	τv	AMONG CHILDREN TV advertising → food purchase requests food purchases TV viewing time → positive attitudes junk food poorer diet quality/health weight status/gain Commercial TV exposure (time) → positive attitudes junk food purchases RTEC* (sales data) poorer dietary behaviours weight status/gain	AMONG CHILDREN TV advertisements for EDNP/EE foods →	TV advertising (in advertising breaks) during children's viewing times	Government regulation					Mixed effectiveness on exposure due to limitations in guidelines. Advertising ban in Quebec showed effectiveness (on fast food purchase propensity)
			food preferences EDNP/FF immediate consumption EDNP/FF Exposure to product placement → immediate brand awareness, attitudes, behavioural disposition to EDNP Exposure to persuasive elements via TV advertisements		Industry self-regulation		\bigcirc	\bigcirc		Loopholes. Criteria not sufficient to identify healthier foods. Signatories often worse than non- signatories. Effectiveness related to household purchasing when overall exposure reduced.
			→ advertisement recall, purchase-request behaviour, food preferences, consumption Celebrity endorsement EDNP products TV →	Product placement on children's/ youth TV programming	Industry self-regulation		\bigcirc	\bigcirc	\bigcirc	Signatories often 'worse' than non- signatories.
			Promotional characters promoted 'free' with food → motivational pull of collectible toys preference when toy associated with healthier options* preference/consumption when toy associated with less healthy options	Persuasive elements TV	Government regulation		\bigcirc	\bigcirc	\bigcirc	Reduced exposure children's channels but ongoing exposure on adult TV airtime/sports channels and more commonly associated with non-core foods on all channels
					Industry self-regulation		\bigcirc	\bigcirc	\bigcirc	Use of promotional characters increased
			Promotional characters on packet → child perceived taste, food preferences possibly food choice Branded packaging → food preferences/intended purchase	Persuasive promotional characters packaged products	Industry self-regulation		\bigcirc	\bigcirc	\bigcirc	Low adoption in Australia and occurs more often among signatories
			Colourful, attractive packaging → child food preferences, purchase requests, perceived taste	Persuasive aesthetic elements of packaging		\bigcirc	\bigcirc	\bigcirc	\bigcirc	Little attention has been given to packaging elements other than persuasive characters and branding
	Internet		Advergames for EDNP foods/drinks companies exposure → responsiveness of children increased 'affect' towards product	Advergames	Self-regulation		\bigcirc	\bigcirc	\bigcirc	Exposure is more prevalent among signatories than non-signatories in US. Limitations to self-regulatory pledges
			Social media conversations for carbonated soft drinks → brand valuation and choice of CSD*	Social media		\bigcirc	\bigcirc	\bigcirc	\bigcirc	Emerging medium Not currently covered by guidelines
	Print media		Non-core food advertisements in magazines → snack food choice*	Print media (children's magazines)	Self-regulation		\bigcirc	\bigcirc	\bigcirc	Australian evidence shows self- regulation has not carried through to print media (magazines)
	Schools			Schools	Self- and Mandatory- regulation		\bigcirc	\bigcirc	\bigcirc	Compliance of company self- regulation low in US Mandatory regulation in schools QLD - high compliance; in US low compliance
	Outdoor	Percentage of outdoor food advertising → brand sales for some (not all) fast food companies* weight status*		Outdoor near schools		\bigcirc	\bigcirc	\bigcirc	\bigcirc	No implementation/evaluation studies identified

⁺See next page for Key.

Summary of evidential support for intervention in the promotion food domain – continued.

FOOD ENVIRONMENT OBJECTIVE	SETTING/ CONTEXT	SUPPORTING EVIDENCE		SPECIFIC	INTERVENTION EFFECTIVENESS Does it work in practice?					
		Observational Studies	Experimental Studies	SETTING/ CONTEXT	"Action"/ intervention	Impact on food environment (exposure)	Awareness, attitudes, brand equity, purchase intent	Food/ menu composition	Purchasing (including purchase request)/ consumption	Comments
Reduce Sports Sponsorship	Sport & Rec	Sports sponsorship → positive attitude towards food company		Sports sponsorship		\bigcirc	\bigcirc	\bigcirc	\bigcirc	No implementation studies identified Supportive descriptive evidence and implementation considerations have been identified in Australia
Reduce exposure to marketing via product placement in stores	Retail Product placement in-store	Position on shelves/in-store → sales unhealthy products at checkouts → child pestering		Location on shelves		\bigcirc	\bigcirc	\bigcirc	•	Evidence from field experiments and small-scale intervention trials in variety of environments
			End-of-aisle displays → positive consumer attitudes; purchases	End-of-aisle display		\bigcirc		\bigcirc		
				Checkouts	Self-regulation		\bigcirc	\bigcirc		Self-regulation=UK Responsibility Deal Self-reported sales data promising
Reduce exposure to misleading advertising	Print media and packaged products	Nutrient claims: perceived healthiness, perceived taste, nutrient profiling criteria					\bigcirc	\bigcirc	\bigcirc	Evidence from comparison study of Norway (regulatory system,) and Germany (no system) for RTECs

Key Supporting evidence

- * One study
- \rightarrow "is associated with" / "had an effect on"

Evidence of association/effect is supportive of intervening

Mixed evidence of association/effect to support intervening

Intervention evidence

- Evidence of effectiveness highly supportive of intervention
- Evidence of effectiveness supportive of intervention
- Mixed evidence to support intervention
- Evidence of intervention ineffectiveness
- Lack of evaluation evidence (gap area)

Introduction

There is no 'ideal' structure or framework around which to summarise the evidence with regard to food promotional marketing to children; the synthesis described for this domain is a 'best attempt' to map the knowledge and evidence, in respect of the wide variety of study types across different modes of exposure and a hierarchy of effects. Examples of the various study types and a proposed hierarchy of unhealthy food promotion effects have been indicated in the recent publication by Kelly and colleagues (2015). The presentation of the evidence in this domain is largely complementary to this hierarchy, although the structure is dictated also by the need for comparability across domains; including the need to structure the information in such a format that it could be condensed into a tabular, summary format to facilitate communication of the evidence to decision-makers and other stakeholders.

A complicating factor is the varying terminology used to describe the exposure, e.g. 'food marketing' 'food advertising' and 'food promotion'; terms that are often used interchangeably in the literature and which can vary within and across different modes of exposure. The literature is mixed regarding use of the different terms and consequently the use of terms is mixed throughout this scoping review. The reader is directed towards the Appendices, the first of which contains a summary of the findings from a brief literature review of the evidence in relation to adults. Many fewer studies have been conducted among adults; although the section on nutrient content claims within the main body of the review is framed around the impact on adults. A second Appendix includes a summary of the findings from a systematic review which illustrates the difficulties in classifying evidence in relation to this domain, especially when the evidence included in that review was primarily from cross-sectional and experimental studies conducted under artificial conditions. A third Appendix includes evidence from point-of-sale marketing - particularly feature and display promotions - that doesn't fit into any single domain and also relates partly to the provision of nutrition information, which was outside of scope for the overall review, in addition to multi-component retail interventions.

Food environment objective: reduce exposure of children to advertising of unhealthy food and beverages

Background

Modes of exposure to advertising of unhealthy foods/beverages

- Chandon & Wansink (2012a; narrative): "Part of the explanation for the duration of the controversy [that food marketing only affects brand preferences and not overall energy intake] is that, unlike other factors such as price or portion size changes, advertising is a complex multidimensional intervention with many variations in the target audience, the nature of the message, the creative techniques used, the size of the budget, the media scheduling, etc. This makes it difficult to estimate reliable effects using non-experimental real-world data."
- Bollars et al (2013; *review*): A summary of modes for the promotional marketing of foods and beverages was listed in the paper by Bollars et al 'Marketing of foods high in fat, salt and sugar to children: update 2012–2013' prepared for the World Health Organisation. The list below indicates the multiple modes that exist by which children are exposed, often subliminally, to marketing.
 - Placement of online advertising:
 - \cdot on search engines
 - \cdot on social networking sites
 - · on news sites, music sites and blogs
 - · around or in TV-on-demand
 - \cdot around or in films and media clips viewed online
 - · around or in online and downloadable games, music and other media.
 - Product placement and branding
 - product placement in scheduled TV and radio programs, films, computer games, downloadable apps
 - · branded books such as counting books for preschoolers

- \cdot branded toys such as the fast food store as a playhouse
- · branded computer games
- · interactive company-owned web sites, e.g. with puzzles and games
- \cdot branding on sports teams and advertising at sports and cultural events.
- Viral marketing
 - word-of-mouth and personal recommendations by consumers, sometimes in return for payment or reward, and increasingly encouraged on social networking sites.
- Sponsorship
 - \cdot sponsorship of TV and radio programs, music videos
 - · celebrity product endorsement
 - \cdot sponsorship of community and school events and contests
 - \cdot corporate gifts of educational materials and equipment
 - · corporate support of health campaigns, sports clubs, school meals.
- Direct marketing
 - · promotional emails
 - promotional sales by telephone, text messaging to mobile phones
 - · promotion and sampling schemes in schools.
- "Advergaming"
 - branding and advertising embedded in video games and interactive fantasy worlds, available online or for downloading (the users may provide their contact details to marketers in return for multiplayer interactive gaming and opportunities for rewards).

- Point of sale and product promotion
 - · packaging vouchers with links to discounts on videos, films, music
 - packaging codes with links to online games, social networking sites or downloadable apps
 - · vending machine codes with links to online immediate discounts.
- Integrated marketing
 - linking film, toy and food products and new media, such as breakfast cereal with on-pack promotion of a brand-promoting game played on a website, with matching Facebook page and Twitter messaging (the game can be played interactively with other people worldwide and is downloadable as an app to play on a smart phone).
- Interactive and user-generated marketing and marketshaping activities (e.g. TV advertisements invite viewers to vote for different flavours of a brand which are then produced and marketed; or the company launches a competition to create a video commercial which individuals put on YouTube for viral distribution).

Reviews of food marketing to children

- There is a substantial number of reviews, many systematic, published in the peer-reviewed and grey literature which are concerned with the effects of food marketing to children across the various modes. The majority of these reviews do not explicitly refer to particular modes of exposure to food advertising in their summary evidence statements.
- Chambers et al (2015; systematic review): 'Reducing the volume, exposure and negative impacts of advertising for foods high in fat, sugar and salt to children: a systematic review of the evidence from statutory and self-regulatory actions and educational measures': Only included primary research reporting on the evidence of policy actions (statutory or regulatory) indicated to reduce the volume,

exposure and other negative impacts of advertising for foods high in fat, sugar and salt (HFSS) to children aged <18 years. Relevant outcome measures included: volume of advertising; advertising exposure; advertising patterns by nutritional content; cost-effectiveness; eating behaviour, health outcomes; and antecedents of eating behaviour. Studies were required to have a comparator (studies with before/after measures, experimental and quasi-experimental designs, or comparisons). Relevant media included TV, internet, radio, magazines and newspaper advertising.

- Nineteen publications provided evidence for the results of statutory regulation while 25 provided evidence for the results of self-regulation.
- Outcome measures varied in approach, quality and results.
- Findings suggest that statutory regulation could reduce the volume of and children's exposure to advertising for foods HFSS, and has the potential to have a wider impact.
- Self-regulatory approaches showed varied results in reducing children's exposure.
- ⁸⁶Only nine of the studies for regulatory approaches were real world (Adams et al 2012, UK; Dhar and Bayliss 2011, Quebec; Goldberg 1990, Quebec; Kinm et al 2013, South Korea; Ofcom 2008, UK; Ofcom 2010, UK; Potvin Kent et al 2011; Potvin Kent et al 2012, Canada; Taras & Gage 1995, US). The other included studies were modelling (of regulatory scenarios) and experimental studies.
- In Kraak & Story (2015; Systematic Review): Although this review is concerned primarily with brand mascots and cartoon characters it cites most of the reviews listed below and their conclusions: "Numerous systematic evidence reviews have documented that food marketing practices strongly influence children's food preferences and purchase requests (Hastings et al 2003; Hastings et al 2006; McGinnis et al (eds) 2006; Cairns et al 2009; Cairns et al 2013; Bollars et al 2015). A rigorous review

conducted by an expert committee of the US Institute of Medicine (IOM) of the National Academies concluded that food marketing also influences children's eating behaviours, contributes to an energy-dense and nutrientpoor diet, increases their risk of unhealthy weight gain, and may contribute to negative diet-related health outcomes (McGinnis et al eds. 2006). The IOM committee concluded that 'even a small influence, aggregated over the entire population of American children and youth, would be consequential in impact' (pp. 9 and 13; (McGinnis et al eds. 2006))."

- Cancer Council Australia (2014; Position Statement): Position Statement — Food Marketing to Children.
- Cairns et al (2013; systematic review): Systematic reviews of the evidence on the nature, extent and effects of food marketing to children. A retrospective summary. (Note that this review is only a summary of the 2008 review (i.e. includes studies only up until Nov 2008). Relative to other factors the weight of evidence that food promotion could be a significant independent determinant of children's weight status was assessed as 'modest'.
- Bollars et al (2013; *review*): Marketing of Foods High in Fat, Salt and Sugar to Children: Update 2012—2013. World Health Organisation.
- Chandon & Wansink (2012; narrative review): "In summary, all reviews of this literature (Harris Pomeranz et al. 2009; Livingstone 2006; McGinnis et al 2006) conclude that food advertising and promotion have a causal and real, although small, direct effect on children's food decisions, and also that food advertising interacts with other marketing factors to influence obesity in a proportion which is not well established."
- Cairns et al (2009; systematic review): The Extent, Nature and Effects of Food Promotion to Children: A Review of the Evidence to December 2008. [Review re-written and published 2013]
- McGinnis et al (eds.) (2006) *Food Marketing to Children and Youth: Threat or Opportunity?* Committee on Food Marketing and the Diets of Children and Youth; Institute of Medicine (IOM).

• Hastings et al (2006; review): *The extent, nature and effects of food promotion to children: a review of the evidence.* Technical paper prepared for the World Health Organisation.

Supporting evidence

Food advertising and brand loyalty

- Brand loyalty created in childhood likely persists into adulthood.
- Connell Brucks et al (2014; US; experimental): Four related experimental studies showed that childhood exposure to advertisements can lead to resilient biased product evaluations that persist into adulthood. Study 1 demonstrated that positive affect toward adrelated stimuli encountered in childhood mediates the relationship between childhood advertising exposure and biased evaluations for products associated with childhood (but not adulthood) advertising. Study 2 demonstrated stronger biases when participants are exposed to childhood advertising cues relative to childhood consumption cues. Studies 3 and 4 showed that even when ability and motivation to correct bias are high, lingering positive affect toward childhood adrelated stimuli is a motivational deterrent to correct biased product evaluations. Study 4 also shows that biased product evaluations can transfer to line extensions.
- Asquith (2014; Canada; *archival research*): This study showed that children's food advertising during the 1930s through advertiser-created 'clubs'(for dozens of national food brands) created 'brand socialisation' and brand loyalty across the years.
- LaTour et al (2010; cited in Boyland & Halford 2013): Exposure to a brand early in childhood in particular is critical for the creation of emotional attachments and the solidification of the relationship with that brand.
- Escalante de Cruz et al (2004; cited in Boyland & Halford 2013; citation): Children are seen as "teenage and adult shoppers of the future"so that any brand loyalty fostered at a young age may reward the company with a lifetime of sales.

Brand awareness and food choices/ consumption

- Only a very limited amount of evidence was identified with respect to brand awareness and food choices/consumption, although it is frequently cited as a key factor affecting children's purchasing decisions.
- Simply creating brand awareness can have an important effect on food choices because it reduces search by enabling people to look for the brands that they already know on the supermarket shelves (Chandon et al. 2009; Van der Lans, Pieters, and Wedel 2008). Familiarity effects are particularly strong for children, who like what they know and prefer to eat what they already like (Cooke 2007). [cited In Chandon & Wansink 2012]
- Halford Boyland Cooper et al (2008; cited in Boyland & Halford 2013; *citation*): Brand is indicated as one of the six key factors affecting children's purchasing decisions alongside fun, taste, peer-pressure, status and packaging.

Brand awareness/logo recognition and diet/BMI

- Small-scale laboratory experiments and crosssectional data indicate that child knowledge and awareness/recognition of brands is not associated with foods consumed, however it does appear to be associated with child BMI.
- Cornwell McAlister et al (2014; US; *experimental*): In two small studies among children aged 3–6 years (study 1 n=69, study 2 n=75), child knowledge of brands of products high in sugar, salt and fat was shown to be a significant predictor of child BMI, even after controlling for their age and gender and when also considering the extent of their TV viewing. Additionally, two different collage measures of brand knowledge (utilised across the two studies) performed similarly, suggesting that this measure may be serving as a surrogate indicator of an overall pattern of product exposure and consumption.

- Ueda Tong et al (2012; India; *cross-sectional*): A study of 306 children aged 3–13 in a south Indian town showed no link between brand logo recognition and poor eating behaviour, distorted nutrition knowledge, or increased purchase requests, but brand logo recognition was positively associated with BMI.
- Kopelman Roberts et al (2007; UK; *logo quiz*): In a study of 476 9–11year olds in the UK using a self-completed questionnaire on food preferences and eating behaviours, brand awareness (logos) was not associated with consumption of a poor diet.

Food advertising⁸⁷ and food preferences

- One systematic review (up to Nov 2008) indicated that the evidence (from experimental and crosssectional studies) was 'modest' and on balance shows that food advertising can influence food preferences.
- Jenkin et al (2014; Systematic Review): Indicates other reviews which provide evidence that food marketing influences the preferences, purchasing behaviour and diets of children (Cairns et al 2013; Hastings 2006; McDermott 2004; McGinnis et al 2006).
- Cairns et al (2013; *Systematic Review*; of studies to Nov 2008): In the systematic review of studies to Nov 2008; 9/16 experimental studies with food preferences as an outcome showed a positive effect of advertising on food preferences. Combined with cross-sectional evidence the overall weight of evidence was assessed as modest and on balance indicates that food promotion can influence food preference.

Food promotion⁸⁸ and purchase request

- Food advertising is associated with purchase requests ('nagging'); particularly among younger children.
- Cairns et al (2013; *Systematic Review of studies to Nov 2008*): 7/8 studies reported statistically significant effects and 1/8 reported no association. Overall the weight of the evidence was assessed as strong and indicates that food promotion can directly influence purchasing choice and requests.

⁸⁷The evidence around 'food promotion' and/or 'food marketing' is presented as distinct from 'TV advertising'; according to the exposure variable(s) used in the original article ⁸⁸NOTE: In all of Halford and colleagues' experiments, foods offered to children were not the same as in the food advertisements. Therefore there is a beyond-brand effect of food advertising (which stimulated consumption of all snack foods on offer). As per experiments by Harris Bargh et al (2009).

Food promotion⁸⁹ and food choices/food consumption

- The same systematic review (up to 2009) indicated that there was 'strong' evidence that food promotion does influence food choices at category and brand levels; and 'modest' evidence that food promotion can influence food consumption behaviours. A more recent cross-sectional survey in The Netherlands supports these findings among lower-income families. A recent Australian survey has shown that a variety of junk food marketing techniques is related to self-reported purchase of those foods by adolescents.
- Morley et al (2014; AUS; cited by Junk Food Injunction): Data from the National Secondary Students' Diet and Activity Survey released by Cancer Council Australia and the National Heart Foundation of Australia shows that teenage boys were more likely to be regular consumers of fast food than girls (46% compared with 34%) and of sugary drinks (28% compared with 14%) (in accordance with higher rates of overweight and obesity among teenage boys than girls aged 8–11 years). In the month before the study just over half of boys (53%) and girls (51%) had tried a new food or drink product they had seen advertised and 40% of boys and 30% of girls had chosen a fast food outlet because it had a special offer or giveaway with the meal, while 42% of boys and 39% of girls said they had bought an extra food or drink product on display at the supermarket checkout.
- Buizen Schuurman et al (2008; The Netherlands; *cross-sectional*): A dietary survey in 234 households with children 4–12 years showed that children's exposure to food advertising was significantly related to their consumption of advertised brands and energy-dense product categories. The relation between advertising exposure and overall food consumption (i.e. branded and non-branded) only held in lower-income families and extended to more generic unhealthy consumption patterns.
- Cairns et al (2013; <u>SR to 2009</u>): 15 studies (type not indicated). 4/6 studies that explored brand level effects found an effect; 6/11 studies reported unequivocal evidence of effects for category levels while 3/11 gave inconclusive results and 2/11 showed no effect. Evidence was assessed as strong and indicated that food promotion does influence food choices at category and brand levels.

- Cairns et al (2013; <u>SR to 2009</u>): 14/18 studies (type not indicated, of which 6/18 showed significant results, 8/18 showed small non-significant results and 4/18 reported inconclusive results) demonstrated positive associations between food promotion and consumption behaviours such as increased frequency of selecting less healthy foods, increased energy intake and increased food intake. Overall the weight of evidence was judged as modest that food promotion can influence food consumption behaviours.
- Hastings et al (2006; <u>*Review*</u>): Food advertising to children has a significant effect on what children choose to eat.

Advertising expenditures and food/ beverage consumption

- An empirical study in the US using regression analysis of sales data across 24 years versus annual advertising expenditures did not find an association between the two variables for carbonated soft drinks (CSD). The authors surmised that CSD advertising has minimal or no effect on aggregate consumption, but is important to brand and market share.
- Wilcox et al (2009; USA; Empirical study): A regression analysis of annual sales data for carbonated soft drinks versus annual advertising expenditure across 24 years, from 1984–2007 showed that aggregate advertising expenditures (not including toys, cartoons, movies and contests) and aggregate consumption for soft drinks in the United States were not significantly related. The authors indicate that while this may seem counterintuitive given the astronomical amounts of dollars spent by carbonated soft drink (CSD) companies on advertising, industry experts often cite stealing competitors' market share as a main reason why soft drink companies advertise heavily. CSD advertising might influence consumers, especially teens, to choose a particular brand of soft drink rather than influence their decision to drink soda, i.e. as seen for beer and cigarettes, advertising has minimal or no impact on aggregate consumption but is important to brand and market share.

⁸⁹NOTE: In all of Halford and colleagues' experiments, foods offered to children were not the same as in the food advertisements. Therefore there is a beyond-brand effect of food advertising (which stimulated consumption of all snack foods on offer). As per experiments by Harris Bargh et al (2009).

Factors affecting vulnerability to food/ beverage advertising among children

- Experimental studies and findings from psychology and neuroscience indicate that children are highly susceptible to the persuasive intent of advertising, however advertising literacy does not necessarily engender less vulnerability to the effect of advertising and may even increase vulnerability to advertising.
- A number of factors, other than advertising literacy, may moderate the relationship between advertising and food consumption. These factors include: advertising attention and neural susceptibility; habitual TV watching; food neophobia; nutrition knowledge; consumption-related family communication; maternal encouragement to be thin; parental diet; home availability of EDNP foods/ beverages; and, peer pressure.
- Multiple observational studies show that overweight/obese children have heightened awareness of and are more responsive to advertising.

Advertising literacy

- Lioutas & Tzimitra-Kalogianni (2015; Greece; child survey): Child self-reported dietary behaviours and responses to a questionnaire examining the influence of advertising on the qualitative assessment of food products showed that children who have little understanding of the persuasive intent of advertising rate advertised foods as healthier and more nutritious. The frequency of unhealthy food consumption is influenced by the entertaining dimension of advertising and the level of the motivational arousal after children's exposure to food advertisements. These authors conclude that food advertising impels children's consumer behaviour through four different modes. First, advertising engenders expectations, which raise purchase motivation. Second, the purchase of advertised foods is accompanied by positive feelings (happiness, satisfaction). Third, the entertaining dimension of advertising generates a pleasant mood, which positively predisposes the evaluation of advertised foods. Fourth, children do not always possess the ability to recognise the persuasive nature of advertising.
- Cancer Council Position Statement (2014; narrative review): "There is substantial evidence from psychological research that children are highly vulnerable to advertising and marketing, as they lack the necessary cognitive skills and experience to interpret advertising messages critically (Kunkel et al 2004)". The American Psychological Association has concluded that until at least the age of eight years, most children do not comprehend that the purpose of advertising is to persuade consumers. Vulnerability to advertising may extend into adolescence as it is not until the reflective stage of cognitive development (age 11–16 years) that children are able to fully understand other people's perspectives and the complexities of communication (Roedder-John et al 1999). The associated ability to make rational judgements and question what they are being told is needed to make judgements about the persuasive intent of marketing (Roedder-John et al 1999; Carter et al 2011; Rozendaal et al 2011). Improving children's knowledge of advertising does not always affect their preference for advertising products. Although children may understand that advertisements are attempting to sell products to them, they do not use this to protect themselves from the techniques employed (Rozendaal et al 2011; Harris et al 2015).
- Reisch, Gwodz et al (2013; Europe; experimental studies and survey data): Based on prior consumer research, five hypotheses were tested on a subsample from the IDEFICS study, a large-scale pan-European intervention study on childhood obesity. The study found that, in terms of advertising, the statistical significance of advertising's credibility on food preferences is especially noteworthy: the study found a highly significant negative effect of advertising's credibility on food preferences, meaning that children who are less sceptical of advertising have less healthful food preferences. In contrast to expectations, the more children feel entertained by advertising, the more healthful their diet. One reason that advertising literacy alone does not seem to help is that this knowledge only guides behaviour when it is accessed and used at the same time as the advertising stimulus, something that marketers carefully avoid. In addition, different processes of persuasion operate at different age levels — that is, at different perceptual stages and levels of advertising literacy — which age-specific advertising takes into account. Thus any action needs to go beyond 'food knowledge' and 'advertising literacy' alone. Food knowledge (healthful) had no influence on food preferences.

- Boyland & Halford (2013; US; cross-sectional survey): Advertising literacy (recognition and understanding of its selling and persuasive intent) and relationship with impact of advertising may depend on a child's age. In a survey among 296 children aged 8–12 years, only understanding advertising's persuasive intent was effective in reducing the impact of advertising exposure on children's advertised product desire. However, this only applies to the older children in the sample (ages 10–12). For the younger children, understanding the persuasive intent even increased the impact of advertising.
- Carter et al (2011; AUS; mixed methods): Children (n=594) were recruited from each grade from Preprimary to Grade 7 from 10 primary schools in Perth, Western Australia and exposed to a McDonald's television advertisement. Understanding the purpose of television advertising was assessed both nonverbally (picture indication) and verbally (small discussion groups of 3-4). Particular distinction was made between selling versus persuasive intent. Consistent with previous literature, a majority of children described the 'selling' intent of television advertising by 7–8 years both nonverbally and verbally, increasing to 90% by 11-12 years. Awareness of 'persuasive' intent emerged slowly as a function of age but even by the oldest children was only 40%. Therefore vulnerability to television advertising may persist until children are far older than previously thought.
- Rozendaal Lapierre et al (2011; *Review*): It is widely assumed that advertising literacy makes children less susceptible to the effects of advertising. However, empirical research does not provide convincing evidence for this view. In this article, the authors explain why advertising literacy as it is currently defined (i.e., conceptual knowledge of advertising) is not effective in reducing children's advertising susceptibility. Specifically, based on recent insights on children's advertising processing, the authors argue that due to the affectbased nature of contemporary advertising, children primarily process advertising under conditions of low elaboration and, consequently, are unlikely to use their advertising knowledge as a critical defence. Moreover,

literature on cognitive development suggests children's ability to use advertising knowledge as a defence will be further limited by their immature executive functioning and emotion regulation abilities. Therefore, they argue that the current conceptualisation of advertising literacy needs to be extended with two dimensions: advertising literacy performance, which takes into account the actual use of conceptual advertising knowledge; and attitudinal advertising literacy, which includes low-effort, attitudinal mechanisms that can function as a defence under conditions of low elaboration.

- Nairn & Fine (2008; Commentary/review): The debate surrounding the ethics of advertising to children generally centres on the age at which children have developed sufficient cognitive resources both to understand the persuasive intent of marketing messages and to critically evaluate them. In this paper the authors argue that this debate requires urgent updating to take into account recent and significant findings from psychology and neuroscience. Substantial evidence now shows that judgements and behaviours, including those relating to consumption, can be strongly influenced by implicitly acquired affective associations, rather than via consciously mediated persuasive information. Contemporary advertising formats typically targeted at children are particularly likely to 'implicitly persuade' in this way. The implications for the ethical and empirical agenda are profound, pointing the way for a re-evaluation of what constitutes responsible children's advertising, a new research agenda and a new approach to media literacy strategies.
- Harris et al (2009): Other proposed conditions necessary for 'defence' against advertising include the ability to produce counter-arguments against advertising and also the motivation to do so. Further, marketing influences can occur even in the absence of cognitive processing and awareness of message exposure (Chartrand 2005). [references indicated by Kelly B, pers. comm.]

- Livingstone & Helsper (2006; *Review*): It is widely assumed in academic and policy circles that younger children are more influenced by advertising than are older children. By reviewing empirical findings in relation to advertising and children's food choice, it is argued that this assumption is unwarranted. The findings do not suggest that young children are more affected by advertising than are teenagers, even though the latter are more media literate. This article critically examines the theoretical gap in the literature regarding the relationship between advertising literacy and advertising effects. By applying a dual process model of cognitive persuasion, it is shown that the evidence is more consistent with the argument that different processes of persuasion are effective at different ages, precisely because literacy levels vary with age.
- Moses & Baldwin (2005; *Review*): Whereas prior research on children and advertising has drawn heavily on Piaget's developmental theory, the authors argue that more recent approaches that focus on the development of children's 'theories of mind' and 'executive functioning' skills may prove more fruitful. The review of research on these topics generates two predictions: first, on the basis of theories-of-mind literature, the authors expect that children have well-formed conceptions of the intentions underlying advertising by seven or eight years of age. Second, on the basis of executive functions literature, the authors expect that children are not able to deploy these concepts effectively in their everyday lives until much later in development.
- The substantial reviews on behalf of the American Psychological Association (Kunkel et al (2004) and in the book by Gunter et al (2005) (both cited in Blades et al 2013) indicate that children do not understand persuasive intent until after eight years of age.

Advertising attention

Beaudoin (2014; US; cross-sectional): Based on social comparison theory and with data from a national survey of adolescents (N=1,436), this study examines how advertising exposure and attention predict descriptive norms specific to unhealthy food consumption. Advertising attention, as compared to exposure, had stronger positive associations with descriptive norms specific to three reference groups (i.e., family, close friends, and students at school). Advertising effects were stronger in two cases for older adolescents than for younger adolescents.

Neural susceptibility

• Yokum Gearhardt et al (2014; US; *experimental*): Scanned the brains of 30 adolescents while they watched a TV show edited to include 20 food commercials and 20 nonfood commercials. Activation in the striatum but not the orbit frontal cortex (OFC) in response to food commercials relative to non-food commercials and in response to food commercials relative to the TV show was positively associated with change in BMI over one-year follow-up, suggesting that there are individual differences in neural susceptibility to food advertising.

Habitual TV viewing

Boyland Harrold et al (2011; *experimental*): An experimental study among 281 children aged 6–13 showed that children who habitually watch more TV are also more susceptible to the effects of TV food advertising. Although all children selected more branded and unbranded fat-rich and carbohydrate-rich items from food preference checklists, those children who habitually watched more TV showed an enhanced preference, particularly for branded foods.

Food neophobia

Dovey, Taylor et al (2011; US; experimental): In an experimental study among 66 children aged 5-7 years, children were exposed to unhealthy food advertisements, healthy food advertisements and toy advertisements embedded into a cartoon in a counterbalanced order on three different occasions. Following the cartoon, children were offered a snack consisting of six food items (chocolate, jelly sweets, potato crisps, Snack-a-Jacks, green seedless grapes and carrot sticks). Food advertisement exposure, irrespective of content (either unhealthy or healthy food items), increased food intake by 47 kcal (11%) in high food neophobic children. Children who scored lower on the food neophobia (fear of novel food) scale ate significantly more (63 kcal, 14%) following the unhealthy food advertisements only. In the healthy advertisement condition, low food neophobic children consumed significantly less chocolate but did not increase their consumption of fruit and vegetables. Therefore although all children over-consumed in response to unhealthy food advertisements, children with low levels of food neophobia appeared to respond to healthy food messages while children with higher levels of food neophobia did not.

Nutrition knowledge

Boyland et al (2015; UK; *experimental*): Fifty-nine children aged 7–10 years. The within-participant, counterbalanced design had two conditions: control (exposure to ten toy advertisements across two breaks of five advertisements each) and experimental (the middle advertisement in each break was replaced with one for a McDonald's Happy Meal® depicting the meal bundle as consisting of fish fingers, a fruit bag and a bottle of mineral water). Following viewing of the advertisements embedded in a cartoon, children completed a hypothetical menu task that reported liking for McDonald's food and fast food in general. Compared to children with high nutritional knowledge, those with low scores selected meals of greater energy content (305 kJ) after viewing the food advertisements.

Gender

 Anschutz Engels et al (2009; The Netherlands; experimental): In this study, food intake among 120 children aged 8–12 who watched a movie interrupted by two-minute food or neutral commercials was higher in boys when they watched the food commercials than when they watched the neutral commercials. In comparison, food intake in girls was slightly lower when they watched the food commercials than when they watched the neutral commercials than when they watched the neutral commercials. Suggesting that boys are susceptible to food cues in commercials. (Note. Converse findings among adult gender differences on one or two studies; cf. Appendix 1)

Weight status

 Rapuano et al (2015; US; experimental): Among 12-15 year olds, this study involving functional magnetic resonance imaging showed that food commercials, compared with non-food commercials, more strongly engage regions of the brain involved in attention and saliency detection, and in processing rewards and that activity of these brain regions correlated with subjects' percent body fat at the time of the scan, i.e. overweight and obese teenagers are more susceptible to food advertising. In addition, those with a higher adiposity mentally simulate eating behaviours offering a potential neural mechanism for the formation and reinforcement of unhealthy eating habits that may hamper an individual's ability to lose weight later in life.

- Whalen et al (2015; UK; experimental): Using a mixedmeasures design with one between-subjects factor (physiological state: hungry or sated) and one withinsubjects factor (advertisement condition: food or nonfood), 110 children aged 7-11 were tested on two occasions. The participants were exposed to each of the two types of advertisements (in a counterbalanced order) before being given the opportunity to eat as much as they wanted from a selection of snacks. Height and weight measurements were taken and parental measures of habitual TV exposure collected. Preliminary results show a trend towards significance for increased consumption in the sated group after food advertisement exposure compared with toy advertisements (10 kcal increase). Sated overweight/obese children showed a significant increase in food consumption (25 g increase) after watching TV food advertisements compared with toy advertisements.
- Keller et al (2012) cite three studies showing that overweight children are more susceptible to food cues and more likely to eat in the presence of such cues compared to non-overweight children.
- Arredondo Castaneda et al (2009; US; *experimental study and parent survey*): Older children (among 4–8 year olds) and children who were overweight were significantly more likely to recognise fast food restaurant logos than other food logos.
- Halford Boyland Hughes et al (2008; US; experimental): An experimental study among 59 children aged 9–11 years demonstrated that not only did food advertising exposure (followed by a cartoon) produce a substantial and significant increase in post-viewing caloric intake (of high fat and/or sweet energy-dense snacks) in all children, but also that this increase in intake was largest in the obese children, where it specifically stimulated intake of energy-dense snacks.
- Forman Halford et al (2009; US; *experimental*): In a study of 43 non-overweight and 20 overweight children from diverse backgrounds, overweight children showed greater responsiveness to food branding on packaged foods in terms of consumption. Overweight children consumed an additional 40 kcal in branded (packaged foods with brands) vs. unbranded (same meals but not served in packaging) meals whereas non-overweight children consumed 45 kcal fewer in branded meals.

- Halford⁹⁰ Boyland Cooper et al (2008; US; *experimental*): Among 37 school children aged 11–13 years, food advertising led to more (branded and non-branded) food items being chosen post-viewing among all children when shown a food advertisement compared to a toy advertisement; but obese and overweight children were more responsive to (had increased preference for) promoted branded food. Among the 10 overweight and three obese children, food advertisement recall was significantly related to the subsequent number of food items selected.
- Halford et al (2007; UK; experimental): In a repeatedmeasures design, 93 children aged 5–7 years, 28 of whom were overweight or obese, were exposed to 10 non-food and 10 food advertisements. BMI was positively related to recognition of food advertisements.
- Halford Gillespie et al (2004; US; experimental): This study examined lean, overweight and obese children's ability to recognise eight food and eight non-food related advertisements in a repeated measures design. While there was no significant difference in the number of non-food advertisements recognised between the lean and obese children, the obese children did recognise significantly more of the food advertisements. The ability to recognise the food advertisements significantly correlated with the amount of food eaten after exposure to them. The overall snack food intake of the obese and overweight children was significantly higher than the lean children in the control (non-food advertisement) condition. These data demonstrate obese children's heightened alertness to food-related cues.

Parental psycho-social and demographic variables

- Anschutz Engels et al (2010; The Netherlands; experimental): Among 121 children aged between eight and 12 years, those who perceived maternal encouragement to be thin ate slightly more when exposed to energy-dense food commercials and especially when exposed to light (low energy versions of the same energy-dense foods) food commercials than when exposed to neutral commercials. In contrast, children who perceived no maternal encouragement to be thin ate more when exposed to neutral commercials than when exposed to either energy-dense food commercials or light food commercials. These findings suggest that exposure to adult-targeted light food cues produced disinhibition in children who experienced maternal encouragement to be thin, resulting in elevated snack food intake.
- Arrerondo Castaneda et al (2009; US; *experimental study and parent survey*): Parents' psychosocial and sociodemographic characteristics were associated with the type of food logo (fast food versus other) recognised by children.

Consumption-related family communication

 Buizen Schuurman et al (2008; US; combined household diary-survey): consumption-related family communication was an important moderator of the relations between advertising and the food consumption variables. Sociooriented family communication (i.e., striving for harmony and conformity) was particularly successful in reducing these relations.

Home availability of EDNP foods

 Pearson Biddle et al (2014; AUS; cross-sectional): Secondary schools in VIC, AUS. Years 7 and 9; n=2984. TV viewing (school day and weekend day) was positively associated with home availability of energy-dense snack foods among adolescent boys and girls and home availability of energy-dense snack foods was positively associated with energy-dense snack food consumption among boys and girls. Home availability partly mediated the association between TV viewing and energy-dense snack consumption.

⁹⁰NOTE: In all of Halford and colleagues' experiments, foods offered to children were not the same as in the food advertisements. Therefore there is a beyond-brand effect of food advertising (which stimulated consumption of all snack foods on offer). As per experiments by Harris Bargh et al (2009).

Rights-based approach to protecting children from exploitation

- Handsley, Coveney et al (2014; AUS; *Discussion Paper*): This article discusses application of the *United Nations Convention on the Rights of the Child* to the regulation of food advertising for the prevention of childhood obesity. It finds that the convention would support strict regulation of food advertising for the prevention of childhood obesity, and in particular that such regulation would be appropriate to the model of co-operation between the state and parents that the Convention posits. The article also raises the question of whether the grooming of children as consumers through advertising might be a form of economic exploitation.
- Mehta, Coveney et al (2014; AUS; qualitative methods with 13 parent-child (aged between 8-13 years) pairs, from South Australia): Ethical concerns raised by parents and children included the marketing of EDNP foods, pester power and family conflict and the use of powerful techniques via the internet. Their views on rights and responsibilities represented a complex mixture of idealistic and pragmatic positions. They appeared to be caught within the tensions of 'problematising' unhealthy food marketing to children both as a social problem and as an individual problem. The stalemate on statutory regulations to protect children from exposure to EDNP food marketing could be advanced by stronger use of ethical arguments to protect children from harmful exploitation and to protect parents from forces that undermine their authority.
- Bollars et al (2013) discuss the 'rights and risks' of regulatory and self-regulatory action, particularly noting the distinction between a rights-based approach to protecting children from exploitation, and a risk-based (or risk-benefit-based) approach where an attempt is made to weigh up the multiple likelihoods of harm and benefit in terms of outcomes, to minimise the risk of harm and maximise the benefit. It recognizes conflicting interests and the costs to different stakeholders, and the need for proportionate action to balance commercial and economic costs against health gains. A rights-based approach is intrinsically more favourable to the protection of children, whereas a risk-based approach offers some protection to the free working of markets and commerce.

• A rights-based approach is more comprehensive in nature and can be more easily formulated such as those that have been implemented in Canada (Quebec), Norway and Sweden. A risk-based approach needs to specify more precisely which marketing messages are and are not allowable, based on an evaluation of the likelihood of harm. Examples include the regulatory frameworks in France, the UK and several other countries.

Implementation examples: selfregulation of food advertising to children

Description

- Ronit & Jensen (2014; *systematic review*) point to Hawkes & Harris (2011) who distinguish between:
 - collective self-regulation pledges that companies can join
 - within-pledge commitments issued by single corporations.

Some companies commit to different pledges with different standards; others commit to varying numbers of pledges within the agreement. Self-regulation based on voluntary participation where companies have a strong say in formulating the standards and benchmarks of the regulation result in standards being set at a low level.

Galbraith-Emami & Lobstein (2013; Review]: These pledges specifically address controls on marketing food and beverages to children and are in addition to the longstanding industry-wide codes of conduct and national regulations on advertising and product promotion. By 2012, some 22 national and regional pledges involving over 90 companies (ranging from 6 to 26 companies in any given national or regional pledge) had been documented, with some companies making different pledges with different criteria, in different regions of the world. Comparison of different company pledges and statements shows inconsistency in terms of the media formats included, the age of children, the proportion of children in the audience, and especially the types of foods that would and would not be restricted. This makes evaluation of the real impact of the pledges hard to assess.

Examples – company commitments

- McDonald's agreed not to market 'sodas' to children via in-store or external advertising or list them on the children's menu. (McDonald's Corporation, '2013 Clinton Global Initiative Commitment to Action' – cited by Otten (2014)
- Some companies, like Walt Disney Co have taken pledges to cut down on the amount of unhealthy advertising aimed at children. Disney says it plans to ban all junk food advertising from its TV channels, websites and radio programs catering to children by 2015. http://time. com/45302/kids-think-apple-slicesare-french-fries/ – cited by Otten (2014)

Examples – collective pledges

International pledges

- Sacks et al (2015; AUS; NZ; Fiji): In all three countries, many of the selected companies were signatories to global industry initiatives such as the International Food and Beverage Alliance (IFBA) Global Policy on Advertising and Marketing Communications to Children (International Food and Beverage Alliance, 2011) and the International Council of Beverages Associations Guidelines on Marketing to Children (International Council of Beverages Associations, 2012). For many of the selected companies, this resulted in a multilayered policy, including policies specified at the global and country levels in addition to commitments through national and global industry initiatives. For example, for Nestle in Australia, their food marketing policy was specified at the global level, the country level and through their affiliations with RCMI and IFBA. For some multinational companies (e.g. Coca-Cola), a policy was specified at the global level, but no mention of that policy was made on the country-level company website. Similarly, there are many cases in which companies were signatories to industry initiatives, but did not include that information on their country-level company websites.
- Galbraith-Emami & Lobstein (2013; *Review*): In 2008, ten globally active companies launched the International Food and Beverage Alliance (IFBA), which presented a series of commitments, including one in which the signatory companies agreed to voluntarily introduce restrictions on advertising to children worldwide. In December 2008, IFBA sent a letter to the Director-General of the WHO announcing that individual pledges had been extended globally, committing the signatory companies "to only advertise products to children under 12 years of age that meet specific nutrition criteria, which are based on accepted scientific evidence and/or national and international dietary guidelines; or to not advertise products at all to children under 12".
- Hawkes & Harris (2011; *Review*): In this analysis of food industry pledges regarding marketing to children (initiatives through international industry associations) it was found that participation of companies in global commitments is relatively low.

United States – CFBAI (Children's Food and Beverage Advertising Initiative)

Galbraith-Emami & Lobstein (2013; Review): "Leading food and beverage companies have responded ... by proposing a series of company-led pledges to change their marketing activities directed at children, so that the mix of foods advertised to children would encourage healthier dietary choices and healthy lifestyles". The first initiatives were undertaken in 2006 by 10 food and beverage companies in the United States and coordinated by the Children's Food and Beverage Advertising Initiative (CFBAI, sponsored by the Better Business Bureau), whereby the companies defined the programs in which they would restrict their marketing (e.g. TV programs in which 50% of the audience is aged under 12 years) and the products that they would or would not promote (each company proposed its own categorisation of its products for this purpose). The numbers of companies signing to the CFBAI increased over subsequent years to 16 by 2012.

Europe – European Union Pledge

Galbraith-Emami & Lobstein (2013; Review): In December 2007, 11 major food and beverage companies operating in Europe announced a common commitment to change the way they advertise to children under the age of 12 in the European Union (EU), in support of the EU's Platform for Action on Diet, Physical Activity and Health, with individual company pledges to be introduced by the end of 2008 under an overarching pledge not to advertise to children under age 12 except for products that fulfilled company-specified nutrition criteria. The number of EU Pledge signatories rose to 19 by late 2012, and the companies state that their advertising represents 80% of food and beverage advertising expenditure in the EU.

Australia — AANA; RCMI & QSRI

$\mathsf{AANA}-\mathsf{Principles}$ and Advisory Notes for Advertising to Children

- AANA March 2014 http://aana.com.au/content/ uploads/2014/05/AANA-Code-For-Marketing-Advertising-Communications-To-Children-Explanatory-Note.pdf
 - In 1999, the Australian Association of National Advertisers (AANA) introduced Principles and Advisory Notes for Advertising to Children, which was intended to complement the existing Children's Television Standards (CTS) and other codes and standards in operation at the time. While the AANA Code of Ethics remained the definitive guide for advertisers, the Principals and Advisory Notes for Advertising to Children were regarded as providing an essential supplementary focus on advertisers' responsibilities in this important area.
 - In 2007, the Principles were replaced with a Code for Advertising to Children as part of advertising selfregulation.
 - Since the 2008 Review of the Children's Code, the AANA has reviewed and updated its Code of Ethics (effective 1 January 2012) and both Free TV Australia and the Australian Communications and Media Authority (ACMA) have issued updated documents relating to programming and advertising to children. Many of the changes related to sexual exploitation of children.

- Adjustments to the Code: a requirement that advertising or marketing communications to children:
 - must not mislead or deceive and must fairly and accurately represent the product in a manner that is clearly understood by children
 - that commercial communication to children should be distinguishable to them as such and not be confused with program or editorial content
 - · advertising should not undermine parental authority through 'pester power'; and
 - a prohibition on the use of popular personalities or celebrities (live or animated) to advertise or market products or premiums in a manner that obscures the distinction between commercial promotions and program or editorial content.
 - · 'Directed primarily to children' new Practice Note "Directed primarily to children" is based on the factors which create a level of engagement with children such that additional protections are required. AANA has incorporated those factors into a Practice Note to accompany the Children's Code. The new Practice Note brings together the community standards viewpoint of the Advertising Standards Board and child psychologist's evidence of children's reactions and engagement with different marketing techniques. The Practice Note will assist advertisers and the ASB in understanding the creative techniques that will bring an advertisement within the Code. The Practice Note also recognises that many creative techniques, such as animation, are used to direct an advertisement to adults, and these advertisements are not necessarily subject to the Children's Code.
- Food and Beverages Advertising and Marketing Communications Code — adopted by the AANA as part of advertising and marketing self-regulation, The object of this Code is to ensure that advertisers and marketers develop and maintain a high sense of social responsibility in advertising and marketing food and beverage products in Australia.

RCMI and QSRI

There are two self-regulatory initiatives managed by Australian Food and Grocery Council (AGFC) that specifically address food and beverage advertising to children, namely the Responsible Children's Marketing Initiative (RCMI), which covers products found in retail outlets and the Australian **Quick Service Restaurant** Industry Initiative (QSRI), which covers food sold in guick service restaurants. These initiatives aim to moderate children's exposure to advertisements for non-core foods. Industry's self-regulatory initiatives are not intended to prevent children from ever viewing an advertisement for non-core foods; rather, their intent is to restrict advertisements that are directed primarily to children through the nature of the advertisement and/or the medium.

RCMI

- In January 2009, the Australia Food and Grocery Council introduced the Responsible Children's Marketing Initiative (RCMI), with immediate effect, which restricted advertising to children aged under 12 years, unless the products being advertised furthered the goal of promoting healthy dietary choices and healthy lifestyles. [Galbraith-Emami & Lobstein 2013] Individual signatory companies establish their own nutrition criteria to determine foods appropriate for marketing to children in their company action plans. Many company action plans do not establish criteria as those companies state that they do not advertise to children <12 years of age.</p>
- The RCMI has 17 signatories (January 2014):
 - Campbell Arnott's; Coca-Cola South Pacific CAP; Cereal Partners Worldwide (Australia); Ferrero Australia; Fonterra Australia New Zealand; General Mills; George Weston Foods; Kellogg Australia; Lion; Mars; Modelez; Nestle Australia Limited; Patties Foods; PepsiCo Australia; Sanitarium Health and Wellbeing Company; Simplot Australia Pty Ltd; Unilever Australasia

RCMI – covers a range of media including TV, radio, print, cinema.

