School Meal Provision

A Rapid Evidence Review

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Executive Summary

Food insecurity is of growing concern in high-income countries and children from socio-economically disadvantaged families are particularly at risk of experiencing hunger and poor nutrition. This can have a detrimental effect on children's development and capacity for learning. Therefore, food security is a serious matter for teachers and schools, particularly in areas where there is a high proportion of socioeconomically disadvantaged students and families. The 2018 NSW Parliamentary enquiry into fresh food pricing recommended that the NSW Department of Education and NSW Ministry of Health (MoH) investigate the need for and cost of a school lunch program targeting socially disadvantaged school students in NSW.

The Physical Activity Nutrition Obesity Research Group (PANORG) at the University of Sydney was contracted by the NSW MoH to provide a rapid review of the literature to determine the research evidence available on impacts of school food provision for socio-economically disadvantaged students, with a particular focus on food security.

Overall summary of evidence

School meal programs delivered in high-income countries included breakfast and lunch programs. These were either offered universally or were targeted at disadvantaged students or disadvantaged schools. Meal programs were offered through full or partial government funding and support in some countries, and through a combination of government and non-government funding in other countries. Free or reduced-price school meal programs increased student participation in these programs and have played a role in protecting vulnerable children from food insecurity. Targeted programs have resulted in stigmatisation for vulnerable students, whereas universal free meal programs have reduced the risk of stigma associated with school meal program participation. Although universal school meal provision in schools increased overall student participation in school lunch and breakfast, it is unclear whether these programs increased meal participation in those who needed it most. There were no studies identified that examined the cost-effectiveness of school meal programs. A small number of qualitative studies of Australian breakfast programs indicate they were highly valued by school staff, parents and children, for providing breakfast to children in need, but challenges regarding implementation and sustainability were raised.

What interventions/programs have been implemented in schools to address food insecurity for socio-economically disadvantaged students?

This review identified only a handful of peer-reviewed publications describing school meal programs in Australia and New Zealand, all of which were breakfast programs mostly delivered in primary schools. The programs were largely volunteer run with some support from school staff, and they relied on the not-for-profit sector for coordination, delivery and donations, the latter also from the private sector.

The majority of studies examined the impact of two well-established federally funded meal programs delivered in elementary, middle and high schools in the United States (US): the *School Breakfast Program* and the *National School Lunch Program*. Eligibility for reduced fee or free meal provision is determined by household income, and schools with more than 40% students certified as 'free-eligible' provide universal free meals to all students. A small number of studies described both universal and targeted breakfast, lunch and snack programs delivered in Canadian elementary, middle and high schools.

Several studies examined government-funded school breakfast initiatives in the United Kingdom (UK), which mainly targeted primary schools in the most disadvantaged areas. A small number of studies described the DIATROFI program in Greece, which provided students with one free daily lunch meal, in schools within deprived areas. Japan and France have universal lunch programs subsidised through the

government, the latter having a sliding scale for eligibility to free meals. One study described a universal lunch program delivered in South Korean elementary and middle schools.

What types of food are provided to children through school meal interventions/programs?

Breakfast programs in Australia, New Zealand, the UK and the US usually provided cereal, milk, bread or toast, spreads, yoghurt, fruit and juice. In Australia, shelf-stable food and drink items were often provided, with sporadic availability of fresh milk, yoghurt, breads and fruit dependent on donations. Lunch programs in the US, Greece, France and Japan usually consisted of meat/meat alternative, carbohydrate, vegetables, fruit and dairy. School meal programs in the US, UK and Greece were based on nutritional guidelines, which specified low sugar, unsweetened juice, whole-wheat cereals and specific macronutrient and micronutrient requirements.

How effective are school meal interventions/programs in addressing food insecurity, health, education and social outcomes in socio-economically disadvantaged students?

It appears that free or reduced-price school meal programs have increased student participation in breakfast and lunch, and have played a role in protecting vulnerable children from food insecurity, food insufficiency, child hunger or breakfast skipping. Several studies from different countries indicated the importance of the universal approach in reducing the risk of stigma associated with children receiving subsidised or free meals. It is unclear, however, whether universal provision increased breakfast and lunch participation in those who needed it most. Other positive health-related and social outcomes for school meal participants were reported, such as healthier eating behaviours, increased fruit and vegetable consumption, reduced nutritional inadequacy of diets and development of friendships. More specifically, participation in school meal programs based on nutrition guidelines were associated with a healthier diet. There was no evidence that universal school meal provision increased average body weight in students. The evidence on whether school meal participation improved academic performance was mixed, however seemed more promising for adolescents. A qualitative study reported improvements in participant's readiness to learn. Overall, there were little or no improvements in school attendance associated with school meal provision.