QSRI

- In the QSRI, the core principles state that any marketing targeted to children, defined as under 14 years of age, must represent healthy foods in the context of a healthy lifestyle (including physical activity and a healthy diet). A standardised set of nutrient criteria apply only to children's meals while other fast food such as fries and burgers can be advertised to children.
- Children in the previous and revised QSRI are 'persons under 14 years of age'
- QSRI covers multiple media including TV, radio, magazines, newspapers, billboards, emails, internet sites and cinemas.
- Australian fast food companies made a similar commitment to promote only food and beverages that represent healthier choices to children under age 14 years (the Quick Service Restaurant Industry initiative). [Galbraith-Emami & Lobstein 2013] Applies a single standard to designated children's meals but does not take account of other food items available to all ages.
- The QSRI has seven (7) signatories:
 - Chicken Treat; Hungry Jack's (action plan not available online); KFC; McDonalds Australia; Oporto; Pizza Hut (action plan not available online); Red Rooster.

Aspects of the RCMI and QSRI codes

- Signatories to the RCMI and QSRI publicly commit to undertake marketing communications to children only when they will further the goal of promoting healthy dietary choices and lifestyles. These initiatives capture advertisements on television (free-to-air and pay-TV), radio, newspapers and magazines, cinema and thirdparty internet sites. The QSRI provides additional focus on outdoor billboards and posters, emails and interactive games. Other core principles of the initiatives relate to:
 - Use of popular personalities and licensed characters
 - Product placement
 - Use of products in interactive games
 - Advertising in schools
 - Use of premium offers
 - On-pack nutrition labelling (QSR only)*
 - Availability of nutrition information (QSR only).
 - For food manufacturers, nutrition information labelling on pack is a regulatory requirement.
 - In relation to television, specific time periods are not covered in these initiatives as they would capture programs that are watched primarily by adults. AFGC does, however, recognise that times when children are likely to be watching television unsupervised by an adult and advertisements that are designed to particularly target children are a different matter and industry must act responsibly in these areas.
- The Advertising Standards Bureau (ASB) manages the complaints process for the RCMI and QSRI. Complaints are assessed according to the RCMI and QSRI core principles on two levels:
 - Whether the products represent a healthy choice
 - Whether the advertisement is directed primarily to children.

- AFGC is pleased that the review found a 'unanimous, emphatic and enduring commitment to ratification of these Australian codes that limit marketing activity and opportunity' amongst signatories and that the RCMI and QSRI have 'effected significant changes in marketing principles and strategies within signatory businesses'.
- Signatories to the Initiative must also abide by the Australian Association of National Advertisers (AANA) Code of Ethics, the AANA Code for Advertising and Marketing Communications to Children and the AANA Food and Beverages Advertising and Marketing Communications Code (see above).
- The AFGC website (http://www.afgc.org.au/our-expertise/ industry-codes/advertising-to-children/) indicates that the initiatives aim to:
 - reduce advertising and marketing to children for food and drinks that are not healthier choices
 - use advertising and marketing to children to promote healthy eating and lifestyles to children
 - provide parents with a means to raise concerns about advertising to children.

Companies that have signed up to the initiatives commit to:

- only advertising healthier choices to children and encouraging a healthy lifestyle through good diet and physical activity
- not paying for or seeking product placement television programs, editorial content or interactive games aimed at children, unless the product is a healthier choice
- not advertising and marketing to children in Australian schools unless they are asked to by those schools.

Updates to the AFGC marketing codes

An independent assessment/review of the AFGC initiatives was conducted in 2012 (July 2012) and embargoed until November 2012 (Tymms 2012). The review comprised 26 findings and made 17 recommendations. These recommendations were considered by the AFGC and their response is indicated below.

Response to the recommendations: (updated 1 January 2014)

- Recommendations that were supported:
 - Rec 1: The purpose and objectives of the codes should be stated in clear measureable terms that are within the direct control of signatories. For example, the codes must be intended to (a) shift marketing principles towards proactive encouragement of a healthy lifestyle and balanced diet; and (b) reduce the amount and type of food and beverage advertising directed to children. A further objective linked to demonstrating a commitment to ongoing extension of the codes should be included.
 - Rec 2: The codes would benefit from being redrafted in plain English legal style.
 - Rec 6: Australian self-regulatory codes should align with international best practice. In particular, the Australian membership should extend the rules of the RCMI and QSRI to cover company-owned and brand websites and where >35% (or lower) of the audience are children.
 - Rec 11: The AFGC in collaboration with its members should gather data measuring (a) the extent of code ratification among all food and beverage manufacturers operating in Australia and (b) the extent of code coverage in terms of the percent of all food and beverage promotions and products directed to children across Australian media. Addressing these information gaps will provide the baseline data necessary for developing a code recruitment strategy and monitoring progress against objectives over time.

- Rec 14: The RCMI and QSRI should include a provision requiring staff within signatory companies to be instructed in the principles and procedures.
- Rec 15: Signatories should prepare their annual reports in a timely manner.
- Rec 17: The Annual Compliance Report should include a transparent account of costs associated with operating the code secretariat, contracting the ASB and NPRC to discharge their complaints handling functions and those costs associated with preparing the Report itself.
- Recommendations that are partially supported:
 - Rec 13: As the codes are enhanced and advertising restrictions are increased, incentives for compliance, including commercially significant sanctions, warrant consideration. There may be a role for government in setting positive incentives.
- Recommendations supported in principle:
 - Rec 4: Key terms and phrases in the code need to have precise requirements ascribed to them, either within the code documents or in underpinning explanatory guidelines. The AFGC should consider resourcing the ASB to develop a 'Determination Summary' initially.
 - Rec 8: QSRI signatories should commence tracking and reporting on improvements to the nutritional profile of products developed to meet the standard nutrition criteria established by the code.
 - Rec 12: As part of the code recruitment strategy, the AFGC should explore the implications of making code ratification a requirement of peak body membership. New levels of peak body membership may need to be developed.

- Recommendations will consider:
 - Rec 3: The RCMI and QSRI should be renamed as 'codes' rather than 'initiatives'.
 - Rec 5: Definitions in the codes need to be consistent with other legal instruments. Currently, the ACMA interpretation of the *Children's Television Standards 2009* that a 'competition' can also be a 'premium' needs to be clarified in the RCMI and QSRI.
 - Rec 7: The AFGC should commence a review of nutrition criteria with a view to adopting appropriate externally-validated category-based aligned nutrition criteria to underpin the RCMI rules within a specified timeframe. The criteria should be used as a benchmark for product reformulation and development, allowing industry to report on improvements to the nutritional profile of products marketed to children over time as part of the code reporting process.
 - Rec 10: The AFGC should seek to broaden the governance arrangements for the codes making involvement more inclusive of key stakeholders. The AFGC should establish a code administration committee comprising of representatives from key stakeholder groups including signatories, consumers and government to monitor code development, adherence to and evaluation of the codes and oversee future direction.
- Recommendations not supported:
 - Rec 9: An ongoing staged approach to harmonizing the RCMI and QSRI such that the two documents can be merged into a single Australian food and beverage industry code will further increase the credibility of voluntary agreements.
 - Rec 16: The AFGC should consider engaging an independent organisation to undertake and develop the Annual Compliance Report for the codes.

Government engagement with industry to develop self-regulation (from WCRF: NOURISHING)

Bulgaria: Article 76 of the Bulgarian Radio and TV Act (enacted in 1998 and amended several times since) requires media service providers to establish codes of conduct on food and beverage marketing to children, namely in relation to food products considered unhealthy because of their fat, trans fat, salt/ sodium and sugar content. Based on Article 76, the Framework for Responsible Communication of Food and Drinks was enacted by the National Council for Self-Regulation (NCSR) as an integral part of NCSR's National Ethical Standards for Advertising and Commercial Communication (2009). The Code and Framework apply to all forms of advertising, including TV, radio, print, internet, cinema, direct marketing, SMS, product packaging, outdoor, and in-store sales activities. The Framework mandates that nutrition information and claims about nutritional and health benefits should be based on scientific evidence. Specific criteria are set out by the Framework to restrict marketing food products and beverages to children that are not recommended to eat in excess because of their fat, trans fat, salt/ sodium, and sugar content. The NCSR is an independent, self-regulatory body of the advertising and commercial communications sector in Bulgaria which works closely with media, advertising and food companies. Adherence to the Code and Framework is voluntary, but once an organisation becomes a member, decisions by the NCSR are binding. Compliance is checked by the NCSR, and complaints are handled free of charge. The Bulgarian government is not participating in the NCSR, however, the NCSR meets yearly with government representatives to present and discuss their activities.

- Denmark: The Code of Responsible Food Marketing Communication was issued by the Forum of Responsible Food Marketing Communication, a co-operation between Danish industry organisations of the food and beverage, retail and media sectors. The Code is a voluntary, self-regulatory initiative, effective since January 2008. It applies to food and beverage marketing to children aged 13 and under via media outlets (TV, radio, internet, SMS, newspapers and comic books). The Code sets guideline limits for salt, sugar and fat content in ten food categories. It is recommended that food products exceeding these limits should not be marketed to children. Food manufacturers themselves determine if their products are suitable for marketing to children. Compliance is checked by the secretariat of the Forum. The Danish government follows the results of the Code, and annual status meetings are held between the Danish Veterinary and Food Administration and the Forum.
- Spain: A voluntary code developed between government and industry sets general guidelines and restricts product placement and use of celebrities in food advertising for signatories.

Regulatory food marketing frameworks

- WHO (2010): World Health Organisation recommendations: WHO set of recommendations on the marketing of foods and non-alcoholic beverages to children. In 2011 promotion of the WHO set of recommendations was one of the actions cited in the political declaration adopted at the 66th session of United Nations General Assembly. In 2012 a framework for implementing the set of recommendations on the marketing of foods and non-alcoholic beverages to children recommended that governments and industry develop or strengthen policies on food marketing to children to reduce the impact of foods high in saturated fats, free sugars and salt
- MacKay et al (2011; AUS): The Obesity Policy Coalition has launched a blueprint for regulating junk food advertising to children. The blueprint sets out a plan for federal, state and territory governments to enact legislation to restrict all forms of advertising and promotion of unhealthy food and beverages to children. It specifies how legislation should operate, the types of advertising and promotion that should be restricted, and proposes definitions for key terms and phrases such as 'unhealthy food' and 'directed to children'. The blueprint has been backed by all leading Australian public health

agencies, including the Australian Chronic Disease Prevention Alliance, the Australian Medical Association, and the Coalition on Food Advertising to Children.

- Chile: In 2012, the Chilean government approved a Law of Food Labelling and Advertising. The government convened an expert committee on children's marketing and requested them to develop regulatory norms to implement the Law with the aim of reducing children's exposure to unhealthy food advertising. The norms have been developed as part of the same process of developing norms on 'warning labels' but have not been implemented. [NOURISHING — Framework Legislation]
- Peru: In 2013, the 'Promoting Healthy Food for Children Act' was passed into law. The law includes a range of provisions designed to discourage unhealthy diets, including food advertising. The Act states that advertising directed to children and adolescents under 16 years old and disseminated through any format or media, should not stimulate the consumption of food and non-alcoholic drinks containing trans fat or high contents of sugar, sodium and saturated fats. The Act requires implementing regulations in order to be applied. [NOURISHING Framework Legislation]

Acceptability of regulation of food marketing/advertising to children in Australia

- Campbell James et al (2014; AUS; *Intercept surveys*): Parents in supermarkets (large regional centre), plus focus groups and telephone interviews. Of the 158 intercept survey participants (30% response rate), 73% reported a food request during the supermarket visit. Most requested food items (88%) were unhealthy foods, with chocolate/ confectionery being the most common food category requested (40%). Most parents (70%) purchased at least one food item requested during the shopping trip. Parents reported difficulties dealing with constant requests and expressed the desire for environmental changes, including confectionery-free checkouts, minimisation of child friendly product placement and reducing children's exposure to food marketing.
- Pollard et al (2013; AUS; *Two adult population surveys in WA*): The majority of adults believe it is important that government regulates food policy options under consideration: nutrition information on food labels (97% versus 2% who think it is not important); health rating on food labels (95% versus 3%); food advertising (83% versus 11%); and the supply of environmentally friendly food (86% versus 9%).

Context/setting: TV

Supporting evidence

TV viewing time and attitudes to food

- A review of two studies and an additional two cross-sectional surveys, one Australian and one American, found that the amount of TV viewing time was independently associated with more positive attitudes towards EDNP and fast food.
- Russell & Buhrau (2015; US; cross-sectional surveys): Among teenage children of members of online panels, heavy TV viewers had less negative and more positive beliefs about the consequences of fast food consumption than light viewers. As direct experience with fast food increases, the relationship between TV viewing and risk perceptions weakens, but the relationship between TV viewing and positive perceptions strengthens. These findings remained after controlling for physical activity and density of fast food restaurants.
- Boyland & Halford (2013; *Review*): Amount of time spent watching TV was found to be predictive of unhealthy conceptions about food and poor eating habits generally (two studies cited).
- Dixon Scully et al (2007; AUS; cross-sectional survey): A cross-sectional survey among 919 children in grades 5 and 6 examined associations between children's regular TV viewing habits and their food-related attitudes and behaviour. The survey showed that heavier TV use (and more frequent commercial TV viewing) was independently associated with more positive attitudes toward junk food.

TV viewing time and diet/health

The majority of studies, including one systematic review (up to 2009; conclusion: evidence was 'moderate'), and several recent, large, repeat crosssectional studies, indicate that overall TV viewing time is independently associated with poorer diet quality and diet-related health.

- Olafsdottir Eiben et al (2014; Sweden; repeat cross-sectional survey). Parental questionnaire for 2–9 year old children's (n=1,733) lifestyle and diet. Cross-sectional analysis showed that the likelihood of consuming SSBs at least 1–3 times per week increased for each hour/day watching TV (OR 1.5, 95% CI 1.2–1.9), and for being exposed to commercials (OR 1.6, 95% CI 1.3–2.1). TV viewing time and commercial exposure contributed to the associations independently of each other.
- Falbe et al (2014; US; *longitudinal study*): Among a cohort of 91 six-year-olds, in 2004 (to 2006 and 2008), each hour-per-day increase in TV, electronic games, and DVD/ videos was associated with increased intake of total foods of low nutritional quality (FLNQ) and decreased intakes of F&V. Across sex and food groups and in sensitivity analyses, TV time was most consistently associated with dietary changes.
- Boyland & Halford (2013; Review): "Numerous studies have demonstrated that energy intake increases during TV viewing and TV viewing is associated with increases in EDNP (HFSS) foods associated with poor overall diet quality and/or lower F&V intake."
- Reisch, Gwodz et al (2013; Europe; experimental studies and survey data): Based on prior consumer research, five hypotheses were tested on a subsample from the IDEFICS study, a large-scale pan-European intervention study on childhood obesity. There was no direct evidence of an influence of TV consumption on diet; although children with TVs in their bedrooms show a higher proportion of sugar intake in their diets (one TV increased the share of sugar by 3.35%).
- Ghimire & Rao (2013; India; *cross-sectional study*): Among 600 children, higher caries prevalence was found among children who watched TV and asked for more food and soft drinks. Cariogenic food advertisements were popular on children's favourite channels.

- Cairns et al (2013; SR to 2009; *cross-sectional studies*): Cross-sectional data indicate relationships between TV viewing and diet-related health status. Four studies reported positive correlations:
 - food promotion and snacking frequency
 - food promotion and lower nutritional diet quality
 - two studies of TV viewing and obesity
 - one study of food promotion and blood cholesterol level.

None of the studies reported the size of the effect, but considered that there was modest evidence of a relationship between TV viewing and diet-related health status.

• Dixon Scully et al (2007; AUS; *cross-sectional survey*): A cross-sectional survey among 919 children in grades 5 and 6 examined associations between children's regular TV viewing habits and their food-related attitudes and behaviour. Heavier TV use was independently associated with higher reported junk food consumption.

TV viewing time and child weight

- Amount of TV viewing time has been positively associated with weight status and weight gain among children in a number of large, longitudinal studies.
- Lee Kim et al (2014; South Korea; cross-sectional):
 2419 children aged 11–13. Amount of TV watched and exposure to EDNP food advertising were associated with an increased risk of overweight and obesity. Although it was not possible to conclude that exposure to TV advertising for EDNP food was associated with an increased risk of obesity, preference for EDNP foods, or overall food intake due to the strong comprehensive effects of TV viewing time, there was a reason to believe the evidence of the effects of advertising in this study.

- Boyland & Halford (2013; *Review*): TV viewing in childhood can independently predict increased adult BMI, suggesting a causal link (citing Viner & Cole 2005). Crucially, the balance of literature suggests that the association between TV viewing and obesity remains significant even when potential confounders such as SES, familial tendency to overweight and levels of physical activity are taken into account. Therefore it was concluded that not only is watching TV a sedentary activity, but it is linked to increased energy intake.
- Beales & Kulick (2013; US; *longitudinal analysis*): Data showed a positive relationship between TV viewing and childhood obesity among children aged older than six years, but not among younger children. Adding controls for the household environment created by the children's parents reduced the size of this effect. However, the study found no significant difference in the effects of viewing commercial versus non-commercial TV. It was therefore deduced that the effect of TV viewing on obesity was not due to advertisements for EDNP foods/beverages. In addition, no significant differences were found between watching programmes for the same intended audience on TV or on video.
- Falbe Rosner et al (2013; US; *longitudinal cross-sectional*): Reported screen-time in relation to concurrent change in BMI across four years among 4287 girls and 3505 boys aged 9–16 years in 2004, 2006 and 2008 indicated that TV time was most consistently associated with BMI gains. Among girls, electronic games and DVDs/videos were also related to increased BMI, possibly due to influences of product placements and advergames on diet and/ or distracted eating. Adolescents, especially overweight adolescents, may benefit from reduced time with multiple types of media.

ACTION:

Regulation of advertising of unhealthy food/beverages during children's TV broadcasting (commercials)

Descriptive evidence

Exposure to EDNP food/beverage commercials on TV

- Children are exposed to significant amounts of advertising for non-core foods and drinks via TV.
- King, Hebden, Grunseit et al (2013; AUS; *commentary*): Over the course of a year, the average child will see 40 hours of food advertising on TV alone. Twenty-two of these hours or 3.5 school days will be filled with advertisements for unhealthy foods.
- Roberts et al (2013; AUS; content analysis): Data were acquired from a national media monitoring company for advertisements broadcast in five major Australian cities from 1 September 2010 to 31 October 2010. Content analysis was undertaken on these advertisements and the advertised foods were assessed against the Australian Guide to Healthy Eating. The data also included advertising expenditures. Results indicated that most advertisements for fruits and vegetables (6%). Advertisements for non-core foods were significantly more frequent during prime time viewing periods (71% vs 60%; P<0.01). High levels of advertising for fast food (28%) and non-core beverages (24%) were recorded.
- Kelly, Chapman, King, Hebden (2011; AUS; content analysis): An examination of television broadcasting for two weekdays and two weekend days between 06.00 and 22.00 in February 2008 compared to data from 2006 and 2007, showed that the overall rate of food advertising decreased over time, from seven food

advertisements/hour/channel in 2006/7 to five in 2008. However the relative contribution of non-core food advertising to overall food advertising remained stable. In 2008, the proportion of food advertisements for noncore foods was significantly higher during children's peak viewing times.

- Kelly Halford et al (2010; various countries including AUS; *content analysis*): Nature and thematic content analysis of TV food advertising to children was compared across several countries (Australia, Brazil, Canada, China, Germany, Greece, Italy, Spain, Sweden, the UK, the US). Each of 13 research groups recorded programming for two weekdays and two weekend days between 06.00 and 22.00, for the three channels most watched by children, between October 2007 and March 2008. Food advertisements composed 11% to 29% of advertisements. Non-core foods were featured in 53% to 87% of food advertisements, and the rate of noncore food advertising was higher during children's peak viewing times.
- Kelly, Hattersley et al (2008; AUS; *content analysis*): The most common foods advertised in children's peak viewing hours are unhealthy foods such as fast food, non-core beverages and confectionery.
- Adams, Tyrrell, & White (2011; UK; content analysis): In approximately a third of food advertisements, an 'incidental food' appeared alongside the item that was the focal point of the advertisement (the 'primary food'). The most common food group represented among primary foods was foods and drinks high in fat and/or sugar (41%, e.g. chocolate, cakes, full-sugar carbonated soft drinks). Among incidental foods the most frequently represented food group was F&V', and these foods were significantly less likely to be high in fat and/or sugar. So where a wider food context was present in the advertisement, this context tended to be healthier than the branded foods that were the focus of the advertisement. The authors concluded that this may be perceived as reinforcing the idea of a balanced diet, or may add an unjustified aura of 'healthiness' to the advertised food.

Supporting evidence: Observational studies

Commercial TV viewing time and attitudes to food

- An Australian cross-sectional survey found frequent commercial TV viewing was independently associated with more positive attitudes towards EDNP food.
- Boyland & Halford (2013; *Review*): Amount of time spent watching TV found to be predictive of unhealthy conceptions about food and poor eating habits generally (two studies cited).
- Dixon Scully et al (2007; AUS; *cross-sectional survey*): A cross-sectional survey among 919 children in grades 5 and 6 examined associations between children's regular TV viewing habits and their food-related attitudes and behaviour. The survey showed that heavier TV use and more frequent commercial TV viewing were independently associated with more positive attitudes toward junk food.

TV advertising and food purchasing requests by children

- Brands and marketing via TV are associated with purchase requests ('nagging') of their parents by, particularly younger, children.
- Henry & Borzekowski (2011; US; *mixed-methods*): In a mixed-methodology study of young children's requests for advertised products, 64 mothers of children aged 3–5 years all indicated that their child engaged in some form of nagging. While overall media use was not associated with nagging, a child's familiarity with commercial TV characters was significantly associated with overall and specific types of nagging. Mothers described *packaging, characters, and commercials* as the three main forces compelling their children to nag.

- Kelly et al (2009; AUS; *parental survey NSW*): Parents of younger children were more likely to report that their child asked for advertised food products, compared with parents of adolescents (65% and 48% respectively).
- O'Dougherty et al (2006; US; *field observations*): A convenience sample of 142 adult-child shoppers across 11 supermarkets. In 67 (50.4%) of the total 133 observations, a child initiated a request. Half (55.2%) of the requests were for sweets or snacks. Nearly half (47.8%) of adults yielded to the child's request. Brands and marketing techniques appeared to be a factor in 28.6% of selections. The most frequent adult refusals either provided an explanation or ignored the request. Adults yield to children's requests for sweets and snacks nearly as often as they refuse them. However, many adults used effective refusal strategies.

TV advertising and food purchases

- A one-year study in the US showed, using sales data, that TV- and on-packet-advertised, childtargeted RTE cereals were purchased 13 times more frequently than non-advertised products.
 - Castetbon Harris et al (2012; US; sales data/crosssectional study of purchases in one year): Compared with non-advertised products, advertised (TV exposure and analysis of packaging) child-targeted RTE cereals were purchased thirteen times more frequently; familytargeted brand purchases were ten times higher; and adult-targeted cereals were purchased four times more frequently. All child-targeted RTE cereals with TV advertising (n=17) had an NPI (nutrient profile index) score in the very poor to poor range — having the highest energy and sugar contents.

Commercial TV exposure and diet

- The majority of cross-sectional studies and one national cohort study, plus a very recent Australian survey, show that the amount of exposure to commercial TV is positively associated with poor dietary behaviours among children and adolescents.
- Kelly et al (2015; AUS; cross-sectional survey): Four hundred and seventeen Australian children aged 10–16 years participated in an online survey, which assessed television viewing habits and consumption of 12 frequently advertised unhealthy food/drinks. After adjusting for age and SES, there was strong evidence of an increase in unhealthy food score, drink score and food/drink combined score, with increasing commercial TV viewing. The link between television viewing and poor diet was strongest for children who watched the most commercial television, and those who were actually exposed to advertisements embedded within programs.
- Lee, Kim et al (2014; South Korea; cross-sectional): Among 2419 children aged 11–13 years, exposure to TV advertising for EDNP food was significantly associated with higher EDNP preference and intake and lower F&V intake, but these associations disappeared when overall TV viewing time was adjusted for.
- Olafsdottir Eiben et al (2014; Sweden; repeat cross-sectional survey). Parental questionnaire for 2–9 year-old children's (n=1,733) lifestyle and diet. Associations between screen habits and consumption of SSBs were found to be independent of parental norms regarding SSBs. A longitudinal analysis revealed that SSB consumption at two-year follow-up was predicted by exposure to commercial TV at baseline (OR 1.4, 95% CI 1.1–1.9). Cross-sectional analysis showed that the likelihood of consuming SSBs at least 1–3 times per week increased for each hour/day of exposure to commercials (OR 1.6, 95% CI 1.3–2.1). TV viewing time and commercial exposure contributed to the associations independently of each other.
- Lee Kim et al (2014; South Korea; cross sectional): Study of 2419 children aged 11 –13. Exposure to TV advertising for EDNP food was also significantly associated with higher EDNP preference and intake and lower F&V intake but these associations disappeared when overall TV viewing time was adjusted for.

- Scully Wakefield et al (2012; AUS; cross-sectional data national): Cross-sectional data from a national survey of 12,188 Australian secondary school students aged 12–17 years were examined. Measures included students' level of exposure to commercial TV and non-broadcast types of food marketing, whether they had tried a new product or requested a product they had seen advertised, and their reported consumption of fast food, sugary drinks and sweet and salty snacks. Results indicated that greater exposure to commercial TV, print/transport/ school food marketing and digital food marketing were all independently associated with students' food choices. High commercial TV viewers⁹¹ (>2h/day) were more likely to report higher consumption of EDNP foods (ORs ranged from 1.31 for fast food to 1.91 for sweet snacks). Some associations between digital food marketing exposure and students' eating behaviours were found; however, print/transport/school food marketing was only related to sweet snack consumption. These study results suggest that cumulative exposure to TV food advertising and other food marketing sources are positively linked to adolescents' food choices and eating behaviours.
- Chandon & Wansink (2012; *narrative review*): Due to the complexities in advertising there is no consensus in the literature about whether TV advertising only affects brand preferences or overall energy intake.
- Andreyeva Kelly et al (2011; US; national cohort study): Data from national cohort study of kindergarten children in the US and TV advertising of RTEC, FFOs, and SSBs to children. The results suggested that soft drink and fast food TV advertising is associated with increased consumption of soft drinks and fast food among elementary school children (grade 5). Exposure to 100 incremental TV advertisements for sugar-sweetened carbonated soft drinks during 2002–2004 was associated with a 9.4% rise in children's consumption of soft drinks in 2004. The same increase in exposure to fast food advertising was associated with a 1.1% rise in children's consumption of fast food.

91 Note: commercial (or overall) TV viewing time is often used as a proxy for exposure to TV advertising and one study has reported that this is a valid proxy measure (cited in Cairns et al 2013).

TV advertising exposure and weight

The vast majority of evidence from a substantial number of cross-sectional and empirical studies indicates a positive association between commercial TV advertising exposure, particularly for EDNP foods and fast foods, and overweight/obesity.

No association

• Fleming-Milici Harris et al (2013; US; *cross-sectional*) indicated that both Hispanic and non-Hispanic children and adolescents view large numbers of TV advertisements for nutrient-poor categories of F&Vs; however Hispanic children and adolescents (but not pre-schoolers) see somewhat fewer of these advertisements (14% vs. 24%) yet have higher rates of obesity.

Positive association

- Lee Kim et al (2014; South Korea; cross-sectional): 2419 children aged 11–13. Amount of TV watched and exposure to EDNP food advertising were associated with an increased risk of overweight and obesity. Although it was not possible to conclude that exposure to TV advertising for EDNP food was associated with an increased risk of obesity, preference for EDNP foods, or overall food intake due to the strong comprehensive effects of TV viewing time, there was a reason to believe the evidence of the effects of advertising in this study.
- McClure Tanski et al (2013; US; cued recall assessment; cross-sectional): A sample of 2541 youth aged 15–23 years viewed a random subset of 20 advertisement frames (with brand names removed) selected from national TV FF restaurant advertisements aired the previous year. Respondents were asked if they had seen the advertisement, if they liked it, and if they could name the brand. Only household income, TV time, and TV fast-food advertising receptivity retained multivariate associations with obesity. For every 1-point increase in TV fast-food advertising receptivity score, the odds of obesity increased by 19%. There was no association between receptivity to televised alcohol advertisements or fast-food restaurant visit frequency and obesity. This cued recall assessment

indicated that TV fast-food advertising receptivity is associated with youth obesity.

- Osei-Assibey Dick et al (2012; <u>Review</u>): In this review of studies on the influence of the food environment on overweight and obesity in children aged up to eight years, the authors considered that there was 'moderately strong' evidence to support interventions on food promotion, large portion sizes, and SSBs.
- Andreyeva Kelly & Harris (2011; US; cohort study): This study collected data from a national cohort study of kindergarten children in the US and TV advertising of RTEC, FFOs, and SSBs to children. The results suggested that soft drink and fast food TV advertising is associated with increased consumption of soft drinks and fast food among elementary school children (grade 5). Exposure to 100 incremental TV advertisements for sugar-sweetened carbonated soft drinks during 2002-2004 was associated with a 9.4% rise in children's consumption of soft drinks in 2004. The same increase in exposure to fast food advertising was associated with a 1.1% rise in children's consumption of fast food. There was no detectable link between advertising exposure and average body weight. but fast food advertising was significantly associated with body mass index for overweight and obese children.
- Zimmerman & Bell (2010; US; *longitudinal data*): Significant association between commercial TV viewing in 1997 and BMI z-score for 0–6 year olds. The study results remained robust even after exercise and eating while viewing were taken into account, indicating that advertisements had a causal association with BMI.
- Chou et al (2008; US; *empirical study*): Data from the 1979 Child–Young Adult National Longitudinal Survey of Youth (matched mother-child data for children ages 3–11) and the 1997 National Longitudinal Survey of Youth (12–18 year olds) were used to estimate the effects of television fast food restaurant advertising on children

and adolescents with respect to being overweight (BMI). Collar expenditures for fast food advertising in the US from 1996 to 1999 were compared across designated areas. The exposure variable equalled the annual number of seconds of fast-food restaurant messages aired on television. For boys aged 3–11, increasing exposure to fast food advertising by half an hour per week is associated with an increase in the probability of being overweight by 2.2 percentage points. This translates to a 15% increase in the number of overweight boys in a fixed population. The corresponding figures for girls aged 3–11 are a 1.6 percentage point, or 12%, increase in the number of overweight girls in a fixed population. For adolescent boys and girls aged 12-18, an increase of 2.5 percentage points (17%) for boys and an increase of 0.6 percentage points (4%) for girls is modelled.

Lobstein & Dibb (2005; cross-country ecological study): A significant, positive correlation was found between levels of childhood overweight in nine countries (seven EU, US, AUS) and number of TV advertisements for sweet or fatty foods broadcast in a 20h period. A significant association was found between the proportion of overweight children and the numbers of advertisements per hour on children's TV, especially those advertisements that encourage the consumption of energy-dense, micronutrient-poor foods. A weaker, negative association was found between the proportion of overweight children advertisements encouraging healthier diets.

Supporting evidence: experimental studies

TV EDNP food advertisements and food preferences

- Two experimental studies produced contrasting findings regarding the impact of advertisements for EDNP foods on food preferences — an experimental study involving fast food showed a positive association, whereas a similar study involving various unhealthy foods found no association.
- Boyland et al (2015; UK; experimental): Study of fiftynine children aged 7–10 years. The within-participant, counterbalanced design had two conditions: control (exposure to ten toy advertisements across two breaks of five advertisements each) and experimental (the middle advertisement in each break was replaced with one for a McDonald's Happy Meal®, depicting the meal bundle as consisting of fish fingers, a fruit bag and a bottle of mineral water). Following viewing of the advertisements embedded in a cartoon, children completed a hypothetical menu task that reported liking for McDonald's food and fast food in general. Children's liking for fast food in general, increased after exposure to the food advertisements relative to control.
- Dixon Scully et al (2007; AUS; experimental): An experiment assessing the impact of varying combinations of TV advertisements for unhealthy and healthy foods on children's dietary knowledge, attitudes and intentions involved 919 children in grades five and six from schools in Melbourne, Australia. Videos of *The Simpsons* were shown with food advertisements interspersed; and pre- and post-questionnaires were used to assess outcomes. There was no support for the hypothesis that children exposed to junk food advertisements show enhanced attitudes and intentions favouring unhealthy foods compared to children not exposed to junk food advertisements. However, advertisements for nutritious foods promote selected positive attitudes and beliefs concerning these foods.

TV EDNP food advertisements and immediate food consumption

- There is mixed evidence from a number of laboratory studies, involving mainly choice experiments, to support a positive association between exposure to unhealthy foods and beverages advertising to children and consumption of those products immediately after exposure.
- Boyland et al (2015; UK; experimental): Fifty-nine children aged 7–10 years. The within-participant, counterbalanced design had two conditions: control (exposure to ten toy advertisements across two breaks of five advertisements each) and experimental (the middle advertisement in each break replaced with one for a McDonald's Happy Meal® depicting the meal bundle as consisting of fish fingers, a fruit bag and a bottle of mineral water).
 Following viewing of the advertisements embedded in a cartoon, children completed a hypothetical menu task that reported liking for McDonald's food and fast food in general. There was no significant difference between the two advertisement conditions for the nutritional content of the meal bundles selected.
- Gregori Ballali et al (2014; *SR*): Evidence from RCTs aimed at assessing the effect of TV advertising on food intake among 4–12 year-olds. The review identified 7/2166 studies that met the inclusion criteria and considered that "the association between TV advertising and energy intake is based on a very limited set of randomised researches lacking a solid ground of first-level evidence".
- Scully et al (2014; narrative review): "The extent to which increased exposure to unhealthy foods and beverages in children-specific programming leads to increased consumption is not clear". In response to advertisements, children increase their consumption of high-fat and/or sweet energy-dense snacks (Halford et al 2004; Halford et al 2008; Vereecken & Maes 2006; Halford et al 2007). In the UK, exposure to food advertising results in increased food intake in children, particularly obese children (Halford et al 2004; 2008; 2007). Thus, overweight and obese children may be more responsive to food

promotion, particularly for energy-dense snacks (Halford et al 2008).

- Harris Bargh et al (2009; US; *experimental*): In two small experiments (1a and 1b), elementary-school-age children watched a cartoon that contained either food advertising or advertising for other products and received a snack ('goldfish' savoury crackers) while watching. Children consumed 45% more when exposed to TV food advertising compared to the non-food advertising conditions. In both experiments (the other was among adults), food advertising increased consumption of products not in the presented advertisements, and these effects were not related to reported hunger or other conscious influences.
- Halford et al (2007; UK; *experimental*): Ninety-three children aged 5–7 years, 28 of whom were overweight or obese, were exposed to 10 non-food and 10 food advertisements in a repeated-measures design. Exposure to food advertisements produced a significant increase in total food intake.
- Halford Gillespie et al (2004; US; *experimental*): This study examined lean, overweight and obese children's ability to recognise eight food and eight non-food related advertisements in a repeated measures design. The ability to recognise the food advertisements significantly correlated with the amount of food eaten after exposure to them. The consumption of all the food offered increased post-food advertisement, with the exception of the low-fat savoury snack.
- Borzekowski & Robinson (2001; US; *experimental*): This [much-cited] randomised-controlled (laboratory) experiment exposed 46 preschoolers to a videotape with embedded commercials. Children who saw a videotape with embedded food commercials were significantly more likely to select the advertised product than children who had not seen the commercials.
- Gorn & Goldberg (1982; US; *field experiment*): Two weeks of daily exposure to televised food and beverage messages at a summer camp altered 5- to 8-year-old
children's afternoon snack choices. Children who viewed candy commercials picked significantly more candy over fruit as snacks. Eliminating the candy commercials proved as effective in encouraging the selection of fruit as did exposing the children to fruit commercials or nutritional public service announcements.

- Fox et al (1980; cited by Gorn & Goldberg 1982; *experimental*): This study tested 4- and 5-year-olds who watched a 12-minute television program with three 30-second commercials (inserted twice) for (1) low nutrition foods, (2) high nutrition foods, or (3) toys (control). One week prior to and immediately after the treatment, subjects were asked to taste food from a tray of 12 foods, eat as much of the foods as they wished, and state their preferences for the foods. No significant between-group differences were found with regard to the amount of food consumed, although a pre-post difference was noted within the low nutrition group, where subjects increased their consumption of sugared food.
- Galst (1979; cited by Gorn & Goldberg 1982; experimental): The nature of exposure to televised messages for foods (highly sugared or healthy), and the presence or absence of adult comments related to the wisdom of eating healthy as opposed to highly sugared foods were examined among sixty-five 3-6 year-olds. For four weeks, children in each of the four treatment conditions viewed two brief cartoons with 4.5 minutes of commercials daily. Each day, following the television exposure, the children made snack selections from a table displaying a large variety of sugared and non-sugared foods. The results of this food selection test revealed an interaction but no main effects (possibly due to lack of control for external variables). Subjects who saw commercials for non-sugared foods and public service announcements (PSAs) followed by adult comments chose significantly fewer sugared snacks.

Supporting evidence: modelling studies

TV advertising and obesity

- Modelling studies indicate that elimination of TV advertising of non-core foods/beverages might decrease obesity levels by up to 14–18%.
- Goris Petersen et al (2010⁹²; simulation modelling); various countries including AUS) estimated the contribution of TV food advertising to the prevalence of obesity among 6–11-year-old children in Australia, Great Britain (England and Scotland only), Italy, The Netherlands, Sweden and the United States. The study used data on the prevalence of childhood obesity and TV food advertising. Simulation modelling showed that TV advertising's contribution to the prevalence of childhood obesity is estimated at 16–40% in the United States, 10–28 % in Australia and Italy and 4–18 % in Great Britain, Sweden and The Netherlands.
- Veerman et al (2009; cited in Scully et al (2014); simulation modelling): One in seven obese children may not be obese in the absence of food advertising. However, differences between the effects of placements in advertisements and in TV programs are likely; further research is required.

SUB-ACTION:

Mandatory/statutory regulation of advertising of unhealthy food/beverages (TV commercials) during children's TV broadcasting

Implementation examples

Countries including Norway, Sweden and the province of Quebec, Canada, have statutory regulations restricting the advertising of any product, not only food and beverage products, which have been in place for decades (Galbraith-Emami & Lobstein 2013; *Review*).

⁹²The estimates for the impact of advertising that were used in this modelling paper are not very robust (a Delphi Survey and one study from 1982) (Kelly B, pers. Comm.)

- Norway: The government already restricts all broadcast advertising to children through legislation in Norway. A voluntary initiative agreed in 2013 calls on industry to follow standards (set largely by government) on a further range of communications channels. It applies to marketing to children under the age of 13. [NOURISHING].
- France: All TV advertising (targeted at children or adults) for processed food and drinks, or food and drinks containing added fats, sweeteners and/or salt, must be accompanied by a message on the principles of dietary education as approved by the National Institute of Health Education. The messages were defined by a 2007 decree:
 - For your health, eat at least five fruits and vegetables a day
 - For your health, exercise regularly
 - For your health, avoid eating too many foods that are high in fat, sugar or salt
 - For your health, avoid snacking between meals.
- Ireland: Advertising and other forms of commercial communication of unhealthy foods, as defined by a nutrient profiling model, are prohibited during children's TV and radio programs where over 50% of the audience is under 18 years old (Children's Commercial Communications Code 2009, last revised in 2013). Content rules also apply to commercial communications for unhealthy foods broadcast outside of children's programs but which are directed at children. [NOURISHING].
- South Korea: TV advertising to children up to 17 years of age is prohibited for specific categories of food before, during and after programs shown between 5–7 pm and during other children's programs (Article 10 of the Special Act on the Safety Management of Children's Dietary Life 2008, amended several times since). The restriction also applies to communication that is assumed to target children (e.g. where free toys are included). [NOURISHING] South Korea introduced regulations to restrict the advertising of EDNP foods to children in January 2010 (Galbraith-Emami & Lobstein 2013).

- UK: Advertising of unhealthy foods, as defined by a nutrient profiling model, is prohibited during TV and radio programs that have 20% more viewers under 16 years old relative to the general viewing population (includes sponsorship of TV programs). The restrictions came into force in February 2007, with a phased implementation by advertisers by end of 2008. [NOURISHING] Note: In Galbraith-Emami & Lobstein 2013 "The UK introduced regulation to restrict advertising of specified foods and beverages, which applied to programming of appeal to children on terrestrial TV from January 2008, and cable and satellite channels from January 2009."
- UK (Ofcom 2007): statutory legislation restricting the advertising of HFSS foods in and around programming specifically made for or of particular appeal to children under 16 years of age was introduced in phases from 2007 with the aim of limiting the exposure of children to HFSS advertising as a means of reducing opportunities to persuade children to demand and consume HFSS products.
- Australia: (information from the Cancer Council Position Statement, 2014; and Sacks et al 2015)
 - In 1999, the AANA introduced Principles and Advisory Notes for Advertising to Children, which was intended to complement the existing Children's Television Standards (CTS) and other codes and standards in operation at the time. While the AANA Code of Ethics remained the definitive guide for advertisers, the Principles and Advisory Notes for Advertising to Children were regarded as providing an essential supplementary focus on advertisers' responsibilities in this important area.
 - In 2007, the Principles were replaced with a Code for Advertising to Children as part of advertising self-regulation.
 - Since the 2008 Review of the Children's Code, the AANA has reviewed and updated its Code of Ethics (effective 1 January 2012) and both Free TV Australia and the Australian Communications and Media Authority (ACMA) have issued updated documents relating to programming and advertising to children. Many of the changes related to sexual exploitation of children.

- Adjustments to the Code: A requirement that advertising or marketing communications to children:
 - must not mislead or deceive and must fairly and accurately represent the product in a manner that is clearly understood by children
 - that commercial communication to children should be distinguishable to them as such and not be confused with program or editorial content
 - advertising should not undermine parental authority through 'pester power'; and
 - a prohibition on the use of popular personalities or celebrities (live or animated) to advertise or market products or premiums in a manner that obscures the distinction between commercial promotions and program or editorial content.
- Other amendments to the Children's Code are for consistency with other regulations that provide a range of protections relating to advertising and marketing to children. 'Directed primarily to children' - new Practice Note 'Directed primarily to children' is based on the factors which create a level of engagement with children such that additional protections are required. AANA has incorporated those factors into a Practice Note to accompany the Children's Code. The new Practice Note brings together the community standards viewpoint of the Advertising Standards Board and child psychologist's evidence of children's reactions and engagement with different marketing techniques. The Practice Note will assist advertisers and the ASB in understanding the creative techniques that will bring an advertisement within the Code. The Practice Note also recognises that many creative techniques, such as animation, are used to direct an advertisement to adults, and these advertisements are not necessarily subject to the Children's Code.

- Food and Beverages Advertising and Marketing Communications Code — adopted by the AANA as part of advertising and marketing self-regulation, The object of this Code is to ensure that advertisers and marketers develop and maintain a high sense of social responsibility in advertising and marketing food and beverage products in Australia.
- Current statutory regulations in Australia apply only to television advertising. The Children's Television Standards (CTS), under the remit of the Australia Communications and Media Authority, contain general restrictions on the amount and content of advertising during children's television programs and periods ('P' for pre-school; and 'C' for children). The CTS prohibit advertising during 'P periods' and restrict the amount of advertising that may be broadcast per hour during 'C periods' to five minutes. However, the CTS do not contain any general restriction of advertising of unhealthy food to children. They contain only one specific provision on food advertising (CTS 32(7)), which prohibits advertisements that contain any misleading or incorrect information about the nutritional value of foods or beverages. The restrictions in the CTS apply only to commercial free-to-air television; C and P programs are broadcast mostly between 4–5 pm when in reality the majority of children watch television outside of these times - e.g. data show that the audience numbers of children aged 0–14 years on commercial FTA television peak between 7–8 pm, with large numbers of children still watching until 9 pm.
- The Commercial Television Industry Code of Practice, administered by Free TV Australia, also applies to FTA television, however only one clause specifically relates to food advertising, and relates narrowly to prohibiting misleading advertising and advertising that expressly discourages an active lifestyle of healthy eating habits. This code does not limit the types of foods that can be advertised to children or the marketing techniques used.

Acceptability of government regulation of tv marketing of unhealthy food/beverages to children in Australia

- Chung et al (2012; AUS; Interviews with representatives from state and territory government departments, statutory authorities, and non-government organisations in Australia (n=22)): Regulation of TV marketing of unhealthy food to children was supported as a strategy for obesity prevention. Barriers to implementing regulation at the state level were: the perception that regulation of TV advertising is a Commonwealth, not state/territory, responsibility; the power of the food industry and; the need for clear evidence that demonstrates the effectiveness of regulation. Evidence of community support for regulation was also cited as an important factor in determining feasibility. However, given that regulation is technically feasible at the state level, in the absence of Commonwealth action, states/territories could act independently.
- Morley et al (2012; AUS; telephone interview survey 1511 adults): 83% of adults were in favour of banning advertising of unhealthy food at times when children watch TV. Of these, the largest proportion indicated these times should be mornings between 6 am and 9 am and evenings between 4 pm and 9.30 pm (43%), followed by all day until 9.30 pm (36%), as opposed to just evenings (16%) or mornings (3%). A total ban on unhealthy food advertising on TV, at all times, was not as well supported by participants, although more than half (56%) were in favour. when asked specifically about whether government should stop, restrict or not regulate unhealthy food advertising on free-to-air and pay TV, approximately nine in ten participants supported restrictions. Support was higher among the higher SES respondents.

Evidence of intervention effectiveness

Outcome: Exposure

There are mixed findings regarding the effect of statutory regulation of TV advertising of unhealthy food/beverages to children (evidence from UK, Australia, Canada, South Korea) in reducing exposure to such advertisements; ineffectiveness is attributed to limitations in the regulatory guidelines.

UK

- Adams et al (2012; Stat Reg 2008; pre- post-study): pre-(2006) post- (2009) study in one region of UK (Tyne Tees).
 51.1% of the food advertisements (14.6% of PMV) were for high fat, sugar and/or salt (HFSS) foods. The study showed that, despite almost universal adherence to the guidelines; exposure of children to HFSS food advertising did not change pre- post- regulations (2006 to 2009; OR 1.05; 0.99–1.12) and relative exposure of all viewers to HFSS food advertising increased (OR 1.54; 1.51–1.57) pre- post-regulation. The authors attributed the lack of effectiveness to the guidelines only applying to a very small proportion of TV broadcast.
- Boyland Harrold et al (2011; *post-only 2008*): Of 18,888 food and beverage advertisements, 56% were for noncore foods and 18% were for core foods. The proportions of core and non-core food advertisements did not differ significantly between children's peak viewing times and non-peak viewing times. Most food advertisements were around soap opera programs followed by general entertainment.
- Ofcom (2010; Stat Reg; pre- post-; non-peer reviewed report⁹³; cited by Tymms 2012): 100% decline in HFSS advertisements affects children during children's TV, 2005–2009. There was a 37% decline in HFSS advertisements during children's air time, and a 1% reduction in children's exposure during adult airtime from 2005 to 2009; however there was a 129% increase in HFSS advertisement spots during non-children's TV, 2005–2009.

⁹³Significant bias possible and/or criteria used to determine compliance may be limited.