Overall, stakeholder perceptions of the school meal programs were positive as they addressed an important need in the community. Participation in the School Breakfast Program was generally lower than the National School Lunch Program, possibly due to parent's perceived responsibility for breakfast provision and the opportunity for family time or barriers to school arrival at School Breakfast Program times. Adolescents were less likely to participate in the National School Lunch Program than younger students. Qualitative studies indicated that many barriers to participation were specific to the school environment and surrounds rather than the meal program e.g. lateness to school, insufficient time, and availability of competitive foods within and outside of the school. Some studies described efforts to reduce barriers to School Breakfast Program and National School Lunch Program access in schools with high proportions of low-income households such as cost, timing and stigma, such as the Community Eligibility Provision and *Breakfast in the Classroom*. Other barriers to school breakfast or lunch participation were identified such as student's preferred taste and the variety and appeal of the meals. Only one study described efforts to address this barrier through taste testing, which increased participation in one study.

School breakfast programs in Australia lack underpinning government policy and face unique implementation challenges compared to those of government-funded programs in the US, UK, France, Japan and Greece. These related to their dependence on funding, volunteers and donations mainly from the not-for-profit and private sector and stakeholders raised concerns about the sustainability of school meal programs. Regardless of these challenges, Australian school breakfast programs have high stakeholder acceptability and are perceived as addressing the important need to support disadvantaged students.

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1. Background

1.1 Introduction

Food insecurity is an issue of growing concern in developed countries and children from socioeconomically disadvantaged situations are particularly at risk of experiencing hunger and poor nutrition.[1, 2] Food insecurity results in a lack of sufficient food and/or inadequate nutrition and has a detrimental effect on children's development and capacity for learning.[3] It is therefore a serious concern for teachers and schools, particularly where there is a high proportion of socioeconomically deprived students whose families are more likely to experience food insecurity.

The role of schools in providing food to students has a long history. School lunch programs have been instituted in several high, medium and low-income countries since early last century, but Australia has never had a comprehensive school lunch program. Programs may be universal or provided only to students with identified need or only to schools in low SES areas. School breakfast programs have a more recent history beginning in the US in the 1960s[4] and in the UK in the 1990s.[5, 6] Similar to school lunch programs, they may be universal or targeted.

In Australia, the longest running school breakfast program is in Western Australia where Foodbank WA has been providing breakfast to schools since 2001.[7] School breakfast programs are conducted in all Australian states where they are run by charitable organisations such as state-level Foodbank organisations and the Red Cross, or by local community groups. Some state Governments provide funding to support their school breakfast programs.

International and Australian research has found evidence of the benefits of school breakfast programs for vulnerable, undernourished students, particularly those from food insecure, socially disadvantaged families, and these benefits range from increased energy, improved attention and behaviour, and overall capacity for learning, although the evidence from Australia is currently very limited.[7-9]

The 2018 Parliamentary enquiry into fresh food pricing[10] recognised the significant negative effects of food insecurity and the real potential to address the problem. Two of the report recommendations related to the role of school food provision and recommended that the NSW Department of Education and NSW MoH investigate the need for and cost of a school lunch program targeting disadvantaged school students in NSW. The Centre for Population Health, NSW MoH therefore contracted researchers from the Physical Activity Nutrition Obesity Research Group (PANORG), at The University of Sydney to conduct a rapid literature review to determine the research evidence available on the nature and impacts of school food provision for socio-economically disadvantaged students.

1.2 Report format

This report is presented in sections and structured as follows:
Section 2 outlines the purpose and research questions addressed;
Section 3 describes the methods used;
Section 4 provides the research questions addressed with relevant evidence synthesised for each;
Section 5 sums up the evidence in relation to the research questions;
Section 6 outlines the limitations of this rapid review, and
Appendices include the search strategy, search results, flow diagram and a table summarising the publications used for this review.