Australia

- Kelly & Chau (2007; CTS; post-only): This study examined whether any food advertisements breached Section 16 of the CTS (which specifies that an advertisement may be broadcast no more than twice within a 30-minute children's viewing period; C period) in a regular week on three Sydney commercial television channels. C periods are nominated at the discretion of broadcasters; hence the study selected periods when a high proportion of children were expected to be viewing. In 357 hours of television viewing during the study week in May 2006, 14 breaches of CTS section 16 were observed for food advertisements during surmised C periods. Most (80%) were for high fat and/or high sugar foods. The authors point out that, while the number of breaches represents a small proportion of total advertisements, it is important to remember that these data correspond to only one CTS clause in one week of television broadcasting. The study also found that food marketers circumvented or exploited a loophole in this clause 26 times during the study week, allowing constant repetition of advertisements to children. These are not breaches but the essence of the Code is contravened
- Chapman Nicholas et al (2006a; Children's TV Standards (CTS)); Regulates the way premium offers may or may not be used to sell products to children on TV; post-only study): The authors compared their findings on exposure to other Australian research and showed that the number of unhealthy food advertisements screened per hour had not changed over the past few years. A total of 194 breaches of the Standards were identified during 645 hours of commercial TV across rural and urban locations. The majority of breaches were of CTS 20(2)(a), relating to the misuse of premium offers to market a product.
- Morton Stanton et al (2005; CTS 20.2a; post-only): Thirty-two percent of the advertisements were for food. A significantly higher number of food advertisements (41%) were shown during 'C' programs (specifically regulated and produced for children 6–13 years of age and suitable for viewing without adult supervision), compared with 30% during the less regulated 'G' programs (suitable for children to view without adult supervision but not produced specifically for a child audience). Thirty-six percent of food advertisements in 'C' time contained a premium offer compared with 17% in 'G' time (P<0.0001). Using a precisely defined interpretation of CTS 20.2a, this study found that 30 (31%) food advertisements breached the standard during 'C' programs. This was a significantly higher proportion than the 54 (12%) breaches in 'G' time (P=<0.0001). The current regulatory system has not resulted in more responsible food advertising during 'C' programs, and the widespread breaches of CTS 20.2a indicate that this standard is ineffective as a means of regulating food advertising.

South Korea

 Kim et al (2013; Stat Reg (Special Act on Safety Management of Children's Dietary Life – in Jan 2010; *pre- post- surveys*): Surveys in 2009 and 2010 indicated positive changes in TV advertising practices of food companies, lowering children's exposure to TV advertising of EDNP foods. Gross rating points (number of sports x audience reach), total advertising budget and number of ad placements, decreased for EDNP food products during all hours and during restricted hours (5.00 pm to 7.00 pm). GRPs for EDNP foods fell 57% across all hours and 82% in restricted hours.

Canada (Quebec)

- Potvin Kent et al (2012; Stat reg Quebec 1978 vs. self-reg CAI Jan 2008 Ontario; comparison study): differences in exposure to food marketing on TV between (Englishspeaking) children in Ontario and AP (Anglophile) and FP (Francophile) in Ouebec. A total of 429 food and beverage advertisements. Food advertisements in the Quebec French sample were statistically significantly higher in total fat, saturated fat and protein, and lower in carbohydrates and sugar per 100 g, and as a percentage of energy than food advertisements in the two (Ontario and Quebec) English samples. A statistically significantly lower percentage of the Quebec French food advertisements were classified as either high fat, sugar or sodium and a smaller proportion of food advertisements were classified as 'less healthy' compared to the Ontario and Quebec English samples. These results suggest that the Quebec advertising ban is influencing the macronutrient profile of advertised foods viewed by French Quebec children during their preferred viewing and that their promotions are marginally healthier than that viewed by the English samples.
- Potvin Kent et al (2011; post-only): differences in exposure to food marketing on TV between (Englishspeaking) children in Ontario and AP (Anglophile) and FP (Francophile) in Quebec. The study included 428 children; 100-112 completed TV viewing diaries for seven days. Also TV programs and advertisements were recorded between 6 am and 12 am. Content analysis of advertisements, contests and sponsorship announcements that aired during children's 90 hours of preferred programming was then undertaken. Twenty-six percent of advertisements, 18% of contests and 22% of sponsorships were food/beverage related. Similar rates of food marketing were seen across all three population groups. French Quebec subjects were exposed to significantly more beverage promotions and fewer grain products, candy and snack food promotions. French Quebec children were targeted less frequently, and media characters/celebrities were used less often than in the English groups. The Quebec advertising ban does not appear to be limiting the amount of food/beverage advertising seen by children aged 10-12. However, food categories and marketing techniques used differ in the preferred viewing of French Quebec children.

Outcome: Brand knowledge/recognition

A group comparison study in Canada indicated that a mandatory ban of TV advertising is more effective than self-regulation in terms of reducing brand recognition; however a comparison study in Ireland and Northern Ireland did not find any difference in brand knowledge according to the two different types of regulation.

Canada (Quebec)

• Goldberg (1990; Canada; ban and self-regulation; *comparison study*): Anglophile children (self-regulation: Ontario) had stronger toy and cereal brand recognition than Francophile (ban: Quebec) children.

Ireland

- Tatlow-Golden et al (2014; Ireland; experimental study): This study examined the brand knowledge of nine food/ drink images/logos⁹⁴ of 172 children aged 3–5 years in two regions of Ireland — Northern Ireland and Ireland. Statutory regulations limit HFSS TV advertising around children's programming in Northern Ireland but not the Republic. Results indicated that food brand knowledge
 - did not differ across jurisdictions
 - increased significantly between 3 and 4 years
 - children had significantly greater knowledge of unhealthy food brands, compared with similarly advertised healthy brands
 - children's healthy food brand knowledge was not related to their TV viewing, their mother's education, or parent or child eating.
 - unhealthy brand knowledge was significantly related to all these factors, although only parent eating and children's age were independent predictors.

The authors concluded that TV advertising alone does not drive children's food knowledge, and unhealthy brand knowledge is present before pre-schoolers develop the concept of healthy eating.

^{ac}Brands selected were: four 'healthy' items: Innocent® (smoothies and juices); Actimel® (yoghurt drink); Frube® (flavoured yoghurt in a tube); and Cheestring® (string cheese) and five 'less healthy' items: Pringles® (crisps/chips); Coco Pops® (chocolate-flavoured sweetened cereal); Cadbury's® (chocolate); McDonalds® (fast food) and Coca-Cola® (sweetened carbonated soft drink).

Outcome: Product reformulation

Mandatory restrictions on TV unhealthy food advertising in South Korea led to food reformulations (company self-report).

South Korea

 Lee Yoon et al (2013; Special Act on Safety Management of Children's Dietary Lives; Jan 2010; *online survey*): examined the four marketing mix components of product, place, price and promotion. Results from an online survey of 108 food companies indicated that restrictions on the advertising of unhealthy food on TV exerted positive effects on EDNP companies with respect to compliance with labelling requirements and reinforcement of nutritional contents, as well as changes to products, such as reducing unhealthy ingredients and fortifying nutrients⁹⁵.

Outcome: Consumption

An advertising ban in Quebec, Canada, was effective at reducing the propensity for purchasing fast food, compared to self-regulation in Ontario.

Canada

- Dhar & Baylis (2011; comparison study): Ontario Frenchand English-speaking groups and households without children in Ontario as control for anglophile (AP) and francophile (FP) Quebec. Household expenditure on fast food was the outcome. It found that the ban in Quebec reduced fast food expenditures in that city, leading to about 17 million fewer fast food meals eaten per year; FP households were significantly less likely to purchase FF if they lived in Quebec than Ontario, and on average spent substantially less. Tentative evidence that impact persists as Francophone children become young adults. The same findings were observed for AP households with no children. For AP and FP households with children. there was an insignificant difference in terms of purchase occurrence and amount spent (no overall cultural differences). The ban's effectiveness is not a result of the decrease in fast food expenditures per week but rather of the decrease in purchase propensity by 13% per week. Overall, the authors estimate that the ban reduced fastfood consumption by US\$88 million per year. The study suggests that advertising bans can be effective provided media markets do not overlap.
- Chou et al (2008; US; Modelling): Data from the 1979 Child–Young Adult National Longitudinal Survey of Youth (matched mother-child data for children ages 3–11) and the 1997 National Longitudinal Survey of Youth (12–18 year-olds) were used to estimate the effects of television fast food restaurant advertising on children and adolescents with respect to being overweight (BMI). Collar expenditures for fast food advertising in the US from 1996 to 1999. The study only included data with local variation (network television, syndicated television, and cable network television advertising were not included in the data because there was no local variation). The exposure variable equals the annual number of seconds of fast-food restaurant messages aired on television. Designated market area=unit of observation. An important conceptual issue that arises in measuring the impact of exposure to advertising on consumer behaviour is whether the effect on any one consumer depends on the total number of hours of advertising aired on television in the consumer's DMA or on the per capita number of hours aired. The advertising literature seems to be mixed with regard to using total exposure or this variable per capita. The most compelling justification for total exposure is that two consumers cannot eat the same apple, but two consumers can watch the same advertisement. The most compelling justification for the per capita specification is that there are more television stations in larger market areas. This lowers the probability that two consumers will see the same advertisement in a larger market even if they spend the same amount of time watching television. Because the first factor seems to us to be more important than the second (two consumers in the same market area certainly can view the same advertisement no matter how large the area), this study emphasised results with total exposure. In preliminary research, the study found that results for per capita exposure were similar to those with total exposure. A ban on these advertisements would reduce the number of overweight children aged 3–11 years in a fixed population by 18% and would reduce the number of overweight adolescents aged 12–18 years by 14%. The elimination of the tax deductibility of this type of advertising would produce smaller declines of between 5% and 7% in these outcomes. However they would impose lower costs on children and adults who consume fast food in moderation because positive information about restaurants that supply this type of food would not be completely banned from television.

95 Note: study showed that some food companies attempted to bypass the regulations by changing marketing channels from TV to other mediums and by reducing product serving sizes.

- Restricting TV advertising was considered to be one of the most cost-effective population-based interventions to reduce childhood obesity in Australia in a study in 2009.
- Magnus et al (2009; AUS; cost-effectiveness study): Removing TV advertising of HFSS food and beverages to Australian children; model assumptions were attained through experts. Estimated total disability-adjusted life years (DALYs) saved was 37,000 (95% UI 16,000, 59,000). When the current value of potential savings in future health-care costs was considered (AUD\$300m (95% UI \$130m, \$480m), the intervention was 'dominant', because it resulted in both a health gain and a cost offset compared with current practice. The authors concluded that, although recognising the limitations of the available evidence, restricting TV food advertising to children would be one of the most cost-effective population-based interventions available to governments today.

SUB-ACTION:

Food/beverage industry selfregulation of advertising of unhealthy products (TV commercials) during children's TV broadcasting

Evidence of intervention effectiveness

Outcome: Exposure⁹⁶

- Self-regulatory pledges made by industry are generally ineffective at reducing the exposure of children to unhealthy food/beverage advertisements and the criteria are not sufficient to identify healthier foods appropriate for advertising to children.
- Exposure by signatory companies is often higher than for non-signatories.

Reviews — food marketing (generally)

- Galbraith-Emami & Lobstein (2013; SR): This systematic review of the peer-reviewed, grey-and industry-sponsored literature indicated that findings from the peer-reviewed literature show continuing high levels of promotion of less healthy food and beverage products and high levels of exposure of children to this promotion, despite industry self-regulation. Similarly, reports in the grey literature from a variety of other authoritative sources show weak or absent reductions, or insufficient evidence of change as a result of the self-regulation.
- The coordinating bodies for the pledge-making companies have published annual reports (2013) showing levels of compliance above 96%, indicating a remarkable level of restriction of children's exposure to the marketing of unhealthy foods or, possibly, that the criteria being used are not appropriate for measuring exposure and impact. Industry-sponsored reports have identified very strong evidence of reduced or low levels of exposure, even in countries or regions where other reports or scientific surveys have not found this to be the case. Assuming that their findings are accurate and genuinely reflect the underlying information, the difference must be due to differences in what is being measured. Possible causes in discrepancies between industry reported compliance and exposure as determined in peer-reviewed evaluations:
 - One possible cause of discrepancy may lie in the lack of complete coverage of the pledges across all food companies: although many of the major companies have signed the pledges, it is possible that advertising from non-pledge members has continued and even increased, but this advertising will not be reported in the industry-sponsored reports that only cover pledge members' advertising activities.
 - A further cause of discrepancy may lie in the definitions – particularly around audience. Most of the scientific papers used times of day when children are likely to be watching TV, whereas the pledges have specified 'children's TV' to be only those TV programs watched by an audience of which over 35% (or in some cases over 50%) are children under 12 years of age. Using such a high percentage of the audience may eliminate most TV programming: an analysis of Australian free-to-air TV watching found no time in weekdays and only a short period at weekends when the proportion of the audience aged under 14 years exceeded 35% (Mackay et al 2011).

⁹⁶Note: 'compliance' is included under 'exposure' however, due to the limitations of many of the countries and companies pledges, compliance does not necessarily mean there have been any changes in exposure to advertisements for unhealthy products. Compliance has been measured mostly as self-reporting by non-independent industry bodies.

- The other main discrepancies arise from different nutrient profiling definitions – peer-reviewed articles used a nutrient profiling scheme applied across all advertised products, whereas under the voluntary pledge schemes each advertised product is categorised according to definitions developed by the producing company.
- Ronit & Jensen (2014; Review): A literature review of industry self-regulation of food and beverage marketing included 22 publications. The studies show that commitments in industry self-regulation schemes tend to be relatively vague and permissive, that the measurable effects of the self-regulations tend to be relatively small and that some extent of public regulation may catalyse the effectiveness of industry self-regulation. Horizontal pressures operating between companies to discipline non-complying companies seem to be fairly weak. The review concluded that although the reviewed studies vary in terms of analytic units and methods applied, they generally stress an ineffectiveness of existing selfregulation schemes.

Reviews - self-regulation tv advertising

Smithers et al (2014; Review; comparison signatories vs. non-signatories): Review of reported TV advertisements for food during children's programs and viewing times since self-regulatory initiatives in 2009 in Australia. Identified eight articles which met selection criteria for systematic review but meta-analysis was not possible because of temporal and methodological differences across studies. The advertising of non-core foods was found to be negligible during programs with a C-(children's) classification but ranged from 1.5 to 6.5/h during children's peak viewing times. From 2006 to 2011, non-core food advertising decreased by 0.18 advertisements per hour every year, whereas fast food advertising increased by 0.09/h; However, these analyses are based on one study with only five time points. During children's viewing times, signatories to industry initiatives advertise non-core foods at higher rates than nonsignatories. Included studies were: two studies by AFGC (2010 grey literature; 2012 grey literature); Hebden, King, Chau & Kelly (2011); Brindal et al (2012); King Hebden Grunseit et al (2013); Hebden King Grunseit et al (2011); King Hebden Grunseit et al (2011); Roberts Pettigrew et al (2012) – [cf. all of these studies described individually below.1

Individual studies97

Australia

- Australian Food and Grocery Council (2015; RCMI and QSRI; industry report): The most recent annual compliance report of the 17 companies signed up to these two initiatives indicated that only four were found not to breach the initiative; Mars Australia and the Wrigley Company breached 102 times, PepsiCo Australia breached 59 times, and Coca-Cola South Pacific and Campbell Arnott's breached 28 times each. Hungry Jack's breached the QSRI 245 times, KFC 57 times and McDonald's 29 times. Note that these breaches were for the limited regulatory criteria, including the industry definition of children's programs and signatory companies' own nutrition criteria. The 2013 study found 260 breaches of the RCMI and 384 breaches of the QSRI compared to 296 and 347 respectively in 2014 (cited in Junk Food Injunction Spring 2015).
- Watson et al (2014; RCMI and QSRI; post-only content analysis April 2013; signatories vs. nonsignatories): Examined products in advertisements (1733 advertisements comprising 127 unique advertisements) in relation to the FSANZ Nutrient Profiling Criteria Scheme (NPCS), developed for health and nutrient claims and a modified form used for the FOP Health Star Rating Scheme in Australia. Seventy-one (56%) unique advertisements failed the NPSC. Fifty-three percent of advertisements by RCMI signatories (17) met the nutrition criteria contained in their company action plans, and of those 63% passed the FSANZ Nutrient Profiling Criteria Scheme (NPCS), developed for health and nutrient claims and a modified form used for the FOP Health Star Rating Scheme in Australia. Of those advertisements that failed CAPs, 93% failed NPSC. Higher percentages of advertisements passed NPSC criteria among non-signatories (51% vs. 32%). Among QSRI, most advertisements were among signatories (76%) of which 83% failed the NPSC; while 53% failed among non-signatories⁹⁸. The one advertisement that was for a children's meal passed the QSRI criteria. The criteria used by the RCMI and QSRI signatories vary widely, and the findings of the study suggest that the criteria are not sufficient to identify healthier foods appropriate for advertising to children.

The foods that most commonly failed were confectionery, fast food, spreads and sauces added to meals. The most common foods that passed nutrient profiling were dairy and protein sources such as eggs. There were only four (3%) unique advertisements for F&V. Of the

⁹⁷Many of the studies have been taken from the most recent systematic review by Galbraith-Emami & Lobstein (2013) but are included here for completeness and to illustrate the findings in relation to the evidence not included in this review.

⁹⁸ Hebden et al (2010; AUS): found that 83% of advertisements by signatories to the RCMI passed the company action plan criteria compared to 53% in the study by Watson et al (2014), as Hebden et al included 'products that were not specified' as passing the Action Plan criteria; rather than indicating them as 'missing data'.

advertisements that passed NPSC, 64% promoted core foods, and 93% of those that failed promoted non-core foods. The difference was for some fast foods that are all classified as non-core (healthiness of general foods groups) but which passed the NPSC (nutrient content such as salt, sugar).

- King Hebden et al (2013; Australian Food & Grocery Council Pledge (RCMI); Jan 2009; TV Sydney; *pre- post-*): Surveys in 2006, 2007, 2009, 2010, and 2011 showed no change in the rate of non-core food advertisements. In 2011 the rate of non-core food advertisements was not significantly different from 2006 or 2010 (3.2/hour vs. 4.1 and 3.1/hour). The rate of fast food advertising was significantly higher in 2010 vs. 2006 (1.8/hour vs. 1.1/ hour) but the same as that in 2011 (1.5/hour).
- King et al (2012; RCMI Jan 2009 & QSRI Aug 2009; TV Sydney; pre- post-)⁹⁹: comparing 2011 with 2006, for children's peak hours, total food advertisements per hour declined by 21%. Advertisements for non-core foods declined 23%, while advertisements for non-core foods, excluding fast food declined 44%; advertisements for fast food increased 34%.
- Australian Food & Grocery Council (2012; cited in Galbraith-Emami & Lobstein 2013 and Tymms 2012; industry report): post-only compliance: In 2011, advertisements for non-core foods screened during children's programs represented 1.6% of all food and beverage advertisements shown across eight channels over 24 hours. In 2010, the equivalent figure was 3.0%; i.e. children were exposed to very low levels of noncore food advertising on TV. The review concluded that compliance was high however "the provision of bonus airtime (whereby a television station fills any unsold commercial airtime with advertisements at no cost to the advertiser and without their prior consent) continued to account for some incidences of non-compliance, as it had in 2010; noting that signatories are developing mechanisms for ensuring that the allocation of bonus airtime does not cause them to be in breach of the RCMI in 2012".
- Roberts et al (2014; self-regulation; *post-only*): 93284 food advertisements, including repeat airings, were analysed from 1464 hours of continuous programming. The majority (63%) included non-core foods. During children's prime viewing times (CPVT), this figure was

significantly higher at 65% versus 61% outside CPVT. Within CPVT, the percentage of advertisements was higher for QSRs (30% vs 26%) and unhealthy beverages (3% vs 2%). Fifteen percent of all advertisements were for sugar-sweetened soft drinks. Premiums were still apparent (10% vs 8%) despite being restricted by the codes. Therefore, Australian children continue to be exposed to a large amount of advertising for non-core foods, despite the introduction of voluntary codes.

- Roberts et al (2013; self-regulation; *post-only*): Most advertised foods were non-core foods (63%), with few advertisements for F&V (6%). Advertisements for non-core foods were significantly more frequent during prime time viewing periods (71% vs. 60%; P<0.01). High levels of advertising for fast food (28%) and non-core beverages (24%) were recorded.
- Roberts et al (2012; RCMI self-regulation; and QSRI; *post-only*): During the two months of data collection there were 332 breaches of the voluntary regulations (RCMI and QSRI), and 619 breaches of mandatory rules (CTS) on advertising repetition and the use of promotional appeals and endorsements. Three companies (Coca-Cola, Kraft, Ferrero) advertised during 'C' programming despite reporting they do not market to children <12 years. Almost 83% of all food and beverages advertised during children's programming were for extra foods (AGHE). There were also breaches in relation to the amount of advertising repetition and the use of promotional appeals such as premium offers, competitions, and endorsements by popular children's characters.

"Self-regulation of food advertising by the food industry is falling short of its potential due to coverage of the voluntary codes being limited to signatory companies and inadequate compliance and reporting levels.' (p. 6) 'The self-regulatory systems were found to have flaws in their reporting and there were errors in the Australian Food and Grocery Council's compliance report. ... Regulations need to be closely monitored and more tightly enforced to protect children from advertisements for unhealthy foods'.

Brindal et al (2012; RCMI and QSRI; Aug 2009 self-regulation): data 2008 and 2010 pre-post-: comparison signatories): For all TV programming, impacts for non-core foods increased approximately 50% from 2008 to 2010 in children's age groups. Advertisements by Pledge signatories accounted for 40% of total food advertisements, and for 63% of non-core food

²⁹Note: the reference for this could not be located by the authors – the one cited in Galbraith-Emami review is incorrect (the reference indicated is the 2013 reference (above)).

advertisements before the introduction of the Pledge, rising to 78% of non-core food advertisements in 2010.

- CSIRO (2011; cited by Tymms 2012): The 2011 report by CSIRO on television food advertising to children in South Australia (SA) indicated that free-to-air (FTA) children's (C) programs contained much less advertising than general (G) programs; that food advertisements made up a small proportion (20%) of total advertising and that approximately half of those were for HFSS food. There was no significant change in the rate of HFSS food advertising on FTA and Pay-TV in SA between 2008 and 2010 for signatories and non-signatories alike. CSIRO recommended redefining the terms to cover children's actual viewing times in order to properly target the instruments and alter children's exposure to advertisements for HFSS food.
- Hebden et al (2011; QSRI; August 2009; comparison signatories): Pre- post- study comparing data from 2009 and 2010 showed an increase in the number of fast food (FF) advertisements for all viewers from 1.1 to 1.5 per hour. There was no change in the number of non-core FF advertisements for all viewers (1.0 per hour) and for children (1.3 per hour). Non-core FF advertisements as a proportion of all FF advertisements decreased for non-Pledge companies more than for Pledge companies.
- King Hebden et al (2011; RCMI Jan 2009; Sydney; prepost-; comparison signatories vs. non-signatories): Data were collected across seven days in May 2006 and May 2007, and four days in May 2009. Average number of food advertisements decreased significantly from 7.9/ hour in 2007 to 5.9/hour in 2009. There was a significant reduction in the rate of non-core food advertising from 2007 to 2009 by RCMI signatories (14 companies) compared with non-signatory companies (22 companies) overall and during peak times, when the largest numbers of companies were viewing. There was no reduction in the rate of non-core advertising by all companies, and these advertisements continue to comprise the majority during peak viewing times. Thus, while signatory companies have significantly reduced their advertising of non-core foods on TV as a result of the self-regulatory pledge; the limited uptake of the self-regulatory code by food companies (14/36 companies) has limited its impact.
- Healthy Kids Association (2011; cited in Tymms 2012; independent audit/post-only compliance): This review involved audits of all marketing material (provided by the signatories) relevant to two fortnight periods in 2010 and 2011. Overall signatory companies were found to meet the requirements of the QSRI in the audit periods, with one suite of advertisements using a licensed character being uncompliant in the first audit and two advertisements being non-compliant in the second audit. Ensuring the compliance of advertising in bonus airtime was again identified as an area for improvement and the review recommended that definitions of licensed characters required updating.

Canada

- Potvin Kent Martin et al (2014; CAI Self-regulatory Initiative; *pre- post-*): The volume of advertisements aired by Canadian Children's Food and Beverage Advertising Initiative (CAI) companies on children's specialty channels decreased by 24% between 2006 and 2011, however, children and teens were targeted significantly more, and spokes-characters and licensed characters were used more frequently in 2011 compared to 2006. The overall nutritional quality of CAI advertisements therefore remains unchanged between 2006 and 2011.
- Potvin Kent & Wanless (2014; CAI self-regulatory Initiative; pre- post-): Content analysis of TV advertisements in Toronto and Vancouver 2006, 2009, and 2011. On children's specialty channels, a 4.5% decrease in total spots aired was observed while spots aired on generalist stations increased by 44% (Toronto) and 45% (Vancouver). On all stations, children's total average exposure to food/beverage advertising increased by 16.8% in Toronto and 6.4% in Vancouver between 2006 and 2009. Significant increases were seen in snacks and yogurt in both cities, and in fast food in Toronto. On children's specialty channels, children's exposure to the food/beverage categories considered increased by 5.4% in Toronto and by 2.5% in Vancouver. Therefore, despite improvements in the volume of spots on children's specialty channels, children's exposure to food and beverage advertising has increased since the implementation of the CAI.
- Advertising Standards Council Canada (2012;¹⁰⁰ for the Canadian CFBAI (CAI); industry report: *post-only compliance TV*): Ninety-two percent of food and beverage advertisements were for CAI-members' products, of which over 80% were for company-defined 'better for you' products, e.g. 'a source of one or more nutrients or essential vitamins'.¹⁰¹

Potvin Kent Dubois et al (2011; *post-only*): Seven-day TV viewing diaries of 272 children aged 10–12 years from Ontario and Quebec. Seventeen corporations were signatory to the Canadian Children's Food and Beverage Advertising Initiative (CAI) and 35 were not signatories. The CAI was responsible for significantly more food/ beverage promotions, and used media characters and repetition more frequently in their food/beverage promotions than the non-CAI group. Nutritionally, the CAI food/beverage promotions were higher in fats, sugar, sodium and energy per 100 grams. A significantly greater proportion of the CAI food/beverage promotions were considered 'less healthy' compared to the non-CAI promotions.

Chile (IFBA)

 Castillo-Lancelloti et al (2010; cited in Galbraith-Emami & Lobstein, 2013; IFBA self-regulation; *post-only*): 56.6% of food advertisements were targeted at children or families. Of these, 13% were for healthy foods, 8% for moderately healthy foods, and 79% for unhealthy foods (at least one red traffic light).

Denmark

Forum for Fødevarereklamer (Denmark) (2010; cited in Galbraith-Emami & Lobstein, 2013; pre- post-): Targeted rating points (number of spots x proportion of audience reach x proportion of audience in target market) scores fell from several hundreds to below 10 for most food products, especially chocolate, ice cream, desserts, soft drinks, cereals, cakes and milk products, after 2007. The analysis shows that HFSS foods are not marketed during children's programs.

¹⁰⁰The latest report was released in August 2015; compliance was indicated on the website to be 'excellent'; http://www.adstandards.com/en/childrensinitiative/default.htm (sighted November 2015). This website also indicates that t "Since the program's inception in 2007, the CAI has continued to change the landscape of food and beverage advertising to children under the age of 12. The CAI has also expanded its membership, increased its scope beyond traditional media, and its participants have reformulated many products to enhance their nutritional profile." Note also that at this website there is mention of "CAI new uniform nutrition criteria to come into effect after December 31, 2015. The new criteria are science-based, comprehensive and progressive and represent an important evolution in the CAI program." (Sighted November 5, 2015) Note: the White Paper which accompanies these new developments has not been sighted by the author.
¹⁰⁰This industry report also indicated 100% compliance for print and advergames mediums

European Pledge

- EU Pledge¹⁰² (2012; cited in Galbraith-Emami & Lobstein, 2013; pre- and post-): for Germany, Hungary, Italy, Poland, Portugal; 97–99% compliance: no advertisements on TV programs with >35% audience of <12 years for pledge-company-defined products; 73% reduction in advertising impacts on children <12 years on TV programs, with >35% audience <12 years, for pledge-company-defined products, compared with 2005; 48% reduction in advertising impacts on children <12 years on all TV programs for pledge-company-defined products, compared with 2005 29% reduction in advertising impacts on all pledge-company products, compared with 2005.
- Tymms (2012; pre- post-): also reported on compliance with the EU Pledge from the first monitoring report of the EU Pledge Secretariat (November 2011) and indicated high levels of compliance across the 19 member countries (99.1% for TV, 100% for print, 100% for online advertising, and 98% for product-related communication in primary schools). Tymms' indicates that, since 2005, there was a 79% reduction in exposure to advertising of products that did not meet companies' nutrition criteria during programs for which >50% of the audiences were children (and a 29% reduction across all programs at all times); though there was little reduction between the years 2010 and 2011. The report highlighted that further strengthening of Pledge requirements was a key challenge. In 2012, commended by the European Commission, the Pledge has been strengthened to apply where >35% of the audience is under 12 and to include all online marketing (such as company-owned and brand websites).

Germany

• Effertz & Wilcke (2012; EU Pledge in Jan 2009; *pre-post-study* 2007/8 and 2010): The absolute number of advertisements fell from 4,924 to 2,657. The proportion of advertisements for non-core foods rose from 12.8% to 18.2%; while the proportion of advertisements for core foods fell from 1.7 to 0.3%.

International Pledge

 Accenture for International Pledge (IFBA) (20120; cited in Galbraith-Emami & Lobstein, 2013; *self-reported compliance*): 97.6% compliance: no advertisements on TV programs with >50% audience <12 years; 100% compliance: no advertisements in children's publications; 100% compliance: no advertisements on child-oriented websites.

 ENESDA (2011; cited in Galbraith-Emami & Lobstein, 2013; self-reported compliance): Belgium, France, Germany, Italy, Poland, Spain; 99% compliance: no advertisements on TV programs with 50%+ audience <12 years; 100% compliance.¹⁰³

Romania (EU Pledge)

Tarcza & Olar (2011; cited in Galbraith-Emami & Lobstein 2013; *post-only*): Foods high in fat and sugar constitute 30% of advertisements seen by children, against 1–5% of advertisements for health-promoting foods. Estimated exposure of children to 90 food advertisements per day. Techniques focus on taste, fun or offers of premiums or competitions. A fifth include a disclaimer (e.g. 'as part of a balanced diet').

South Korea

 Han et al (2013; IFBA¹⁰⁴): pre- post- study 2004 compared to 2009. The number of food advertisements per day fell by 19% for all viewers, 33% for children and 35% for adolescents. For children, beverage advertisements fell by 22%, sweets and snacks 73%, fast food 30% and instant noodles 25%. For adolescents equivalent figures were falls of 31%, 71%, 21% and 28%, respectively.

Spain

Romero-Fernández et al; (2010, 2013; cited in Galbraith-Emami & Lobstein 2013): post-only compliance (2008) comparison of signatories and non-signatories; analysis for Sept 2005 PAOS self-regulation. Of 264 food advertisements aimed at children, 77% were for products from PAOS Code signatories, and of these advertisements 49% were non-compliant, plus 21% of uncertain compliance. Among non-signatories, 51% of advertisements were non-compliant. During 'reinforced protection' time (8.00–9.00 am and 5.00–8.00 pm) 43% of signatories' advertisements were non-compliant and 29% of uncertain compliance. Using the UK HFSS model, 60% of the advertisements were less healthy, 71% during children's protected viewing times and 54% at other times, i.e. using the UK HFSS model to regulate food advertising would entail the withdrawal of most food commercials.

¹⁰²Study also indicates that there was 'no promotion of company-defined products on pledge-company-owned websites 'with particular appeal to children' however the summary states: " "However, the compliance monitoring program for company-owned websites has shown that there is significant room for improvement."
¹⁰³Also: no advertisements in publications with 50%+ audience <12 years; 98–100% compliance: no advertisements on websites with 50%+ audience <12 years; 96% compliance: no brand-owned web-</p>

¹⁰³Also: no advertisements in publications with 50%+ audience <12 years; 98–100% compliance: no advertisements on websites with 50%+ audience <12 years; 96% compliance: no brand-owned websites are likely to attract >50% audience <12 years.

¹⁰⁴Note: This study is cited in Galbraith-Emami & Lobstein (2013) as a pre- post- study but it is not indicated as such in the published article, rather the data are indicated to be a baseline for the mandatory regulations in 2009.

US

- Schermbeck & Powell (2015; US; *post-only*): This study compared the Children's Food and Beverage Advertising Initiative's (CFBAI's) April 2014 list of food and beverage products approved to be advertised on children's television programs with the federal Interagency Working Group's (representing the Federal Trade Commission, the Centers for Disease Control and Prevention, the Food and Drug Administration, and the US Department of Agriculture) nutrition recommendations for such advertised products. Products were assessed by using the nutrients to limit (saturated fat, trans fat, sugar, and sodium) component of the Interagency Working Group's recommendations. Fifty-three percent of the listed products did not meet the nutrition recommendations and, therefore, were ineligible to be advertised.
- Powell Schermbeck et al (2013; post- only; comparison signatories): US Children's Food and Beverage Advertising Initiative (CFBAI): Most food and beverage products in TV advertisements seen by children do not meet the IWG (federal Interagency Working Group) nutrition recommendations and less than one half of such advertisements are covered by self-regulation. 97.8% and 98.1% of Children's Food and Beverage Advertising Initiative (CFBAI) company-member advertisements seen on children's programming were for products high in NTL, compared to 80.5% and 89.9% of non-CFBAI product advertisements. Thus, products advertised on children's versus general-audience programming and by CFBAIversus non-CFBAI-member companies are particularly of low nutritional guality, suggesting that self-regulation has not successfully protected children from exposure to advertising for unhealthy foods and that continued monitoring is required.
- Powell Harris et al (2013b; analysis of FTC reports): Federal Trade Commission (FTC) released two reports documenting food and beverage marketing expenditures to children and adolescents. The recently released 2012 report found an inflation-adjusted 19.5% reduction in marketing expenditures targeted to youth from \$2.1 billion in 2006 to \$1.8 billion in 2009. Two-thirds of this decline was due to reductions in fast-food kids' meal premiums and advertising on children's television; while less expensive forms of marketing, including digital media, sponsorships, product placements, and philanthropic promotions increased. The current article indicates

that the CFBAI is limited in scope and effectiveness: expenditures increased for many non-covered marketing techniques (i.e., product placement, movie/video, crosspromotion licenses, athletic sponsorship, celebrity fees, events, philanthropy, and other); only two restaurants are members of CFBAI, and non-premium restaurant marketing expenditures were up by \$86.0 million (22.5% inflation-adjusted increase); industry pledges do not protect children aged >11 years, and some marketing appears to have shifted to older children; nutritional content remains poor.

- Harris Sarda et al (2013; *post- only*): CFBAI pledges. TV advertisements during various viewing times. Just 45–48% of food advertisements viewed by children met current CFBAI definitions of child-directed advertising. Expanding this definition to include advertising during programs with a child-audience share of 20% or higher and/or 100,000 or more child viewers would cover 70–71% of food advertising seen by children but just one third of advertisements seen by adults. The authors concluded that children viewed an estimated 35% fewer food advertisements during TV programs with a high child-audience share (50%) in 2009 compared with 2004. However, ensuring that nutrition standards apply to the majority of food advertisements viewed by children requires broader definitions of child-directed advertising.
- Kunkel Castonguay et al (2014; *unknown study type*): This study found that the industry self-regulatory pledge has resulted in only marginal improvements in the overall nutritional quality of foods advertised to youth.
- Berning & McCullough (2013; nonlinear time series models): This study examined the effects of the voluntary restriction of TV advertising of soft drinks to children. The authors found that the market leader reduced its advertising to both adults and children following the ban, and the second largest firm reduced advertising to adults. However, advertising by a non-participating firm increased for adults following the ban, indicating some potential negative impacts of voluntary restrictions when they are not adhered to by all companies within the same industry.

- Berning et al (2013; *exploratory*): The authors evaluated three US guidelines that deal with TV advertising of breakfast cereals, which are both heavily advertised and a common meal item for children. They found that the majority of cereals advertised primarily to children from 2006 to 2008 do not meet any of the current and proposed self-regulatory nutrition guidelines, and that this is generally due to excessive sugar content. Further, children and adolescents are exposed to more advertising for products that do not meet the nutritional guidelines.
- Rudd Center (2012; CFBAI; 2007; pre- post- 2004, 2007, 2011; cited in Galbraith-Emami & Lobstein, 2013; report): Children aged 2–11 years 2011 — all food advertisements: exposure was down by 8.4% from 2004, but up by 5.1% from 2007. There was a rise from 2004 in exposure to advertisements for: fast food and other restaurants; yogurt and candy. There was a rise from 2007 in exposure to advertisements for: fast food and other restaurants, carbonated and non-carbonated beverages, yogurt and dairy, confectionery. For children aged 12–17 years in 2011 all food advertisements: exposure was up by 14.5% from 2004 and up by 27.1% from 2007. Most categories are increasing exposure. The authors stated that: "Total food and beverage advertising seen by children declined 5% in 2011 compared with the previous year. However, children continued to view approximately 13 advertisements per day that almost exclusively promoted categories of products with little or no nutritional value. Increases in child exposure since 2007 demonstrate that the CFBAI has had limited effect on this unhealthy food advertising landscape."
- Kolish & Hernandez (2012; cited in Galbraith-Emami & Lobstein, 2013; Children's Advertising Research Unit monitoring; *post-only; compliance*): In 2012, 81% of all food advertisements were for Pledge-companies' compliant foods (the remainder were for non-Pledge company brands). In 2012, 90% of Pledge companies' advertisements were for products containing 'food groups to encourage' or a 'good source' of an important nutrient, up from 83% in 2009. In 2012, 72% of Pledgemembers' advertisements were for foods containing at least a half-portion of whole grains or fruit, and 22% were for advertisements that included non/low-fat milk, yogurt or dairy drinks.
- Tymms (2012; citing the Council of Better Bureaus 2011; and Accenture 2012): In December 2011, the US Council of Better Business Bureaus published a report on

compliance with the BBB Children's Food and Beverage Advertising Initiative, including an analysis of performance from 2006–2011. Compliance was found to be high, and there were few violations — advertisements misplaced by external advertising agencies and broadcasting networks. Ongoing improvements in the nutrition profile of products advertised directly to children were recorded and form a key component of reporting. The core principles of the Initiative were enhanced to include social media in 2009; to apply where >35% of the audience is under 12 years old in 2011, and were enhanced again to incorporate standard nutrition criteria (by Dec 2013).

- Powell et al (2011; CFBAI; 2007; pre- post-): surveys 2003, 2005, 2007, and 2009. Children aged two to five and six to 11 years saw, respectively, on average, 10.9 and 12.7 food-related television advertisements daily in 2009, down 17.8% and 6.9% from 2003. Exposure to food and beverage products high in saturated fat, sugar, or sodium fell 37.9% and 27.7% but fast-food advertising exposure increased by 21.1% and 30.8% among two to five and six to 11 year-olds, respectively, between 2003 and 2009. In 2009, 86% of advertisements seen by children were for products high in saturated fat, sugar, or sodium, down from 94% in 2003. The percentage of food advertisements with HSFSS fell from 94% to 86% for children aged two to five years, and from 94% to 87% for children six to 11 years.
- Powell et al (2010; CFBAI; 2007) surveys (content analysis) 2003, 2005, 2007: Comparing 2007 to 2003; daily average exposure to food advertisements fell by 13.7% and 3.7% among young children aged two to five and six to 11 years, respectively, but increased by 3.7% among adolescents aged 12 to 17 years. Exposure to sweets advertisements fell 41%, 29.3%, and 12.1%, respectively, for two to five and six to 11, and 12-17 year-olds. Beverage advertisements were down by about 27% to 30% across these age groups, with substantial decreases in exposure to advertisements for the most heavily advertised sugar-sweetened beverages — fruit drinks and regular soft drinks. Exposure to fast food advertisements increased by 4.7%, 12.2%, and 20.4% among children aged two to five and six to 11, and 12-17 years, respectively, between 2003 and 2007.

- Kunkel et al (2009; cited in Galbraith-Emami & Lobstein 2013; pre- post-): food advertisements per hour fell from 10.9 (2005) to 7.6 (2009): 'Whoa' products down from 84% of food advertisements to 73%; 'Slow' products rose from 13% of food advertisements to 27%; 'Go' products down from 3% of food advertisements to <1%. In 2009, 534 food advertisements were recorded, of which 29% were from non-CFBAI signatory companies. Non-signatory company advertisements were 83% 'Whoa' products; signatory company advertisements were 68% 'Whoa' products, although all 381 advertisements from signatory companies complied with the companies' own nutrient profile definitions.
- Sixsmith & Furnham (2009; cited in cited in Galbraith-Emami & Lobstein 2013: post-only): Child-focused advertisements contained more health claims, leisure settings, male characters, cartoons and fantasy elements. Compared with non-child-focused advertisements, childfocused advertisements were more frequently categorized as promoting 'unhealthy' products, more frequently showed fast food, confectionery and snack foods, and less frequently showed fruits or vegetables.

Outcome: Purchasing

A single study of the CFBAI among confectionery companies showed that self-regulatory pledges which result in the elimination of TV advertising to all age groups significantly reduce household purchasing of those companies' products.

US

 Huang & Yang (2013): During 2006–2008 Hershey's, Mars and Cadbury-Adams completed their CFBAI pledges. The current findings indicate that CFBAI implementation reduced purchasing frequency by households with children of Cadbury-Adams' bubble gum (by 80%) but not Hershey's or Mars chocolate. This seems to have resulted from Cadbury Adams's eliminating advertising to all age groups, whereas children continued to be exposed at high levels to Hershey's and Mars chocolate advertising on general programs. The authors conclude that restricting only child-directed advertising may not effectively reduce advertising exposure to children, but reducing advertising exposure overall can significantly lessen household purchasing.

Self-regulatory pledges — modelling study

• Zhang et al (2014; *modelling study*): This study showed that it is important for a market leader to participate in self-regulatory pledges: if a follower company participates but the market leader does not then the market coverage of the advertised product is likely to expand in the majority of cases.

ACTION:

Restrict food/beverage product placement during children's/ youth TV programming

Descriptive evidence

- Content analysis of programming across the UK, Ireland and the US indicate that, during TV programming/movies, branded appearances are relatively rare, although perhaps increasing in prevalence. Food/beverage placements generally during programming are increasing (US); placement of unhealthy foods particularly those high in sugar, is prevalent across several countries (UK, Ireland, US), and more prevalent in youth-oriented shows than adult-oriented shows (US).
- Food and beverage placement motivating cues are most commonly social/celebratory (UK, Ireland, US).
 - Scully Reid et al (2015; UK and Ireland; *content* analysis): Compared advertisements on UK and Irish TV (BBC and RTE) July–October 2010 during children's programming. Examined 'food/beverage placement', 'food/beverage context', 'characters' and 'cue motivations' (social, excitement, reward and upset, punishment) and health-related (hunger/thirst, weight, healthy living).; and 'cue outcomes' (positive enjoyment such as from winning a prize or race; feeling better following the cue or providing aid to other people) and negative (pain or personal harm, disgust, physical grimacing, crying, excessive consumption, vomiting, harm to other people), or neutral. A total of 1155 food and beverage cues were recorded, totalling 4.8% of the total recorded period, averaging 13.2 s per cue. Sweet snacks

were the most frequent food cue (13.3%), followed by sweets/candy (11.4%). Tea/coffee was the most frequent beverage cue (13.5%), followed by sugar-sweetened beverages (13.0%; accounting for 25.0% of all beveragespecific placements). The outcome of the cue was positive in 32.6%, negative in 19.8%, and neutral in 47.5% of cases. The most common motivating factor associated with each cue was celebratory/social (25.2%), followed by hunger/thirst (25.0%). Comparison of UK and Irish placements showed both to portray high levels of unhealthy food cues.

They also indicate that during programming, no specific food or beverage brands were identified. This low level of food or beverage brand specification is consistent with previous work in this area: among the most popular US shows, only 6% of food items and 5% of drink items provide specific brand identification (citing Greenberg et al 2009). Brand appearances for most food industry companies, except for Coca-Cola, are relatively rare during prime-time programming aimed at young audiences.

The authors concluded that eating (particularly the ingestion of fatty and sugary foods and SSBs) is portrayed to children in an attractive and appealing light in TV programs.

- Roseman et al (2014; US; *content analysis*): Food references on US children's cable programming have almost doubled in recent years. Disney channels' show 16.6 food and beverage scenes per hour, contrasted with 6–9 on prime-time programming.
- Skatrud-Mickelson Adachi-Mejia et al (2012; US; content analysis) examined movie ticket receipts and number of brand appearances. Youth in the USA saw over three billion food, beverage or food-retail establishment (FRE) impressions on average, annually from 1996 to 2005. Those aged 12–18 viewed over half of all impressions, with PG-13-rated movies containing 61.5% of impressions. There were no significant trends in brand appearances by food, beverage or FRE impressions over the decade, although there was a decreasing trend in R-rated impressions for both foods and beverages, but not FREs.

- Sutherland et al (2010; cited in Uribe et al 2015; *content analysis*): Of the 20 most viewed movies between 1996 and 2005, 69% of them contained at least one food, beverage or retail food establishment brand. A total of 1180 brand placements were identified.
- Greenberg et al (2009; US): Portrait of food and drink in commercial TV series. A previous US study examined the content and presentation of food and drink across different TV program genres designated for different age groups and showed that unhealthy foods with high fat or sugar were significantly more prevalent in youthoriented shows than in adult-oriented shows. This study also showed that food and beverage cues occur most commonly outside the home, with human characters, most commonly a white adult male playing a major role within the program plot, and our results are consistent with this. However, by contrast with this other study, the current study found that food and beverage placements were more likely to be verbal and part of a meal; and social or celebratory motivations for food and beverage depictions within children-specific programming were most common.

Supporting evidence: observational studies

- A recent Australian survey among adolescents showed that the link between TV viewing and poor diet was strongest for children who were actually exposed to advertisements embedded within programs (in addition to those who watched the most commercial TV).
- Kelly et al (2015; <u>AUS</u>; cross-sectional survey): Four hundred and seventeen Australian children aged 10–16 years participated in an online survey, which assessed television viewing habits and consumption of 12 frequently advertised unhealthy food/drinks. After adjusting for age and SES, there was strong evidence of an increase in unhealthy food score, drink score and food/drink combined score, with increasing commercial TV viewing. The link between television viewing and poor diet was strongest for children who watched the most commercial television, and those who were actually exposed to advertisements embedded within programs (product placements).

Supporting evidence: experimental studies

- There are mixed findings from small laboratory studies for the effect of product placement on immediate brand awareness, attitudes and behavioural disposition towards EDNP foods/drinks.
- Uribe & Fuentes-García (2015; Chile; experimental): Among 483 Chilean children aged nine, 12 and 15 years old, the stimuli for the experiment consisted of four versions of the movie Richie Rich, with an edited version involving two scenes depicting product placements of McDonald's (all other placements were removed) serving as the experimental condition. The experimental condition also included commercial breaks, which in some instances included an advertisement for McDonald's: other advertised brands/products were selected as being of equal recall. Brand awareness and the behavioural disposition (toward junk food (product category) and McDonald's (brand)) increased when children were exposed to product placement (in comparison with the control group) and there was no significant difference in top-of-mind brand awareness (immediate brand recall) in terms of age. Older children (12–15 years) scored higher in brand awareness, but scored lower in behavioural disposition than nine-year-old children. The use of advertising and placement (synergy) increased the effect of these communication tactics on children.

Uribe & Fuentes-García summarised in the introduction to their article, that, in terms of product placement, there is some evidence in favour of an increasing brand recall among older children, another couple of studies that show no differences in terms of behavioural effects, and no studies examining the effect of placement on children's brand attitude. The only studies supporting the existence of a behavioural relationship between the exposure to brand placement and behavioural disposition toward it had been found using placement in video games (van Reijmersdal, Jansz et al 2010).

- Matthes & Naderer (2015; Austria; experimental): Almost all research on the effects of product placements on children has focused on brand attitudes or behavioural intentions. Drawing on the important difference between attitudes or behavioural intentions on the one hand and actual behaviour on the other, this paper tests the effects of brand placements on children's food consumption. Children from six to 14 years old were exposed to an excerpt of the popular movie Alvin and the Chipmunks, including placements for the product Cheese Balls. Three versions were created: one without placements, one with moderate placement frequency, and one with high placement frequency. Results showed that exposure to high-frequency product placements exerted a significant effect on snack consumption, but no effect on brand or product attitudes. These effects were independent of children's ages.
- Volmers (1995; US; experimental): Among a sample of children aged seven, nine and 11 years old, preferences after watching a film clip of the film *Lassie* (which includes different brands such as Pepsi, Casio, John Deere, American Gas, Quaker Oats, and Pennzoil); the children exposed to brand placements significantly increased their level of mention of the promoted brands compared to those in a control group (which watched the same film but without the scenes with the brand placements). However, the study did not detect a positive relationship between the exposure to product placement and a more positive attitude towards different brands. The study did not demonstrate a positive relationship between being exposed to a brand in a movie and the immediate behaviour of preferring it.
- Hudson and Elliott (2013; *experimental*): A sample of 225 children viewed the same television program, but with either healthy products or unhealthy brands digitally inserted. Post-viewing survey indicated strong spontaneous recall for the products placed, especially for the unhealthy products, and particularly among older children. This study detected that the presence of product placements of both unhealthy and healthy food products had only a modest influence on immediate behaviour.

Auty & Lewis (2004; experimental): Groups of school children aged six to seven years and 11-12 years were exposed to a brief film clip (from Home Alone): half of each class was shown a scene with Pepsi Cola being spilled during a meal, while the other half were shown a similar clip with no drink being spilled. Before subsequent interviews children were allowed to help themselves to Pepsi or Coke. Those who had seen the branded clip made a significantly different choice of drink. The responses to the interviews suggest that it is not simply exposure to the film but rather previous exposure together with a reminder in the form of recent exposure that affects choice. Age (and by implication processing skill) does not appear to be a mediating factor affecting choice, because implicit memory (mere exposure) seems to be more important than explicit recall.

Evidence of intervention effectiveness (self-regulation)

Outcome: Exposure

- In the US, brand placements were more likely among CBFAI self-regulatory signatory companies than non-signatories, and brand placements by Coca-Cola (a signatory) were frequent.
 - Speers et al (2011; US; CFBAI self-regulation; cited in Galbraith-Emami & Lobstein, 2013; post-only; comparison signatories vs. non-signatories): Analyses of product placements in TV programs showed that food-related brand appearances were seen by children 281 times. CFBAI signatories accounted for 224 of these brand placements (198 from Coca-Cola). Adolescents saw 444 food-related brand placements, of which 320 were from CFBAI signatories (269 from Coca-Cola). Brand appearances for most food industry companies, except for Coca-Cola, are relatively rare during prime-time programming with large youth audiences. Coca-Cola has pledged to refrain from advertising to children, yet the average child views almost four Coke appearances on prime-time TV every week.

ACTION:

Restrict use of persuasive techniques in TV advertising aimed at children

Descriptive evidence

Exposure of children to persuasive techniques in TV advertising

- A substantial proportion of TV advertisements to children contain persuasive elements and such advertisements are mainly associated with non-core foods/beverages.
- Jenkins et al (2014; Systematic Review): Most frequently reported persuasive marketing techniques used to promote food to children in 38 studies: 21 premium offers (free gift such as toy or card; competition; rebates; vouchers); 21 promotional characters; 20 nutritional and health claims; 17 theme of 'taste'; 17 emotional appeal of 'fun'. Premium offers were found in between 20–39% of food advertisements in Australia, often in association with fast foods (60% of advertisements in one Australian study) (Hebden et al 2011; Roberts & Pettigrew 2007; Hill & Radimer 1997; cited in Jenkins et al 2014; SR).
- Brindal et al (2013; *Review*): Techniques specifically designed to appeal to children in TV advertising include nutrition claims, promotional characters, and premium offers. These are used more for unhealthy than healthy foods.
- Kelly Halford et al (2010; AUS; content analysis) Kelly et al (2010): Nature and thematic content analysis of TV food advertising to children, compared across several countries (Australia, Brazil, Canada, China, Germany, Greece, Italy, Spain, Sweden, the UK, the US). Each of 13 research groups recorded programming for two weekdays and two weekend days between 06.00 and 22.00, for the three channels most watched by children, between October 2007 and March 2008. Food advertisements composed 11% to 29% of advertisements. Non-core foods were featured in 53-87% of food advertisements, and the rate of non-core food advertising was higher during children's peak viewing times. Most food advertisements containing persuasive marketing were for non-core products. Across all sampled countries, children were exposed to high volumes of television advertising for unhealthy foods, featuring child-oriented persuasive techniques.

- Hebden King et al (2011; Sydney; content analysis) examined marketing techniques used to market unhealthy foods and beverages to children on Sydney free-to-air TV. Advertisers' use of persuasive techniques generally did not differ by type of food advertised. Marketing techniques with greater prominence in unhealthy food advertising were palatability (54% of unhealthy food advertisements), convenience (52%), fantasy/imagination (28%), fun/happiness (17%) and cartoon characters (9%). Advertisements emotionally appealing to parents (24%) were significantly more likely to make general health or nutrition statements (38% vs. 17%), and appealed to children concurrently through fun/happiness and fantasy/imagination appeals. Children were depicted in advertisements as eating with friends or family, situated within the home and frequently snacking on less healthy foods. The range and complexity of these techniques complicate the restriction of their use in food advertising to children.
- Hebden King et al (2011b; AUS; content analysis): Advertisements broadcast on the six Australian subscription TV channels most popular with children were recorded over four days in February 2009. Persuasive techniques (promotional characters, premium offers and nutrition claims) were used to advertise non-core foods less frequently than core and miscellaneous foods.
- Kelly et al (2008; AUS; content analysis): Advertisements broadcast on all three commercial Australian TV channels were recorded for an equivalent one-week period in May 2006 and 2007 (714 h). Food advertisements were analysed for their use of persuasive marketing, including premium offers such as competitions and the use of promotional characters, including celebrities and cartoon characters. Advertised foods were categorised as core, non-core or miscellaneous foods. A total of 20,201 advertisements were recorded, 25.5% of which were for food. Significantly more food advertisements broadcast during children's peak viewing times, compared to nonpeak times, contained promotional characters (P < 0.05) and premium offers (P < 0.001). During programs most popular with children, there were 3.3 non-core food advertisements per hour containing premium offers, compared to 0.2 per hour during programs most popular with adults. The majority of advertisements containing persuasive marketing during all viewing periods were for non-core foods.

- Hill & Radimer (1997; AUS; *content analysis*): TV watched by children aged under 10 years. Twenty-seven hours of children's TV programs were viewed. Give-aways (20%) and messages relating to taste (16%) and fun (14%) were the main advertising strategies used to sell foods to children, with the notable exception of breakfast cereal advertisements.
- Exposure to food cues, messages, and themes that attract children to foods in TV advertisements for non-core foods is high.
- LoDolce Harris et al (2013; US; content analysis): Highsugar ready-to-eat cereals (RTEC) are the packaged food most frequently promoted in child-targeted food advertising on TV. Children viewed 1.7 advertisements per day for RTEC, and 87% of those advertisements promoted high-sugar products. The messages presented in high-sugar advertisements viewed by children were significantly more likely to convey unrealistic and contradictory messages about cereal attributes and healthy eating. For example, 91% of high-sugar cereal advertisements viewed by children ascribed extraordinary powers to these products, and 67% portrayed healthy and unhealthy eating behaviours.
- Castonguay et al (2013; US; *content analysis*): TV advertisements during children's programming in 2011. The majority of these advertisements (72%) promote foods of low nutritional quality, yet 53% employ a healthrelated message. Food companies assert that promoting physical activity in their marketing is encouraging children to maintain a healthy lifestyle.
- Pettigrew & Roberts (2012; AUS; content analysis): The study examined 93,284 TV food advertisements for depictions of violence/aggression, mocking, nagging, boredom, loneliness, food craving, mood enhancement, and the emotional use of food across 61 days of programming time. Sixteen percent of the advertisements contained negative themes, with mood enhancement and food craving being the most commonly depicted negative themes. Advertisements with negative themes were more likely to be for non-core foods and to be aired during children's popular viewing times than at other times.

- Cairns et al (2013; SR to Nov 2008): Themes used include taste, humour, action-adventure, fantasy, and fun.
- Roberts & Pettigrew (2007; AUS; Perth; content analysis): sample of TV food advertisements screened during children's morning TV programming. Across 28.5 hours of children's programming, 950 advertisements were aired, 212 of which were for food products (22.3%). The qualitative themes evident in the advertisements were the prevalence of grazing, the denigration of core foods, exaggerated health claims, and the implied ability of certain foods to enhance popularity, performance and mood.
- Hill & Radimer (1997; AUS; content analysis): TV watched by children aged under 10 years. Twenty-seven hours of children's TV programs were viewed. Give-aways (20%) and messages relating to taste (16%) and fun (14%) were the main advertising strategies used to sell foods to children, with the notable exception of breakfast cereal advertisements.
- Exposure of children to promotional characters in TV advertisements for food is high in Australia and most food advertisements using promotional characters are for non-core foods.
- Kelly et al (2008; AUS; content analysis): TV: Advertisements broadcast on all three commercial Australian TV channels were recorded for an equivalent one-week period in May 2006 and 2007 (714 h). Food advertisements were analysed for their use of persuasive marketing, including premium offers, such as competitions, and the use of promotional characters, including celebrities and cartoon characters. Advertised foods were categorised as core, non-core or miscellaneous foods. A total of 20 201 advertisements were recorded. 25.5% of which were for food. Significantly more food advertisements broadcast during children's peak viewing times, compared to non-peak times, contained promotional characters (P < 0.05) and premium offers (P < 0.001). The majority of advertisements containing persuasive marketing during all viewing periods were for non-core foods.

- Castonguay et al (2013; US; *content analysis*): The study analysed TV advertisements during children's programming in 2011. Nearly three quarters (73%) of food advertisements targeting children use a familiar character. Food companies assert that promoting physical activity in their marketing is encouraging children to maintain a healthy lifestyle.
- Jenkins et al (2014; SR; citing (Hebden et al 2011; Roberts et al 2012; Hebden et al 2011b; Roberts & Pettigrew 2007): Promotional characters (Ronald McDonald; Tony the Tiger); licensed characters (SpongeBob, Spiderman); unknown cartoon characters; celebrities or popular personalities including sports persons, health professionals or scientists are found to be common in Australia.
- Boyland et al (2012; UK; content analysis): Popular UK commercial broadcasting children's/family viewing were recorded for two days (6 am–10 pm) every month in 2008 and recordings were screened for advertisements. 18888 advertisements. Assessed use of persuasive appeals (fun, taste, health/nutrition), premium offers (giveaways, competitions, contests, vouchers), promotional characters (brand equity and licensed characters), celebrity endorsers, and website promotion in food advertisements. Promotional characters, celebrity endorsers and premium offers were used more frequently to promote non-core than core foods, even on dedicated children's channels. Brand equity characters featured on a greater proportion of food advertisements than licensed characters.

Supporting evidence: experimental studies

- A recent systematic review indicated there is 'good evidence' that the use of techniques such as premium offers (free gifts, toys, discounts, and competitions) promotes brand loyalty in children; and other persuasive techniques including the use of promotional characters, nutrition- and health-related claims, and appeals to taste and fun, increase children's recall and enjoyment of advertising, purchase-request behaviour, food preferences and consumption behaviour.
- Bernhardt et al (2015; US; experimental): Among 100 children aged 3–7 years shown advertisements that aired by McDonald's and Burger King on national US television between 2010–2011, premiums/tie-ins were recalled much more frequently than healthy food. Although all children's advertisements contained images of healthy foods (apples and milk) children were significantly less likely to recall seeing any food after viewing children's advertisements versus adult advertisements: the latter rarely included premiums/tie-ins.
- Jenkins et al (2014; *SR*): There is good evidence that the use of techniques such as premium offers (free gifts, toys, discounts and competitions) promotes brand loyalty in children; and other persuasive techniques including the use of promotional characters, nutrition- and health-related claims, and appeals to taste and fun, increase children's recall and enjoyment of advertising, purchase-request behaviour, food preferences and consumption behaviour.
- Castonguay (2014; US; *experimental*): This study investigated whether exposing children to a TV advertisement for a sugar-laden 'Frosted Flakes' cereal that depicts physical activities influences their perceptions of the promoted food as healthy and appealing differently than exposure to an advertisement for the same product without the depiction of physical activities. Exposure to advertising promoting an unhealthy food alongside portrayals of physical activity had an immediate strengthening effect on children's perceptions of the food's healthfulness. Likewise, younger children held more positive attitudes toward the promoted food when they viewed an advertisement associating it with

physical activities. However, children's attitudes toward and intentions to engage in any form of exercise did not differ as a result of the advertisement they had viewed, regardless of the child's age. The author considered that the findings are consistent with a growing body of research revealing that children respond favourably to food advertisements that associate a product with healthfulness; and contrast with food companies' assertions that promoting physical activity in their marketing is encouraging children to maintain a healthy lifestyle.

- Rose et al (2012; US; *qualitative experimental study*): A content analysis of TV advertisements targeting children documented the prevalence of fantasy appeals, including fantasies that centre on product ingredients, animals, and adventures. A qualitative analysis of eight and nine year-old children's responses to food advertisements revealed substantial variability in their understanding of advertising, inference of manipulative intent, and use of persuasion knowledge. An experiment among eight to ten year-old children found that fantasy was associated with positive attitudes toward an advertisement when perceived manipulative intent was low and negative evaluations when perceived manipulative intent was high.
- There is evidence from experimental studies (and child self-report) to suggest that TV advertisements endorsed by a celebrity can influence children's image of the advertised brand, their purchasing intentions and consumption of the product.
- Simões & Agante (2014; Portugal; *child self-report survey*): Purchase intentions among children aged seven to 11 years. Findings from a questionnaire completed by 334 children indicated that sponsorship can influence children's image of the advertised brand and their purchasing intentions, especially in the case of nonfamiliar brands. Additionally, our research suggests that sponsorship can affect the purchasing intention for lowinvolvement products, while brand image is more affected in the case of high-involvement products, contrary to our expectations. Moreover, results show that the majority of children do not recognise sponsorship's persuasive intent.

- Boyland & Halford (2013; UK; *Review*): Celebrity endorsements are effective at increasing children's preferences for the product¹⁰⁵ being promoted (cites Erdogan 1999; Ross et al 1984).
- Boyland et al (2013; UK; *experimental*): premium sports celebrity endorser. Children aged eight to 11 years from the UK, who viewed endorsed commercials or TV footage of a celebrity endorser outside a food context, consumed significantly more of the endorsed product. Data suggest that the ubiquitous nature of celebrity media presence may reinforce unhealthy eating practices in children, although research with other endorsers is needed.
 Walkers crisps. UK Gary Linkeker (footballer) Walker Crisps brand won broadcast award for 'consumer's favourite in the food and drink category'.
- Neeley & Schumann (2004; US; *experimental*): Experiments support 'previous' findings that, although character action and voice may influence a young child's attention to an advertisement, character and product recognition, and even a positive attitude toward the product; the relation between spokes-characters and a child's preference, intention and choice of a product is uncertain.
- Ross et al (1984; US, experimental): Two studies tested the effects of TV advertisements with celebrity endorsement on the product preference and understanding of eight to 14-year-old boys. Study 1 compared two advertisements for a model racer. One had celebrity endorsement (by a famous race driver) and footage of real automobile racing featuring the celebrity (live action); the second had neither feature. Study 2 employed one ad for a different brand of model racer edited to generate a 2 by 2 (endorser presence coupled with inclusion of live racetrack action) factorial design. A total of 415 boys were exposed to one of the experimental advertisements or a control advertisement, embedded in a new animated children's adventure program. Preference for the advertised brand of model racer (pre- and post-viewing) and a number of cognitive variables were assessed. Exposure to endorsement led to increased preference for the toy and belief that the celebrity was expert about the toy. Live action led to exaggerated estimates of the physical

properties of the toy and the belief that the advertisement was not staged. The eight to 10-year-olds associated the glamour of the endorser with the toy and were more reliant on his advice than were 11–14-year-olds. However, the two age groups were not differentially affected by the advertisements. Contrary to the speculation of many researchers, understanding about advertising intent and techniques and cynicism about advertisements had almost no influence on product preference after viewing.

Parental acceptability

- Parental acceptability of regulation around the use of persuasive elements in TV advertising of unhealthy food to children in Australia is high (one study).
- Morley, Chapman et al (2008; AUS; cross-sectional survey): A randomly selected sample of 400 parents of children under 14 years in all Australian States and Territories completed the cross-sectional telephone survey in March 2007. Parents were concerned about unhealthy food advertising to children (67.3%), use of popular personalities (67.7%), toys (76.4%), and advertising volume (79.7%). Older parents, of high socioeconomic status (SES), with fewer household TVs were more likely to be concerned. Only 47.4% of parents were aware of current regulations and those with a tertiary education were more likely to be aware: odds ratio (OR) 2.96 (95% CI: 1.55–5.65). Parents supported a change from selfregulation (92.8%), a ban on unhealthy food advertising to children (86.8%) and, to a lesser extent, a ban on all food advertising (37.3%).

¹⁰⁵Not restricted to food/beverage products.

Misleading depictions

• Bernhardt et al (2014; US; descriptive qualitative study under experimental conditions): This study was concerned with the depiction of apple slices (Fresh Apple Fries) by Burger King (BK). Whereas the product was sold packaged in a cellophane bag, children's BK advertisements depicted the apple slices in a container that resembled one used for french fries. A convenience sample of 99 children (age range 3 - 7 years) was shown depictions of healthy foods in fast-food advertisements that aired on TV from July 1, 2010, through June 30, 2011. They were then exposed to two still images drawn from the advertisements - for milk and apples. Children were asked what they saw and not prompted to respond specifically to any aspect of the images. Among the 99 children participating, only 51 (52%) and 69 (70%) correctly identified milk from the McDonald's and BK images, respectively, with a significantly greater percentage correct (P=.02 for both) among older children. The children's recall of apples was significantly different by restaurant, with 79 (80%) mentioning apples when describing the McDonald's image and only 10 (10%) for the BK image (P < .001). The percentage correct was not associated with age in either case. Conversely, although french fries were not featured in either image, 80 children (81%) recalled french fries after viewing the BK advertisement.

Of the 4 healthy food images, only depiction of apples by McDonald's was communicated adequately to the target audience. Representations of milk were inadequately communicated to preliterate children. Televised depictions of apple slices by BK misled the children in this study, although no action was taken by government or self-regulatory bodies.

Implementation examples

- Jenkins et al (2014; *SR*): This systematic review indicated that the many advertising codes and regulations around the world do not generally have similar rules around the persuasive content of such marketing.
- *Ireland* (Broadcasting Authority of Ireland 2012): Regulations issued recently by the Broadcasting Authority of Ireland prohibit endorsements of foods with high fat, sugar and salt content by celebrities, sports stars, TV program characters and characters from cinema releases. (Scully et al 2014)
- **Australia:** Some regulatory content rules limiting promotional or premium offers, the use of promotional characters and celebrities and nutritional health claims in food advertising targeted at children. [NOURISHING]
- UK: Boyland et al (2012; OfCom 2007): Regarding the use of characters and celebrity endorsement, the content rules stated that licensed characters ("those characters that are borrowed equities and have no historical association with the product") and celebrities popular with children may not be used in HFSS advertisements targeted directly at pre-school or primary school children. The prohibition does not apply to these (brand equity) characters, defined as "those that have been created by the advertiser and have no separate identity outside their associated product or brand". Regulations still permit the use of celebrities 'of general appeal' (appealing to all age groups).

Evidence of intervention effectiveness: government regulation

Outcome: Exposure

- Regulatory control in the UK led to a reduction in the use of persuasive elements (the use of promotional characters and other techniques known to appeal to children) on children's TV channels but this form of food advertising remained widespread on popular commercial channels during adult airtime/ sports channels; and these elements are more commonly associated with non-core foods on all channels.
- Boyland, Harrold et al (2012; UK; content analysis; postonly): This extensive analysis of television advertisements demonstrated that the use of persuasive marketing techniques to promote unhealthy foods was extensive in broadcasting popular with children despite regulations. In 2008, 54.8% non-core vs. 20.9% core foods featured a promotional character. In addition, of the food advertisements featuring promotional characters or celebrities, these advertisements were more likely to be promoting core foods on children's channels than on the sport channel (24.8% versus 11.1%; p=0.001). Promotional characters or celebrities were more likely to feature on non-core food advertisements on the sport channel than on children's channels (77.5% versus 61.8%; p=0.013). Further tests demonstrated that of the food advertisements featuring promotional characters or celebrities, a greater proportion were for non-core foods on children's channels than on family channels (61.8% versus 45.8%; p < 0.001). Promotional characters, celebrity endorsers and premium offers were used more frequently to promote non-core than core foods, even on dedicated children's channels. Brand equity characters featured on a greater proportion of food advertisements than licensed characters. A food brand website was promoted in a third of food advertisements (websites are not covered by the statutory regulation on food advertising).
- Ofcom (2010; UK; Statutory Reg; pre- post-; non-peer reviewed report¹⁰⁶; cited by Tymms 2012): Between 2005 and 2009, there was a reported decrease in the use of persuasive marketing techniques (such as licensed characters) in TV advertisements during children's airtime but an increase during adult airtime. There was a 100% decline in HFSS advertisement impacts on children during children's TV from 2005–2009. There was a 37% decline in HFSS advertisements during children's airtime; and a 1% reduction in children's exposure during adult airtime from 2005 to 2009; and a 129% increase in HFSS advertisement spots during non-children's TV.

Evidence of intervention effectiveness: industry selfregulation

Outcome: Exposure

- There was an increase in exposure to promotional characters in food and beverage advertisements on TV after self-regulatory pledges in Canada and the European Union.
- Potvin Kent et al (2014; Toronto, Canada; Canadian Children's Food and Beverage Advertising Initiative (CAI); *pre- post- content analysis*): Spokes-characters and licensed characters were used more frequently in 2011 compared to 2006.
- Effertz & Wilcke (2012; EU Pledge Jan 2009: *pre- post-study 2007/8 and 2010*): In both periods the use of persuasive marketing techniques was greater for non-core foods than for other foods (or for toys). While the use of premiums decreased compared with other commercials, the use of promotional characters in non-core food commercials increased, especially during children's programs.

¹⁰⁶Significant bias possible and/or criteria used to determine compliance may be limited.

Context/setting: fast food outlets — toy premiums/ giveaways

ACTION:

Restrict toy premiums or giveaways with unhealthy food/ beverages

Descriptive evidence

- Toy premiums or giveaways are present in many TV advertisements for fast food in the US.
- Bernhardt et al (2013; US; content analysis): Almost all of the 92 QSR children's meal advertisements that aired during the study period were attributable to McDonald's (70%) or Burger King (29%); 79% of 25,000 TV placements aired on just four channels (Cartoon Network, Nickelodeon, Disney XD, and Nicktoons). Visual branding was more common in children's advertisements vs. adult advertisements, with food packaging present in 88% vs. 23%, and street view of the QSR restaurant present in 41% vs. 12%. Toy premiums or giveaways were present in 69% vs. 1%, and movie tie-ins present in 55% vs. 14% of children's vs. adult advertisements. Median food image diagonal length was 20% of the advertisement diagonal for children's and 45% for adult advertisements. The audio script for children's advertisements emphasised giveaways and movie tie-ins whereas adult advertisements emphasised food taste, price and portion size. Children's QSR advertisements emphasised toy giveaways and movie tie-ins rather than food products. Compliance with self-regulatory pledges to focus on actual food products instead of toy premiums was not supported by this analysis.
- Elliott (2015; commentary): Although the concept developed slowly, 'fun' in association with children's food became increasingly prevalent. McDonald's applied the idea to fast food by introducing the Happy Meal into its US national menu in 1979. This well-known children's meal came in a colourful box adorned with games, jokes and puzzles, and with a toy. It was explicitly advertised on television as 'food and fun in a box' (McDonald's, 1979). It is worth noting that the ongoing popularity of this children's meal has allowed McDonald's to lay claim to being the largest toy distributor in the world (Industry News, 2011, p. 9). Moreover, despite the ongoing debate over the ethics of manipulating children to request fast food in order to get a toy, McDonald's has defended its 'fun food' approach. When McDonald's launched its Ice Age Happy Meal 'event' in the US market in 2009 with a collection of eight toys from the popular children's movie, McDonald's global chief marketing officer pointed to the Ice Age-themed wrapping found on packaged McDonald's Apple Dippers and its low fat white and chocolate milk. He affirmed that the Happy Meal event "reach[ed] kids in a fun and responsible way" ('Fun Heats Up,' 2009).
- Leibowitz et al (2012; *cited in Otten 2014*): For restaurants, including toys with children's meals is the leading form of food marketing directed at children by expenditure; amounting to \$341 million in 2009 in the US.

Supporting evidence: experimental studies

- There is mixed evidence from experimental studies regarding the effect of toy giveaways on food preferences and consumption when the toy is associated with a less healthy option.
- Gregori et al (2014; India; *experimental*): 1680 children were randomised to food exposure with or without a toy and then to TV viewing and advertising and *ad libitum* eating study. No effect on calories consumed (223kcal) after toy or no toy and no effect of TV advertising.
- Niven et al (2015; AUS; experimental): 904 Grade 1 and 2 students from Melbourne were randomly assigned to one of four conditions relating to healthy and unhealthy meals, with and without a toy premium. All participants were shown a trailer for a current children's movie followed by an advertisement for a McDonald's Happy Meal associated with that movie (Conditions 2–4) or an advertisement for a children's leisure activity (Condition 1). Participants were shown meal options on screen and asked to choose their preferred meal before completing detailed meal ratings. Children shown meals with no premiums, premiums with healthy and unhealthy meals, and premiums with only unhealthy meals were significantly more likely to select an unhealthy meal compared to children shown meals where only the healthy meal was accompanied by a premium. Healthy meals accompanied by a premium were rated more favourably relative to unhealthy meals on appearance, likelihood of asking their parents for the meal and how they would feel if their parents bought the meal for them. The results showed, therefore, that children are least likely to choose unhealthy meals when movie tie-in premiums only accompany healthy meals.
- Gregori et al (2013; Argentina, Brazil, Mexico; experimental): 600 children (balanced according to gender and age groups, 3–6 and 7–10 years old) were randomised in three school facilities and exposed to food (snacks) alone or food associated with toys in an experimental setting. All of the children received the same meal at lunchtime. The products were packages in which chocolate was associated with toys in an egg-shaped container partially filled by chocolate. The

children were asked to eat *ad libitum* for 20 minutes during the afternoon break. In addition, the children were randomised into two groups and either shown or not shown a movie cartoon, with three different levels of exposure to commercials in the TV viewing condition (one, two or three advertisements). No significant differences emerged between the 'toys' and 'no toys' groups even after taking into account exposure to TV, commercials and other confounding factors, i.e. two studies by the same authors under experimental settings did not indicate any effect of toys on caloric intake of children when allowed to eat *ad libitum*.

- Hobin et al (2012; US; *experimental*): A between-groups experimental study was conducted with 337 children aged 6–12 years attending day camps in Ontario, Canada. Children were offered one of four McDonald's Happy Meals® as part of the camp lunch program: two 'healthier' meals that met the nutritional criteria and two meals that did not. In the control condition, all four meals were offered with a toy premium. In the intervention condition, the toy was only offered with the two 'healthier' meals. Children were significantly more likely to select the healthier meals when toys were only offered with meals that met nutritional criteria (OR=3.19, 95% CI: 1.895 –.40). The effect of pairing toys with healthier meals had a stronger effect on boys than girls (OR=1.90, 95% CI: 1.14–3.17).
- McAlister & Cornwell (2012; experimental): These studies involved choice experiments showing the children pictures of the means with/without a toy pictured as a giveaway. Study 1, conducted among 85 children aged 3–5 years, and their mothers, addressed the role of collectible toys as premiums accompanying food offerings and showed that these premiums influence children's attitudes toward both unhealthful and healthful meal offerings. In Study 2, among 56 children aged 3–5 years, a choice task revealed that a healthful meal is favoured when it is paired with a collectible toy premium and the unhealthful meal is presented with no premium.

- McAlister et al (2011; US; *experimental*); Among 103 preschoolers the motivational pull of collectible toys can be very strong, with some children agreeing to pay the 'cost' of sharing with a confederate child in order to obtain a collectible toy. Most children demonstrated a desire to, and were capable of, exhibiting collecting behaviour, and preferred collectible toys over non-collectible toys.
- Hawkes¹⁰⁷ (2009; review): No studies were identified on the effects of the promotions often used to target EDNP foods to children and youth, such as collector and prize promotions.

Earlier studies are reported in various papers, including one by Miller and Busch (1979) who reported that inclusion of a premium in an advertisement for breakfast cereal affected children's likelihood of selecting the cereal in a choice task.

Evidence of intervention effectiveness

- Outcome compliance: Two implementation studies in the US indicate that toy ordinances resulted in the toys not being distributed or advertised in conjunction with unhealthy meals/beverages.
- Outcome food/menu reformulation: May have affected the promotion of healthier meals, but did not affect the number of healthful items offered, probably because the ordinance wording allowed toys to be sold separately.
- Outcome food prices: There was some indication (from a magazine article) that the toy ordinance led to fast-food outlets dropping the prices of children's meals.
- Otten et al (2014; US; *implementation evaluation*): San Francisco's toy ordinance (2011): first citywide ordinance to improve nutritional standards of children's meals sold at restaurants by preventing the giving away of free toys or other incentives with meals unless nutritional criteria were met. Parent-caregiver/child dyads (n=762) who were restaurant customers were surveyed at two points before and one seasonally matched point after ordinance

enactment at Chain A and B restaurants (n=30) in 2011 and 2012. Both restaurant chains responded to the ordinance by selling toys separately from children's meals, but neither changed their menus to meet ordinancespecified nutrition criteria. Among children for whom children's meals were purchased, significant decreases in kilocalories, sodium, and fat per order were likely due to changes in children's side dishes and beverages at Chain A. In conclusion although the changes at Chain A did not appear to be directly in response to the ordinance, the transition to a more healthful beverage and default side dish was consistent with the intent of the ordinance. Study results underscore the importance of policy wording, support the concept that more healthful defaults may be a powerful approach for improving dietary intake, and suggest that public policies may contribute to positive restaurant changes.

- Otten et al (2012; US; implementation evaluation): Aug 9, 2010, Santa Clara County CA became the first US jurisdiction to implement an ordinance that prohibits the distribution of toys and other incentives to children in conjunction with meals, foods, or beverages that do not meet minimal nutritional criteria. Affected restaurants showed a 2.8- to 3.4-fold improvement in children's menu assessment scores from pre- to post-ordinance with minimal changes at unaffected restaurants. Response to the ordinance varied by restaurant. Improvements were seen in on-site nutritional guidance; promotion of healthy meals, beverages, and side items; and toy marketing and distribution activities. In conclusion, the ordinance appears to have positively influenced marketing of healthful menu items and toys as well as toy distribution practices at ordinance-affected restaurants, but did not affect the number of healthful food items offered.
- Hess (2012; online commentary): Several Santa Clara fastfood outlets responded to the toy ban by dropping their kids' meal prices. (US Magazine article: http://magazine. good.is/articles/does-banning-toys-make-fast-foodhealthier; sighted 14 May 2015).

¹⁰⁷The review by Hawkes (2009) crosses all aspects of sales promotions and provides an in-depth examination of the effect of sales promotions on increased category sales and consumption and brand-switching in the short-term and the lack of evidence of the effect in the longer-term. Much of the data are not related to EDNP foods and drinks and cross all aspects of food (and other products) promotions. Some more (extensive) findings of this review are included in the retail domain. Domain.

Public support

Obesity Policy Coalition (citing previously unreleased research by Cancer Council Australia; http://www.opc. org.au/latestnews/mediareleases/pages/mr20110825. aspx#.Vma3HNJ95t8): Eighty-five percent of Australian grocery buyers want greater regulation of the use of toys and giveaways to market junk food to children.

Implementation examples USA

- In the US, CFBAI does not address 'Children's meals' or child-targeted marketing through toys or other premiums (Kolish 2011)
- In 2006, Disney ended its cross-promotional deal with McDonald's.
- In 2011, Jack in the Box announced it would no longer offer or market toys with its children's meals. (Satran J; 'Huffingdon Post June 22, 2011, cited by Otten (2014)).
- Similarly Otten (2014) indicated that Taco Bell announced in July 2013 that it would eliminate children's meals and toys/premiums from its menu over the next year.
- New York: New legislation would prohibit fast food chains from selling a toy with a meal that contains more than 500 calories (2090 kJ), or 600 mg of sodium (cited by Otten 2014).

Australia

 In Australia in 2011, KFC removed toys from their meals; McDonald's and Hungry Jack's did not remove their toys. McDonald's said they have already done a lot to offer healthier alternatives to children.

Context/setting: packaged products (retail)

ACTION:

Restrict use of persuasive elements on unhealthy food/ beverage packaged products targeting children

Supporting evidence: descriptive studies

Description

Hawkes (2010; narrative review): indicated that the use of packaging as a marketing vehicle is evidently increasing. Marketing analysts suggest two reasons for this. First, many food choices are made at the point of sale, so 'the package becomes a critical factor in the consumer decision-making process, because it communicates to consumers at the time they are actually deciding in the store'. Second, the nature of the food advertising market is changing. Estimates from the USA suggest that expenditure on food advertising is declining, and that other methods of marketing such as packaging now have greater weight in the marketing mix. It combines all the 'Ps' of marketing: the package contains the product, packages convey messages about product attributes to consumers as part of public relations, and often its price, while also carrying promotions. By combining all these different aspects, packaging has become an integral part of the product. The most obvious marketing technique used on packaging to attract children is promotions, like competitions, collector promotions and premiums. Many of these take the form of cross-promotions, in which manufacturers use the products of other companies such as animated characters and toys from TV, movies and Internet games to promote their own products. Other tie-ins are with 'branded' athletes, sports teams and events, theme parks, and charities. The US Federal Trade Commission recently reported that cross-promotions on

packaging are now a significant strategy used to market foods to children and adolescents.

In fact, one of the core principles of industry-led efforts to address marketing to children is that it should only concern promotions that target children directly, and (as shown in this paper) packaging is used to target children both directly and indirectly (via their parents) putting it outside the scope of the pledges (Hawkes 2010). As put by Unilever, packaging is excluded from their pledge on marketing to children because it is "primarily influential to the consumer at the point of purchase, when adults accompany very young children and make final purchasing decisions"¹⁰⁸.

In a real sense, the packaging has become the product. Changing the packaging would essentially be the same as changing the entire essence of the product. That makes intervening in packaging a politically more dangerous game than regulating advertising — and, potentially, even more effective.

Exposure

- A large proportion of packaged products aimed at children are marketed to children using a range of elements, particularly promotional characters.
- Musicus et al (2014; US; audit/survey): The inflection angle of spokes-characters' gaze on RTEC boxes make incidental contact with children or with adults, as they are placed on the shelves/in the aisles, respective to whom they are targeted. Eye contact increased feelings of trust and connection to the brand, as well as choice of brand over competitors.
- Mehta Phillips et al (2012; AUS; *audit/content analysis*) showed that in a supermarket in Adelaide, 157 discrete products were marketed to children via product packaging. Most (75.2%) represented non-core foods, being high in fat or sugar. Many marketing techniques (more than 16 unique marketing techniques) were used to promote child-oriented food products. A median of 6.43 marketing techniques per product was found.

¹⁰⁸Cf. sections of review (in Retail and Pricing domains) indicating the influence of young children on purchases at the supermarket, so-called 'pester power'

- Harris, Schwartz & Brownell (2010; US; *time series audit*): The use of cross-promotions on food packages targeted at children increased by 78% between 2006 and 2008 in the supermarket surveyed, and only 18% of the crosspromoted products met accepted nutrition standards. More than half of the cross-promotions appealed primarily to children between six and 12 years of age, and over one-fifth targeted pre-school children.
- Page, Montgomery et al (2008; US; *content analysis*): In a content analysis of 122 cereal product packages front panel characteristics, premium offers, cross-promotions, activity features, characters and celebrities, web sites, and other content features were assessed. The study found that cereal packaging contains a wide variety of features likely to enhance the impulsivity of children to choose a particular product at the point-of-sale (e.g. children's characters, appears ready-to-eat, games and other fun activities).
- Chapman et al (2006a; AUS; *audit*): In an audit of nine supermarkets in Sydney it was found that between 9% and 35% of food products used promotional tactics. The use of TV, movie celebrities and cartoon characters for promotion was most common, making up 75% of all promotions. Giveaways accounted for 13% of all promotions. When used, giveaways were commonly used in conjunction with another promotional method. Data from this study also confirmed that 82% of all food promotions were for unhealthy foods and only 18% were used to promote healthy foods. However, for dairy snacks and ice cream the majority of promotions, 99% and 65%, respectively, were healthier choices.

Supporting evidence

- A one-year study in the US showed, using sales data, that (TV and on-packet) advertised childtargeted RTE cereals were purchased 13 times more frequently than non-advertised products.
- Castetbon Harris et al (2012; US; *sales data/cross-sectional study of purchases in one year*): Compared with non-advertised products, child-targeted RTE cereals advertised via TV and on-packet were purchased thirteen times more frequently; family-targeted brand purchases were ten times higher; and adult-targeted cereals were purchased four times more frequently.

SUB-ACTION: Restrict use of promotional characters on unhealthy packaged foods

Supporting evidence: descriptive studies

Exposure

- Exposure to promotional characters on packaged foods is high in Australia and other countries and these characters, particularly licensed and companyowned characters, occur more frequently on less healthy products.
- Devi Eyles et al (2014; NZ; content analysis): In a survey of breakfast cereals in Auckland, 2013; 26% did not meet healthy criteria. Cereals for children were even less healthy. Of the 52 products (21% of total) displaying promotional characters, 48% were for 'cereals for kids' and of those 72% featured on 'less healthy' cereals. Previous studies found RTE cereals marketed to children have more sugar than those marketed to adults.

- Bragg Liu et al (2013; US; content analysis): This study examined 102 products (53 foods and 49 beverages) that had sports references as part of their packaging in the US: 72.5 % featured a character exercising, 42.2 % were endorsed by a professional sports entity and 34.0 % were child-targeted. The median nutrition score for food products was 36 (1=unhealthiest and 100=healthiest; scores of >/=63 are considered healthy according to this model). More than two-thirds of beverages (69.4 %) were 100 % sugar-sweetened. Children saw significantly more commercials for these products than adults.
- Jenkins et al (2014; *SR*): Promotional characters (Ronald McDonald; Tony the Tiger); licensed characters (SpongeBob, Spiderman); unknown cartoon characters; celebrities or popular personalities including sportspersons, health professionals or scientists have been found to be common in Australia (Hebden et al 2011; Roberts et al 2012; Hebden et al 2011b; Roberts & Pettigrew 2007).
- Hebden King et al (2011; AUS; *audit*): Three supermarket chains. Products featuring promotional characters on packaging (n=352) were predominantly less-healthful food and beverages (70%). Nutritional composition varied significantly by character type, with 69% of products with sportspersons, celebrities, or movie tie-ins being healthful, compared with 38% of licensed and 16% of companyowned characters.
- Chapman et al (2006a; AUS; *audit*): Nine supermarkets in Sydney: extent and nature of food promotion to children. The study found that within the seven food categories between nine and 35% of food products used promotional tactics. The use of TV, movie celebrities and cartoon characters for promotion was most common, making up 75% of all promotions. Giveaways accounted for 13% of all promotions. When used, giveaways were commonly used in conjunction with another promotional method. Data from this study also confirmed that 82% of all food promotions were for unhealthy foods and only 18% were used to promote healthy foods. However, for dairy snacks and ice cream the majority of promotions, 99% and 65%, respectively, were healthier choices.

Supporting evidence: experimental studies

- A substantial number of experimental (laboratory) studies have shown that promotional characters on packaged foods affect children's perceived taste and food preferences, and possibly food choices.
- Enax et al (2015; *experimental*): Among 179 primary school-aged children, presentation of yoghurt-cereal-fruit snacks presented with different packaging cues plain label, health label, or fun label featuring cartoon characters elicited different explicit preferences and effort provision (handgrip strength). Results showed that packaging cues significantly induce a taste-placebo effect in 88% of the children, i.e., differences in taste ratings for objectively identical products. Taste ratings were highest for the child-directed product that included cartoon characters. Also, applied effort to receive the child-directed product was significantly higher. The results confirm the positive effect of child-directed marketing strategies also for healthy snack food products.
- ¹⁰⁹Smits et al (2014; *Systematic review conducted Feb* 2014; 15 studies; 3–12 year-olds; 'The persuasiveness of child-targeted endorsement strategies: A systematic review'):
 - RQ1: Does a basic endorser effect exist? Yes, and diversity of study designs resulting in similar findings support the ecological validity of effect; cognitive measures were most often used for younger age ranges; choice or behaviour measures were more spread out over the age continuum from 3 to 12 years.
 - RQ2: Is the strength of the endorsement effect influenced by endorser type? Yes, but too little is known about the magnitude of the absolute endorsement effect for unfamiliar characters.
 - RQ3: Does the endorsement strength differ according to the type of food being promoted? Yes, but too few studies on actual food choice and consumption.

¹⁰⁹This article was sourced early 2015, and has not been fully assessed — it is a thorough review of the topic 'The persuasiveness of child-targeted endorsement strategies' and examines study type and therefore validity in depth. The reader is directed to the original article for a full appraisal.

- Danovitch & Mills (2014; US; experimental): This study noted that children are exposed to advertisements and products that incorporate familiar characters, such as Dora the Explorer and Bob the Builder, virtually from birth. Experiments (n=125) explored how four-year-olds evaluate messages from familiar characters and how their trust in a familiar character's testimony relates to their product preferences. Children endorsed objective and subjective claims made by a familiar character more often than those made by a perceptually similar but unfamiliar character even in situations where they had evidence that the familiar character was unreliable. Children also preferred low-quality products bearing a familiar character's image over high-quality products without a character image up to 74% of the time (whereas control groups preferred the low-quality products less than 6% of the time when they did not include a character image). These findings suggest that young children are powerfully influenced by familiar characters encountered in the media, leaving them vulnerable to advertising messages and clouding their judgments about products.
- Letona Chacon et al (2014; Guatemala; *experimental*): 121 children (mean age 7.4 years) from four (two preschool and two elementary) public schools tasted three food types: potato chips, crackers and carrots. Each was presented in two identical packages, except that one had a licensed character and the other did not. Children were significantly (P<0.001) more likely to prefer the taste of the foods inside the package with the licensed character compared with the one with no character. Most (66%) chose the food in the package with the character for a snack. Younger children (P<0.001) were more likely to prefer the taste of the food inside the package with the character.
- Kotler et al (2012; US; experimental): One experiment focused on children's self-reported preference, whereas the second focused on actual choice. The results of the experiments suggest that popular characters can make a difference in encouraging children to select one food over another. In the first experiment, children were more likely to indicate a preference for one food over another when one was associated with characters that they liked and with whom they were familiar. This effect was particularly strong when a sugary or salty snack branded

by a favoured character was competing with a healthier option branded by an unknown character or no character. Alternatively, when children were asked to choose between a healthy food and a sugary or salty snack, branding of the healthy food with a favoured character did not significantly change appeal of that healthy snack. However, when foods within the same category (i.e. two vegetables, two fruits, or two grains) were asked to compete against each other, character branding strongly influenced children's food choice. Findings from the second experiment suggest that children are more willing to try more pieces of a healthy food if a favoured character, in comparison with an unknown character, is promoting that food.

Keller Kuilema et al (2012; US; experimental): Two experimental studies examining the effect of foods packaged with or without a logo from a popular fastfood restaurant and to demonstrate the efficacy of using licensed (spokes) characters (cartoon characters) to package and promote intake of fruits and vegetables were conducted among 4-6 (n=43) and 7-9 (n=41) yearold children. The experiments showed that branding has an important influence on what and how much children eat, but that some children may be more susceptible to these influences than others. The presence of (fast-food) branding alone was associated with increased intake of laboratory test-meals in some children, particularly overweight 4–6 year-old children and 7–9 year-old girls. In addition, in a pilot intervention among 4-5 (n=16) vear-old children the authors demonstrated a possible role for use of licensed cartoon characters, fun and colourful packaging, and the use of 'premiums' or prizes placed within packaging, in increasing intake of healthful, traditionally un-marketed, fruits and vegetables in containers.

- Smits & Vandebosch (2012; Belgium; *experimental*): Among 6–7 year-olds, adding a spokes-character (a gnome, not a 'celebrity') to a food product increases the appetite, the wished-for frequency of consumption and the expected number of purchase requests for that product, for grapes and apples as well as for cookies and chocolate.
- Dixon Scully et al (2011; AUS; experimental): In a webbased choice experiment, parents (n=1551, of 5–12 year-olds) were more likely to choose an EDNP product if it included a sports celebrity endorsement (OR=2.37, 95% CI 1.70, 3.32; P < 0.001; among those who do not read the Nutrition Information Panel). Sports celebrity endorsements also enhanced parent's perceptions of typical consumers of the product, perceptions of product healthiness and quality, as well as purchase intention; especially among those who do not read the NIP.
- Lapierre Vaala et al (2011; New England US; experimental): Study with 80 children mean age 5.6 years; children who saw a popular media character on the packet/box reported liking the cereal more (mean [SD], 4.70 [0.86]) than those who viewed a box with no character on it (4.16 [1.24]). Those who were told the cereal was named Healthy Bits liked the taste more (mean [SD], 4.65 [0.84]) than children who were told it was named Sugar Bits (4.22 [1.27]). Character presence was particularly influential on taste assessments for participants who were told the cereal was named Sugar Bits. The authors concluded that the use of media characters on food packaging affects children's subjective taste assessment. Messages encouraging healthy eating may resonate with young children, but the presence of licensed characters on packaging potentially overrides children's assessments of nutritional merit.
- Roberto Baik et al (2010; US; *experimental*): Forty 4–6 year-olds tasted three pairs of identical foods (graham crackers, gummy fruit snacks, and carrots) presented in packages either with or without a popular cartoon character. Children significantly preferred the taste of foods that had popular cartoon characters on the packaging, compared with the same foods without characters. The majority of children selected the food sample with a licensed character on it for their snack, but the effects were weaker for carrots than for gummy fruit snacks and graham crackers. Branding food packages

with licensed characters substantially influences young children's taste preferences and snack selection and does so most strongly for EDNP foods.

- Ulger (2008; Turkey; *experimental*): This study compared between child-appeal packages and TV advertising and suggests that packages with cartoon trade characters play a more effective role compared to TV advertising in preschoolers' food preferences. Preschoolers who watched a cartoon film CD embedded with commercials (the treatment group) and who watched the same CD without commercials (the control group) selected the chocolate wafer with a cartoon trade character (73.6% vs. 26.3%) rather than the advertised one.
- Robinson, Borzekowski et al (2007; US; experimental) reported that children preferred the taste of food and drink items displaying the McDonald's branded packaging to identical products in matched, but unbranded, packaging. This was true even of items that were not available for purchase at McDonalds at the time, such as carrot sticks. Among 63 preschoolers aged 3.5–5.4 years showed that branding of foods (in this case McDonald's) influences young children's taste perceptions. Moderator analysis found significantly greater effects of branding among children with more TV sets in their homes and children who ate food from McDonald's more often. This, along with other studies, shows that those more exposed to advertising may be more susceptible.
- McNeal & Ji (2003; AUS; cited in Hawkes 2010): This study on the perception of breakfast cereal packaging by children showed that packaging helps to create brand awareness, because it "has the power to evoke images of its products, brand names and salient attributes from the memories of young, inexperienced consumers".
- Hill & Tilley (2002; UK; *qualitative; cited in Hawkes 2010*): A focus group study on breakfast cereals found that children can recognise the characters used on the front of breakfast cereal packs.

Evidence of intervention effectiveness

Outcome: Exposure

- Self-regulation regarding cross-promotions on food packaging in the US were ineffective at reducing exposure, which increased post- self-regulation.
- Adoption of the RCMI in Australia is low among those companies promoting heavily to children via characters on packaging; and occurs among those companies who are signatories.
- Harris et al (2010; US; CFBAI 2007; *pre- post-*): This study examined food packaging of all supermarket products with cross-promotions appealing to children for third-party products pre- and post- self-regulatory CFBAI. The number of these products increased from 96 to 171 over the years 2006 to 2008.
- Hebden King et al (2011; <u>AUS</u>; *audit*): In an audit of packaged foods in three supermarket chains; only 13 of the 75 companies using characters on packaging were signatory to the RMCI, suggesting that adoption of the self-regulatory initiative is low.

SUB-ACTION:

Restrict aesthetic elements of packaged food products aimed at children

Supporting evidence: experimental studies

 Branded packaging (especially that targeted towards children) can affect food preferences/ intended purchase

- Jones & Fabrianesi (2008; AUS; *choice experiment*): Findings from an examination of parents' perceptions of branded snack foods targeted at children in a major Australian city in an intercept survey (n=100) suggested that:
 - (i). adults' perceptions of advertised food products and, most importantly, purchase intentions for those products, differ according to the version of the advertisement seen (for three of the products, 42–54% would buy the product after seeing the child version compared with 82–84% after seeing the adult version).
 - (ii). adults clearly perceive distinctly different messages in advertisements for the same products which are targeting parents vs. those targeting children (e.g. for three of the products, 74–92% perceived that the adult version of the advertisement suggested the food was nutritionally beneficial compared with 2–14% perceiving this for the child version).

It is clear that the messages conveyed to children about specific foods are quite different to the messages conveyed to adults — and importantly parents — about the same foods.