1.3 Glossary

BIC	Breakfast In Classroom
BMI	Body mass index. A measure of weight calculated as weight (kg) divided by height (m^2). In growing children, BMI varies with age and sex; to be meaningful in children, BMI must therefore be compared to a reference-standard that accounts for child age and sex.
CEP	Community Eligibility Program
CI	Confidence interval. A range of values so defined that there is a specified probability that the value of a parameter lies within it (for example 95% CI).
DoE	NSW Department of Education
FSSM	Food Security Survey Module
MoH	NSW Ministry of Health
NSLP	National School Lunch Program
OENI	Occupational Education Needs Index
RCT	Randomised controlled trial
RPM	Reduced-price meal
FRPM	Free or reduced-price meal
SBC	School Breakfast Club
SBP	School Breakfast Program
SES	Socioeconomic status
SNAP	Supplemental Nutrition Assistance Program
UFM	Universal Free Meals

Note: abbreviations reflected in the glossary may be used in the summary table in Appendix 3 but not in the body of the report.

2. Aim

2.1 Purpose of the review

The objective of this rapid review is to investigate the impact of meals provided at school, particularly for disadvantaged students.

2.2 Research questions to be addressed

Question 1*:* What interventions/programs have been implemented in schools to address food insecurity for socio-economically disadvantaged students?

Question 2*:* What types of food are provided to children through school meal interventions/programs?

Question 3*:* How effective are school meal interventions/programs in addressing the following outcomes in socio-economically disadvantaged students?

- Food security (e.g. uptake, accessibility, hunger)
- Health outcomes (e.g. dietary behaviour, weight status)
- Educational outcomes (e.g. school attendance, academic performance)
- Social outcomes (e.g. friendship, stigma)
- Economic outcomes (e.g. cost effectiveness)
- Process outcomes (e.g. school meal participation, acceptability and feasibility)

3. Methods

3.1 Review type

We used a rapid evidence review to provide an assessment of the evidence related to the research questions outlined in section 2.2. Rapid reviews use a rigorous and systematic method, but make concessions to the breadth or depth of the systematic review process to fit a tight timeframe.[11]

3.2 Search strategy

A systematic search for research evidence from the published literature was undertaken using a search strategy developed with input from Centre for Population Health staff. The search was implemented using a range of electronic databases representing different disciplines (i.e. Medline via Ovid, ERIC via Ovid, Psych Info, EMBASE, Scopus). An example of the search strategy used for Medline via Ovid is Appendix 1.

3.3 Eligibility criteria for evidence reviews

The focus of this review were studies which described meal interventions delivered to socioeconomically disadvantaged primary or secondary school students and which collected data on process or impact outcomes associated with food security, health, educational, social and economic outcomes. Specific inclusion and exclusion criteria are listed below.

Study type: systematic reviews, intervention evaluation studies (cohort/longitudinal, controlled trials, observational), cross sectional studies and qualitative studies were included. Non-systematic literature reviews, protocol papers, conference papers and book chapters were excluded. Due to the limited number of publications on school meal interventions there were no exclusion criteria based on study quality.

Publication language: English papers were included.

Publication date: Articles published from 1 January 2000 to 28 August 2020 were included.

Intervention and setting: Targeted or universal school meal interventions delivered in primary or secondary school settings in high income countries, with attention to evidence from Australia, New Zealand, Canada, the US, Europe and the UK. Meal programs delivered outside of a school setting and school feeding programs in low-middle income countries were excluded.

Population of interest: Socioeconomically disadvantaged primary and secondary school-aged children and adolescents (5-18 years). Studies that described universal programs were included if they presented any of the outcomes listed below for socioeconomically disadvantaged populations.

Process and impact outcomes: Studies reporting the impact of (or association between) the intervention and the following objectively or subjectively measured outcomes:

- Food security (e.g. accessibility, meal uptake, hunger, breakfast skipping).
- Health, educational, social and economic outcomes:
    - Health (e.g. dietary behaviour, weight status)
    - Educational (e.g. academic achievement, cognitive function, school attendance)
    - Social (e.g. social connections, peer interactions, stigma, friendships)
    - Economic (e.g. cost effectiveness)
- Process outcomes (e.g. reach, acceptability, feasibility).

Data collected from children, parents, school staff, volunteers or other program stakeholders were included.

3.4 Evidence review search results

Of 177 records identified (163 through database searching and 14 through other sources), 155 articles were assessed for eligibility; 56 met the inclusion criteria and were included in the narrative synthesis for this rapid review. The article selection process is outlined in more detail in the PRISMA flow diagram in Appendix 2.

3.5 Data extraction

Two reviewers (BM, LC) shared the data extraction task due to the rapid nature of this review; relevant information from each study was summarised and tabulated (see Appendix 3). Any uncertainty was discussed by both reviewers and resolved. Information extracted included the aim, study design, type of school meal intervention and foods offered, targeted age group, school or year level, measure for disadvantage used, the outcomes measured and how, where possible, and the main findings and conclusions. No quality appraisal of studies was undertaken due to time restraints.