Robinson et al (2007; US; *experimental*): Sixty-three children aged 3–5 years were provided with five pairs of identical foods and drinks from McDonalds, with one of the pairs being in branded McDonald's packaging and the other in plain packaging. The children consistently preferred the taste of the food in the branded packaging, even though it was exactly the same as the food in the plain packaging. [cited in Hawkes 2010]

- Colourful, attractive packaging affects children's food preferences, food purchase-requests, and perceived taste of food.
- Elliott Carruthers et al (2013; Canada; experimental): among preschool children aged 3–5 (n=65), five pairs of identical foods in packaging from McDonald's and in matched packaging that was either plain, Starbucksbranded, or colourful (but unbranded) were tasted. Children preferred the taste of foods wrapped in decorative wrappings, relying more on aesthetics than on familiar branding when making their choices. The findings suggest the need to explore questions beyond commercial advertising (and brand promotion) on TV and other media platforms. More attention should be directed at the important role of packaging in directing children's food preferences.
- Elliott et al (2008; Canada; *experimental*; cited in Hawkes 2010): The study indicated that children are affected by the look of food packages and the on-pack promotions. The results varied with age: younger children were more likely to choose a product because of cross-promotions, while older children were more influenced by the visuals of the package. Several of the children said that it was the colour of the packaging that attracted them to the product; and other studies by the same authors indicated that colours (especially green) and pictures on the front of the package also affected their beliefs about whether the product was healthy or not.
- Silayoi & Speece 2007; Silayoi & Speece 2004 (cited in Hawkes 2010): Package attributes such as colour and technological features have been found to affect product choice, depending on the type of consumer.
- McNeal & Ji (2003; experimental study; cited in Hawkes 2010): This study on the perception of breakfast cereal packaging — pre-dating the extensive use of front-ofpack symbols — found that children were not aware of the nutrition label, suggesting that visuals have a much more powerful impact in conveying the perception of healthiness to children.

Gelperowic & Beharrell (1994; UK; cited in Hawkes 2010): An older study from the UK found that attractive packages targeting children are likely to encourage them to pester their parents to buy the product. In the focus group study, mothers said they yield to this pressure if they perceive the product as being 'healthy'. Mothers also preferred colourful packaging of 'healthy' yoghurt relative to plain packaging and said that that colourful, captivating packaging is more likely to encourage children to try 'healthy' foods.
Context/setting: internet

ACTION:

Restrict advergames and other internet advertising of unhealthy food/beverages to children

Supporting evidence: descriptive studies

Review findings

- Bollars et al (2013; *Review conducted on behalf of the WHO*):
- Internet spending was indicated to comprise 20% of all money spent on food/beverage marketing in 2010 and it was expected to rise to 30% by 2015; by which time it was predicted to be worth some US\$38 billion out of a total US\$126 billion spent on all advertising in western Europe.
- Games include prompts for users to order home-delivery food while playing the game.
- Some sites offer videos of advertisements which, in countries such as Norway, Sweden or the United Kingdom, might be considered to be breaking the local regulations if the same advertisement were to be shown during children's TV. In the United States, one large company's advergames attracted over four million unique child visitors and a further three and a half million unique teenage visitors in 2009.
- Sites that offer social gaming (multi-player online games) are expected to grow rapidly. Although the games may or may not have embedded advertising, the sites can include banner advertising and other marketing messages showing the brand. Figures from the United States indicate that advertisers spent an estimated US\$192 million advertising on social game sites in 2011, a 60% increase over 2010 and predicted to rise by a further 40% in 2012.
- Various studies have found that production features like these encourage children to return to the website and to play the advergame multiple times, therefore maximising the players' interactions with the promoted brand.
- Advergames are designed to be amusing and engaging, demand focused attention from the player, and children are active seekers in their interactions with the content (Wise et al 2010). They are engaging with the brand.

Exposure

- Exposure to internet advertising, particularly advergames, is extensive and predominantly feature EDNP foods/beverages, contain persuasive elements and do not notify users of their commercial intent.
- Soontae & Kang (2014; *content analysis*) analysed 131 (top online gaming) websites for advergames, particularly for food, were presented. Very few websites made a distinction between advergames and general games. Only about 10% of the advergames notified users of their commercial nature via ad breaks during the game, and those breaks demonstrated potential problems in terms of visibility, content and readability. Furthermore, advergames featuring food products in the games tend to show foods high in calories and with low nutritional value.
- Soontae & Kang (2013; *content analysis*) analysed the format, content and characteristics of online ad breaks. The results showed that many websites do not provide any type of ad break. Furthermore, the content and characteristics of ad breaks revealed problems of low visibility, readability and deficiency in terms of stating the commercial intent of advergames.
- Weatherspoon Quilliam et al (2013; US; content analysis) identified 143 websites that marketed foods (n=439) to children aged 2–11 years via advergames. Foods were classified according to nutrition recommendations of USDA, FDA, CSPI, and the IOM. The websites advertised 254 meals, 101 snacks, and 84 beverages. Proportions of meals and snacks meeting USDA and FDA recommendations were similarly low, with the exception of saturated fat in meals and sodium content in snacks. Inconsistency in recommendations was evidenced by only a small proportion of meals and fewer snacks meeting the recommendations of all the agencies per their guidelines. Beverage recommendations were also inconsistent across the three agencies that provide recommendations (USDA, IOM, and CSPI). Most (65–95%) beverages advertised in advergames did not meet some of these recommendations. The overall results indicated that a large number of foods with low nutritional value are being marketed to children via advergames. A standardised system of food marketing guidance is needed to better inform the public about healthfulness of foods advertised to children.

- Landon (2013; UK; content analysis): A review of the nature and extent of marketing to children in the UK in 2010. Marketing effort is moving into new media, although traditional media such as TV remain important. The analysis of 63 food company websites show that food and drink marketing aimed at children and seen by children continues to be dominated by pre-sugared breakfast cereals, soft drinks, confectionery, savoury snacks and fast food outlets, and all of the brands use a variety of child-appealing techniques on product packaging such as licensed or equity–brand characters, free gifts, prizes and give-aways.
- Ustjanauskas et al (2014; content analysis): Display advertising on children's websites is a prominent technique to promote food to children. This study showed more than three billion advertisements on popular children's websites in a 12 month period (mid 2009mid 2010). Although portrayed by food companies as healthier dietary choices, 84% of the advertisements promoted products high in fat, sugar and/or sodium. Breakfast cereals and fast foods advertised most: 83% on just four websites. Advertisements for foods designated by companies as healthier dietary choices appropriate for child-directed advertising were least likely to meet independent nutrition standards.
- Cheyne Dorfman et al (2013; content analysis and website usage data) found that top breakfast cereal manufacturers (the third largest food marketers to children) maintain child-oriented websites, using strategies unique to the internet to capture and maintain children's attention. These include branded engagement techniques such as advergames, videos, site registration, and viral marketing, including inviting friends to join the site. The authors found three progressive levels of telepresence on child-targeted cereal websites: sites with more than one engaging feature, multiple techniques present on individual pages, and the construction of a virtual world. Using internet traffic data, the authors confirm that these techniques work: cereal marketers reach children online with lengthier and more sophisticated engagements than are possible with traditional, passive media such as TV advertisements or product packaging. Despite the cereal

manufacturer's self-regulatory pledge to improve their marketing to children, their marketing practices exploit children's susceptibility to advertising by almost exclusively promoting high-sugar cereals using deeply engaging techniques.

Thomson (2011; content analysis): A critical study of the contradictions of Millsberry.com, a General Mills (GM) advergaming website used to market GM's breakfast cereal brands to children. The paper takes a critical semiotic approach to argue that Millsberry. com sends players contradictory messages about health by simultaneously promoting nutritional wellness and consumption of high-sugar cereals, essentially conflating the two. Players on Millsberry.com create a virtual self (a buddy) who lives in the fictional town of Millsberry, and a buddy's health is tracked over time as players make nutritional choices for the buddy. Health on Millsberry equates to eating from multiple food groups (nutritional balance) and eating only until full (caloric moderation). Yet both of these health messages are essentially undermined by play on the site. Nutritional balance is undermined by both the excessive promotion of highsugar cereals and the differences between depictions of branded and unbranded foods. Caloric moderation is contradicted by digital advergames that operate on a logic of maximal consumption, by narratives of branded spokes-characters' endless appetites for cereal, and by giveaways of 'free' boxes of virtual cereal that can be eaten by the buddy in a single bite. The study concludes that such mixed messages about nutritional health are highly problematic.

- Martinez et al (2013; Sweden; *individual interviews; qualitative*): The 20 Swedish teenagers in this study had an ambivalent or negative view of online advertising; they reported avoidance tactics used in order to escape advertisements, but they also find it difficult to cope with advertisements due to their frequent appearance, colour and motion.
- Harris et al (2011; US; *exposure analysis*): This study showed that 1.2 Million children visit US food company websites with advergames every month, and spend up to one hour per month on some of the sites. They primarily promote candy, high-sugar cereals, and fast food. The study also found that children were 77% more likely to visit websites featuring advergames and spent 88% more time on these sites than other pages.
- Sandberg et al (2011; Sweden; *explorative study*): A study of 15-year-old Swedish teenagers aimed to discuss their exposure potential, actual, and perceived to online advertising. Eye-tracking technology showed that teenagers are exposed to 10% of all the potential advertisements, but that they are mainly unaware of this actual exposure. Food advertisements had the highest impact.
- Culp Bell et al (2010; content analysis): A content analysis was conducted of websites advertised on two children's networks, Cartoon Network and Nickelodeon. A total of 290 web pages and 247 unique games on 19 internet sites were examined. Advergames, found on 81% of websites, were the most predominant promotion strategy used. All games had at least one brand identifier, with logos being most frequently used. On average, websites contained one 'healthful' message for every 45 exposures to brand identifiers. These sites almost exclusively promoted food items high in sugar and fat.
- Harris et al (2009; *cited by Harris et al 2015*): Eight childtargeted advergame sites featured high-sugar cereals on most pages and typically incorporated the cereal as part of the game (e.g. creating bumper boats out of Fruity Cheerios or brand characters in an Apple Jacks racing game). The two most popular sites, Millsberry. com and Postopia.com, averaged 767,000 and 265,000

young visitors per month, respectively. Millsberry was especially engaging, featuring a virtual world where children could create their own avatar and explore a branded 'city'. Visitors averaged 66 per min per month on the site. In addition, cereal companies placed banner advertising on popular children's websites (e.g. Nick. com, Disney Channel) to drive traffic to their advergames. Furthermore, product packaging featured numerous messages to attract children's attention, such as promotions and brand characters on the front and games and advergame URLs on the back.

- Lingas et al (2009; US; content analysis): This study assessed the nutritional quality of food and beverage products advertised on 28 websites popular with children. Of the 77 advertised products for which nutritional information was available, 49 met the Institute of Medicine criteria for foods to avoid, 23 met criteria for foods to neither avoid nor encourage, and five met criteria for foods to encourage.
- Lee et al (2009; US; *content analysis*): This study examines how food marketers use advergames, custom-built and branded online games, to promote food products to children and provides the nutritional content of the food products featured in the advergames. The results reveal that food marketers use advergames heavily, with candy and gum or food products high in sugar most frequently appearing in the analysed games. Children are often invited to 'play with' the foods integrated as active game components. Finally, despite the educational benefits of interactive games, fewer than 3% of the games analysed in this study appear to educate children about nutritional and health issues.

- Kelly Bochynska et al (2008; AUS; content analysis): This study examined internet food marketing in popular children's websites and food product websites in Australia. Food product websites (n 119) and popular children's websites (n 196) were selected based on website traffic data and previous research on frequently marketed food brands. On food product websites these marketing features included branded education (79.0% of websites), competitions (33.6%), promotional characters (35.3%), downloadable items (35.3%), branded games (28.6%) and designated children's sections (21.8%). Some food manufacturers and fast food chain websites also feature a kids' club. Food references on popular children's websites were strongly skewed towards unhealthy foods (60.8% v. 39.2% healthy food references; P<0.001), with three times more branded food references for unhealthy foods. Branded food references displayed similar marketing features to those identified on food product websites. The authors concluded that internet food marketing uses a range of techniques to ensure that children are immersed in brand-related information and activities for extended periods, thereby increasing brand familiarity and exposure.
- Alvy & Carter (2008; cited in Bollars et al 2013; content analysis): A content analysis of four popular children's websites revealed that advergames utilised branded characters and other attention-getting features like animation, colourful text, and dynamic images to appeal to children.

- Cowburn & Boxer (2007; UK; *content analysis*): Among food advertising in UK children's magazines and the websites to which they were directed to, almost half of food advertisements directed readers towards Internet food marketing sites. They found evidence that these sites are using at least some of the 'marketing tricks' which have been identified as a cause for concern.
- Moore & Rideout (2007; systematic content analysis of food marketers' websites that either target children directly or contain content of interest to them): A content analysis of major food advertisers' websites found that 90% of the promoted brands were of poor nutritional quality, containing high levels of fat, sodium, and sugars that are unhealthy for children. The authors identified 11 online marketing practices of public policy relevance.

Recognition by parents

 Newman & Oates (2014; UK; *qualitative study*): Investigating parents' and children's understanding of food marketing communications in the UK, the authors found that parents attempt to counter food marketing messages across a wider range of communications than previously identified, but that newer media such as advergames and websites are not fully recognised as channels of food marketing.

Supporting evidence: experimental studies¹¹⁰

- A substantial number of experimental studies show that children are responsive to advergames and it is likely that playing an advergame increases affect (emotion) towards a product and increases energyintake while playing the games or immediately afterwards.
- Folkvord Anschűtz et al (2015; The Netherlands, experimental): This study examined the potential moderating role of attentional bias (i.e., gaze duration, number of fixations, latency of initial fixation) in the effect of advergames promoting energy-dense snacks on children's snack intake. A randomised between-subject design was conducted with 92 children who played an advergame that promoted either energy-dense snacks or non-food products. Eye movements and reaction times to food and non-food cues were recorded to assess attentional bias during playtime using eye-tracking methods. Children could eat freely after playing the game. The results showed that playing an advergame containing food cues increased total intake. Furthermore, children with higher gaze duration for the food cues ate more of the advertised snacks. In addition, children with a faster latency of initial fixation to the food cues ate more in total and ate more of the advertised snacks. The number of fixations on the food cues did not increase actual snack intake. Food advertisements are designed to grab attention, and this study shows that the extent to which a child's attention is directed to a food cue increases the effect of the advertisement.
- An et al (2014; Seoul; experimental): This study examined whether children (aged 8–9 years; n=129) recognised advergames as a type of advertising and the efficacy of an advertising literacy program. The experimental groups played an advertising literacy game and the control group played a science game before exposure to an advergame. Results indicated that without the advertising literacy education, about three-quarters of the children did not recognise advergames as a type of advertising. However, those with advertising literacy education showed a significantly enhanced understanding. Also, a series of

mediation tests showed that recognition of advertising was an indirect-only mediator between the advertising literacy and sceptical attitudes toward advertising. Only those who viewed the advergame as a type of advertising demonstrated more sceptical attitudes toward it.

- Rifon Quilliam et al (2014; *experimental*¹¹¹): Using a customized online game, these authors examined how food advergames exert their influence on children. The findings of the experiment demonstrate the effects of brand integration and interactivity (playing versus watching) on children's brand recall, attitudes, taste expectations, purchase requests and health perceptions for brands placed in a game. The results offer evidence that younger children are responsive to advergames and warrant additional study in this domain.
- Folkvord Anschultz et al (2014a; The Netherlands; experimental): This study examined impulsivity, advergames and food intake among 261 children aged 71 –0 years who played an advergame promoting either energy-dense snacks or non-food products. As an extra manipulation, half of the children in each condition were rewarded for refraining from eating, the other half were not. Children could eat freely while playing the game. Overall, playing an advergame containing food cues increased general caloric intake. Furthermore, rewarding children to refrain from eating decreased their caloric intake. Finally, rewarding impulsive children to refrain from eating had no influence when they were playing an advergame promoting energy-dense snacks, whereas it did lead to reduced intake among low impulsive children and children who played non-food advergames. The advergame promoting energy-dense snacks overruled the inhibition task to refrain from eating among impulsive children, making it more difficult for them to refrain from eating. The findings suggest that impulsivity plays an important role in susceptibility to food advertisements.

¹¹⁰A study conducted among adults: Van Reijmersdal et al (2015; The Netherlands; experimental): The aim of this study was to investigate whether the effects of advergame disclosures ('e.g. This game contains advertising for Bachelors Noodles to influence you') were moderated by gamers' moods. The effects of disclosures on brand recall, game attitude, and brand attitude via activated persuasion knowledge were examined to determine if they were different for people in positive moods than in negative moods. An experiment (n=127 Dutch people aged 177 –9-79 years) showed a moderated mediation effect: advergame disclosures activated persuasion knowledge, which resulted in higher brand recall, but also in more negative game and brand attitudes. This mediated effect was only significant for people in positive moods: a disclosure raised awareness of the advergame's persuasive nature, which subsequently led to more critical processing. People in negative moods already processed the advergame in a critical manner.

111 Experimental study in this section generally relates to a simulated experimental condition such as use of a customised online game or games conducted under laboratory/controlled conditions

- Folkvord Anschutz et al (2014; The Netherlands; experimental): Gaze duration and latency of initial fixation of children on food cues while playing an advergame was associated with increased intake of the advertised snacks post-playing, i.e. the extent to which a child's attention is directed to a food cue increases the effect of the advertisement.
- Blades Oates et al (2013; *narrative*): Much marketing aimed at children is now via the Internet and little is known about children's awareness of advertising on the web. One important component of understanding advertisements is the ability to distinguish advertisements from other messages, and the authors suggest that young children's ability to recognise advertisements on a web page is far behind their ability to recognise advertisements on TV.
- Owen et al (2013; UK; *qualitative; interviews* combining open-ended and cued response formats to questions about the nature, extent and understanding of different types of advertising): Among 134 grade 2 and grade 5 students, children demonstrated a significantly more sophisticated understanding of TV advertising compared with non-traditional advertising. Embedded advertising practices (movie and in-game brand placement) were most difficult for children to understand. Thus, children appear to have limited knowledge of alternative marketing tactics and consequently lack the cognitive skills to evaluate them critically.
- Folkvord Anschutz et al (2013; The Netherlands; *experimental*) examined the effect of advergames that promote energy-dense snacks or fruit on children's ad libitum snack and fruit consumption and to examine whether this consumption differed according to brand and product type (energy-dense snacks and fruit). 270 children aged 8–10 years. The main finding was that playing an advergame containing food cues increased general energy intake, regardless of the advertised brand or product type (energy-dense snacks or fruit), and this activity particularly increased the intake of energy-dense snack foods. Children who played the fruit version of the advergame did not eat significantly more fruit than did those in the other groups.

- Cornish (2014; UK; qualitative, exploratory study): Fortytwo in-depth interviews among parents with children aged 5–12 years in the UK showed that parents have limited understanding of the effectiveness of online advertising and this restricts their ability to protect their children from online marketing endeavours. Parents recognise online persuasive techniques only when they themselves have been exposed to them (e.g. banners, pop-up advertisements) and are often unable to appreciate more subtle marketing techniques in their persuasive capacity (e.g. advergames). In addition, they erroneously believe that children respond to online marketing the same way adults do. Finally, parents display naivety in their conviction that their children would never be taken in by marketers but, paradoxically, this complacency is only limited to online advertising.
- Blades et al (2013; UK & Indonesia; *experimental*) invented a number of websites to see if children can identify advertisements. In contrast to the adults, children had difficulty identifying the advertisements (which included food products). Six-year-olds only identified just over a guarter of the advertisements, eight-year-olds identified about half the advertisements and 10-year-olds identified about three-quarters of the advertisements. Carried out in the UK and then in Indonesia (with the same web pages translated). Neither country had any specific regulations about advertising to children on web pages. The Indonesian children were the same age as the children in the UK, but had less experience of the web (Ali et al 2009), and found that performance for equivalent age groups in both countries was very similar. A similar study among Chinese children – seven-year-olds only identified about half of the advertisements; nineyear-olds' could identify most of the advertisements. The adults (who almost always identified the advertisements correctly) usually gave several different reasons why each image might be an advertisement and the majority of the adults' reasons referred to the text of the image, and/or the persuasive nature of the image, and/or the fact that the image contrasted with the rest of the page. In contrast to the adults, the children often only suggested a single reason for identifying each image as an advertisement, and their reasons included much more

subjective justifications. The youngest age group reported that they were guessing, or that they pointed to an image because they liked it, or that they thought they had seen it somewhere else (even though the advertisements on our web pages were invented ones). The nine- and 11-year-olds sometimes gave more sophisticated reasons for identifying an advertisement, but nearly half of the reasons given by these two age groups were that they liked the image or that they (incorrectly) thought they had seen the image before. This study cited a study by Ali et al (2009) which showed that the presence of price information helped older children to identify web advertisements.

- Van Reijmersdal et al (2012; The Netherlands; experimental): This study examined the effects of three factors typically associated with advergames: brand prominence, game involvement, and (limited) persuasion knowledge on cognitive and affective responses. An experiment among seven to 12 year-old children (n = 105) showed that brand prominence and game involvement influenced children's responses, while persuasion knowledge did not. Brand prominence led to increased brand recall and recognition, whereas game involvement led to more positive brand attitudes. The effect of game involvement was mediated by game attitude, indicating that children are susceptible to affective mechanisms induced by the game. Crucially, the results demonstrated that brand prominence evokes cognitive responses, while game involvement leads to affective responses. The study also revealed that persuasion knowledge (i.e. knowledge of the commercial source of the game and its persuasive intent) did not influence cognitive or affective responses to the brand or game. This implies that even if children understand the game's commercial and persuasive nature, they do not use this knowledge as a defence against the advergames' effects.
- Redondo (2012; US; experimental) examined three versions of a casual advergame created and posted on a popular website. Two of the versions contained embedded advertisements for M&Ms — one more conspicuous than the other. The third version had no advertisement. Among 405 adolescents. The positive affect induced by the casual advergame transferred to M&Ms when it was not inhibited by negative reactions to the brand placement. The transfer of affect occurred after both a brief exposure to the prominent placement and a long exposure to the subtle placement, but no transfer was observed under the opposite set of conditions. Significant transfer in female adolescents but the absence of transfer in their male counterparts suggests a strong gender bias. There are two implications for marketers who want to persuade adolescents through casual advergames. First, these marketers should segment their casual advergames by designing subtle placements for games with lasting appeal and prominent placements for games with brief appeal. Second, to strengthen male adolescents' brand preferences, marketers should not focus on casual advergames but search for more appropriate entertainment vehicles.
- Choi & Lee (2012; *experimental*) examined whether the use of an animated spokes-character embedded in online game affects the persuasiveness of advertising. Specifically, this study looks at how product types moderate the magnitude of such effects. The results show a significant interaction effect between character presence and product type on both brand attitude and purchase intention. The effects of an animated spokescharacter on brand evaluation and purchase intention were more pronounced for utilitarian products than for hedonic products.

- Harris et al (2011; US; *experimental*): Among 152 children aged 71 –2 years, children who played advergames promoting unhealthy foods consumed 56% more unhealthy snack foods and consumed one-third fewer fruits and vegetables than children who played the control and healthy games. Children who previously played advergames were affected the most; older and younger children were similarly affected. Advergames encouraging healthy eating did increase fruit and vegetable consumption: however, only one website in the analysis used advergames to promote primarily healthy foods. These findings support the need for restrictions on companies' use of advergames to market nutritionally poor foods to children.
- Hernandez & Chapa (2010; US/Mexico; experimental): This study examined factors affecting Mexican adolescents' brand recognition and choice of snack products contained in advergames. Recognition tests and snack choice procedures were conducted where three issues were examined:
 - (i). the effect of product and electronic media experience on adolescents' memory;
 - (ii). the effect of positive affect (liking) of both product and advergames on adolescents' memory
 - (iii). exploration of the effect of positive affect, experience, and enhanced memory, on adolescents' product choice.

Multivariate analyses revealed that adolescents who exhibited positive affect toward both advergames and featured food products demonstrated elevated recognition performance. The positive effect of product experience on memory was confirmed. Interestingly, familiarity with videogame consoles enhanced adolescents' brand recognition scores as compared to television watching or computer usage. Among the participants, more than 65% selected snacks were promoted on advergames over other snacks. The difference was statistically significant. A positive relationship between liking, enhanced memory and snack choice was found. The findings suggest that promotion of snack brands in advergames has the potential to influence not only adolescents' memory but also choice.

- Pempek & Calvert (2009; experimental): Children in the treatment conditions played a less healthy or a healthier version of an advergame twice before choosing and eating a snack and completing the experimental measures. Children in the control group chose and ate a snack before playing the game and completing the measures. Both groups comprised black American children aged 9–10 years. Children who played the healthier version of the advergame selected and ate significantly more healthy snacks than did those who played the less healthy version. Children reported liking the advergame.
- Ali et al (2009; UK and Indonesia; experimental): For TV, children can distinguish advertisements from programs by about five years of age. However, less is known about understanding of website advertisements among young children. In this study children were shown printed copies of invented web pages that included advertisements, half of which had price information, and asked the children to point to whatever they thought was an advertisement. Two experiments were conducted to test a total of 401 children, aged six, eight, 10 and 12 years of age, from the United Kingdom and Indonesia. Six-year-olds recognised a quarter of the advertisements, eight-year-olds recognised half the advertisements, and the 10- and 12-year-olds recognised about three-guarters. Only the 10- and 12-year-olds were more likely to identify an advertisement when it included a price. The authors contrast their findings with previous results about the identification of television advertising, and discuss why children were poorer at recognising web page advertisements.
- Mallinckrodt & Mizerski (2007; <u>AUS</u>; *experimental*): A sample (n=295) of five- to eight-year-old children participated in an experiment, which included a control group, where the treatment group played a 'Froot Loops' cereal advergame that made a superiority claim for the cereal compared to fresh fruit. Measures of their responses to the brand featured, as well as their level of persuasion knowledge, were collected. Although the treatment group failed to believe Froot Loops were healthier than fruit, the older children in the group reported significantly higher preference for the brand over other cereals and other food types. No differences in intentions to request the cereal were found. Children's preferences for the Froot Loops brand were not associated with their persuasion knowledge about the advergame.

Evidence of intervention effectiveness

Outcome: Exposure¹¹²

Self-regulatory pledges in the US and Canada have not reduced advertising of unhealthy foods on company websites/advergames; and exposure is more prevalent among signatories than nonsignatories in the US.

US

- Cheyne Dorfman et al (2013; *post-only*) found that top breakfast cereal manufacturers (the third largest food marketers to children) maintain child-oriented websites, using strategies unique to the internet to capture and maintain children's attention. Despite the cereal manufacturer's self-regulatory pledge to improve their marketing to children, their marketing practices exploit children's susceptibility to advertising by almost exclusively promoting high-sugar cereals using deeply engaging techniques.
- Quilliam et al (2011; cited in Galbraith-Emami & Lobstein 2013; *post-only*): Analysis of advergames on websites of CFBAI signatories vs. non-signatories, 2009. Of 70 advergames for children on sites owned by CFBAI-signatory companies, 55 promoted only unhealthy foods, nine healthy foods, and six both healthy and unhealthy foods. Of 30 advergames for children on sites owned by non-CFBAI signatory companies, 16 promoted unhealthy foods, 11 healthy foods, and three healthy and unhealthy foods.

Canada

 Potvin Kent et al (2013; comparison study; self-regulation (CAI; English-language) vs. regulation (French-language)): There were statistically no fewer French language (Quebec) websites (n=22) with child-directed content compared to English language websites (n=27). There were no statistically significant differences in the number of the various marketing features, or in the average number of marketing features between the English and French websites. There were no fewer CAI websites (n=14) with child-directed content compared to non-CAI websites (n=13). Neither statutory regulation nor self-regulation reduced the number of websites with child-directed advertising content, although self-regulation did increase the number of websites with healthy messages and child protection features.

Brady et al (2010; *post-only*): authors examined the website content (24 websites) of 10 food manufacturers signed up to the self-regulatory CAI January 2008, for content aimed at children <12 years old. Twenty-three of the 24 sites showed product logos and/or packs. The large majority of sites targeted children younger than 12 (83%). An array of innovative online marketing techniques, most notably free website membership (63%), leader boards (50%), advergames (79%), and branded downloadable content (76%), were used to encourage children's engagement with branded food and beverage promotions. Eighteen sites promoted confectionery, eight sites sweetened breakfast cereals, eight sites milk and alternatives, five sites potato chips, four sites meat and alternatives, three sites crackers, two sites soft drinks, two sites F&V, one site each for sports drinks, fast food and cookies. These sites therefore promoted products that did not feature in the Canadian guidance for healthy eating, thereby contradicting the spirit of the CFBAI.

Implementation examples

- South Korea: High-calorie food with low nutritional value may not be advertised to children up to 17 years of age on the internet using gratuitous gifts other than food which may entice children to buy such foods; an example of gratuitous gifts are toys (Article 10 of the Special Act on the Safety Management of Children's Dietary Life 2008, amended several times since). [NOURISHING]
- Cicchirillo & Lin (2011; cited in King 2012): Additional managerial implications for ethical practices include advertising literacy education programs to help children understand the persuasive nature of advertisements and the addition of direct links to nutritional sites within the company's advergames.

¹¹²Harris et al (2011; US CFBAI): This experimental study of advergames cites two noteworthy limitations in the companies' self-regulatory pledges. First, the CFBAI only sets nutrition criteria for foods advertised to children younger than the age of 12, which is typically defined as advertising that appears in the media with a child audience composition of 35% or higher. This definition is inapplicable to Internet marketing, as audience compositions are lower for even obvious child-targeted websites. Therefore, participating companies are able to market to children, while still meeting the terms of their CFBAI company pledges. The second limitation regards the CFBAI's permission for participating companies to market 'better-for-you foods' as long as their nutritional criteria matched the government guidelines and recommendations.

Public support for non-broadcast media marketing

- Parental support in Australia for government restriction of the use of non-broadcast media marketing of unhealthy food to children is high (one study).
- Kelly et al (2009; parent survey): Parental awareness and attitudes of food marketing to children: A community attitudes survey of parents in New South Wales, Australia. The majority of parents were concerned about food marketing to children, with the highest level of concern registered for the positioning of food at supermarket checkouts (83% of parents concerned). Parental awareness of certain non-broadcast media food marketing (e.g. print, radio and premium offers) to children was low. The majority of parents (91%) did not trust the industry to protect children from food marketing. Most parents (81%) believed that the government should restrict the use of non-broadcast media marketing of unhealthy food to children.

ACTION:

Restrict advertising of unhealthy food/beverages via social media

Supporting evidence: descriptive studies

- Two studies conducted in Australia and a systematic review indicate that food marketing on Facebook is extensive and uses common marketing techniques that are both unique to social marketing sites and common to other marketing mediums. Adolescent and young adult Facebook users appear most receptive to engaging with this content, as indicated in one study in Australia.
- Kelly Vandevijvere et al (2015; AUS, NZ; *Review and descriptive study*): New media marketing includes promotions on company-owned and third-party websites

(not owned by the company), social media, email, and marketing via mobile devices through text messages, applications (apps), and branded games. Mobile devices also allow advertising messages to be context-aware, by linking with location tracking software. This review paper, focused particularly on monitoring opportunities, also presents the findings of a not-yet-published study examining the nature and extent of food marketing on a popular social networking site in New Zealand. The 'newsfeed' was documented from the posts of 20 major food and beverage companies (commonly advertised on TV and mostly for energy-dense nutrient poor foods and drinks). The results revealed that food marketing on Facebook was extensive, highly interactive and characterised by a range of potentially powerful persuasive techniques unique to this marketing medium. Over the study period, 468 promotions for the 20 food brands were identified. Common marketing techniques used to promote foods on Facebook included: interactive components (with links to web pages, frequent requests for 'comments', 'likes' and 'shares', conversations between brands and consumers and the occasional use of voting polls); promotions (most commonly competitions, giveaways and new product promotions); cross promotions (linking in with other new media via advertisements on YouTube, and links to company food brands and specific advertising campaign websites). As well, promotional techniques common to other marketing mediums, such as television, were also evident and included the use of promotional characters and nutrition claims.

Freeman et al (2015; AUS; commentary and narrative review): A narrative review of the issues surrounding young adults and food marketing indicates that factors such as identity development and shifting interpersonal influences differentiate young adulthood from other life stages and influence the adoption of both healthy and unhealthy eating behaviours. EDNP food and beverage marketing campaigns use techniques to normalise brands within young adult culture, in particular through online social media.

- Freeman et al (2014; AUS; content analysis): assessed the amount, reach and nature of EDNP food and beverage marketing on Facebook, among 13 international pages and 14 Australian-brand pages of which four companies had both national and international pages (Coca-Cola, Subway, Slurpee, Maltesers). Pages widely used marketing features unique to social media that increase consumer interaction and engagement. Common techniques were competitions based on user-generated content, interactive games, and apps. Four pages included apps that allowed followers to place an order directly through Facebook. Adolescent and young adult Facebook users appeared most receptive to engaging with this content.
- Galbraith-Emami & Lobstein (2013; Systematic Review): Online advertising includes advertising within search engines and 'pop-up' advertising, but this is by no means the only form of digital media being exploited for product promotion. The use of social networking sites for advertising and brand promotion has also increased rapidly: global expenditure on advertising on social networking sites reached an estimated \$US5.5bn in 2011 and is predicted to reach \$US10bn annually by 2013. The use of social media for marketing is founded on evidence that it can increase advertisement recall, awareness of the product or brand and purchase intent.

With 56,000 new fans joining it daily, Coca-Cola's fan page was rated the 11th most popular in the world in mid-2011, with a total of nearly 32 million 'fans'. It was the only food-related product with such a high ranking, the next-placed product being Starbucks with 23 million fans, having gained 13 million in a year. Although some social media sites require users to declare their age as being over 13 years, there is good evidence that younger children routinely access these sites: 33% of children aged 8–12 years in the UK have a profile on Facebook or on a similar site with a hypothetical 13 years of restriction.

Supporting evidence: observational studies

- Empirical data indicate that advertising of carbonated soft drinks (CSDs) via social media and subsequent conversations around brands and the nutritional aspects of CSDs affects beverage branding and choice (one US study).
- Liu & Lopez (2014; *demand modelling study*): A random coefficient, discrete choice model of consumer demand was formulated that includes social media conversations and Nielsen sales data on carbonated soft drinks (CSDs) to social media conversations on Facebook, Twitter, and YouTube. Consumers' conversations about brands and nutritional aspects of CSDs were shown to have a significant impact on their valuation of brand characteristics and ultimately on their choices of CSDs.

Context/setting: children's print media

ACTION:

Restrict advertising of unhealthy food/beverages in children's magazines

Supporting evidence: descriptive studies

- Food marketing in Australian magazines is mainly for non-core (EDNP) foods and are generally not clearly identified as advertisements.
- No, Kelly et al (2014; NZ; content analysis): Examined the nature and extent of unhealthy food marketing and non-branded food references in magazines targeted at and popular among children and adolescents 10–17 years old in NZ. A content analysis was conducted of all food references (branded and non-branded) found in the five magazines with the highest readership among 10-17 year olds, and the three magazines (of which two were already included among the five most popular magazines) targeted to 10–17 year olds. Branded food references (30% of total) were more frequent for unhealthy (43%) compared to healthy (25%) foods. Magazines specifically targeted to children and adolescents contained a significantly higher proportion of unhealthy branded food references (n = 51/71, 72%) compared to the most popular magazines among children and adolescents (n=133/317, 42%), of which most were targeted to women. 'Snack items' such as chocolates and ice creams were marketed most frequently (n = 104; 36%), while F&V were marketed the least frequently (n=9; 3%). Direct advertisements accounted for 27% of branded food references and 25% of those featured health or nutrition claims. In summary, both branded and non-branded food references were common within magazines targeted at and popular among children and adolescents, and skewed toward unhealthy foods.
- Jones Gregory et al (2012; AUS; *content analysis*): Examined all issues of Australian children's magazines published in the calendar year 2009 for references to foods or beverages. Approximately 16% of the 1678 food references identified were portrayals of branded food products (or food brands). However, only 83 of these 269 were clearly identified as advertisements. Of these 269 branded food references, 86% were for non-core

(broadly, less healthy) foods, including all but seven of the advertisements. Of the branded food references, 31% were in advertisements, 39% were in editorial product placements, and 25% were in competitions and puzzles.

The authors concluded that recent reductions in televised promotions for non-core foods, and industry initiatives to reduce the targeting of children, have not carried through to magazine advertising.

- Jones & Reid (2010; AUS; content analysis): Possible food promotions in seven top-selling Australian children's magazines published in 2005. In addition to regular food advertisements, the number of advertisements for premiums, editorials, puzzles or games, competitions and branded non-food promotions by food companies was recorded. Only 58 out of the 444 items identified could be classed as regular food advertisements. Several advertisements appeared to be in breach of codes regarding advertising to children and premiums. The pervasiveness of covert food marketing in the present study was contrary to previous findings and raises questions about the effectiveness of legal restrictions and self-regulation of advertising in protecting children from commercial food messages that may not be regarded as advertising.
- Kelly & Chapman (2007; AUS; content analysis): conducted a content analysis of 16 popular Australian children's magazines. There were a high number of overall food references within the children's magazines, with the majority of these being for unhealthy food products (63.7% unhealthy versus 36.3% healthy foods, p < 0.001). The food groups with the highest proportion of branded food references, and therefore paid marketing, were ice cream and iced confections (85.6% branded references), fast food restaurant meals (83.4%), highsugar drinks (78.9%) and snack foods (73.4%). Of all magazines, those targeting males and children aged 7-12 years had the highest proportion of unhealthy food references (78.1 and 69.8% unhealthy food references, respectively). Food references within children's magazines are common and skewed towards unhealthy foods. Children's high magazine readership rates and a lack of advertising and product placement regulations for magazines in Australia make this media an attractive target for food marketers.

 Cowburn & Boxer (2007; UK; content analysis) conducted a content analysis of top UK children's magazines. Food advertising appeared as 'cover-mount' free gifts and as part of the main bound issue. Children aged 6–10 years were the most frequent recipients of food-based free gifts, all of which were confectionery. No food advertising was found in magazines aimed at pre-school children and it formed a small percentage of total advertising in the magazines aimed at children of school age and above. Most food advertisements were for 'less healthy' foods, although advertisements for 'healthier' food products did appear infrequently.

Supporting evidence: experimental studies

- One Australian experimental study showed an effect of unhealthy food advertising in magazines on snack food choice among primary school children.
- Jones & Kervin (2011; <u>AUS</u>; *experimental*): In three vacation care centres in NSW, children aged 5–12 years were randomised to read either a magazine with food advertisements or a magazine with no food advertisements. They then chose two food items from the intervention store to eat after the session. Data were also collected on attitudes to advertising and snack food preferences. Children in the experimental condition were more likely to choose advertised foods than those in the control group. Interestingly, the majority reported taste and healthiness as the most important factors in snack food choices; however, when faced with the actual food choice, they predominantly chose unhealthy foods (82 unhealthy and only 12 healthy items were chosen).

Evidence of intervention effectiveness

Outcome: Exposure

- Australian evidence (one study) indicates that selfregulation within the RSMI and QSRI initiatives has not carried through to magazine advertising.
- Jones et al (2012; cited in systematic review by Galbraith-Emami & Lobstein 2013): RSMI and QSRI *post-only*.
 Of the 269 branded references in 139 children's magazines published in 2009, 86% were for non-core products. Of the branded food references, 31% were in advertisements, 39% in editorial product placements, and 25% in competitions and puzzles. Therefore the initiatives have not carried through to magazine advertising.

Implementation considerations — self-regulation of marketing to children (overall)

- Permissive and inconsistent nutrition criteria are used to classify unhealthy foods
- Policies are not transparent
- Policies do not restrict the volume of food advertisements to children nor apply during high rating programs for children (prime/family viewing)
- Policies do not extend to all modes of advertising
- There is no independent monitoring or sanctions for non-compliance

Examples of identified insufficiencies

Review summary

- Galbraith-Emami & Lobstein (2013; systematic review of regulatory codes marketing to children):
 - "We recognise the remarkable efforts that have been made by many food and beverage companies to reduce their marketing of some of their products directly to children, and that new nutrient profiling schemes and new definitions of children's programming have been offered by the pledge members for implementing in 2013 or 2014".
 - The emergence of new media channels which can directly access children raises further concerns about the nature of regulations needed to control exposure of children to unhealthy food marketing. There is recognition that company-owned websites should be included in pledges, but less recognition of the use of social networking sites, smart-phone apps, downloadable advergames, or the cross-branding of healthier food and beverage products and non-food products with unhealthy food-related brand identities, or marketing in school and other child-friendly settings.
 - Similarly, self-regulation does not generally include retail displays and in-store promotion, product design and formulation, or product labelling and packaging. In particular it does not cover the use of licensed characters and tie-in characters from TV shows and cinema films being used on product packaging, a marketing strategy which not only serves to attract attention to the product in the retail setting but also to promote the food product by association when the characters are then seen in TV shows, films and videos.

- Therefore the narrow range of media, the weak definitions of marketing, the absence of many large food companies and the lack of enforceability or penalties for failure suggest that self-regulatory pledges are unlikely to be sufficiently comprehensive to have the desired effect of reducing children's exposure to promotional marketing of unhealthy food products unless tied to stronger government oversight.
- Comprehensive, preferably statutory measures are recommended, with adequate monitoring of compliance and adequate sanctions for noncompliance, and based on government-led definitions of the media to be covered, the products to be controlled and the audience to be protected.

Nutrient profiling criteria

- Sacks et al (2015; AUS, NZ, Fiji): Across all three countries, only a small minority of companies used independent nutrient-profiling criteria to specify which of their products were eligible to be marketed to children, and almost all of the companies that used in-house nutrientprofiling criteria did not disclose the details of these.
- Watson et al (2014; AUS): The Food Standards Australia New Zealand (FSANZ) nutrient profiling criteria provide an independent assessment of the overall healthiness of a product and have potential to form the basis of nutrient criteria for regulating food marketing to children in Australia. Moderate agreement of the NPSC to noncore/core classification indicates usefulness. NPSC could not be used to determine the 'main component of a meal' (e.g. for fast food) as per a NZ study (Jenkin et al 2009). However, the NPSC (as do all sets of criteria) do not address brand-only advertisements; yet branding of foods and beverages has been shown to influence young children's taste perceptions (cites Robinson et al 2007; for fast food branding). Could be addressed by placing restrictions on brand-only food advertisements in programs where there are large numbers of children watching. Any set of criteria needs to clearly define 'mixed meals' and 'product ranges'. Industry criteria are more permissive than the FSANZ Nutrient Profiling Scheme (NPSC).

- Kolish (2014; US): In July 2011, the CFBAI announced an agreement that new CFBAI-developed categoryspecific uniform nutrition criteria would become, as of December 31, 2013, the foundation for the child-directed advertising of the now 17 companies participating in the CFBAI ('participants').
- Corpes (2014; UK): Highlights an incident in the UK where McDonald's was cleared of misrepresenting its health 'one of your five a day' claims on a fizzy fruit juice (60% fruit juice and the remainder fizzy water) – should juice be exempt?
- Scarborough et al (2013; UK): Compared eight nutrient profiling models around the world using UK TV data set and found a large variation in the proportion of advertisements that passed the different models (2–47%).
- Rayner Scarborough et al (2013): This paper gives a definition of 'nutrient profiling' and outlines the scope 'marketing of foods to children' and it's 'regulation' for the purposes of the paper. It then points out that nutrient profiling has many other purposes besides the regulation of marketing of foods to children. It briefly outlines the ideal process for developing a nutrient profile model and summarises how nutrient profiling models have been validated to date. It discusses how existing nutrient profiling models for the purpose of regulating the marketing of foods to children can be compared and it concludes that nutrient profiling has much potential but that there are several obstacles to overcome before an ideal model for regulating the marketing of foods can be agreed.
- Elliott (2012) suggests that a concentration on the nutrient profile of foods is wrong-headed. The slippage in terms from 'better-for-you' foods to 'healthy dietary choices' is problematic and also makes it difficult for children to identify the healthy choice. Nutritionism further works to sidestep important questions pertaining to the ethics of food marketing, not to mention the way that marketing foods as fun and entertainment works to encourage overeating in children.

Limitations to Australian self-regulatory schemes

- Companies set their own nutrition criteria to categorise which of their products represent healthier dietary choices.
- Sacks et al (2015; <u>AUS</u>, NZ, Fiji): Even in Australia a large proportion of the most prominent food companies do not have publicly available policies related to food marketing to children and product formulation. In Australia, 55% of the selected packaged food manufacturers had a policy related to food marketing to children available on the company website. Similarly, a high percentage of the selected Australian and New Zealand soft drink manufacturers (100 and 67%, respectively) had policies on their websites; under the commitments of the Australian Beverages Council 2014). Sixty percent of selected fast food restaurants in Australia had online food marketing policies. Where they existed, policies on food marketing to children generally focused on those aged less than 12, did not apply to all types of media, marketing channels and techniques, and did not provide transparency with respect to the products to which the policies apply.
- Box 1: Key gaps in the Responsible Children's Marketing Initiative (Reeve & Magnusson 2014)

Escape clause	Effect
Only applies to children under the age of 12 years	Does not cover older children or adolescents who are also influenced by unhealthy food marketing.
Only applies to TV that is 'directed primarily to children'	Does not prevent advertising junk food in TV programs that children watch regularly unless they comprise >35% of the audience.
Only covers advertising content that is 'directed primarily to children'.	Leaves room for advertisers to use creative techniques that are highly appealing to children, such as imagery of children enjoying their products, toys, cartoon characters and school-based settings.
Excludes many media and marketing techniques	The code does not apply to product packaging and labelling, sponsorship, point-of-sale advertising and brand advertising.
Companies may choose their own nutrition criteria to identify 'healthy choice' products	Weak nutrition criteria allow companies to market highly processed sugary cereals and other unhealthy products to children.

- Mills C (2014; Advertising Standards Board; ANZOS paper presentation): An analysis of 25 complaints to the Advertising Standards Board regarding advertisements for foods and beverages alleged to target children in 2013 and 2014 in Australia showed that recent changes to the codes appear to have weakened the protections in place for children. The recent changes include the narrowing of the definition of advertising that is considered 'directed primarily to children', with findings suggesting the rules are increasingly permissive of a range of child-oriented techniques; and the change whereby advertisers themselves now define the criteria by which products are assessed to be 'healthier' (and therefore able to be advertised to children). Overall the analysis suggests that, in Australia, the protections afforded by self-regulation of advertising have been eroded by amendments made unilaterally to the voluntary code by advertisers; and the self-regulatory system is not consistent with the WHO Set of Recommendations on the marketing of foods and non-alcoholic beverages to children 2010.
- Hebden King et al (2010; RCMI; *descriptive study*): Although the self-regulatory commitments of companies signed to the AFGC Initiative may appear to be responsible, examination of the fine print showed that there are many limitations of the Initiative including:
 - inadequate definitions for when and where food marketing to children can occur
 - permissive definitions of foods considered appropriate for advertising.

The study also identified numerous examples of ongoing food marketing to children by AFGC companies that illustrate these limitations.

- Kelly & Chau (2007; content analysis; CTS; *descriptive study*): There is a need to:
 - improve clarity of the code, to expand children's (C) periods to include viewing times when high numbers of children are actually watching
 - to actively monitor advertisements
 - to adopt clear procedures for complaints and investigation of alleged breaches
 - to impose penalties for confirmed breaches.

Limitations to UK self-regulatory schemes

Boyland & Halford (2013; UK; descriptive study): Within the UK programming regulations it is indicated that the Code applies to 'programs of particular appeal to young children'. The regulations method applies advertising restrictions if programs have an audience in which the proportion of viewers under 16 years is at least 20% higher than the proportion of children in this age group in the general population. This means that the food advertising restrictions do not apply to programs that also have a high adult audience. This describes most family programming and particularly primetime entertainment shows, which frequently attract child audiences of over one million (a greater child audience than typically watches child-specific programming) (Which?, 2006; Which?, 2008). Also does not cover (1) brand equity characters such as Tony the Tiger (Kellogg's Frosties) and (2) brand advertising — no food products are shown but brand logo and message [with strong associations to the HFSS foods under that brand name] still repeatedly reinforced.

andon (2013):	
Gaps and potent	ial weaknesses in UK regulations and codes (Landon 2013) ¹¹³
Communication	TV advertising scheduling rules do not catch programs watched by the largest numbers of children because of the way that child audiences are calculated.
	TV advertising content rules for food and drink do not all apply up to age 16. Some apply to pre-school and primary aged children. Scheduling rules (BCAP code) apply up to 16.
	TV product placement rules do not cover programs or films made outside the UK.
	On-demand services are not subject to scheduling restrictions on HFSS advertising.
	Radio advertising content rules for food and drink do not all apply up to age 16. Some apply to pre-school and primary aged children.
	Radio advertising scheduling is not subject to restrictions on HFSS advertising (unlike TV).
	Mobile marketing is not covered by food and drink rules unless the commercial messaging is defined as 'advertising'.
channel	Vending is controlled in schools but not in other places where children may gather.
	Branding on vending machines is not covered by school food regulations
	In-school marketing such as voucher collection schemes, sampling, branded school equipment is not subject to rules (except specified sales promotions).
	Product packaging is not restricted (with the exception of on-pack advertising for another product or sales promotion).
	Point of sale in-store communications are not defined as advertising.
	Sponsorship for HFSS food products is not restricted (other than program sponsorship in broadcast media and specified sales promotion sponsorship).
	Peer to peer and viral promotion of HFSS food products is not restricted.
Marketing technique	Product and brand integration in digital media (e.g. product or brand placement in advergames) of HFSS food products is not restricted.
	Digital advertising rules are applicable to marketing communications 'that are directly connected with the supply or transfer of goods, services, opportunities or gifts' There are no restrictions on brand promotions online to match those applying to TV brand promotion.
	Food labelling and packaging (including gifts, claims, cartoons and licensed characters) of HFSS food products are not restricted.
	Use of equity-brand characters is not restricted.
	Formulation and presentation (including colours, flavours, shapes) of HFSS food products are not restricted.
	Premiums and giveaways (including toys with children's meals) are not restricted.
	Promotions at point of sale (including shelf ticketing, product display, positioning in store, dump bins and in-store sampling) are not generally covered unless defined as 'advertising' or 'sales promotions'.

¹¹³In addition, it should be noted that regulations apply to 'advertising' and to 'marketing communications which are directly connected with the supply of goods and services' such as sales promotions. Other promotional activity falls outside of these definitions, such as the presentation or 'editorialising' about brands or products via websites or mobile messaging. In-school marketing (other than sales promotions), product packaging, point-of-sale marketing and sponsorship (other than TV program sponsorship) are also excluded. Techniques including product and brand integration in digital media, formulation and presentation of products (including colours, flavours or shapes), premiums and give-aways and peer to peer marketing are excluded. Equity-brand characters (fictional characters owned by the manufacturing company) are specifically exempted from all regulations, codes and pledges.

Additional discussion papers — implementation including monitoring

- Raine Lobstein et al (2013) examine the political environment, evidence, issues, and challenges of placing restrictions on marketing of unhealthy foods and beverages within Canada. They recommend a national regulatory system prohibiting commercial marketing of foods and beverages to children and suggest that effective regulations must set minimum standards, monitor compliance, and enact penalties for non-compliance.
- The need and potential processes for monitoring food and non-alcoholic beverage promotions to children are indicated in Kelly King et al (2013); Brinsden Lobstein et al (2013).
- Halford & Boyland (2013): Discuss 'setting the research agenda' around the marketing of foods and non-alcoholic beverages to children.
- Policy and systems changes needed in marketing foods to children are also discussed in Katz Fox et al (2013).
- To address food marketing to children, governments need to develop clearer statements of the objectives to be achieved, define the indicators that can demonstrate this achievement, and require the relevant stakeholders to account for the progress being made (Hawkes & Lobstein 2011).

Context/setting: schools

ACTION:

Restrict promotion of unhealthy food and beverages in schools

Supporting evidence: descriptive studies

- Advertising by food and beverage companies in schools in the US is substantial (but has not been audited in Australia).
- Harris & Fox (2014): In the US food companies spend \$1.8 billion annually in youth-targeted marketing, with the promotion of fast food, sugary drinks, sugary breakfast cereals, and candy accounting for 90% of these expenditures. In 2009, food and beverage companies spent \$149 million (90% of which is on SSBs) on inschool marketing. This amount represents 8% of total youth-targeted food marketing expenditures and the third-largest category of promotional activity behind TV and premiums.
- Bollars et al (2013; US): Food and beverage companies continue to promote their brands in schools and the school environment. The companies place their brands or logos on educational material, prizes and awards, equipment, clothing and vending machine surfaces. Although most member States have restrictions on the advertising of alcohol and tobacco on school premises, most of them have few or no restrictions on the promotion of brands of food and beverage (see section on regulatory and self-regulatory action below). Figures for in-school marketing in Europe are not accessible. In the United States in 2008, food companies spent US\$186 million on in-school advertising, 90% of which was spent on soft drink promotion. There are also moves in the United States towards greater commercial exposure through advertising on dedicated TV channels for schools and TV and audio commercials on school buses. Marketing also occurs in out-of-school activities such as children's ski-schools and swimming events.

Evidence of intervention effectiveness

Outcome: Exposure (Industry self-regulation)

- Compliance with self-regulation in Maine (US) was low.
- Polacsek, O'Rourke et al (US; 2012): Three major soft drink companies in the US pledged to phase out soft drink sales in schools, an action deemed to be catalysed by latent possibility of public regulation. Before passage of the ban in Maine, US (see below), legislators were assured by industry advocates that soda marketing on school scoreboards and vending machines would be removed (Mello et al 2008). However, this study found noncompliant marketing on vending machine exteriors and scoreboards in their evaluation study (below) indicating that self-regulation had not occurred.

Outcome: Exposure (Government mandatory regulation)

- Implementation with mandatory regulation of advertising in schools in Queensland was reported to be high, although compliance with regulation in Maine (US) was low.
- Dick et al (2012; AUS; survey): 'Smart Choices', became mandatory in Queensland state schools from 1 January 2007, and applies to all situations where food and drink is supplied in the school environment including tuck shops, vending machines, school excursions, school camps, fundraising, classroom rewards, school events such as celebrations and sports days, and food used in curriculum activities. Evaluation of the implementation of 'Smart Choices' involving a survey of Principals and P&Cs indicated that proportional implementation was, respectively,: vending machine advertising (85% and 84%); sponsorship and advertising (93% and 84%); fundraising events (80% and 84%); and sporting clubs (73% and 75%).

- Polacsek, O'Rourke et al (2012; US): In 2007, the state of Maine passed a law prohibiting brand-specific advertising of certain unhealthy foods and beverages on school grounds at any time. The ban applies to 'foods of minimum nutritional value' as defined by federal law. Evaluation of compliance with this regulation indicated multiple instances of non-compliant marketing in nearly every school. Coca-Cola and Pepsi marketing predominated. A disproportionate amount of marketing, including marketing of foods not meeting the FMNV standard, was found in teachers' lounges, a location that is exempted from the state's nutritional standards for foods sold on school grounds, but not legally excused from the Chapter 156 restriction on marketing of non-nutritious products.
- WCRF/NOURISHING (sighted July 2014): In 2011 the Spanish Parliament approved a Law on Nutrition and Food Safety, which stated that kindergartens and schools should be free from advertising, which is reportedly not enforced and is at the discretion of regional authorities.

Context/setting: outdoor advertising

ACTION:

Ban or restrict outdoor advertising of unhealthy food/ beverages, particularly near schools

Supporting evidence: descriptive studies

- Sugar-sweetened carbonated beverages are the products most commonly advertised around primary schools in NSW; and non-core food products are more likely to be advertised close to a primary school compared with outdoors overall in NSW and the Philippines.
- Advertising of food/beverages was higher among low SES in the UK; and are considered by school staff to negatively affect school efforts to improve the food environment (NZ).
- Kamal & Wilcox (2014; *narrative*): It may be important to consider that billboard and other outdoor advertising do double service they serve as advertising to remind and influence consumer's brand choice and also may act as signage, or directions indicating the outlet location.
- Kelly, King et al (2014; The Philippines and Mongolia; *audit*): In the city of Ulaanbaatar, Mongolia and Manila, the Philippines; the density of food advertising was twice as high in the area closest to schools compared to the area further from schools (0.9 vs 0.5 in Ulaanbaatar and 6.5 vs 3.3 advertisements per 100 m2 in Manila). Almost all food advertisements were for non-core/unhealthy foods/drinks (92% in Ulaanbaatar and 85% in Manila), and soft drinks were most frequently promoted.

- Adams Ganiti et al (2011; Northern England; *audit*): All outdoor advertisements in a city in Northern England were identified during October–December 2009. A total of 1371 outdoor advertisements were identified; 211 (15%) of these were for food. The advertisements covered 6765 m², of which 1326 m2 (20%) was for food. Total advertising and food advertising space was largest in the least affluent tertile. There was little evidence of socio-economic trends in the type or nutritional content of advertised foods.
- Harris et al (Rudd Centre for Food Policy and Obesity; 2010; US; report): Fast food establishments spent a collective \$156 million on outdoor advertising in 2009.
- Walton, Pearce et al (2009; NZ; audit and interviews): Outdoor food advertisements surrounding four case study primary schools in New Zealand were examined. Interviews with school management and students among the schools with a higher percentage of students passing food outlets and advertisements considered that their presence affected efforts within schools to improve the food environment.
- Kelly, Cretikos et al (2008; <u>AUS</u>; *audit*): Around 40 primary schools in Sydney and Wollongong, 9151 advertisements were identified, of which 2,286 (25%) were for food, 80% of were for non-core food (n=1,834). Soft drinks and alcoholic beverages were the food products most commonly advertised around primary schools (24% and 22% of food advertisements, respectively). Non-core food products were twice as likely to be advertised close to a primary school (95 non-core food advertisements per km² within 250m vs 46 advertisements per km² within 250–500 m).

Supporting evidence: observational studies

- There is evidence from a large study using advertising data in the US that the percentage of outdoor advertising is associated with brand sales for some, but not all, fast food companies.
- Kamal & Wilcox (2014; US;): A large study using advertising data at the population level, showed that for print advertising Dominos, Jack-in-the-Box, and Wendy's showed a significant positive relationship with brand sales whereas for outdoor advertising a significant positive relationship was found for McDonald's, Domino's and Wendy's with brand sales. (four brands — Jack-in-the-Box, Sonic, Subway and Wendy's — showed significant positive relationship between electronic advertising expenditures and sales.)
- Cross-sectional data from two states in the US support an association between the percentage of outdoor advertising and overweight/obesity.
- Lesser Zimmerman et al (2013; Los Angeles and Louisiana; cross-sectional study): indicated a relationship between the percentage of outdoor food advertising and overweight/obesity. The higher the percentage of outdoor advertisements promoting food or non-alcoholic beverages within a census tract, the greater the odds of obesity among its residents, controlling for age, race and educational status. For every 10% increase in food advertising, there was a 1.05 (95% CI 1.003 – 1.093, p<0.03) greater odds of being overweight or obese, controlling for other factors. Given these predictions, compared to an individual living in an area with no food advertisements, those living in areas in which 30% of advertisements were for food would be a 2.6% more likely to be obese.

Food environment objective: reduce sponsorship of sports by companies selling non-core foods/beverages

Context/setting: outdoor advertising

ACTION:

Restrict unhealthy food and beverage company sports sponsorship

Supporting evidence: descriptive studies

- Sports sponsorship is much more likely to be associated with unhealthy products.
- Macniven et al (2015; AUS; *website audit*): A structured survey tool identified and assessed sponsoring companies and products displayed on the websites of the 53 national and state/territory sport governing bodies in Australia receiving government funding. Identified products were categorised as healthy or unhealthy, based on criteria developed by health experts. There was a total of 413 websites operated by the 53 sports, with 1975 company or product sponsors identified. Overall, 39 sports had at least one unhealthy sponsor, and 10% of all sponsors were rated as unhealthy. Cricket had the highest percentage of unhealthy sponsors (27%) and the highest number of unhealthy food and beverage sponsors (n=19).
- Kelly, Bauman et al. (2014; AUS; *audit*): In NSW, weekly total person-time exposure for children was highest for outdoor soccer (91,200 children × median frequency of two sessions per week of 1 h duration=182,400 h/week). Considering rates of sponsorship at different sports, children would be exposed to food/beverage sponsorship to the greatest extent for rugby league and outdoor cricket.

- Lindsay, Thomas et al. (2013; AUS; content analysis):
 Using the Australian National Rugby League 2012 State of Origin three-game series content analysis of the frequency, duration, placement and content of advertising strategies, comparing these strategies both within and across the three games. On average, per game, there were 17 episodes (SD=7.55), and 2.74 minutes (SD=0.78) of unhealthy food and beverage marketing. Content analysis revealed that there was a considerable embedding of product marketing within the match play, including within-match commentary, sporting equipment, and special replays.
- Carter et al (2013; NZ; *website audit*): This study involved a review of 308 websites of national and regional New Zealand sporting organisations to identify food and beverage sponsors, which were then classified as healthy or unhealthy using nutrient criteria for energy, fat, sodium and fibre levels. 18 key informants from national and regional sporting organisations about sponsorships were also interviewed. Food and beverage sponsorship of sport is not extensive in New Zealand. However, both healthy and unhealthy brands and companies do sponsor sport. Relatively few support their sponsorships with additional marketing. Interviews revealed that although many sports organisations felt concerned about associating themselves with unhealthy foods or beverages, others considered sponsorship income more important.
- Bragg, Yanamadala et al. (2013; US; *audit*): In the US, of 512 brands endorsed by 100 different athletes, food/ beverages represented 23.8%. Seventy-nine percent of the 62 food products in athlete-endorsed advertisements were energy-dense and nutrient-poor, and 93.4% of the 46 advertised beverages had 100% of calories from added sugar. Adolescents saw the most TV commercials that featured athlete endorsements of food.

- Kelly, Baur et al. (2011; AUS; content analysis): An analysis of national and state sporting organisations' websites for the nine most popular sports for children and from four Australian states and territories was conducted. Forty-three sponsors were identified across 55 websites. Overall, 9% of sponsors were food companies and 3% were alcohol manufacturers. The majority of food companies (63%) did not meet criteria as healthy sponsors.
- Maher et al. (2006; NZ; audit): In New Zealand, internet-based evidence of sports sponsorship at the national, regional and club level was identified. Sports sponsorship associated with sponsors' products classified as 'unhealthy' (e.g. food high in fat and sugar, gambling and alcohol) were over twice as common as sponsorship associated with sponsors' products classified as 'healthy' (32.7% (95% Cl=29.1, 36.5) versus 15.5% (95% Cl=12.8, 18.6) respectively).
- Recall of sports sponsorship is high among Australian children, and sports sponsorship by food and beverage companies positively affects children's attitude towards those companies.
- Pettigrew, Rosenberg et al. (2013; AUS; *survey*): In a study of 164 children (5–14 years old), 76% of the children aligned at least one correct sponsor magnet with the relevant sport. Just over half the children (54%) correctly matched the most popular sport (an Australian Football League team) with its relevant sponsor (a fast-food chain).
- Kelly, Baur et al. (2013; AUS; *survey*): Two-thirds of children recalled sponsors of their favourite elite sports team/athlete, with 428 sponsors recalled. Of these, 11% were food/beverage companies and 3% were alcohol-related. For 39% of sponsors, children reported feeling better about the company after it had sponsored a team/ athlete.
- Kelly, Baur et al. (2011; AUS; *survey*): Children aged 10–11 years were more likely than older children to report that they thought about sponsors when buying something to eat or drink (P < 0.01); that they liked to return the favour to sponsors by buying their products (P < 0.01); and that sponsors were 'cool' (P=0.02). Most children had received a voucher or certificate from a food or beverage company to reward sport performance (86% and 76%, respectively). Around one-third of children reported liking the company more after receiving these rewards.

- Parents and the sporting community are supportive of restricting unhealthy food and beverage sports sponsorship or promotion in Australia.
- Kelly, King et al (2014; AUS; *Delphi survey*): Consensus on priority health promotion objectives for community sports clubs was gained based on informed expert judgements. The highest ranked standards included restricting unhealthy food and beverage company sponsorship.
- Kelly, Baur et al (2013; AUS; *survey*): Among 825 parents, 75% supported the introduction of policies to restrict unhealthy food, beverage and alcohol sponsorship of children's and elite sports. More parents (81%) supported the introduction of alternative funding models to allow these companies to sponsor sport provided there was no visible branding.
- Grunseit et al (2012; AUS; *survey*): 73.9% of surveyed Australian elite and sub-elite athletes (n=1990) disagreed that athletes should promote unhealthy foods and alcohol.

- Pettigrew, Pescud et al (2012; AUS; *telephone survey*): Among 2005 adults in Western Australia, almost half of the respondents reported that the promotion of fast foods is inappropriate at community events, and only one-third thought it was appropriate to promote fast foods at events where children are likely to be present, with two-thirds believing that such promotion would send contradictory messages to parents. A quarter of respondents considered it acceptable for free fast food to be distributed at events or for children to be rewarded for participation with fast food vouchers.
- Kelly, Baur et al (2012; AUS; *survey*): Sports clubs known to have food sponsors and representing the most popular sports for Australian children across a range of demographic areas were recruited. Interview-based questionnaires were conducted at clubs with parents (n=200) and officials (n=20), and with governing sporting associations (n=20). Fifty percent of officials and 70% of parents supported restrictions to children's sport sponsorship. Respondents were most supportive of restricting the use of unhealthy food logos on children's uniforms.
- Kraak Story et al (2011; AUS; online survey): Among 825 parents and 243 children aged 10–16 years in NSW, three-quarters of parents supported the introduction of policies to restrict unhealthy food, beverage and alcohol sponsorship of children's and elite sports. More parents (81%) supported the introduction of alternative funding models to allow these companies to sponsor sport provided there was no visible branding. Two-thirds of children recalled sponsors of their favourite elite sports team/athlete, with 428 sponsors recalled. Of these, 11% were food/beverage companies and 3% were alcoholrelated. For 3% of sponsors, children reported feeling better about the company after it had sponsored a team/ athlete.
- Kelly Chapman et al (2011; AUS; *survey*): Community support for the introduction of a sport sponsorship fund is particularly high. This system could ensure financial viability of sports clubs while reducing children's exposure to marketing of unhealthy food and beverages at sports clubs. Funding provided could be used to support the adoption of healthy practices such as healthy eating.

Victorian Health Promotion Foundation (VicHealth) (2010; AUS; community attitudes survey): The VicHealth Community Attitude Survey on Healthy Community Sporting Environments among a random sample of 1500 Victorian adults (43% were involved in some capacity with a local sports club; 1000 from Melbourne and 500 from regional Victoria) between 20 October and 17 November 2009 to determine community sentiment on these issues. Forty-nine percent of survey respondents were opposed to the sale of junk food, and 53% were opposed to junk food sponsorship at community sports clubs. There was very high support (81%) for the removal of junk food sponsorship at community sports clubs if clubs were supported to replace any lost revenue, and 77% of respondents would support a levy on junk food advertising if the funds generated by the levy were allocated to community sports clubs. Eight out of 10 people agreed that it is the responsibility of community sports clubs to promote healthy eating.

Implementation issues

- There is mixed information regarding the funding implications for sporting clubs if they restrict unhealthy food and beverage sponsorship.
 - Healthway webpage (2014; AUS): https://www.healthway. wa.gov.au/healthy-club/ (modified 11/8/14 sighted 14 May 2015): Healthway in WA provides sponsorship to sport, arts, racing and community events organisations and community groups which encourage healthy lifestyles. Healthway has resolved to absorb the Healthy Club Sponsorship program into the existing under \$5,000 Sport Sponsorship program. This change will provide sporting clubs interested in extending the reach of health promotion campaigns and creating healthy environments with access to an increased level of support and the opportunity to seek sponsorship all year round.

- https://www.healthway.wa.gov.au/programs/co-sponsorship-policy-and-guidelines/ Last modified 17/10/2014; sighted 14 May 2015. Healthway has a co-sponsorship policy which was introduced to ensure the promotion of unhealthy brands and messages do not undermine health messages at sponsored events and activities. This policy was reviewed in 2010, and again in 2013, to ensure it continues to reflect community expectations and is based on the most up-to-date health promotion information and evidence.
- Kelly, King et al (2013; AUS): Monitoring may be necessary for understanding the scope of the problem, and for promoting and guiding the development of meaningful policy interventions.
- Pettigrew et al (2012; AUS): A health promotion agency in Western Australia funds a wide range of events and programs with the proceeds of taxes levied on tobacco products. Proceeds from a tax on unhealthy foods and beverages could forseeably be used to sponsor community events and thus reduce dependence on companies that promote unhealthy products.
- Kelly, Baur et al (2011; AUS): In a random sample of Australian sports clubs, 347 sponsors were identified, of which 17 were food or beverage companies. Fifty percent of food company sponsorship arrangements did not meet criteria for healthy sponsors. For most clubs, less than a quarter of their income came from sponsorship. Any restriction of unhealthy food and beverage company sponsorship of children's sport may not result in major funding difficulties for clubs, as this funding represents a relatively small proportion of their income base.

Food environment objective: reduced exposure to marketing via product placement in stores

Context/setting: retail — product placement in-store

ACTION:

Placement of products in stores to encourage purchase of healthier foods/ drinks and discourage purchase of less healthy foods/drinks

SUB-ACTION

Location on shelves

Supporting evidence: descriptive studies

- Aisle management and placement of items is increasingly used in retail to increase traffic, sales and profits. Many purchases are unplanned and customers 'buy what they see' as more visible, convenient to reach and attractive.
- Castelli et al (2014; narrative): "Shelves on which products are displayed are one of the most important resources in the retail environment".
- Liu et al (2014; narrative): Behavioural biases mean that consumers are highly susceptible to food cues. A number of behavioural biases relevant to overeating including present-based biased preferences, visceral factors, food cues and status quo bias and default options. Present-biased preferences refer to the human tendency to overestimate immediate benefits relative to delayed benefits; for example, the immediate benefits of consuming a high-calorie snack are more salient than the long-term potential for negative effects on weight and health. Moreover, people tend to be willing to impose greater self-control on their future selves, but once the future becomes the present, people again lack the selfcontrol to stick to their long-term goals. Visceral factors

- emotions and drives - lead consumers to attend and respond to short-term desires in favour of long-term self-interest and are often activated by exposure to a cue, such as a smell, sound or sight, that temporarily elevates craving for a desired item. Food cues (whether based on sight, taste or cognition) increase the desire to eat regardless of hunger level (cite Lambert et al 1991). Restrained eaters are particularly susceptible to unhealthy food cues. Status guo bias and default options — the highly visceral nature of food suggests that once a tempting food is presented to a person, it is difficult to avoid purchasing/eating it. It also points to the importance of how options are presented to people in the first place. Individuals are highly prone to sticking with the current or default option even when superior options are available, regardless of the order in which the alternative options are presented. All of these behavioural biases mean that placing different foods in different parts of stores may help and/or hinder their purchase/consumption.

- Stilley et al (2010; and others; cited in Payne et al 2014): Probability of unplanned purchases in grocery stores is very high (e.g. 42–93%). Such purchases are made quickly, are affect and/or stimulus driven, and based on rules-of-thumb (perceptions of what is common, normal or appropriate to buy). In contrast to planned purchases, unplanned purchases frequently result from in-store promotion of forgotten needs and unplanned wants. The proportion of planned purchases is higher if a shopping list is used.
- Adjoian et al (2013; US; *cross-sectional*): Sugar-sweetened beverages are placed in the most prominent position in US stores and this is more pronounced in higher-consumption neighbourhoods.

- Cohen & Babey (2012; narrative) in their paper 'Candy at the cash register — a risk factor for obesity and chronic disease', highlight the widely acknowledged promotional strategy known as 'impulse marketing', which encourages spur-of-the-moment, emotion-related purchases that are triggered by seeing the product or related message. It works through the placement and display of products in retail outlets. Most purchasing decisions are made very quickly and automatically without substantial cognitive input, in less than a second; and choices of foods high in fat and sugar are made more quickly than are choices of healthful foods such as F&V (cites Thomas et al 2011).
- Kamasak (2008): Early in the 1970s it was shown that environmental cues within a retail setting could have a potential effect on consumer perceptions and behaviours. Kamasak cites Markin et al (1976) as stating *"the retail store is a bundle of cues, messages and suggestions which communicate to consumers"*.
- Larson (2006; Review): The review paper indicates 'core principles for supermarket aisle management'. Aisle management —dividing a store into clusters or zones (e.g. aisles) and striving to increase traffic, sales, and profits from each of those zones, is one option several companies are using. Larson reports several industrysponsored studies showing the importance of managing the aisles, citing one study sponsored by Coca-Cola indicating that shoppers only travelled through 41% of the supermarket on average; although customers doing a major stock-up trip tended to skip fewer aisles, covering 58%. In another quoted study, 58.6% of shoppers visited the bread products aisle (for an average of 42.3 seconds) and 36.4% visited the beverages/soft drinks aisle (spending 81.4 seconds). A study by Unilever showed that retailers could attract more 'quick trips' by placing the type of products that guick-trip shoppers want in convenient, high-visibility areas of the store.

The review indicated a number of experiments in laboratories and stores which have found several store environmental variables that can change shopper behaviour (various papers cited):

- using frozen and refrigerated cases with glass doors create barriers and may reduce browsing and purchasing by consumers
- wall colours can affect impressions about products
- adding pleasant aromas may boost sales
- spotlights at the end of aisles (EOA) increases the time spent looking at products in EOA displays and sales signs to suggest touching products to 'feel the quality' tended to increase purchases by some consumers
- making the shopping experience too arousing for taskoriented shoppers could have a negative impact on sales.

Supporting evidence: experimental studies

Marketing studies

- A small number of marketing studies conducted several decades ago indicate the importance of location on the shelf in terms of sales.
- Larson (2006; review): "Findings on the effects of shelf space, shelf positions and product facings are mixed".
 Larson (2006) cites Drèze et al (1994) as showing that 4–6% sales gains could be achieved with better product placement and space allocation; and their simulations showed that an item moved from the worst shelf location to the best location would result in a sales increase of nearly 60%. If the initial shelf arrangement was more reasonable however, sales and profits improvements could be quite small. Cross-category linkages were indicated to be important.

- Drèze et al (1994; experimental in-store): Showed that position was far more important than the number of facings. In this study, customised space-to-movement changes (in facings, deletion of slow-moving items, changes in shelf height, and some changes in product positioning) led to changes in sales and profits ranging from -2% to 8%. Position was far more important than number of facings two facings at eye level generated more sales for a product than five facings on the bottom shelf. Two positions were clearly favoured on the vertical axis the well in the refrigerated section, and slightly below eye-level in the other categories.
- Curhan (1972; experimental in-store): Indicated that not all F&V are the same: hard fruit and cooking vegetables, within season, are considered almost 'staples', whereas salad vegetables and soft fruit generally are more perishable, vary more in day-to-day guality, availability and price, and require more care in handling and refrigeration, as such they are more discretionary. Curhan used a factorial design to examine, among other aspects, the effect of location quality on sales of the various types of F&V. Location guality (separate floor tables, end of large tables, high-traffic positions) only had an effect on sales of hard fruit and vegetables ('staples') and had a larger effect on sales of low-volume than high-volume cooking vegetables, but had a negligible effect on the more discretionary soft fruits and salad vegetables, except for high-volume products. The author considered that, since most supermarkets prominently display seasonal soft fruit, non-seasonal items probably lack visibility in a category where visibility is important.

Evidence of intervention effectiveness

Outcome: Sales /Purchases (Location on shelves)

- Evidence from a substantial number of field experimental and intervention studies in a variety of environments (grocery stores, supermarkets, cafeterias) indicates that placing healthier items at eye level, at the front of stores, and making them easier to reach, increases sales.
- Ensaff et al (2015; UK; *field experiment, school canteen*): A small set of changes to the choice architecture of a secondary school canteen showed that, among 980 students, the selection of designated items (plant-based products) significantly increased during the intervention (six weeks duration) and post-intervention periods, compared to baseline. Logistic regression revealed the independent effect of the intervention, with students 2.5 times as likely to select the designated food items during the intervention period compared to baseline.
- Foster et al (2014; *intervention study, grocery stores*): Intervention stores (six months: placement, signage and product availability) showed significantly greater sales of skim and 1% milk, water (in aisle and at checkout), and two of three types of frozen meals compared with control store sales during the same time period. This effect was achieved by simple change in stacking from horizontal to vertical for the desired products, and by increased prime placement at eye level. No differences were found between the stores in sales of cereal, whole or 2% milk, beverages, or diet beverages. The lack of effect on cereal sales was attributed to brand loyalty and lack of impulse buys in this category.

- Thorndike et al (2014, 2012; US; *field experiment, hospital cafeteria*): Choice architecture that increased the visibility and convenience of 'healthy' items, colour-coded as green, in a large hospital cafeteria, enhanced the effectiveness of traffic light labelling with the largest changes observed among beverages. There was a 25.8% increase in purchases of bottled water in phase two of the intervention when the choice architecture component was implemented over three months. Purchase of SSBs decreased by 16.5% in phase one labelling only and decreased by a further 11.4% in Phase two when placement improved. This intervention was assessed over a further 24 months and showed sustained healthier choices due to traffic light labelling and product placement in the cafeteria setting.
- van Kleef et al (2012; The Netherlands; *field experiment, workplace canteen*): Laboratory and field studies examined shelf layout of an impulse display including both healthy and unhealthy snacks near the checkout counter of a workplace canteen and on higher vs lower shelves. Regarding shelf height location of healthy snacks, no significant differences were observed. There was also no significant interactive effect of shelf arrangement by assortment structure. Employees preferred shelf displays including a larger healthy snack assortment located at top shelves. Employees also felt more freedom in choice when healthy snacks were displayed at top shelves compared to lower shelves.
- Dannefer et al (2012; US; *intervention study, grocery stores*): In the Healthy Bodegas Initiative the most commonly implemented aspects of the intervention included placing refrigerated water at eye level, in addition to stocking canned fruit with no sugar added, offering a healthy sandwich, and identifying healthier items. Among the 124 people at baseline and the 153 after the intervention who purchased beverages, the percentage purchasing at least one bottle of water increased from 6% (n=8) to 12% (n=18).
- Glanz et al (2012; *integrative Review: 'Retail grocery store marketing strategies and obesity'*): Indicated no published evaluations of community-level strategies on placement.

- Gittelsohn et al (2012; *Review*): Four trials involved moving unhealthy products to the back of the store and shifted healthier products to the point of service, however the article did not indicate which of these four studies were. Presumably they were part of broader store interventions therefore they were not able to ascertain effectiveness of this aspect alone.
- Rozin et al (2011; *field experiment, cafeteria*): In this study the accessibility of different foods in a pay-by-weightof-food salad bar in a cafeteria were varied slightly. Findings indicated that making a food slightly more difficult to reach (by varying its proximity by about 10 inches) modestly, but reliably, reduces intake, in the range 8–16%.
- Kamasak (2008; Turkey; field experiment, supermarkets): The impact of shelf levels on product sale was examined in an experimental field study in supermarkets for the biscuit category. Biscuits were chosen as they are subject to impulse purchase and did not have a high brand loyalty and, at the time of year, were not subject to price promotions. The product was displayed at knee-level shelves across 10 small and medium-sized supermarkets for one month, was then raised to the next shelf up (waist to shoulder level) for one month, and then the top shelf (eye-level) for one month. Sales data showed that there was a significant difference between the mean sales scores (at least one of them) of the biscuits placed in different shelf levels: the difference between 'knee-level' and 'eye-level' sales and the difference between 'waistto-shoulder' and 'eye-level' sales were each significantly different (in favour of eye-level) but sales differences between 'knee-high shelf sales' and the 'waist-toshoulder level shelf sales' were not significant. Overall the degree of relation was considered to be not strong. Note that brand and brand loyalty factors were purposefully omitted in this research.

Outcome: Sales/ Purchases ('Proximity'/ food groupings)

- Review findings based on several field experiments indicate that the organisation of products in terms of proximity to other products or the way products are grouped in supermarkets, affects cross-category purchases. However, the findings are not sufficient to make recommendations regarding groupings/ placement of items in relation to other products for affecting purchases.
- Hollands et al (2013; *Systematic Review*)¹¹⁴: This review of 'proximity' (altering proximity of options by changing layout) primary studies identified related to dietary behaviours, with a variety of outcomes reflecting changes in consumption, purchasing or selection of products. The majority of studies reported an effect of the intervention on behaviour, however the majority of studies were not in the supermarket/store setting.
- Glanz et al (2012; *Review; 'Retail grocery store marketing strategies and obesity'*): Proximity of categories to one another can influence cross-category purchases, as both facing aisles and EOA displays can increase purchases on a scale comparable to other marketing mix strategies, although these effects are not observed symmetrically across products. If consumers' purchase products from 'virtue' categories early in a shopping trip, they increase purchasing from 'vice' categories later in the trip (may vary by socio-demographic factors).

- Desai & Ratneshwar (2003; US; *experimental*): In a study involving manipulation of snack foods on shelves in a simulated grocery store environment among 184 undergraduate students, it was found that grouping low-fat salty snacks together led to higher sales than mixing them with their parent brands and other regularfat snacks. Similarly, low fat versions of junk food may be perceived as better tasting and less healthy when placed in the health food section than in the junk food section.
- Drèze et al (1994; US; *field experiments*): This study measured the effectiveness of two shelf management techniques: 'space-to-movement,' in which shelf sets were customised based on store-specific movement patterns and 'product reorganisation', where product placement was manipulated to facilitate cross-category merchandising or ease of shopping. The study found modest gains (4%) in sales and profits from increased customization of shelf sets and 5-6% changes due to shelf reorganization: organising ready-to-eat cereals by type reduced category sales by 5% and alphabetising canned soup reduced sales by 6%. Modelling of the experimental data estimated the impact of shelf positioning and facing allocations on sales of individual items. The modelled data showed that location had a large impact on sales, whereas changes in the number of facings allocated to a brand had much less impact as long as a minimum threshold (to avoid out-of-stocks) was maintained.

¹⁴Altering microenvironments to change population health behaviour towards an evidence-base for choice architecture interventions (Hollands et al 2014); Note: Also published in grey literature as: Altering choice architecture to change population health behaviour: a large-scale conceptual and empirical scoping review of interventions within micro-environments.

SUB-ACTION: End-of-aisle (EOA) display

Evidence of intervention effectiveness

Marketing studies and two field experiments in supermarkets indicate that end-of-aisle displays positively influence consumer attitude towards products and encourage purchases.

Marketing studies

- Cohen & Babey (2012a); Sorensen (2003); cited in Nakamura et al (2014): Around 30% of total supermarket sales come from the end of aisles.
- Payne et al (2014; review): Marketing studies show that EOA displays significantly positively influence consumer attitude towards a product (even if the brand is not well-known).

Field experiments

- Nakaamura et al (2014; field experiment): UK grocery store 2010–11; after controlling for price, price promotion, and the number of display locations for each product; EOA display increased sales volumes in all three alcohol categories: by 23.2% for beer, 33.6% for wine, and 46.1% for spirits, and for three non-alcohol beverage categories: by 51.7% for carbonated drinks, 73.5% for coffee, and 113.8% for tea. The effect size was equivalent to a decrease in price of between 4% and 9% per volume for alcohol categories, and a decrease in price of between 22% and 62% per volume for non-alcohol categories. EOA displays appear to have a large impact on sales of alcohol and non-alcoholic beverages. Restricting the use of aisle ends for alcohol and other less healthy products might be a promising option to encourage healthier in-store purchases, without affecting availability or cost of products; "interventions restricting displays of alcohol and SSBs in aisle ends may be as effective as some pricing interventions and may be applicable to other nonalcohol categories".
- Gabrielli & Cavazza (2013; *field experiment*): For toothpaste and instant chocolate pudding mix in EOA display stands, EOA display stands significantly influenced consumers' attitudes towards the product, and, indirectly, their purchase intention.

SUB-ACTION:

Checkouts

Supporting evidence: descriptive studies

- Unhealthy products at checkouts predominate and are within reach of children, who exhibit considerable pester power; parents express a desire for confectionery-free checkouts.
- In a poster presentation at ANZOS (2014), Gannon et al reported on data from an online survey of parents and their experiences at supermarket checkouts. The snapshot study (Parents' Jury, VIC) found that 90% of parents had been pestered to buy unhealthy foods at checkouts; 77% of parents would prefer to shop in a store where all checkouts are free from confectionery and sugary drinks; and 63% of parents said they would switch to a similar shop nearby if it provided junk-free checkouts.
- In the UK, research based on Tesco Club Card data found that families with young children have, on average, the least healthy shopping baskets, while pensioners and older adults are the healthiest shoppers. An earlier study by the grocer found that 65% of customers said removing confectionery from checkouts would help them make easier choices (Tesco extends candy checkout ban to C-stores; Oliver Nieburg, 06 Jan 2015; http:// www.confectionerynews.com/Markets/Tesco-checkoutconfectionery-ban?utm_source=copyright&utm_ medium=OnSite&utm_campaign=copyright)
- Thornton et al (2012; AUS; cross-sectional): In Melbourne CBD, snack food displays were most prominent at checkouts, with only five stores not having snack foods at 100% of their checkouts. Snack foods were also present at a number of end-of-aisle displays at both the front (median 38%) and back (median 33%) of store), and in island bin displays (median number of island displays=7; median total circumference of island displays=19.4 metres). Chocolate items were the most common snack food item on display. There was no difference in the availability of these snack food displays by neighbourhood disadvantage.

- Dixon et al (2006; AUS; *cross-sectional*): Among 24 randomly selected supermarkets within a 20 km radius of Melbourne CBD, most checkouts displayed chocolate (87%), gum (81%) and sweets (80%). Only 7% of checkouts had their checkout displays out of reach of children.
- Campbell et al (2012, 2014; AUS; *qualitative*): In this focus group study, parents reported difficulties dealing with constant requests and expressed desire for environmental changes including confectionery-free checkouts, minimization of child friendly product placement and reducing children's exposure to food.
- Dixon et al 2006; AUS; *qualitative*): Food requests from children are common during supermarket shopping. Despite the majority of the requests being unhealthy, parents often purchase these foods.

Evidence of intervention effectiveness

Outcome: Implementation

- Evidence from the UK indicates that voluntary agreements for healthier checkouts are not effective in achieving implementation.
- Horsley et al (2014): UK Government's 'Responsibility Deal' (RD): convenience supermarkets in the UK that had all signed up to the RD; 12/13 stores; however 89% of products on display at checkout were unhealthy (using FSA criteria). One store was a notable exception and this had only fruit and nuts at the checkouts.

Outcome: Sales

- Industry media statements from real world implementation trials in the UK and US indicate enhanced overall sales when less healthy items are replaced by healthier items at checkouts.
- Two field experiments (one canteen, one convenience store) indicate that substituting healthier snack items at the checkout results in increased overall sales (use of not-commonly-purchased items may increase effectiveness).

Field experiments

- van Kleef et al (2012; The Netherlands; *Laboratory and field study*): Shelf layout of an impulse display including both healthy and unhealthy snacks near the checkout counter of a canteen and on higher vs. lower shelves was examined Higher probability of healthier snack choice (purchase) when 75% of assortment consisted of healthy snacks compared to 25%.
- Sigurdsson et al (2014; Norway; *field study*): Norwegian study showed that substituting healthier snack options at the checkout lines of a convenience store increased sales of those items (if they were not commonly purchased items) showed a substantial increase in the sales of healthy food products and a concurrent decrease in the sales of less healthy items. It was important that the healthy items at checkout were not commonly purchased items; for example, an earlier study by Sigurdsson et al (2011; Norway) reported that displaying bananas at check-out locations failed to increase sales.

Real world implementation

• Lidl (UK) launched a trial 'Healthy Till' in each of its 600 stores in January 2014 by replacing 'treat' items such as chocolate with products of a higher nutritional value like multivitamin juice, oatcakes and fresh fruit. Initial figures showed the Healthy Till seeing 20% higher footfall than traditional tills. It isn't clear from the website if the tills were continued beyond the 10-week trial period.

[http://www.lidl.co.uk/en/2027.htm; accessed Nov 6, 2014]

Aldi (UK) has indicated that it will introduce healthier tills in all of its stores across the UK in January 2015. All confectionery, chocolate, and sweets will be removed and replaced with healthier options including dried fruit, nuts, juices, and water. The move followed a 16-week trial in selected ALDI stores from Feb–June 2014, in which "The healthier tills trial quickly showed that healthier foods prove more popular with our shoppers than the traditional checkout offer of confectionery and sweets."
 [Giles Hurley, joint Managing Director of corporate buying]

http://www.theguardian.com/business/2014/aug/27/aldibans-sweets-checkouts-uk-stores WalMart (US) expanded from two to three checkouts with healthier snacks, as anecdotal evidence indicated huge success and increased profits/sales compared to confectionery. http://www.communitycommons.org/ sa_success_story/healthier-check-out-aisles-at-the-walmart-in-anderson-calif/

Implementation examples

- TESCO: UK and Ireland: Tesco removed confectionery from checkouts at large stores in the UK in 1994, but has now extended the ban to Tesco Metro and Express convenience stores. Sainsbury's and the Co-operative have a 'no sweets' policy at checkouts in large stores in the UK but the bans do not apply to smaller stores. As indicated above (effectiveness), Lidl and Aldi removed confectionery from till zones in 2014; Morrisons. Asda and M&S continue to stock sweets at checkouts.
- TESCO: The retailer said it had replaced the confectionery with healthier snacks including dried fruit, nuts and cereal bars, and every food item on the checkout would be one of the 'five a day', have no red traffic light ratings, be in calorie-controlled snack packs or be deemed by the department of health to be a 'healthier snack'. Confectionery would also be removed from areas adjacent to the tills for example, racks of sweets at children's eye level next to checkout queues. http://www. dailymail.co.uk/news/article-2893129/Now-Tesco-bans-chocolate-checkouts-Supermarket-extends-bans-Express-Metro-stores-bid-tackle-childhood-obesity.html (sighted 01/01/2015)

Food environment modification: Reduced exposure of adults (and children) to misleading advertising

Context/setting: Nutrition (nutrient content) claims

ACTION:

Nutritional guidelines regarding nutrition claims relating to unhealthy food/beverages

Supporting evidence: descriptive studies

Exposure

 Adults/parents are exposed to a large number of nutrition and health claims in print media, via TV advertisements and on packaged products.

Print media

Pitts Burke et al (2013; UK; content analysis): UK women's magazines and associations with the type and nutritional content of products promoted. All advertisements for food and alcohol in 108 issues of popular UK monthly women's magazines were identified and text-based marketing messages classified using a bespoke coding framework. This information was linked to existing data on the type (i.e. food group) and nutritional content of advertised products. A total of 2,687 marketing messages were identified in 726 advertisements. Consumer messages such as 'taste' and 'guality' were most frequently found. Marketing messages used in advertisements for food and alcohol were notably different. The relationship between type and nutritional content of products advertised and marketing messages used was not intuitive from a consumer perspective: advertisements for foods 'high in fat and/or sugar' were less likely to use messages related to health, but more likely to use messages emphasising reduced amounts of specific nutrients. Almost all advertisements included consumer-related marketing messages. Marketing messages used were not always congruent with the type or nutritional content of advertised products.

- Nan et al (2013; US; content analysis): a content analysis of health- and nutrition-related claims used in food advertisements in popular women's and men's magazines showed that nutrient content claims (e.g. 'low in fat') are the most predominantly used, followed by general nutrition claims, structure/function claims, and healthy claims. The least used category is health claims. Use of health- and nutrition-related claims differs across food groups and types of magazines.
- Jones Williams et al (2008; AUS; content analysis) examined the use of health claims in the 30 most frequently appearing food advertisements in Australian magazines. Of 28 advertisements where a claim was identified, for only one did more than 90% of experts (nutritionists and marketers) believe the claim to be accurate. Nutritionists were more likely than marketers to perceive that the target audience would identify with the advertisement, and nutritionists more likely to perceive that the target audience would believe and misunderstand the nutritional information provided. This research showed that experts in both nutrition and marketing perceive that there is considerable potential for food advertising to mislead consumers.
- Williams (2007; AUS; content analysis): From January to June 2005, a survey of all print advertisements for food in Australia's 30 top-selling magazines was undertaken. The results were compared with those from a 1996 survey of health claims in Australian magazines and more recent surveys of claims for food on product labels and on internet sites. The survey found that 29.5% of 390 advertisements for food carried a health claim. Many of the claims were high-level claims (29%) or therapeutic claims (8%), which are not permitted by prevailing food standards. The most common benefits being promoted related to cardiovascular disease, energy, cancer and weight control, and most claims referred to the effect of the whole food, rather than specific ingredients. Results were similar to previous studies of food labels and internet sites.

TV advertisements

• Dixon et al (2013; AUS; *review*): Four of the six Australian studies documented the presence of nutrition and health claims. In one of these studies, nutrition claims were documented for 37% of core/miscellaneous food advertisements and 9% of non-core (unhealthy) food advertisements.

Packaged products

- Mayhew et al (2015; 16 countries; cross-sectional): A cross-sectional study of chip and sweet biscuit packages were collected from 16 countries at different levels of economic development in the EPOCH (Environmental Profile of a Community's Health) study between 2008 and 2010. A total of 737 packages were evaluated for nutrition labelling, selected promotional marketing techniques relevant to nutrition and health, and health and nutrition claims. Overall 86% of packages had nutrition labels, 30% had health or nutrition claims (only 2% had health claims), and 87% displayed two marketing techniques and one health or nutrition claim.
- Wellard et al (2014; AUS; audit and nutritional assessment): A survey of all fruit snacks, soups and fruit and vegetable juices and fruit drinks indicated that 48% (n=366) of these products carried at least one fruit and vegetable claim, of which 34% did not meet nutrient profiling. Products carrying claims referencing the number of servings of fruit and vegetables had more energy, sodium, saturated fat and sugar, and less fibre, than fresh fruit and/or vegetables.
- Devi Eyles et al (2014; NZ; audit and nutritional assessment): New regulations are being implemented to restrict nutrition and health claims to products that meet certain 'healthy' criteria. This study investigated the difference in nutritional quality, labelling and promotion between 'healthy' and 'less healthy' breakfast cereals, and between breakfast cereals intended for children compared with other breakfast cereals on the NZ market. Twentysix percent of cereals did not meet the 'healthy' criteria. Significantly more nutrition claims (75%) and health claims (89%) featured on 'healthy' cereals, nutrition claims (65%) were more predominant than health claims (17%).

- Song Halvorsen et al (2014; US; audit) examined 127 cereal boxes. On the front panel, there was an interesting contradiction between health-related textual and graphical messages. The nutrient claim appeared on more than half of cereals for children, which is significantly higher coverage compared with that of adult cereals. On the other hand, the representation of a bowl of cereal was far more likely to appear artificially-coloured or sweetened on child-targeted cereal boxes; and to contain less fruits and nuts compared with adult-targeted cereals. Results on the back and side panels showed that messages targeting adults are mostly health related (e.g. well-being, purity) while messaging to children focuses less on health-related messages and more on games, toys and other entertaining topics. Nutritionally, child-targeted cereals overall are less nutritious than adult-targeted cereals and have higher rankings of sugar sources in the ingredients.
- Maschkowski et al (2014; Germany and Norway; audit): This study compared packaged products in a country with a government-approved nutrient profiling scheme (Norway) with one that didn't (Germany). Many products in the German 2010 sample (n=128) were marketed as healthy products, with 84% displaying any kind of health-related information on the packaging such as nutrition claims, health claims, whole grain claims, clean labelling or healthy ingredients in the product name. Some products carried several claims. In particular, 58% of RTEC packaging contained nutrition claims, 7% displayed health claims and 12% applied a clean labelling claim. Whole grain claims were made by 31% of RTECs, which contained between 7–93% whole grain. The whole grain content of the entire German 2010 sample ranged between 7–100%. Furthermore, 57% of products collected in Germany made reference to healthy ingredients in the product name, such as vitamins and minerals and/or whole grain. The packaging of the German 2012 sample (n=73) displayed fewer nutrition claims (22%) and no health claims but slightly more whole grain claims (37%), which contained between 14–95% whole-grain. Content analysis of the Norwegian 2012 sample indicated that 50% of the products displayed nutrition claims, a share of 11% made use of health claims, 29% depicted the Nordic Keyhole and 11% of the Norwegian RTE cereals packaging applied a 'free from' claim. Whole grain claims were displayed on 45% of RTE cereals. They contained between 39–100% whole grains. A share of 26% products displayed both
wholegrain claim and Nordic Keyhole. RTE cereals advertised to children from the German 2010 sample had significant higher OFCOM scores compared with nonchild-advertised RTE cereals. They were significantly higher in sugar and lower in fibre as compared with other RTE cereals. There was also a significant difference between the nutrition profiles of the German and Norwegian RTE cereals sampled in 2012. Cereals purchased in Norway were on average lower in energy, lower in sugar, higher in dietary fibre and had a much lower OFCOM score. As expected, most highly-processed German RTE cereals were of low nutritional quality. Only a minority qualified against any of the nutrient profiling schemes. The rate was even lower for RTE cereals marketed to children because of their high sugar and low fibre content. Furthermore, children's RTE cereals belong to the product categories that are most strongly advertised. In addition, a substantial proportion of parents (40%) mistakenly believe that food marketed to children is nutritionally optimised for the needs of children, according to a representative survey of the Federation of German Consumer Organisations.

- Snowdon et al (2013; Pacific Islands; *audit*): Over onequarter of packaged foods included some nutrient- or health-related claims.
- Schermel et al (2013; Canada; *audit*): nutritional marketing present on 48.1% of Canadian food packages, with nutrient content claims being the most common (45.5%). The marketing messages used most often related to total fat and trans fat (15.6% and 15.5% of nutrient content claims, respectively).
- Mehta Phillips et al (2012; AUS; *audit*): In a supermarket in Adelaide, 157 discrete products were marketed to children via product packaging. Claims about health and nutrition were found on 55.5 % of non-core foods.
- Hampshire et al. (2011; cited in Maschowski et al 2014; Germany): Cereals displaying a fibre claim did not have better nutrition profiles than those without. Only cereals advertising the claim 'no-sugar added' scored better.

 Elliott (2008; Canada; audit and nutritional assessment): Excluding confectionery, soft drinks and bakery items, 367 products aimed specifically at children were assessed for their nutritional composition. The article examines the relationship between 'fun food' images/messages, product claims and actual product nutrition. Among other findings, it concluded that approximately 89% of the products analysed could be classified as of poor nutritional quality owing to high levels of sugar, fat and/or sodium.

Healthiness of products carrying nutrition claims

- Many products carrying nutrition claims would not meet current nutrient profiling criteria for healthy foods.
- De la Hunty et al (2014; US; *narrative*): "Our view is that the health claims approval process is currently tilted too much towards the protection of the consumer from unwarranted health claims and not enough towards empowering consumers to choose a healthier diet."
- Hughes et al (2013; AUS; audit and nutritional assessment): Proposed Australian regulation of claims on food labels includes requirements for products carrying a health claim to meet nutrient profiling criteria. This would not apply to nutrition content claims. Observational survey of claims on food packages across three categories: non-alcoholic beverages, breakfast cereals and cereal bars. Nutrient profiling was applied to products carrying claims to determine their eligibility to carry health claims under the proposed regulation. Three large metropolitan stores from the three major supermarket chains in Sydney, Australia were surveyed in August 2011. All claims on 1028 products were recorded. Two-thirds of products in the three categories (ranging from 18 to 78%) carried at least one claim. Of those carrying health claims, 31% did not meet the nutrient profiling criteria. These would be ineligible to carry these claims under the proposed regulation. Additionally, 29 % of products carrying nutrition content claims did not meet the nutrient profiling criteria. The number of products carrying nutrition content claims that did not meet the nutrient profiling criteria suggests that comprehensive regulation is warranted. Promotion of unhealthy foods using claims is potentially misleading for consumers and hinders their ability to select healthier foods. Implementation of the proposed regulation represents an improvement to current practice.

- Komatsu et al (2013; international; narrative): Compared food legislation (in Brazil (existing and new), the EU, and the US) regarding the adequacy of a functional guava mousse to comply with standards for the nutrient content and nutrient comparative claims. Important differences between the legislations for achieving some claims were noted, especially when the serving portion was used as standard instead of 100g. This would require some attention by regulatory authorities, once the possibility of manufacturers to reduce or to increase the products' serving portions up to achieve a claim, misunderstanding the consumer, may exist.
- Gorton et al (2010; NZ; *narrative*): Such claims should therefore only be permitted to be placed on healthy foods.
- Mariotti et al (2010; *overview*): This overview discusses the potential pitfalls of a new regulatory framework for health claims in the EU. Assessment of the relevance of health claims has mainly been related to scientific substantiation, and the issue of relevance in terms of public health has been largely overlooked. This article delves beyond the issue of scientific substantiation of claims and reviews possible discrepancies between consumer perception/understanding of health claims and the public health nutrition reality, which can confuse or mislead the consumer and ultimately impact public health nutrition. Six pitfalls are described and a comprehensive overview of the critical examination of any health claim is proposed.

Supporting evidence: experimental studies

Nutrition and health claims positively affect perceived healthiness and perceived taste of products, including EDNP foods, in adults and children.

Adults

 Abrams et al (2015; US; focus group): Thematic analysis indicated that parents of preschool children associated characters and other playful visuals with higher sugar content and artificial ingredients but they were also led to believe the product was healthier based on visuals of fruit, more realistic pictures, health claims, cross-branding with healthier foods, and visuals suggesting the product was more natural. Parents agreed that they rarely think beyond their initial impression.

- Maubach et al (2014; *choice experiment*): Health claims increased rankings of less nutritious options, though this effect was less pronounced when the products featured a multiple traffic light label.
- Lwin et al (2014; *experimental*): Using realistic threedimensional packaging shows that for restrained eaters (i.e., those who try to restrict their food intake), nutrition claims on 'healthy' products and nutrition seals on 'unhealthy' products are effective at enhancing perceptions of product healthfulness. Unrestrained eaters, in contrast, are largely unaffected by nutrition seals and claims.
- Wong et al (2014; Canada; *experimental*): This study was a randomised mock-packaged experiment with online survey of Canadian consumers. Tested claims related to plant sterols (PS) or oat fibre (OF) versus 'tastes great' on cereal boxes. All claims that mentioned either PS or OF resulted in more positive attitudes than the taste control claim (P<0.0001), despite all products within each study having the same nutrition profile. How consumers responded to the nutrition claims between the two studies was influenced by contextual factors such as familiarity with the functional food/component and the food product that carried the claim.
- Wong et al (2013; Canada; *experimental*): Randomised mock-package experiment: three sodium claims (disease risk reduction, function, and nutrient-content claims) and a tastes-great claim (control). Food packages with any sodium claim resulted in more positive attitudes toward the claim and the product healthfulness than did packages with the taste control claim, although all mock packages were identical nutritionally. In general, participants attributed (often inappropriate) additional health benefits to low-sodium products beyond the well-established relation of sodium and hypertension.
- Dixon Scully et al (2011; AUS; *experimental*): 1551 parents of 5–12 year olds. Nutrient claims and sports celebrity endorsements tip consumer preferences towards EDNP products bearing such promotions, especially among the majority who do not read the nutrition information panel (NIP). These parents were significantly more likely to choose an EDNP product if it included a nutrient claim (OR 1.83, 1.312 –.56).

- Harris Thompson et al (2011; US; *survey*): A study among 306 parents of children aged between two and 11 years recruited through an online panel, showed that the majority of parents misinterpreted the meaning of claims commonly used on children's cereals ('supports your child's immunity', 'whole grain', 'fibre', 'calcium and vitamin D', 'organic'). They inferred that cereals with claims were more nutritious overall and might provide health-related benefits for their children; and these beliefs predicted greater willingness to buy the cereals. These findings indicate that common front-of-package nutrition-related claims are potentially misleading, especially when placed on products with high levels of nutrients to limit (e.g. sugar, sodium) and low levels of other nutrients to encourage (e.g. fibre, protein).
- Verhagen et al (2010; Europe; *overview*): Consumers can hardly distinguish between graded levels of evidence, and they make only little or no distinction between nutrition and health claims.
- Gorton et al (2010; NZ; intercept survey): Survey assessing understanding and interpretation of claims '97% fat free' and 'no added sugar', of supermarket shoppers: Nearly three-quarters (72%) of participants correctly estimated the fat content of a 100g product that was '97% fat free', and understood that a product with 'no added sugars' could contain natural sugar. However, up to three-quarters of Māori, Pacific, and Asian shoppers assumed that if a food carried a '97% fat free' or 'no added sugar' claim it was therefore a healthy food. Similarly, low-income shoppers were significantly more likely than medium- or high-income shoppers to assume that the presence of a claim meant a food was definitely healthy. Nutrition content claims have potential for harm if the food they are placed on is not healthy overall. Such claims should therefore only be permitted to be placed on healthy foods.
- Drewnowski et al (2010; US; online consumer panel): Consumer perception of healthfulness was most strongly driven by the declared presence of protein, fibre, calcium and vitamin C and by the declared total absence of saturated fat and sodium.

• Williams (2005; *Review*): Consumers view a food as healthier if it carries a health claim and this 'halo' effect may discourage them from seeking further nutrition information. Consumers do not clearly distinguish between nutrient content, structure-function, and health claims. There is some evidence that the use of health claims improves the quality of dietary choices and knowledge of diet-disease relationships.

The 'halo effect' created by nutrition (and health) claims may lead to over-consumption.

- Cavanagh et al (2014; *experimental; with restrained and unrestrained eaters*): "Thus, although restrained and unrestrained eaters' perceptions are similarly affected by branding and caloric information, brands and caloric information interact to affect restrained eaters' consumption. This laboratory study reveals that labelling foods as 'low calorie' may create a halo effect which may lead to over-consumption of these foods in restrained eaters".
- Faulkner et al (2014; *experimental with isoenergetic drinks*): This laboratory study showed that the larger portions selected for the 'reduced fat' food in association with lower perceived energy density and anticipated consumption guilt suggests that such nutrition claims could be promoting inappropriate portion size selection and consumption behaviour.

Children

- Heller et al (2015; US; *experimental*): Among children aged 4–7 years, showing different food label photos that varied with regard to fruit content (i.e. real fruit versus 'sham' fruit) and television advertisements with similar fruit content and label elements, indicated that labels and advertisements for sham fruit foods mislead children with regard to the food's real fruit content.
- Soldvani et al (2012; US; *experimental*): Among 47 grade 4 and grade 5 children in California, packets of cookies and crackers with a nutrition claim were perceived as "healthier" and better tasting.
- Elliott ((2008); Hill & Tilley (2002); Canada; cited in Hawkes 2010 review): Most of the products with nutrition claims targeted at children were actually not very nutritious when judged against the cited nutrition criteria, but children perceived products as 'healthy' simply because the package included claims. These authors also said that the presence of an ingredient list, a 'health' front-of-pack symbol, or a symbol denoting that the food contained no allergenic products, made them think the product was healthy.

Evidence of intervention effectiveness

Outcome: Exposure

- The presence of a government-approved nutrient profiling system underpinning nutrient claims (in Norway) is associated with healthier packaged products (ready-to-eat cereals).
- Maschkowski et al (2014; Germany and Norway;
 comparison study): In Norway, where the governmentalapproved nutrient profile is in place, RTECs had on average higher whole grain contents than in Germany.
 As a result, significantly higher contents of fibre were observed in Norwegian products. Moreover, the Nordic Keyhole, which requires a minimum amount of 50% whole grain, was depicted on more than half of the products with whole grain claims and even on two children's products, signalling a consistent relationship between health-related on-pack information and the nutritional value of RTECs as a result of governmentapproved regulation.

Discussion

Reduce exposure of children to advertising of non-core food/ beverages

Background

Overview

Children are exposed to food/beverage advertising via a vast array of modes, including online, sponsorship, direct marketing, viral marketing, advergaming, point-of-sale promotions, product placement and branding in movies, and TV.

A substantial number of reviews, many systematic, of food marketing to children are found in the peer-reviewed and grey literature. Many of these reviews refer mainly to 'food promotion' or 'food marketing' as an entity rather than referring to specific modes of food and/or beverage advertising/ marketing/promotion. Many of the earlier reviews — particularly that by Cairns et al (2013) for which the publication date belies the date of evidence retrieval (up to November 2009), refer to small-scale experimental studies in a laboratory or simulated setting, rather than to real world implementation evaluation. More recent systematic reviews have included regulatory approaches in the real world across the various modes of exposure (e.g. Chambers et al 2015 and Galbraith-Emami & Lobstein 2013).

The evidence indicated in the paper by Kelly et al. (2015; as mentioned in the Introduction) supports a logical sequence of effects linking food promotional marketing to individual-level weight outcomes; and in our review brand awareness, TV viewing time, and commercial TV viewing time was found to be associated with 'weight' in observational studies; but not in any small-scale experimental studies. This is not unexpected as weight, as pointed out by Kelly et al., is a distal outcome. Likewise, weight outcomes were not identified in any of the evaluations of real world implementation or intervention studies, largely due to the difficulty of directly linking intervention exposure to this outcome in this domain.

Effect of food advertising

Brand awareness is a prerequisite of children's requests and choices for branded foods (Tatlow-Golden Hennessy et al (2014) and is likely to affect food choices. A small number of studies indicate that brand loyalty created in childhood likely persists into adulthood. Small-scale laboratory studies and one crosssectional study indicate that child knowledge and awareness/ recognition of brands is not associated with foods consumed, however findings from one laboratory study and one crosssectional study (in India) supports an association between brand awareness and child weight status.

The evidence with respect to 'food advertising' and food preferences was summarised in two systematic reviews and indicates that the evidence (from small-scale experimental and cross-sectional studies) is 'modest' and on balance indicates that food advertising can influence food preferences. Food advertising and branding has been associated with purchase requests (or 'nagging') by children. The review by Cairns et al (2013)¹¹⁵ indicated that the evidence was 'strong' that food promotion can directly influence purchasing choice and requests among children. The same review indicated that there was 'strong' evidence that food promotion *does* influence food choices at category and brand levels; and 'modest' evidence that food promotion *can* influence food consumption behaviours. An observational study indicates this effect among lower-income families only.

An empirical study in the US using regression analysis of sales data across 24 years versus annual advertising expenditures did not find an association between the two variables for carbonated soft drinks (CSD). The authors surmised that CSD advertising has minimal or no impact on aggregate consumption, but they did indicate that it is important to brand and market share.

¹¹⁵Note that this review includes studies published only up to November 2008 and the studies are predominantly cross-sectional and experimental studies conducted under artificial, laboratory conditions

Factors affecting vulnerability to food/ beverage advertising among children

Experimental studies and findings from psychology and neuroscience indicate that children are highly susceptible to the persuasive intent of advertising. A lack of 'advertising literacy' — the recognition and understanding of the selling and persuasive intent of advertising — among children is often used as an argument for restricting advertising to children. However, there is mixed evidence from a small number of studies as to the effect that advertising literacy has on food preferences. There was some evidence that increased understanding of advertising's persuasive intent may actually increase the impact of advertising among some child age groups. Other proposed conditions necessary for 'defence' against advertising include the ability to produce counter-arguments against advertising and also the motivation to do so. Further, marketing influences can occur even in the absence of cognitive processing and awareness of message exposure.

A number of factors other than advertising literacy, may moderate the effects of food/beverage advertising, increasing or decreasing child and youth susceptibility to such advertising. These factors include: advertising attention (older adolescents affecting descriptive norms) and neural susceptibility (with suggested individual differences in neural susceptibility to advertising); habitual TV watching; food neophobia; nutrition knowledge; consumption-related family communications (striving for harmony and conformity reduced consumption); maternal encouragement to be thin (increased consumption); parental diet; home availability of EDNP foods/beverages (consumption); and peer pressure.

Multiple observational and experimental studies show that overweight/obese children have heightened awareness of/are more responsive to advertising.

Some experts argue that the 'stalemate' on statutory regulations to protect children from exposure to EDNP food/beverage marketing could be advanced by stronger use of ethical arguments, including a rights-based approach to protect children from exploitation.

Industry self-regulatory pledges

Industry self-regulation of food advertising ranges from collective self-regulation pledges that companies can join, to within-pledge commitments issued by single corporations. Examples of international and country-level pledges include the Responsible Children's Marketing Initiative (RCMI) and Quick Service Restaurant Industry Initiative (QSRI) in Australia, the Children's Food and Beverage Advertising Initiative (CFBAI) in the USA, and the European Union Pledge. These pledges vary with respect to which modes of advertising they cover. Government has also engaged with industry to develop selfregulatory codes in Bulgaria, Denmark and Spain.

Food marketing legislation frameworks

Framework legislation exists under the World Health Organisation, and in countries including Chile and Spain.

There is substantial public acceptability of government regulation of food marketing to children in Australia, with two surveys of adults indicating up to 83% support for such regulation.

Context/setting: television

Children are exposed to large amounts of advertising for non-core foods and beverages during children's viewing times, family viewing times and from movie and program in-product placement.

Effect of TV viewing and TV commercials

TV viewing time has been independently positively associated with more positive attitudes towards EDNP food. The majority of observational studies, including several recent, large, repeat cross-sectional studies, indicate that overall TV viewing time is independently associated with poorer diet quality — including higher consumption of fast food, sugar-sweetened beverages, snack foods and EDNP foods, and lower F&V consumption — and diet-related health such as blood cholesterol levels. In addition, the amount of TV viewing time has been positively associated with weight status and weight gain among children

in a number of large longitudinal studies. A recent review for the World Health Organisation indicated that the balance of literature suggests that the associations between TV viewing and obesity remain significant even when potential confounders such as socio-economic status, familial tendency to overweight, and levels of physical activity, are taken into account; and also that a causal link is supported by the independent prediction of higher adult BMI with more TV viewing.

Although TV viewing has been used as a proxy for exposure to commercials, and has been validated in some studies, estimates of association with weight-related and weight outcomes determined using the amount of viewing of *commercial* TV provide more direct evidence of the need to intervene in this area. The particular role of TV commercials/advertisements on diet-related outcomes, including weight status, independent of TV viewing time overall, is indicated in a substantial number of cross-country and within-country studies involving large sample sizes.

An Australian cross-sectional study found that frequent commercial TV viewing was independently associated with more positive attitudes towards EDNP food; and parental report and field observations indicate that brands and marketing in TV. in addition to packaging and characters (see below) are associated with purchase requests by children to parents. Empirical sales data from the US over a one-year period indicated that TV and on-packet advertised, child-targeted RTE cereals were purchased 13 times more frequently than non-advertised products. The majority of cross-sectional studies and one national cohort study, plus a very recent Australian survey, show that the amount of exposure to commercial TV is positively associated with poor dietary behaviours among children and adolescents. Likewise, the vast majority of evidence from a substantial number of cross-sectional and empirical studies indicates a positive association between commercial TV exposure, particularly for EDNP foods and fast foods, and overweight/ obesity.

In conclusion, the majority of evidence from large cross-country and within-country studies support a positive association between exposure to TV advertising of EDNP foods and beverages and BMI. Two experimental studies produced contrasting findings regarding the impact of TV advertisements for EDNP foods on food preferences. Exposure to advertisements for fast food during a cartoon show among 7–10 year-olds was associated with higher liking for fast food post-viewing compared to a control group, whereas a similar study among grade five and six students in Australia involving various unhealthy foods found no association, although an association was shown between TV advertisements for healthier foods and preferences for those foods post-viewing. There are similarly mixed findings from a number of laboratory studies, involving mainly choice experiments, to support a positive association between exposure to unhealthy food and beverage TV advertisements and consumption of these products immediately post-viewing.

Simulation and data modelling studies indicate that eliminating TV advertising to children might reduce obesity levels by up to around 14–18%; and that it would be a cost-effective measure.

A number of surveys in Australia indicate that parents are highly supportive (up to 83% in a survey of 1511 adults) of a ban on advertising of unhealthy food/beverages at times when children watch TV, with the majority supporting a ban for a longer period during the broadcasting day. The ban is also supported by state government representatives.

Statutory regulation of TV advertising

Statutory regulation of TV advertising of non-core foods and beverages during children's broadcasting has been implemented in Australia (Children's TV Standards 2005), the UK (OfCom 2006), South Korea (Special Act on Safety Management of Children's Dietary Life, January 2010), and in Quebec (since 1978).

These regulations have showed mixed effectiveness in terms of reducing child exposure to such advertisements, largely due to an increase in those advertisements during prime family viewing times. In the UK, despite nearly 100% compliance, exposure of children to HFSS food advertising did not change pre- postregulations. This was attributed to the guidelines only applying to a very small proportion of TV broadcasting. One UK study showed that proportions of core and non-core advertisements did not differ significantly between children's peak viewing and non-peak viewing times. Indeed, in one region of the UK, relative exposure of all viewers to HFSS food advertising increased. Regulations only applied to a small amount of broadcast.

In Australia, several studies indicated that the early Children's TV Standards did not affect the number of unhealthy food advertisements during children's programming and compliance was low, with a large number of breaches occurring. In South Korea, however, pre- post- audits of TV advertising indicated that the statutory regulation in 2010 led to a decrease in total advertising budget and number of advertisements for EDNP during all hours and during restricted hours.

A comparison of levels of brand recognition among children in two different regions of Canada where there was a statutory ban on TV advertising to children (Quebec) and one where there was self-regulation (Ontario) indicated a positive effect of the ban; the Quebec advertising ban did not affect overall exposure to food/beverage advertising by children aged 10-12, although there was evidence of an effect on the food categories advertised and marketing techniques used, resulting in reduced toy and cereal brand recognition. Contrary evidence was found in a comparison of brand knowledge/awareness among preschoolers in Ireland and Northern Ireland; the latter for which there was statutory regulation around HFSS TV advertising at children's viewing times, did not find any differences. The evidence from Canada also suggested that the healthiness of food/beverage products advertised to children improved in response to the ban. Additionally the advertising ban in Quebec was deemed to be effective at reducing fast food purchasing propensity — food expenditure data indicate that the ban led to about 17 million fewer fast food meals eaten per year (household expenditure on fast food was reduced by 13% per week due to reduced purchasing propensity), with households significantly less likely to purchase fast food if they lived in Quebec rather than Ontario.

A company self-report indicated that mandatory restrictions on TV unhealthy food advertising in South Korea led to compliance with labelling requirements and reinforcement of nutritional contents examination, as well as changes to products such as reducing unhealthy ingredients and fortifying nutrients, i.e. product reformulation.

Food/beverage industry self-regulation tv advertising

A large number of agreements have been made around the world. These can largely split into two types: (i) collective selfregulation pledges that companies can join, and (ii) withinpledge commitments issued by single corporations. The evidence provided in this review is limited largely to the former type. Agreements include: the International Food and Beverage Association (cross-country; including Chile; South Korea); Children's Food and Beverage Advertising Initiative (CFBAI; USA); European Union Pledge (various including Germany, Romania, UK); Responsible Children's Marketing Initiative (RCMI; Australia); Quick Service Restaurant Initiative (QSRI; Australia); Canadian Children's Food and Beverage Advertising Initiative (CAI; Canada); Forum for Fødevarereklamer (Denmark); and PAOS (Spain).

A vast evidence base from pre- post- evaluations, post-only evaluation studies and comparison studies between signatories and non-signatories to self-regulatory pledges across these countries exists. A significant systematic review by Galbraith-Emami & Lobstein (2013) reports on these and other findings and the current review builds on these findings.

The evidence indicates that self-regulatory pledges made by industry are generally ineffective at reducing the exposure of children to unhealthy food/beverage advertisements; and, that exposure by signatory companies is often higher than for non-signatories. One of the major reasons seems to be that the nutrition criteria are not sufficient to identify healthier foods appropriate for advertising to children (cf. below for further inadequacies of current regulatory and self-regulatory approaches to reducing food advertising to children).

A single study of the CFBAI (US) among confectionery companies showed that self-regulatory pledges which result in the elimination of TV advertising to all age groups, i.e. that reduce TV advertising exposure during adult as well as child viewing times, significantly reduce household purchasing of those companies' products.

A modelling study showed that it is important for a market leader to participate in the initiative (self-regulatory pledges); if a follower company participates but the market leader does not then the market coverage of the advertised product is likely to expand in the majority of cases.

Restrict food/beverage product placement during children's/youth tv programming

Although branded appearances are indicated to be relatively rare, evidence from the US suggests that food/beverage placements during programming are increasing and that placement of unhealthy foods is high in the UK and Ireland. Eating of EDNP foods and drinking of SSBs are placed most commonly in an appealing light as social or celebratory cues in TV programs. Product placement is more prevalent during youth-oriented shows than adult-oriented shows in the US.

There is mixed evidence from small laboratory studies for the effect of product placement on immediate brand awareness, attitudes and behavioural disposition towards EDNP foods/ drinks.

A recent Australian survey among adolescents showed that the link between TV viewing and poor diet was strongest for children who were actually exposed to advertisements embedded within programs , in addition to those who watched the most commercial TV.

In the US self-regulatory environment (CFBAI), brand placements were more likely among signatory companies than nonsignatories; and brand placements by Coca-Cola (a signatory) were frequent.

Restrict use of persuasive techniques in tv advertising aimed at children

This action is based on the rationale that a substantial proportion of TV food/beverage advertisements to children, in Australia and internationally — especially among noncore foods/beverages — contain persuasive elements, food cues, messages and themes such as: premium offers (free gifts, competition, rebate, vouchers); promotional characters; nutritional and health claims; themes of 'taste' and 'palatability'; fantasy/imagination themes; and the emotional appeal of 'fun' 'happiness' and physical activity. A wide-variety of positive and negative themes is presented during these food advertisements. Health-related messages for foods of low nutritional quality are common, as are unrealistic and contradictory messages. extraordinary 'powers', the implied ability of certain foods to enhance popularity, performance and mood. The range and complexity of these techniques complicates the restriction of their use in food advertising to children. Persuasive elements

occur frequently in relation to advertising of food/beverages to children; and significantly more food advertisements during children's peak viewing times, compared to non-peak times, contain these persuasive elements in Australia.

A recent systematic review provided good evidence that the use of techniques such as premium offers (free gifts, toys, discounts, and competitions) promotes brand loyalty in children, and other persuasive techniques including the use of promotional characters, nutrition- and health-related claims, and appeals to taste and fun increase children's recall and enjoyment of advertising, purchase-request behaviour, food preferences and consumption behaviour.

A recent laboratory study showed that children respond favourably to food advertisements that associate a product with healthfulness — in this case a sugar-laden ready-to-eat cereal depicting enjoyment of physical activity — and contrast with food companies assertions that promoting physical activity in their marketing is encouraging children to maintain a healthy lifestyle.

One of the most commonly used persuasive elements is that of promotional characters, including media celebrities, sports celebrities and cartoon and movie characters. One review and two more recent laboratory studies and child self-report indicate that TV advertisements endorsed by a celebrity can influence children's image of the advertised brand, their purchasing intentions and consumption of the product.

A single study indicates that parental acceptability of regulation around the use of persuasive elements in TV advertising of unhealthy food to children in Australia is high. Parents were concerned about unhealthy food advertising to children (67.3%), use of popular personalities (67.7%), toys (76.4%), and advertising volume (79.7%).

A recent systematic review indicated that "research and many of the advertising codes and regulations in many countries centre on limiting the quantity of unhealthy food advertising without similar rules around the persuasive content of such marketing". In Ireland the 2009 Commercial Communications Code states that food advertising must not feature celebrities; and the Broadcasting Authority of Ireland in 2012 prohibited endorsements of foods with HFSS content by celebrities, sports stars, TV program characters, and characters from cinema releases. In Australia there are some regulatory content rules limiting promotional and premium offers, the use of promotional characters and celebrities and nutritional health claims targeted at children. In the UK, there is regulation around the content of food advertising regardless of when it is scheduled, prohibiting the use of licensed characters, celebrities, promotional offers and health claims in advertisements for HFSS products targeted at pre-school or primary school children. Also product placement is covered by restrictions on broadcast advertising.

Regulatory control in the UK led to a reduction in the use of persuasive elements (the use of promotional characters and other techniques known to appeal to children) on children's TV channels but this form of food advertising remained widespread on popular commercial channels during adult airtime/ sports channels; and these elements are more commonly associated with non-core foods on all channels.

There was an increase in exposure to promotional characters in food and beverage advertisements on TV after self-regulatory pledges in Canada and the European Union.

Context/setting: fast food outlets — toy premiums

Toy premiums or giveaways are present in many TV advertisements for fast food in the US and probably also in Australia as indicated above, although specific data relating to exposure were not identified in this scoping review. In 2009 in the US it was the leading form of food marketing directed at children by expenditure; amounting to \$341 M.

Evidence from four laboratory studies conducted in a number of different countries provide mixed evidence of the effect of toy giveaways on food preferences or consumption: two studies indicated no differences between toy or no toy, whereas two other studies indicated that collectible toys as premiums influence children's attitudes towards both healthful and unhealthful meal offerings, and that the motivational pull of collectible toys can be very strong. One study protocol has been published to examine among primary school aged children in Melbourne, whether: (i) movie tie-in premiums accompanying fast-food meals influence young children's meal choices and their perceptions of these meals; and, (ii) effects of these promotions occur to the same degree for both unhealthy and healthy fast-food meals.

Toy ordinances in the US, one in San Francisco and one in Santa Clara county, prohibited the distribution of toys and other incentives to children in conjunction with meals, foods or beverages that did not meet minimal nutritional criteria. The findings were somewhat mixed and difficult to disentangle: for example, changes to purchases of children's meals did not appear to be directly in response to the Ordinance in San Francisco. However the two implementation evaluations indicated that the toy ordinance resulted in the toys not being distributed or advertised in conjunction with unhealthy meals/ beverages. The ordinance appears to have positively influenced marketing of healthful menu items and toys as well as toy distribution practices at ordinance-affected restaurants, but did not affect the number of healthful food items offered probably because the ordinance wording allowed toys to be sold separately. In addition, there was an indication from a magazine article that the toy ordinance led to fast-food outlets dropping the prices of existing children's meals, i.e. an unintended negative consequence.

In Australia, KFC, but not McDonald's or Hungry Jack's, have removed their toys. A recent experimental study in Australia showed that children are least likely to choose unhealthy meals from fast food outlets when movie tie-in premiums only accompany healthy meals.

It is worth noting that it is not only the actual toy giveaway that is important. A recent study in the US¹¹⁶ found that more than 20% of fast food restaurants used child-directed marketing inside or on their exterior. The limitation of children's exposure to marketing via this means at the point-of-purchase is largely unexplored and not contained within current marketing guidelines.

¹¹⁶Ohri-Vachaspati et al (2015).

Context/setting: packaged products (retail)

A large proportion of packaged products aimed at children are marketed to children using a range of elements similar to those used in TV advertisements, including: children's characters; appears 'ready-to-eat'; games and other fun activities. The major promotional tactic is the use of TV and movie celebrities and cartoon characters. For example, in a supermarket in Adelaide it was determined that between 9% and 35% of products aimed at children used promotional tactics; with the use of TV, movie celebrities and cartoon characters making up 75% of all promotions. Sixteen unique marketing techniques were observed on the product packaging marketed to children in this study; with a median of 6.43 marketing techniques per product found.

A one-year study using sales data in the US showed that TV and on-packet advertised child-targeted ready-to-eat cereals (RTEC) were purchased 13 times more frequently than non-advertised products.

Promotional characters include licensed characters, unknown cartoon characters, celebrities, popular personalities including sports personalities, health professionals or scientists. An audit of Australian packaged foods showed that nutritional composition varied significantly by character type, with 69% of products with sportspersons, celebrities, or movie tie-ins being healthful, compared with 38% of licensed and 16% of company-owned characters. These characters occur, therefore, most often on less healthy options. Only 13 of the 75 companies using characters on packaging were signatory to the Australian Food and Grocery Council Responsible Marketing to Children Initiative (RMCI).

A substantial number of experimental, laboratory studies have shown that promotional characters on packaged foods affect children's perceived taste and food preferences, and possibly food choices.

Self-regulation regarding cross-promotions on food packaging in the US were ineffective at reducing exposure, which increased post- self-regulation. Adoption of the RCMI in Australia is low among those companies promoting heavily to children via characters on food packaging, and occurs among those companies who are signatories. Branded packaging has been found to affect food preferences and intended purchase among children. In one study, children consistently preferred the taste of the food in branded (McDonald's) packaging than plain packaging, even though the food was the same. Additionally, experimental studies have shown that colourful, attractive packaging affects children's food preferences, purchase-requests and perceived taste of food. However, the aesthetic elements of packaging of less healthy food/beverage items have not been investigated in terms of intervention.

Context/setting: internet

Exposure to internet advertising, particularly via advergames, is extensive, and may not be fully recognised by parents as a medium of advertising. Advergames and food company websites predominantly feature EDNP foods/beverages. Breakfast cereals and fast foods are advertised most, with studies showing up to 84% of promotions for products high in fat, sugar, and/or sodium.

In particular, there is evidence that cereal manufacturers promote high-sugar cereals using deeply engaging techniques; and promoting nutritional wellness and the consumption of high-sugar cereals simultaneously, essentially conflating the two messages. Other marketing features used globally and on Australian websites include branded education, competitions, promotional characters, downloadable items, branded games and designated children's sections. The top online gaming websites for advergames do not notify users of their commercial nature via ad breaks during the game.

There are several studies which indicate that young children's ability to recognise advertisements on a web page is far behind their ability to recognise advertisements on TV. A substantial number of laboratory experiments using simulated conditions indicate that younger children are responsive to advergames in terms of brand recall, attitudes, taste expectations, purchase requests and health perceptions. Studies indicate that playing an advergame increases affect (emotion) towards a product and increases energy intake while playing the games or immediately afterwards. As is the case for TV advertisements, there are mediators to susceptibility to food advertising via advergames, including latency of initial fixation on the food cue, and impulsivity.

In accordance with TV advertising, self-regulatory pledges in the US and Canada have not reduced advertising of unhealthy foods on company websites/advergames; and exposure is more prevalent among signatories than non-signatories in the US.

As part of the Special Act on advertising in South Korea, highcalorie food with low nutritional value may not be advertised to children up to 17 years of age on the internet using gratuitous 'gifts' other than food (such as toys) which may entice children to buy such foods.

Social networking sites for advertising and brand promotion have increased rapidly and websites widely use marketing features unique to social media that increase consumer interaction and engagement, including competitions based on user-generated content, interactive games, and apps. Although social media sites require users to declare their age as being over 13 years, there is good evidence that younger children routinely access these sites. In particular, several studies conducted in Australia and a systematic review indicate that food marketing on Facebook is extensive and uses common marketing techniques that are both unique to social marketing sites as well as common to other marketing mediums.

Adolescent and young adult Facebook users' appeared most receptive to engaging with this content, as indicated in a study in Australia. Empirical data in the US indicate that advertising of carbonated soft drinks (CSDs) via social media (Facebook, Twitter and YouTube) and subsequent conversations around brands and the nutritional aspects of CSDs, have a significant impact on their valuation of brand characteristics and ultimately on their choices of carbonated SSBs. A narrative review of the literature in relation to young adults and marketing, particularly via online media, indicates that restrictions on EDNP food and beverage marketing should be extended to include internetbased advertising and also should aim to protect vulnerable young adults, reducing the likelihood that unhealthy eating behaviours become embedded and hence track into later adulthood.

Parental support in Australia for government restriction of the use of non-broadcast media marketing of unhealthy food to children is high (81%; single study).

Context/setting: children's print media

There have been a number of studies in New Zealand and Australia indicating the content of advertising in children's magazines. Magazines specifically targeted to children and adolescents contained a significantly higher proportion of unhealthy branded food references in Australia. For example, in one study examining the content of all Australian children's magazines published in 2009, 86% of the 269 branded food references were for non-core foods. In another study, the food groups with the highest proportion of branded food references were ice creams and iced confections, fast food restaurant meals, high-sugar drinks, and snack foods. Advertisements are using at least some of the 'marketing tricks' that have been identified as a cause for concern.

One Australian experimental study showed an effect of unhealthy food advertising in magazines on snack food choice among primary school children.

The Australian self-regulatory initiatives administered under the auspices of the Australian Food and Grocery Council (AFGC), the RCMI and the QSRI, have not carried through to magazine advertising.

Implementation considerations: self-regulation of marketing to children (overall)

A large number of weaknesses or insufficiencies exist such that food and beverage companies, even if they are signatories, and perhaps especially if they are signatories, can circumvent selfregulatory pledges and codes to continue to advertise unhealthy foods and beverages to children via multiple media. The major weaknesses relate to:

- 1. the permissive and inconsistent nutrition criteria used to classify unhealthy foods
- 2. the lack of transparency of industry policies
- 3. TV restrictions apply only to child programming times and do not extend to family viewing times/programs
- 4. lack of extension to all modes of advertising
- 5. no independent monitoring or sanctions for non-compliance.

These and other insufficiencies have been discussed at length by a number of authors and these discussions are summarised in the text.

Context/setting: schools

To the authors' knowledge the extent of advertising by food and beverage companies in Australian schools is not documented, although such advertising is extensive in the US.

Before the passage of a ban in Maine, US, legislators were assured by industry advocates that soft drink marketing on school scoreboards and vending machines would be removed but this did not occur. Compliance with the subsequent ban was extremely low in Maine.

A law intended to keep kindergartens and schools free from food and beverage advertising in Spain is reportedly not enforced.

An evaluation of the mandatory school-based nutrition policy in Queensland, 'Smart Choices', involving a survey of Principals and P&Cs indicated that proportional implementation was, respectively, vending machine advertising (85% and 84%); sponsorship and advertising (93 and 84%); fundraising events (80% and 84%); and sporting clubs (73% and 75%).

Reduce sports sponsorship by food/beverage companies

Context/setting: sports sponsorship

Studies from Australia, NZ, and the US highlight the extent of sports sponsorship associated with unhealthy foods/ beverages. Content analysis in Australia has shown considerable embedding of product marketing within match play, including within match commentary, sporting equipment and special replays. Exposure to food/beverage sponsorship among children's sports in NSW would be highest for rugby league and outdoor cricket. A content analysis of websites of sporting organisations in Australia indicated that 63% did not meet criteria as healthy sponsors.

Recall of sports sponsorship is high among Australian children, and sports sponsorship by food and beverage companies positively affects children's stated preferences for and intended purchase of the company's products. In Australia ,older children are likely to think more about sports sponsors when buying products than younger children, and are more likely to buy the products associated with the sponsor. Sports sponsorship encourages children to 'feel better' about the company.

Parents and the sporting community are supportive of restricting unhealthy food and beverage sports sponsorship or promotion in Australia. For example, 75% of 825 Australian parents surveyed supported the introduction of policies to restrict unhealthy food, beverage and alcohol sponsorship of children's and elite sports. In this survey, more parents (81%) supported the introduction of alternative funding models to allow these companies to sponsor sport provided there was no visible branding.

Healthway, in WA, has a co-sponsorship policy which was introduced to ensure the promotion of unhealthy brands and messages do not undermine health messages at sponsored events and activities among sport, arts, racing and community events organisations and community groups. No evaluation studies were identified.

Although there is considerable support for restricting sports sponsorship of unhealthy foods/beverages in Australia; the funding implications for sporting clubs if they uphold such restrictions are uncertain, although thought to be modest in Australia. Australian experts indicate that monitoring may be necessary for understanding the scope of the problem, and for promoting and guiding the development of meaningful policy interventions.

Reduce exposure to marketing via product placement in-store

Context/setting: retail — product placement in-store

Marketing studies have concentrated on three main areas: aisle management and position on shelves; end-of-aisle (EOA) displays; and, checkouts.

Location in-store/on shelves

Aisle management and placement of items is increasingly used in retail to increase traffic, sales and profits. Many purchases are unplanned and customers 'buy what they see' as more visible, convenient to reach and attractive. A small number of oft-cited marketing studies conducted several decades ago indicate the importance of location on the shelf in terms of sales.

Evidence from a substantial number of field experiments and intervention studies in a variety of environments (grocery stores, supermarkets, cafeterias) indicates that placing healthier items at eye level, at the front of stores, and making them easier to reach, increases sales. Summaries of findings in review articles based on a small number of experimental studies indicate that the organisation of products in terms of groupings and proximity to other similar or different products affects crosscategory purchases, however these findings do not come from the intervention literature and are insufficient to make specific recommendations regarding groupings or the placement of items in relation to other products for decreasing purchases of less healthy products, and increasing purchases of healthier products.

End-of-aisle displays

Marketing studies and two field experiments in supermarkets indicate that end-of-aisle (EOA) displays positively influence consumer attitude towards products and encourage purchases. This suggests that action to restrict the placement of less healthy food/beverage items EOA in-store might decrease the purchase of these items.

Checkouts

Unhealthy products at checkouts predominate in Australia (as indicated in the most recent data from Melbourne published in 2012) and these products are within easy reach of children who exhibit considerable pester power. Parents in Australia express a desire for confectionery-free checkouts.

Two field experiments — one in a canteen in The Netherlands, and one at the checkout lines of a convenience store in Norway — indicate that substituting healthier snack items at the checkout results in increased overall sales; and there is an indication from the latter study that it may be important that the healthy items at checkout are not commonly purchased items, e.g. displaying (commonly purchased) bananas at checkout locations in the Norwegian trial failed to increase sales.

Evidence from the UK Government's Responsibility Deal indicates that, although all convenience supermarkets in the UK had signed up to the deal. 89% of the products on display at checkouts were unhealthy (according to FSA criteria). One store was an exception, selling only fruit and nuts at the checkouts. Tesco removed confections from checkouts at all large stores in the UK in 1994, but this has recently been extended to Tesco Metro and Express convenience stores. Sainsbury's and the CO-OP have a 'no sweets' policy at large stores in the UK.

Online industry media statements from implementation of pilot studies in Lidl and Aldi in the UK and WalMart in the US indicate an increase in till profits among 'healthier' tills. As such Aldi indicated it would introduce healthier tills in all of its stores across the UK in January 2015.

Healthier tills in the UK replaced 'treat' items with products of a higher nutritional value, such as multivitamin juice, oatcakes, and fresh fruit. WalMart included physical activity 'toys' such as skipping ropes instead of confectionery at their 'healthier tills'.

Reduce exposure to misleading advertising

Context/setting: nutrition and health claims

Adults/parents are exposed to a large number of nutrition and health claims in print media, via TV advertisements and on packaged food/beverage products. For example, in magazines in the UK a content analysis indicated that the relationship between type and nutritional content of products advertised and marketing messages used was not intuitive from a consumer perspective: advertisements for foods 'high in fat and/ or sugar' were less likely to use messages related to health, but more likely to use messages emphasising reduced amounts of specific nutrients. Almost all advertisements included consumerrelated marketing messages. Marketing messages used were not always congruent with the type or nutritional content of advertised products. A similar situation exists for Australian magazines.

Many products carrying nutrition claims would not meet current nutrient profiling criteria for healthy foods. A 2011 audit and nutritional assessment of 1028 products in supermarkets in Sydney showed that 29% of products carrying nutrient content claims did not meet the nutrient profiling.

A number of laboratory studies and choice experiments have shown that nutrition and health claims positively affect perceived healthiness and perceived taste of products, including EDNP foods and beverages in adults and children; i.e. they provide a 'health halo effect'. In addition, two laboratory studies suggest that the 'halo effect' created by nutrition (and health) claims may lead to overconsumption.

There is no current regulation around the use of nutrition claims in Australia, yet the number of products carrying nutrition content claims that do not meet the nutrient profiling criteria, and the potential for them to mislead consumers into thinking an EDNP food is healthy, suggests that comprehensive regulation is warranted. Norway has a government-approved nutrient profiling scheme underpinning nutrient claims: an evaluation study comparing formulation of RTE cereals in Norway compared to Germany, where no such scheme exists, showed that they contained significantly more fibre and that there was a consistent relationship between health-related on-pack nutrition claims and the nutritional value of RTECs in this country.

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Appendix 1: INFORMAS and NOURISHING frameworks

<u>s</u>		Public sector policies and actions					Private sector policies and actions				
ORGANISATION	PROCESSES	How much progress have (international, national, state and local) governments made towards good practice in improving food environments and implementing obesity/ NCDs prevention policies and actions? <i>(University of Auckland)</i>					How are private sector organisations affecting food environments and influencing obesity/NCDs prevention efforts? (Deakin University)				
FOOD ENVIRONMENTS	IMPACTS	Food composition	Food labelling	pr	Food promotion		Food provision			Food prices	Food trade & investment
		What is the nutrient composition of foods and non-alcoholic beverages? (The George Institute)	What health- related labelling is present for foods and non-alcoholic beverages? (University of Oxford)	What is the exposure and power of promotion of unhealthy foods and non-alcoholic beverages to different population groups? (University of Wollongong)		What is the nutritional quality of foods and non-alcoholic beverages provided in different settings (eg. schools, hospitals, workplaces)? (University of Toronto)		What is the availablilty of healthy and unhealthy foods and non-alcoholic beverages in communities and within retail outlets? (University of Auckland)		What is the relative price and affordability of 'less healthy' vs 'healthy' foods, meals & diets? (Queensland University of Technology)	What are the impacts of trade & investment agreements on the healthiness of food environments? (Australian National University)
POPULATIONS	OUTCOMES	Population diet				Physiological & metabolic risk factors			Health outcomes		
		What is the q different <i>(Universit</i>)	What are the burdens of ob other risk factors? (WHO)			pesity and	What are the burndens of NCD morbidity and mortality? <i>(WHO)</i>				

Figure 1

The International Network for Food and Obesity/NCDs Research, Monitoring and Action Support (INFORMAS) Framework (Swinburn et al 2013)

Domain		Policy Area	Policy Options/Actions					
	N	Nutrition label standards and regulations on the use of claims and implied claims on foods	e.g. Nutrient lists on food packages; clearly visible "interpretive" and calorie labels; menu, shelf labels; rules on nutrient and health claims					
FOOD ENVIRONMENT	ο	Offer healthy foods and set standards in public institutions and other specific settings	e.g. Fruit and vegetable programmes; standards in education, work, health facilities; award schemes; choice architecture					
	U	Use economic tools to address food affordability and purchase incentives	e.g. Targeted subsidies; price promotion at point of sale; unit pricing; health-related food taxes					
	R	Restrict food advertising and other forms of commercial promotion	e.g. Restrict advertising to children that promotes unhealthy diets in all forms of media; sales promotion; packaging; sponsorship					
	I	Improve the quality of food supply	e.g. Reformulation; elimination of trans fats; reduce energy density of processed foods; portion size limits					
	S	Set incentives and rules to create a healthy retail environment	e.g. Incentives for shops to locate in underserved areas; planning restrictions on food outlets; in-store promotions					
FOOD SYSTEM	н	Harness supply chain and actions across sectors to ensure coherence with health	e.g. Supply-chain incentives for production; public procurement through "short" chains; health-in-all policies; governance structures for multi-sectoral engagement					
NGE	I	Inform people about food and nutrition through public awareness	e.g. Education about food-based dietary guidelines, mass media, social marketing; community and public information campaigns					
EHAVIOUR CHA COMMUNICATI	N	Nutrition advice and counseling in health care settings	e.g. Nutrition advice for at-risk individuals; telephone advice and support; clinical guidelines for health professionals on effective interventions for nutrition					
Δ	G	Give nutrition education and skills	e.g. Nutrition, cooking/food production skills on education curricula; workplace health schemes; health literacy programs					

Figure 2

Food policies to promote healthy diets: The ©WCRF International NOURISHING framework. (Hawkes et al 2013)

Appendix 2: Examples of schemas for grading/rating evidence

- The University of Wisconsin assigns an evidence rating to a strategy based on the quantity, quality and findings of available research. Ratings were:
 - Scientifically Supported: Strategies with this rating are most likely to make a difference. These strategies have been tested in many robust studies with consistently positive results.
 - **Some Evidence:** Strategies with this rating are likely to work, but further research is needed to confirm effects. These strategies have been tested more than once and results trend positive overall.
 - **Expert Opinion:** Strategies with this rating are recommended by credible, impartial experts but have limited research documenting effects; further research, often with stronger designs, is needed to confirm effects.
 - **Insufficient Evidence:** Strategies with this rating have limited research documenting effects. These strategies need further research, often with stronger designs, to confirm effects.
 - **Mixed Evidence:** Strategies with this rating have been tested more than once and results are inconsistent or trend negative; further research is needed to confirm effects.
 - Evidence of Ineffectiveness: Strategies with this rating are not good investments. These strategies have been tested in many robust studies with consistently negative and sometimes harmful results.
- Spencer et al (2013):
 - Weak: Field-based summaries or evaluations in progress that have plausible impact (e.g. abstracts, book chapters without peer review, demonstration projects lacking appropriate evaluation)
 - **Moderate:** Intervention evaluations without peer review of practice or publication that have evidence of impact (e.g. case studies with appropriate evaluation, evaluation reports, peer-reviewed abstracts and presentations)
 - **Strong:** Case-control or cohort analytic studies; peer-reviewed publications; published reports from consensus panels (e.g. nonsystematic review of published intervention evaluations with peer review of practices that have evidence of impact)
 - **Rigorous:** Intervention evaluations or studies with systematic review that have evidence of impact (e.g. meta-analyses, Guide to Community Preventive Services)

- Haby & Bowen (2010): The Victorian Department of Health recommended categories for assessing the strength of evaluation and research evidence of health intervention effectiveness:
 - Strong evidence of effectiveness: One SR or MA of comparative studies or several good quality RCTs or comparative studies (Levels I-III NHMRC)
 - Sufficient evidence of effectiveness: One RCT; one comparative study of high quality; or several comparative studies of lower quality (Levels II-III NHMRC)
 - Some evidence of effectiveness: Impact evaluation (internal or external) with pre- and posttesting; or indirect, parallel or modelling evidence with sound theoretical rationale and program logic for the evaluation (Level IV)
 - Weak evidence of effectiveness: Impact evaluation conducted but limited by pre- or posttesting only; or only indirect, parallel or modelling evidence of effectiveness (Level IV)
 - Inconclusive evidence of effectiveness: No position could be reached because existing research/ evaluations give conflicting results; or available studies are of poor quality or have very small sample sizes
 - No evidence of effectiveness: No position could be reached because no evidence of impact/outcome available.
 - Evidence of ineffectiveness: Good evaluations (high quality comparative studies) show no effect or a negative effect.
Guide to Community Preventive Services (USPSTF): Assessing the strength of evidence of a body of evidence on effectiveness of population-based interventions (based on Briss et al 2000)

Figure 3

Relationship between strength of evidence of effectiveness and reccomendations (reprinted from *Am. J. Prev. Med.*, Vol. 18, No. 1S, Briss PA, et al., Developing an evidence-based Guide to Community Preventive Services—methods, p.40, Copyright 2000, with permission from *Am. J. Prev. Med.*) (4)

Strength of evidence of effectiveness	Recommendation
Strong	The intervention is recommended on the basis of strong evidence of effectiveness.
Sufficient	The intervention is recommended on the basis of sufficient evidence of effectiveness.
Insufficient evidence	Available studies do not provide sufficient evidence to determine the effectiveness of the intervention.
Sufficient or strong evidence of ineffectiveness or harm	Use of the intervention is discouraged on the basis of suffiecent or strong evidence of ineffectiveness or harm.
Insufficient empirical information, supplemented by expert opinion	The intervention is recommended on the basis of expert opinion

Relationship between strength of evidence of effectiveness and recommendations. Reprinted from Am. J. Prev. Med., Vol. 18, No. 1S, Briss PA et a., Developing an evidence-based Guide to Community Preventive Services — methods, p. 40.

Figure 4:

Assessing the strength of a body of evidence on effectiveness of population-based interventions in the Guide to Community Preventive Services (reprinted from Am. J. Prev. Med., Vol 18, No. 1S, Briss PA, et al., Developing an evidence-based Guide to Community Preventive Services—methods , p.40, Copyright 2000, with permission from Am. J. Med.) (4)

Evidence of effectiveness ^a	Execution (good or fair ^b)	Design suitability (greatest, moderate, or least)	Number of studies	Consistent ^c	Effect size ^d	Expert opinion ^e
Strong	Good	Greatest	At least 2	Yes	Sufficient	Not used
	Good	Greatest or moderate	At least 5	Yes	Sufficient	Not used
	Good or fair	Greatest	At least 5	Yes	Sufficient	Not used
	Meets design, ex	Meets design, execution, number, and consistency criteria for sufficient but not				Not used
	strong evidence					
Sufficent	Good	Greatest	1	Not applicable	Sufficient	Not used
	Good or fair	Greatest or moderate	At least 3	Yes	Sufficient	Not used
	Good or fair	Greatest, moderate or	At least 5	Yes	Sufficient	Not used
		least				
Expert opinion	Varies	Varies	Varies	Varies	Sufficient	Supports a recommendation
Insufficient ^f	A. Insufficient de	esigns or execution	B. Too few studies	C. Inconsistent	D. Small	E. Not used

^a The categories are not mutually exclusive; a body of evidence meeting criteria for more than one of these should be placed in the highest possible category

^b Studies with limited execution are not used to assess effectiveness

^c Generally consistent in direction and size of effect.

^d Sufficient and large effect sizes are defined on a case-by-case basis and are based on Task Force opinion

e Expert opinion will not be routinely used in the Community Guide but can affect the classification of a body of evidence as shown

^f Reasons for a determination that evidence is insufficient will be described as follows; A. Insufficient designs or ecexcutions; B. Too few studies; C. Inconsistent; D. Effect size too small; E. Expert opinion not used. These categories are not mutually exclusive, and one or more of these will occur when a body of evidence fails to meet the criteria for strong or sufficient evidence.

Assessing the strength of a body of evidence on effectiveness of population-based interventions. Reprinted from Am. J. Prev. Med., Vol. 18, No. 1S, Briss PA et a., Developing an evidence-based Guide to Community Preventive Services — methods, p. 40.

Appendix 3: Selection of publications detailing potential areas for action with regard to food environments (Main author and title)

- Hawkes et al (2013): A food policy package for healthy diets and the prevention of obesity and diet-related noncommunicable diseases
- Brinsden et al (2013): Monitoring policy and actions on food environments: rationale and outline of the INFORMAS policy engagement and communication strategies
- Lloyd-Williams et al (2014): Smorgasbord or symphony? Assessing public health nutrition policies across 30 European countries using a novel framework
- Bromley et al (2013): Utilising a novel framework to assess public health nutrition across 30 European Countries (EuroHeart II Project); uses the 4Ps of marketing approach — Product (reformulation, elimination, new healthier products); Price (taxes, subsidies); Promotion (advertising, food labeling, health education); and Place (schools, workplaces etc)
- Bastian and Coveney (2011): Local evidence-based policy options to improve food security in South Australia: the use of local knowledge in policy development
- Good et al (2010): An audit of local government planning tools for their potential use in addressing community food and nutrition issues
- Allender et al (2009): Moving beyond 'rates, roads and rubbish': How do local governments make choices about healthy public policy to prevent obesity?
- Sacks et al (2008): A systematic policy approach to changing the food system and physical activity environments to prevent obesity

- Magnusson (2008): What's law got to do with it? Part
 2: Legal strategies for healthier nutrition and obesity prevention
- Brescoll et al (2008): Assessing the feasibility and impact of federal childhood obesity policies
- Chriqui (2013): Obesity prevention policies in US States and Localities: Lessons from the field
- Brennan et al (2011): Accelerating evidence reviews and broadening evidence standards to identify effective, promising and emerging policy and environmental strategies for prevention of childhood obesity
- Brennan et al (2014): Childhood obesity policy research and practice: Evidence for policy and environmental strategies
- Hodge et al (2008): Legal themes concerning obesity regulation in the United States: Theory and practice
- Backholer et al (2014): A framework for evaluating the impact of obesity prevention strategies on socioeconomic inequalities in weight
- Capacci et al (2012): Policies to promote healthy eating in Europe: a structured review of policies and their effectiveness
- Brambila-Macias et al (2011): Policy interventions to promote healthy eating: a review of what works, what does not, and what is promising
- McKinnon RA et al (2009): Considerations for an Obesity Policy Research Agenda

Appendix 4 – price elasticity

Price elasticity (PE) of demand (PED) is a measure used in economics to show the responsiveness, or elasticity, of the quantity demanded of a good or service to a change in its price. More precisely, it gives the percentage change in quantity demanded in response to a one percent change in price (*ceteris paribus*, i.e. holding constant all the other determinants of demand, such as income).

In the context of the current report, measures of PE indicate how price-sensitive consumers are to taxes/subsidies on foods and beverages, i.e. how much they may change their purchasing behaviour if a tax is applied to less healthy foods and/or a subsidy applied to more healthy foods.

Price elasticities are almost always negative, although analysts tend to ignore the sign even though this can lead to ambiguity. Only goods which do not conform to the law of demand, such as Veblen¹¹⁷ and Giffen¹¹⁸ goods, have a positive PED. In general, the demand for a good is said to be inelastic (or relatively inelastic) when the PED is less than one (in absolute value): that is, changes in price have a relatively small effect on the quantity of the good demanded. *The demand for a good is said to be elastic (or relatively elastic) when its PED is greater than one (in absolute value):* that is, changes in price have a relatively in the sum of the good demanded. *The demand for a good is said to be elastic (or relatively elastic) when its PED is greater than one (in absolute value):* that is, changes in price have a relatively large effect on the quantity of a good demanded. [Wikipedia]

Two measures are generally reported:

- own-price elasticity (OPE) = measure of how much the consumption of a particular good changes with a change in the price of the good itself.
- cross-price elasticity (CPE) = how much consumption of a given good changes with a change in another good's price, holding everything else constant.

The net health impact of any tax or subsidy on food is a delicate balance of OPEs and CPEs, the baseline distribution of foods consumed, assumptions about whether total expenditures on food remain the same, and other factors (Ngheim et al 2013). Ngheim et al (2013):

- 1. If there is no close substitute for a good then the change in consumption with the change in price will be less pronounced, i.e. less elastic.
- 2. Necessities have lower PEs than luxuries.
- 3. The larger the budget share of a good in a consumer's overall expenditures, the higher the PE, because consumers are more sensitive to the price of an expensive good than a cheaper one.
- 4. When consumers have more time to adjust to a change in price, PEs are usually larger.
- 5. Consumers who purchase at high frequencies or volumes are more price sensitive than consumers who do so at low frequencies or volumes.
- 6. If addicted to the good in question, PEs are less elastic/lower.
- 7. Level of disaggregation of product groupings is also important.
- 8. Short run vs long-run PEs (timeframe depending on how quickly consumers need time to 'react').
- 9. Demand behaviour determined by consumers' preferences so PEs will vary according to context. Therefore care must be taken when applying PEs determined in one country, for example, to another
- 10. Also varies according to social grouping.

¹¹⁷Luxury goods, whereby decreasing their price decreases demand for them.

118In the Giffen goods situation, the income effect dominates, leading people to buy more of the goods, even as its price rises. Typically, the Giffen good is still the cheapest source of a necessary resource (e.g. calories), therefore displacing alternative sources from the fixed amount of income being spent on the resource. (http://en.wikipedia.org/wiki/Consumer_theory#Income_effect)

Appendix 5 – Effects of advertising among adults¹¹⁹

- Kemps Tiggermann et al (2014; AUS; experimental): Exposure to TV food advertisements led to completion of word stems with more food- and eating-related words/ and also increased self-reported desire to eat among overweight and obese female undergraduate students (n=160).
- Zimmerman & Shimoga (2014; US; experimental): Among 351 adult participants randomised to one of four experimental conditions - exposure to televised food advertising vs. exposure to non-food advertising, and within each of these groups, exposure to a task that was either cognitively demanding or undemanding — those exposed to food advertising chose 28% more unhealthy snacks than those exposed to non-food-advertising with a total caloric value that was 65 kcal higher. The effect of advertising was not significant among those assigned to the low-cognitive-load group, but was large and significant among those assigned to the high-cognitiveload group: 43% more unhealthy snacks and 94 more total calories. The authors concluded that televised food advertising has strong effects on individual food choice, and these effects are magnified when individuals are cognitively occupied by other tasks.
- Mills Tanner & Adams (2013; SR): Nine studies were identified on adults but were mainly of medium-tolow quality. All conducted in France, The Netherlands, US. The majority (7/9) of experimental studies involved showing TV programs or movies interspersed with food or beverage advertisements.
- van Strien et al (2012; experimental): Food advertising influenced intake of crisps but not chocolate, although effect varied across subjects according to general eating scores. Overall the results did not show conclusively whether or not food advertising affects food-related behaviour, attitudes or beliefs in adults, but suggests that the impact varies inconsistently within subgroups including gender, weight and existing food psychology.
- Messer et al (2011; experimental): investigated willingness to pay for hamburgers and found no effect of generic beef advertising, although did counteract negative beef marketing related to diseases.
- Anschutz Engels et al (2011; experimental): Experimental study among adults (n=82) showed that food energy intake (freely available chips and chocolate-coated peanuts) in women was higher when they watched the food commercials than neutral commercials but an opposite effect was observed among men.

- Koordman et al (2010; experimental): TV advertisements for SSBs positively affected concomitant SSB consumption among women, whereas commercials for water had no effect on consumption.
- Wonderlich-Tierney (2010; experimental): Examined the number of cookies eaten during food advertisements and found no effect of the commercial condition on food intake.
- Scully Dixon et al (2009; AUS; survey): In a crosssectional telephone survey of 1495 adults in Victoria, high viewers (of commercial TV) were more likely to eat fast food for dinner at least once weekly compared with low viewers (aOR=1.45; 95% CI 1.04, 2.03). Moderate viewers (aOR=1.53; 95% CI 1.01, 2.31) and high viewers (aOR=1.81; 95% CI 1.20, 2.72) were more likely to eat fast food for snacks at least once weekly compared with low viewers.
- Harris Bargh et al (2009; US; *experimental*): Adults watched a TV program that included food advertising that promoted snacking and/or fun product benefits, food advertising that promoted nutrition benefits, or no food advertising. The adults then tasted and evaluated a range of healthy to unhealthy snack foods in an apparently separate experiment. Adults consumed more of both healthy and unhealthy snack foods following exposure to snack food advertising compared to the other conditions. In both experiments (the other was among children), food advertising increased consumption of products not in the presented advertisements, and these effects were not related to reported hunger or other conscious influences.
- Bellisle et al (2009): Measured food consumption in a number of varied environments but did not find an effect from viewing with and without food-related cues in advertisements.
- Harris et al (2009): Those who viewed advertisements for snack foods consumed more than those who watched advertisements for healthy foods; but food score was not significantly different from those who watched non-food advertisements. Snack food advertising had the largest influence on food consumption in men and groups of restrained eaters.

¹¹⁹Although not linked to specific action, as advertising to adults is not considered unethical, this section is included for completeness.

- Mohr Wilson et al (2007; AUS; *survey*): Data in Australia by Nielsen Media Research (n=20527); Predictors of more frequent consumption of fast food at take away (and, to a lesser extent, eat in) included lower age especially under 45 years. The data includes information on adults and impact of sponsorship to relative indifference to health consequences of behaviour, greater household income, more exposure to advertising, greater receptiveness to advertising, lesser allocation of time for eating, and greater allocation of time to home entertainment. There were no effects for occupational status or education level.
- Bellisle & Dalix (2001): Among women, selective recognition of food advertisements, as assessed through the identification of an item from a list of products which may or may not have been shown in the advertisements, was greater among overweight and obese participants than those of normal weight.
- Riskey (1997): A study of Frito-Lay brands showed that sizable sales volume increases occurred for around half of the brands advertised. Advertisements for smaller brands were more likely to result in significant volume increases, and advertisements for new innovations were more successful in comparison with existing product lines or attributes.
- Falciglia & Gussow (1980): Food advertising increased the consumption of cookies among women while watching TV advertisements; the effect was greatest among obese women.

Appendix 6 – Action: Point-of-purchase (POP) promotion of healthier food in retail¹²⁰

Description

In the current evidence synthesis, POP information and promotion excludes those strategies that were only pricing, availability, or placement.

The description of this action area is complex. Different authors use different terms and definitions and many interventions combine different elements of promotion. Examples of how the different reviews have categorised the interventions include:

- The most recent systematic review by Liberato et al (2014) on nutrition interventions at point-of-sale to encourage healthier food purchasing indicates the standardisation of terms as a research priority. The review included nutrition education and promotion in-store:
 - Interactive (with customers and/or store owners) activities (intense)
 - Non-interactive activities (less-intense) activities such as use of mass media and promotional or educational flyers where there is no direct customer/store-owner interaction.
- The systematic review of supermarkets and grocery storebased interventions to promote healthful food choices and eating practices by Escaron et al (2013) identified five strategies used alone or in combination: POP, promotion, advertising, availability, and pricing:
 - POP typically entailed use of food demonstrations, taste testing, signs, labels, and other printed materials highlighting healthful food choices or describing recipes with the goal of influencing purchasing decisions towards more healthful options.
 - Promotion and advertising typically used games, newspaper inserts, multimedia advertising, supermarket tours, and other activities to promote the purchase of more healthful foods.

Health priming is included as part of this action.

Evidence of intervention effectiveness

Outcome: Purchasing

Although there is substantial heterogeneity in intervention type and several reviews therefore indicate insufficient evidence, there is sufficient experimental evidence to indicate that POP promotion and advertising (in various forms, including health priming and appealing to social norms) can be effective in increasing purchases of healthier options, including F&V, especially when combined with other complementary interventions including availability, placement and pricing.

Field experiments

Wansink et al (2014), in an experimental study in a supermarket, showed that simply partitioning a shopping cart with either a flyer insert or with a simple strip of yellow duct tape led to healthy choices becoming salient and led to a significant sales increase in F&V. In the case of a partition for 50%, the market basket allocation of F&V increased from 36.3% to 55.3%, a comparative sales percentage increase of 52.4%. Simply increasing the size of the partition from 35% to 50% increased the dollars spent on F&V by 17.2% (\$14.97 to \$17.54). The study showed that, for grocery store managers, small, innovative in-store changes can have a win-win impact (F&V often higher profit margins and higher spoilage costs for not selling quickly) on shoppers and sales.

¹²⁰This section is included as it has traditionally been considered as a part of the 'marketing' literature but was considered to be extraneous to the current review as the focus was on protecting children from advertising and adults and children from potentially misleading claims – the provision of nutrition information was outside-of-scope as it was not (beyond labeling) part of currently considered broader environmental and policy change; also because these point-of-sale 'sales' promotions have usually been part of multi-component interventions in the retail setting, for which it has been difficult to determine the efficacy of any single component. Nevertheless, a number of reviews and studies in relation to POS promotions were identified in the course of searching for the main body of literature; and is included here for reference purposes

- Payne et al (2014) Targeting unplanned F&V purchases (i.e. slack) through promotion in-store allows benefits to retailers economically (F&V are higher margin) and allows shoppers to improve their nutrition without increasing their costs — provided in-store marketing of fresh F&V by modifying grocery carts and grocery floors to provide information of what is common, normal or appropriate F&V purchases. Experimental study in supermarket with grocery carts:
 - Half-carts: sign and yellow line across shopper trolley: sign in top half said "In the front of your cart please put only healthy foods such as fruit, vegetables, dairy, meat". Bottom half "in the back of your cart place everything else such as chips, detergent, soft drinks, breakfast cereal" — preliminary evidence promising compared to regular carts, half-carts doubled produce purchases.
 - Social messages on grocery carts (shopping trolleys) —
 "In this store, most people choose at least five produce
 items" and listed which ones were most popular.
 Smiley icon on the card with a 'thumbs up'. Produce
 purchases increased by 10% compared to control
 stores by second week of placement and overall
 spending was not affected.
 - Grocery floor arrows "follow the green arrow for your health/heart/weight" produce purchases increased by 9%, again total sales same
- In the randomised controlled trial (RCT) by Foster et al (2014): intervention stores (six months; placement, signage and product availability) showed significantly greater sales of skim and 1% milk, water (in aisle and at checkout), and two of three types of frozen meals compared with control store sales during the same time period. No differences were found between the stores in sales of cereal, whole or 2% milk, beverages, or diet beverages.
- 'Let's Shop Healthier' Healthier Choices Pilot led by Damien Edwards saw the sale of fresh fruit rise by 20% and the sale of frozen fruit by nearly 30% in a trial supermarket over a 15-week period in 2013. Edwards installed life-size cut-outs of doctors and nurses by the fruit and vegetable sections with 'Let's Shop Healthier' slogans around the store. Floor stickers at the fish counter provided further prompts, and free 'bags for life' were also available for shoppers to pick up at the fresh produce section when purchasing fruit or vegetables. (Cited in Corpes 2014).

- Rahkovsky et al (2013; US): The Guiding Stars Program (GSP) involving shelf labels affected the demand for ready-to-eat (RTE) cereals in one supermarket in the US. Significantly increased the demand for cereals that GSP considers more nutritious at the expense of cereals that GSP considers less nutritious.
- Simple health prime to reduce the purchases of EDNP snack foods in a grocery store among overweight individuals (Papies et al 2013; US). Field experiment findings suggest that health priming can lead to healthier grocery shopping (bought almost 75% fewer snacks) among overweight consumers, without relying on conscious awareness during shopping.
- Milliron et al (2012; Phoenix, US) intervention involving brief shopping education by a nutrition educator and an explanation and promotion of a supermarket POP healthful shopping program that included posted shelf signs identifying healthful foods, sample shopping lists, tips, and signage, resulted in greater purchasing of fruit and dark-green/yellow vegetables but no other differences.
- Healthy Bodegas Initiative outreach staff worked intensively with store owners to make positive changes based on 16 health-promoting criteria (increasing fresh produce, stocking healthier snacks, beverages, grocery and deli items; changes to overall store environment including improved produce displays and placing refrigerated water at eye level): stores received incentives as they advanced levels, including produce display crates and reusable shopping bags to offer to customers who purchased fresh produce (Dannefer et al 2012). Stores also received promotional materials to market their healthier products to customers. Linked to community. The most common implementation aspects were placing refrigerated water at eye level, stocking canned fruit with no sugar added, offering a healthy sandwich, and identifying healthier items. Owners reported increased sales of healthier items, but identified barriers including consumer demand and lack of space and refrigeration. The percentage of customers surveyed who purchased items for which a healthier option was promoted (lowsodium canned goods, low-fat milk, whole-grain bread, healthier snacks and sandwiches) increased from 5% to 16%.

- Healthy Kids POP kiosk (Holmes et al 2012) led to overall increase in the proportion of sales of the featured items to total store sales during the intervention period; Individual items that increased sales during the intervention period included whole-wheat bagels, bananas, radishes, honey, sunflower seeds, baked tortilla chips, and almond butter (P<0.05). 61.7% of the patrons interviewed noticed the kiosk, with 28.7% indicating that they purchased at least one item. 58% said the kiosk encouraged them to buy healthier foods.
- In the Baltimore Healthy Stores Intervention (Gittelsohn et al 2010; US), an intervention in nine food stores including two supermarkets and seven corner stores (and eight comparison stores) involved an environmental component to increase stocks of more nutritious foods and provided POP promotions including signage for healthy choices and interactive nutrition education sessions. Exposure to intervention materials was modest in the intervention area, and overall healthy food purchasing scores, food knowledge, and self-efficacy did not show significant improvements associated with intervention areas were significantly more likely to report purchasing promoted foods because of the presence of a BHS shelf label.

Evidence of intervention effectiveness

Outcome: consumption/diet/weight

There is an indication from a small number of intervention trials that improvement in precursors to a healthier diet (and possibly BMI) is improved by the use of POP and wider promotion of healthier foods/drinks.

Reviews

- Liberato et al (2014; SR):
 - Nutrition education (NE) and promotion alone through supermarkets/stores including posters, signs, flyers, nutrition education sessions, store-tours, taste-testing and cooking demonstrations: 15 studies:
 - three short-term non-interactive (Achabal et al 1987, weak; Bergen & Yeh 2006, weak; Jeffery et al 1982, strong)

- three long-term non-interactive (Ernst et al 1986, weak; Levy et al 1985, strong; Rodgers et al 1994, strong)
- nine short-term interactive (Connell et al 2011, moderate; Foster et al 2014, moderate; Milliron et al 2012, strong; Ni Mhurchu et al 2010, strong; Reger et al 1999, strong; Reger et al 2000, strong; Silzer et al 1994, weak; Winett et al 1991, weak)
- NE plus enhanced availability of healthy food through increasing the stock of healthy food and/or drinks (one long-term study; Gittelsohn et al 2010, strong)
- NE plus monetary incentives such as price discount or food coupons or food vouchers (nine studies) with two subcategories:

NE + *Monetary incentives provided to customers (6 studies):*

- five short-term (Ni Mhurchu et al 2010, strong; Anderson et al 2001, weak; Anderson et al 1997, weak; Phipps et al 2014, moderate; Winett et al 1997, moderate)
- · one long-term (Kristal et al 1997, weak)
- · Insufficient strong studies

NE + Monetary incentives provided to customers and store-owners (3 studies)

- · one short-term (Ayala et al 2013, moderate)
- \cdot two long-term (Gittelsohn et al 2010b, weak; Song et al 2009, weak)
- \cdot Insufficient studies
- Nutrition intervention through shopping online (1 study; Huang et al 2006, moderate)
- Overall the review indicated that there was either too much heterogeneity in outcome measures, too few strong studies or too few studies overall, in each category to draw firm conclusions with respect to nutrition interventions POS in terms of purchasing, nutrient intake and mediating factors.

- Escaron et al (2013) scored the evidence on supermarket and grocery store interventions on study design, effectiveness (sales/purchasing data), and reach. The number of studies was also taken into consideration:
 - POP and promotion and advertising (n=15): level of evidence was considered sufficient (highest level)
 - POP, increased availability, promotion and advertising (n=3): level of evidence considered sufficient
 - POP, pricing, promotion and advertising, increased availability (n=2): sufficient
 - POP, pricing, promotion and advertising (n=2): insufficient evidence but highest score for effectiveness
 - POP and pricing (n=1): insufficient evidence
 - POP alone (n=6): insufficient evidence.
- Systematic review of sales effects of product health information at POP (health information at the product level) by Van't Riet (2013): product health information was delivered using shelf tags (eleven studies; 65% of total), posters (six studies; 35%), brochures (four studies; 24%), flyers (three studies; 18%), a multimedia, publicaccess system (two studies; 12%) and in one case (6%) package labels. Overall the evidence was mixed. Of all 17 studies, five yielded a positive effect on product sales and five studies yielded positive findings for some products but not for all products. Ten studies thus yielded evidence for the (partial) effectiveness of product health information. In contrast, three studies yielded an increase in healthy purchases for some products, but a decrease in healthy purchases for other products. Moreover, four studies yielded no evidence of any increase in healthy purchases. Unfortunately this review didn't synthesise the evidence according to intervention type hence, without further analysis, the data can only inform the evidence for the effectiveness of POP information overall. Interventions were more likely to be effective when they lasted for a longer time, when they included additional intervention components, when they targeted the absence of unhealthy nutrients instead of or in addition to the presence of unhealthy nutrients.

- Review by Gittelsohn et al (2012) indicated that:
 - 12 trials used in-store signage (e.g. shelf labels, posters).
 - seven trials (Scottish Grocers Federation Healthy Living Neighbourhood Shop) used media outside the stores; Zhiwaapenewin Akino'maagewin and Baltimore Healthy Stores used educational fliers and promotional give-aways.
 - two trials (Apache Healthy Stores and Healthy Bodegas) also used multilingual social marketing materials in community venues (e.g. newspapers).
 - three trials, including Live Well Colorado Healthy Corner Store Initiative, used coupons or vouchers to increase healthy food purchases; and seven trials used cooking or taste tests to introduce unfamiliar foods.
 - Food stocking and in-store promotional materials were placed and maintained with relatively high fidelity (acceptability).
 - Significant increases in sales of promoted foods of between 25–50% (through increased availability and promotion) among all trials that collected sales data (Apache Healthy Stores, Baltimore Healthy Stores, Good Neighbors Program, Scottish Grocers Federation Healthy Living Neighbourhood Shop, Have a Heart Paisley).
 - Of the 10 trials that reported impact on consumer purchasing and consumption behaviours, nine observed significantly increased frequency of purchase of at least one promoted food. Seven out of 10 trials reported increased purchasing frequency, by weight, of promoted foods, including F&V, low-fat milk, highfibre cereals, and water.

- Review by Levy (2012) identified 10 intervention trials examining the effectiveness of POP Information (POPI) in the supermarket setting:
 - Shelf labelling (Patterson et al 1992 & Rodgers 1994 'Eat for Health'; Scott et al 1991 'The Lifestyle 2000 experience'; Sutherland et al 2010 'Guiding Stars'; Steenhuis et al 2004 'nutrition education and shelf labelling'; Levy et al 1995 'Nutrition information program'; Lang et al 2000).
 - Brochures and leaflets (Lewis et al 2002; Patterson et al 1992 & Rodgers et al 1994 'Eat for Health'; Scott et al 1991 'The Lifestyle 2000 experience'; Sutherland et al 2010 'Guiding Stars'; Kristal et al 1997; Steenhuis et al 2004 'nutrition education and shelf labelling'; Levy et al 1995 'Nutrition information program').
 - Signage and posters (Lewis et al 2002; Patterson et al 1992 & Rodgers 1994 'Eat for Health'; Narhinen & Nissenen 2000 'staged health promotion campaign'; Scott et al 1991 'The Lifestyle 2000 experience'; Sutherland et al 2010 'Guiding Stars'; Kristal et al 1997; Steenhuis et al 2004 'nutrition education and shelf labelling').

Levy concluded that "there is some evidence of the effectiveness of POPI for increasing sales of selected foods; shelf-labelling schemes in conjunction with leaflets or brochures were more likely to show a positive effect over the long term." Key findings from POPI interventions were:

- Studies of longer duration showed greater effect.
 High quality studies over one to two years were able to show shifts in sales despite individual category promotions within the intervention period.
- Studies using objective measures of effect such as sales data were more likely to show an effect.
- Studies focussing on specific food categories rather than general nutrition information showed greater effect
- POPI needs be tailored according to the segmentation of shoppers visiting the store.

- Messages that work well with low-income shoppers may be different to those that work well with shoppers with fewer disadvantages.
- Multi-strategy studies such as shelf labels plus recipes and leaflets, combined with coupons or advertising campaigns — were more likely to show moderate effects.
- Simple guidance systems such as the star ratings of the Guiding Stars program are more likely to be accepted by a wider audience and are easier to interpret rather than nutrient focused messages. Star rating systems indicating healthier choices eliminate the need for knowledge of nutrient-disease relationships.

Levy (2012) also examined the evidence from six supermarket nutrition education intervention trials (Patterson et al 1992 & Rodgers et al 1994 'Eat for Health'; Scott et al 1991 'The Lifestyle 2000 experience'; Ni Mhurchu et al 2010 'price discounts and tailored nutrition education'; Steenhuis et al 2004 'nutrition education and shelf labelling'; Evans et al 2000 'supermarket nutrition centre staffed by a registered dietician'; Levy et al 1995 'Nutrition information program') and concluded that:

- There is some evidence for the effectiveness of nutrition education when combined with other strategies such as POPI and price discounting for changing purchasing or consumption behaviour.
- There is some evidence of the ineffectiveness of nutrition education for changing purchasing behaviour when used as a sole strategy.

Levy (2012) also considered that "promotional campaigns using taste testing and demonstrations are effective in changing purchasing behaviour. Nutrition education through a video booth was also effective."

Interventions

- Gittelsohn et al (2013; US): A 14-month intervention trial (Navajo Healthy Stores) on the Navajo Nation sought to increase availability of healthier foods in local food stores and to promote these foods at the POP and through community media in 10 stores. BMI showed a trend towards impact of the intervention; and greater exposure to the intervention was associated with significantly reduced BMI, improved healthy food intentions, healthy food getting and healthy cooking methods.
- Ayala et al (2013; US): In US Latino retail stores, this evaluation showed that staff training to promote F&V, including how to implement a food marketing campaign and installing store equipment to promote F&V; increased availability of vegetables but not fruit; did lead to increase in F&V intake (although self-efficacy decreased).
- Mead et al (2014; Canada): In 'Healthy Foods North'

 indigenous stores in Canada a 12-month program community-wide and POP interactive educational taste tests and cooking demonstrations, media (e.g. radio advertisements, posters, shelf labels), and events held in multiple venues, including recreation centres and schools, resulted in improved healthy eating knowledge, selfefficacy and behavioural intentions.

Implementation barriers/ enablers

- Remote stores in Australia: RIST evaluation indicated that store managers had insufficient time or expertise for promotion (RIST evaluation report, 2010).
- In the Healthy Bodegas study (Dannefer et al 2012) owners were reluctant to purchase perishable items for fear they would not sell. The intervention was changed to give stores more choice in the changes they made. Owners requested an increase in the number of cooking demos and expansion in selection of in-store promotional materials. The intervention was also expanded to the provision of fruit salad starter kits, produce storage shelves and baskets, blenders, and small fridges.
- Fidelity of at least one intervention program (Change4Life convenience store program, UK) was low (Adams et al 2012; UK).

Abbreviations

AANA	Australian Association of National Advertisers
ACMA	Australian Communications and Media Authority
AFGC	Australian Food and Grocery Council
AIHW	Australian Institute of Health & Welfare
ALPA	Arnhem Land Progress Association
AP	Anglophile
ASB	Advertising Standards Bureau
AUS	Australia
BMI	Body mass index
BRFSS	Behavioral risk factor surveillance survey
CAI	Canadian Children's Food and Beverage Advertising Initiative
CARDIA	[biracial US cohort] Coronary Artery Risk Development in Young Adults
CFBAI	Children's Food and Beverage Advertising Initiative
CHD	Coronary heart disease
CPE	Cross price elasticity
CPI	Consumer price index
CPVT	Children's prime viewing time
CSD	Carbonated soft drinks
CSFII	Continuing survey of food intakes by individuals
СТЅ	Children's Television Standards
CVD	Cardiovascular disease
DALY	Disability-adjusted life years
EC	Energy cost
ED	Energy density
EDNP	Energy-dense nutrient-poor
EU	European Union
kcal	kilocalorie
kJ	kilojoule
F&V	Fruit and vegetables
FES	Food environment score
FFO	Fast food outlet
FFQ	Food frequency questionnaire
FLNQ	Foods of low nutritional quality
FM	Farmers' market
FMNP	Farmers' market nutrition program
FOP	Front-of-pack
FOPL	Front-of-pack label
FP	Francophile

FTA	Free-to-air
FTC	Federal Trade Commission (US)
FVMM	Fruit & Vegetables Make the Mark program
g	grams
GST	Goods and services tax
HFB	Healthy Food Basket
HFSS	High fat, sugar, and salt
IBLP	Item-based loyalty program
IDEFICS	Identification and prevention of dietary- and lifestyle-induced health effects in children and infants study
IFBA	International Food & Beverage Alliance
IHD	lschaemic Heart Disease
INFORMAS	International Network for Food and Obesity (/non-communicable diseases) Research, Monitoring and Action Support
IFBA	International Food and Beverage Alliance
IOM	Institute of Medicine (US)
IWG	Interagency working group
MA	Meta-analysis
MJ	Mega joules
NSW	New South Wales
NCPS	Nutrient profiling criteria scheme
NHANES	National Health and Nutrition Examination
NHMRC	National Health and Medical Research Council
NT	Northern Territory
NSFP	Norwegian School Fruit Program
NYC	New York City
NZ	New Zealand
Ofcom	Office of communications
ОН	Out-of-home
OPE	Own price elasticity
OR	Odds ratio
PANORG	Physical Activity, Nutrition & Obesity Research Group
PE	Price elasticity
PED	Price elasticity of demand
POS	Point-of-service
QLD	Queensland
QSRI	Quick Service Restaurant Initiative
QUALY	Quality-adjusted life years
RCMI	Responsible Children's Marketing Initiative

RCT	Randomised controlled trial
RTEC	Ready-to-eat cereals
SA	South Australia
SD	Soft drinks
sd	Standard deviation
SES	Socio-economic status
SNAP	Supplemental Nutrition Assistance Program (US)
SA	South Australia
SD	Soft drinks
sd	Standard deviation
SES	Socio-economic status
SNAP	Supplemental Nutrition Assistance Program (US)
SSB	Sugar-sweetened beverage(s)

SR	Systematic review
ТА	Takeaway
TV	Television
UK	United Kingdom
US	United States of America
USDA	United States Department of Agriculture
VAT	Value Added Tax
VIC	Victoria
WA	Western Australia
WHO	World Health Organization
WIC	Special Supplemental Program for Women, Infants, Children (US)

Glossary

Acceptability (to stakeholders)	The degree of acceptance of the intervention by the various stakeholders including: parents and carers; teachers; health care professionals; the general community; policy makers; the private sector; government and other third party funders
Advergames	Digital games or fantasy worlds with inbuilt advertising or branding
Analytical epidemiology	Attempts to provide the 'why' and 'how' of health-related events by comparing groups with different rates of [disease] occurrence and with differences in demographic characteristics, genetic or immunological make-up, behaviours, environmental exposures, and other so-called potential risk factors
Analytic study	A study which tests hypotheses about exposure-outcome relationships; includes a comparison group; answers 'why' and 'how'. Examines associations between variables — there may be hypothesised causal or therapeutic relations
Ad valorem tax	A tax whose amount is based on the value of a transaction or of property, e.g. tax imposed as a percentage of a given beverage's value (20% of price)
BMI z-score	Body mass index z-score: a percentile relative to some specified distribution of BMI-for-age
Branding	The creation of names, symbols, characters and slogans that help identify a product and create unique positive associations which differentiate it from the competition and create additional value in the consumer's mind
Case control study	A study that compares people with a specific disease or outcome of interest (cases) to people without that disease or outcome (controls) and which seeks to find associations between the outcome and prior exposure to particular risk factors. Useful if past exposure can be reliably measured. Requires matching.
Case series study	This type of study is classified as observational (same as cohort study) because there is no comparison group as in an analytical study
Cluster randomised controlled trial (cluster RCT)	RCT in which the sample size is the number of groups, not people
Cost	The cost is the amount spent by a business making the product. Cost is often split into two elements: the variable cost (costs that vary in proportion to the quantity being made) and fixed costs (costs that are required for production to take place but which do not vary as output varies).
Cohort study (specifically prospective)	Examines multiple health effects of an exposure; subjects are defined according to their exposure levels and followed over time for outcome occurrence. An analytical (as opposed to descriptive) observational study.
Cross price elasticity	A measure of the responsiveness of buyers of a good to changes in the prices of related goods
Cross-sectional study	Examines relationship between exposure and outcome prevalence in a defined population at a single point in time; difficult to determine temporal relationship
Descriptive epidemiology	(Type 1 evidence). Characterisation of the distribution of health-related states or events. Provides the 'what', 'who', 'when' and 'where' of health-related events. Used to search for causes and other factors that influence the occurrence of health-related events, to generate hypotheses and can be used as the basis for justifying an intervention/program to address this problem. Also trend analysis. [Type 1 evidence; Armstrong et al 2014].
Descriptive research	Provides an accurate portrayal of characteristics of a particular individual, situation or group
Determinants epidemiology	Used to search for causes and other factors that influence the occurrence of health-related events such as diseases, syndromes, and injuries.
	Epidemiological factors include: predisposing factors; enabling/disabling factors; precipitation factors; reinforcing factors.

Ecological data / ecological correlational studies	Use aggregate data (e.g. proximity to nuclear power plant, per capita consumption of saturated fats). Useful for generation of hypotheses, supporting hypotheses or for intervening at the population level (rather than hypothesis testing). Examines relationship between exposure and outcome with population-level rather than individual-level data.
Econometrics	The quantitative analysis of actual economic phenomena based on the concurrent development of theory and observation, related by appropriate methods of inference
Effects on equity	The likelihood that the intervention will affect the inequalities in the distribution of obesity in relation to: socioeconomic status; ethnicity; locality; gender
Effectiveness analyses (extrapolated evidence)	Modelled estimates of the likely effectiveness of an intervention that incorporate data or estimates of the program efficacy, program uptake, and (for population effectiveness) population reach
Effectiveness trials	Measure the degree of beneficial effect under 'real world' circumstances (note that efficacy and effectiveness trials exist on a continuum)
Efficacy trials	Measure whether an intervention produces the expected result under ideal circumstances
Environmental level	Any intervention designed to influence the physical and built environments
Evaluative research	Seeks to determine the quality or worth — often assessing the relevance, effectiveness, and consequences of activities/actions
Evidence check review	Rapid review of existing research and evidence that is tailored to a policy agency's individual needs. An evidence check review is a concise summary of evidence that answers specific policy questions presented in a policy-friendly format (reference: SAX Institute)
Excise tax	Tax levied on the manufacture, sale, use, or distribution [of beverages]. May also include a fixed fee or tax levied on an activity or an occupation, such as a privilege fee for selling fountain soda.
Experiment	An orderly procedure carried out with the goal of verifying, refuting, or establishing the validity of a hypothesis. Provides insight into cause and effect by demonstrating what outcome occurs when a particular factor is manipulated
Experimental studies in real world setting (intervention evidence)	Experimental studies where the investigator has control over the allocations and/or timing of the experimental exposure, e.g. RCTs, or non-randomised trials
Experimental studies in artificial settings (experimental evidence)	Experimental studies conducted under laboratory conditions or simulated environments (e.g. choice experiments in virtual supermarkets)
Experimental research	Objective, systematic, controlled investigation for the purpose of predicting and controlling phenomena and examining probability and causality among selected variables
Expert opinion (informed opinion) (experience-based evidence)	The considered opinion of experts in a particular field, e.g. scientists able to peer-review and interpret the scientific literature, or practitioners, stakeholders, and policy-makers able to inform judgements on implementation issues and modelling assumptions (incorporates 'expert' and 'lay knowledge')
Explanatory research	Seeks to make observations intelligible and understandable
External validity	Degree to which one can generalise the study's findings to other populations and circumstances — or the extent to which the effects observed in a study are applicable outside the study — otherwise termed 'generalisability' or 'applicability'
Feasibility	The ease of implementation considering such factors as: the availability of a trained workforce; the strength of the organisations, networks, systems and leadership involved; existing pilot or demonstration programmes

Fiscal	Using the tax system to increase or reduce the financial cost
Guidelines	Creating documents that recommend or mandate practice. This includes all changes to service provision
Grey literature	That which is produced on all levels of government, academics, business and industry in print and electronic formats, but which is not controlled by commercial publishers. More broadly it has been defined to include everything except peer-reviewed books and journals accepted by Medline
Health claim	Any representation that states, suggests or implies that a relationship exists between a food or a constituent of that food and health
Impact evidence	Type 2 evidence. This type of evidence is used to identify what work is required to address a problem and so is an extension of Type 1. It comprises the results of an evaluation (qualitative and/or quantitative).
Implementation Evidence	Type 3 evidence. This type of evidence is used to identify what works, for whom, in what context and why, and so is an extension of Type 2 evidence. It is usually the result of a process evaluation and provides important evidence about how to implement interventions/programs to achieve health improvement (Armstrong et al 2012)
Indirect (or assumed) evidence (extrapolated evidence)	Information that strongly suggests that the evidence exists, e.g. a high and continued investment in food advertising is indirect evidence that there is positive (but proprietary) evidence that the food advertising increases the sales of those products and/or product categories
Individual/behavioural level	Any intervention designed to influence individual behaviour
Internal validity	Degree to which one can say with certainty that the intervention being studied is responsible for producing an effect (prerequisite for external validity)
Interpretive research	Seeks to identify and explain meanings, usually from a particular perspective
Interrupted time series designs	Multiple observations over time that are 'interrupted' usually by an intervention or treatment. May or may not include a control group. Attempts to detect whether the intervention has had an effect significantly greater than the underlying trend
Intervention	Action taken on behalf of individuals, systems or communities/populations to improve or protect health status
Knowledge mapping	Process of creating maps of associations between items of information to understand and illustrate knowledge flows, sources, assets, and gaps at the organisation, community or policy level
Knowledge synthesis for public policies	Method of synthesising public policies that considers multiple effectiveness and contextual aspects, and integrates data from logic modelling, literature reviews, and deliberative processes
Legislation	Making or changing laws
Mediators	Causal mechanisms
Meta-analysis	The statistical combination of data from multiple individual studies
Modelling study	Answers the question: If we intervene [to change the food environment] [strategy to change food environment indicator], what are the likely impacts on population purchasing behaviours, consumption/dietary behaviours, health and weight?
Moderators	Characteristics of studies, populations, settings

Natural experiment	An empirical study in which individuals (or clusters of individuals) exposed to the experimental and control conditions are determined by nature or by other factors outside the control of the investigators, yet the process governing the exposures arguably resembles random assignment. Thus, natural experiments are observational studies and are not controlled in the traditional sense of a randomised experiment. Natural experiments are most useful when there has been a clearly defined exposure involving a well-defined sub-population (and the absence of exposure in a similar sub-population) such that changes in outcomes may be plausibly attributed to the exposure; else subject to bias and confounding. Often recommended as a way of understanding the impact of population-level policies on health outcomes or health inequalities.
Non-randomised controlled studies (controlled before and after studies)	Study design where participants or populations are allocated by the investigator, in a non- randomised fashion, to an intervention or control group. The outcome of interest is measured both at baseline and after the intervention period, comparing either final values if the groups are comparable at baseline, or if not, changes in outcomes. The lack of randomisation in these types of studies may result in groups being different at baseline.
NOURISHING	A policy framework to promote healthy diets and reduce obesity. Developed by the World Cancer Research Fund International
Nutrient content claim	Description of a nutritional property of a food
Nutrient-to-price ratio	Nutrient adequacy score/price per 100g. The nutrient adequacy score is mean of percent daily values for 16 key nutrients, as provided by 100g of food.
Observational epidemiology	Epidemiological studies that do not involve interventions but may involve comparisons of exposed and non-exposed individuals, e.g. cross-sectional, case-control and cohort studies
Observational study	A study that draws inferences about the possible effect of a treatment on subjects, where the assignment of subjects into a treated group versus a control group is outside the control of the investigator
Own price elasticity	A measure of the percentage change in the quantity demanded 'caused' by a percentage change in price (usually negative)
Parallel evidence	Evidence of intervention effectiveness for another public health issue using similar strategies. It also includes evidence about the effectiveness of multiple strategies to influence behaviours in a sustainable way, e.g. health-promoting schools approach
Pilot intervention	Limited implementation at discrete number of sites
Policy level	Any intervention designed to influence the legal/regulatory environment
Post-test only design	A type of experimental design in which the experimental and control groups are measured and compared after implementation of an intervention. Comparisons are made only after the intervention, since this design assumes that the two groups are equivalent other than the randomly assigned intervention. Between-group differences are used to determine treatment effects.
Pre-test post-test design	The basic premise behind the pre-test post-test design involves obtaining a pre-test measure of the outcome of interest prior to administering some treatment, followed by a post-test on the same measure after treatment occurs. Pre-test–post-test designs are employed in both experimental and quasi-experimental research and can be used with or without control groups.
Price	The price is the amount customers pay for a product. When you pay a price for something, the price represents the value of what you have to give up in order to acquire a product or service.
Price of Food Energy, or Price per Calorie (\$/calorie)	The price of food energy is calculated as the price per 100 grams of a food divided by the number of calories contained in 100 grams

Process evaluation	Study of the process of the delivery of the intervention. It can be used to help disentangle the factors that are responsible for successful outcomes, implementation of the intervention, and intervention integrity. Process data have conventionally been drawn from observational quantitative research but increasingly use qualitative and quantitative research methodologies, as appropriate
Program/policy evaluation (experimental evidence)	Assessment of whether a program or policy meets both its overall aims (outcome) and specific objectives (impacts) and how the inputs and implementation experiences resulted in those changes (process)
Quasi-experimental study design	Shares similarities with the traditional experimental design or RCT but is not truly randomised. Sometimes called non-randomised, pre- post- intervention study designs.
Randomised controlled trials	Trials where participants or populations are randomly allocated (for example, computer generated randomisation, random number table) to an intervention or control/comparison group and are followed up over time to assess differences in outcome rates
Rapid realist review	Tool for applying a realist approach to a knowledge synthesis process in order to produce a product that is useful to policy-makers in responding to time-sensitive and/or emerging issues, while preserving the core elements of realist methodology. Specifically designed to engage knowledge users and review stakeholders to define the research questions and to streamline the review process
Rapid review	Accelerated and streamlined systematic reviews conducted within a short time frame or with limited resources and that feed directly into decision-making
Regulation	Establishing rules or principles of behaviour or practice
Sales tax	An ad valorem tax levied on the sale of goods and services at the point of purchase
Scoping review	Review of a broad research question to map out the key characteristics of a knowledge area and the main sources and types of information available
Societal/community level	Any intervention designed to influence social norms and community resources
Sponsorship	Either financial or in-kind assistance given to a person, organisation, or event, in return for promotional opportunities
Structured rapid review	Streamlined systematic review conducted within a short time frame or with limited resources and that feeds directly into decision-making
Sustainability	The durability of the intervention considering such factors as: the degree of environmental or structural change; the level of policy support; the likelihood of behaviours, practices, attitudes, etc. becoming normalised; the level of ongoing funding support needed
Systematic review	Structured review of a clearly-defined research question. Uses systematic and explicit procedures to identify, select, critically appraise, extract and analyse data from primary research ¹²¹
Theory and program logic (experience-based evidence)	The rationale and described pathways of effect based on theory and experience, e.g. linking changes in policy to changes in behaviours and energy balance, or ascribing higher levels of certainty of effect with policy strategies like regulation and pricing compared with other strategies such as education
Time series study	A quasi-experimental research design in which periodic measurements are made on a defined group of individuals both before and after implementation of an intervention. (same variable at regular intervals in the form of aggregate measures of a population)
Volumetric tax	Tax applied on a per volume basis

¹²¹ A systematic review has the following features: (a) a defined review protocol that sets out the research question being addressed and the methods to be used; (b) a defined search strategy that aims to detect as much of the relevant literature as possible; (c) explicit documentation of the search strategy so that readers can assess its rigour and completeness; (d) explicit inclusion and exclusion criteria to assess each potential primary study; and (e) specification of the information to be obtained from each primary study including the quality criteria by which the primary studies are to be evaluated.