4. Results for school meal programs

Included studies were primarily from the United States of America (US, n=35).[8, 12-45] The countries of origin of the remaining papers were: the United Kingdom (UK, n=6),[5, 6, 46-49] Australia (n=5),[50-54] Canada (n=3),[55-57] Greece (n=3),[58-60] Japan (n=2),[61, 62] France (n=1),[62] New Zealand (n=1)[63] and South Korea (n=1).[64] The majority of studies focused on primary schools (or up to middle school in US studies), with only two studies conducted in secondary schools[12, 57] and 11 studies conducted across all school years.[21, 32, 34, 35, 38, 45, 46, 54, 59, 60, 65]

4.1 What programs have been implemented in schools to address food insecurity in socio-economically disadvantaged students

All studies included in this rapid review were related to school meal programs and address food insecurity in socio-economically disadvantaged students. Of the included studies, 23 related to breakfast programs, 21 related to lunch programs and 12 related to breakfast and lunch programs.

A brief description of programs outlined in these studies are presented by country and are based on the summaries provided by the authors of each study. Due to the rapid nature of this review, it was not possible to provide the primary reference for each meal program. The school meal programs described below reflect only programs which were the focus of studies included in this review, (i.e. published in the peer-reviewed literature) and therefore do not provide a comprehensive overview of all school meal programs offered in these countries.

Note: Appendix 4 provides an overview of some school meal programs in high-income countries which were identified from an internet search. The report does not include a discussion of these programs.

4.1.1 The United States of America

The US federally funded School Breakfast Program (SBP) and National School Lunch Program are administered and implemented locally by schools. The Healthy, Hunger-Free Kids Act of 2010 re-authorised funding for child nutrition and school meal programs, including to update nutrition standards for school meals.[12] From 2012, the Community Eligibility Provision allows schools to provide breakfast and lunch at no cost to all students, if more than 40% of their students are certified as 'free-eligible' through participation in other means-tested programs such as Supplemental Nutrition Assistance Program or Temporary Assistance for Needy Families program.[8, 15, 24, 27]

For schools not eligible for Community Eligibility Provision, the National School Lunch Program offers access to meals and a la carte items in the school cafeteria according to eligibility, determined by household income and graded according to full-fee, reduced fee or free meal provision. The School Breakfast Program is offered to students according to eligibility, with the price of breakfast varying according to parental income (full-price, reduced-price or free).[19] Breakfast in the Classroom is a model of delivery for the School Breakfast Program, whereby breakfast is available to students in the classroom at the start of the day.[20, 23] Breakfast in the Classroom is intended to support students who do not or are not able to take advantage of before-school breakfast in the school cafeteria.[39]

4.1.2 United Kingdom

The provision of breakfast in UK schools is advocated in the School Food Plan which aims to improve the provision and uptake of meals provided throughout the school day while educating children, parents and school staff on the importance of good nutrition. Studies included in this rapid review were from England[5, 6, 47, 65] and Wales.[48, 49]

England: School Breakfast Clubs were an initiative of the Department of Health to develop breakfast club provision in schools serving disadvantaged areas across England. They aimed to provide breakfast to children who might otherwise start the school day without breakfast, offer healthy eating choices, establish a positive relationship at the start of the school day, improve poor attendance or lateness, and improve attitude, behaviour and motivation to learn.[46] The School Food Plan receives financial support from the UK Government and specifies that funding is allocated to support the setup of sustainable breakfast clubs in England's poorest schools.

Wales: The Welsh Assembly Government's Primary School Free Breakfast Initiative is committed to providing a free healthy breakfast to students of all state-maintained primary schools in Wales.

4.1.3 Australia

School meal programs from Australia represented in the published literature included studies from New South Wales,[53] Western Australia,[54] South Australia,[52] Victoria[50] and Tasmania.[50, 51]

New South Wales: Breaking Bread, Breaking Barriers is a volunteer-run breakfast program addressing poor breakfast consumption before school and food waste. It operates on Friday mornings before school for children attending a single regional public school. The program is delivered by a not-for-profit organisation, which delivers meals on-site using donated foods collected from supermarkets and small local business.[53]

Western Australia: Foodbank WA established school breakfast programs to support schools throughout Western Australia to provide free breakfast and emergency meals to students. These school breakfast programs provide breakfast to students at school in a safe environment, under the supervision of teachers or community volunteers.[54]

South Australia: KickStart For Kids is one South Australian school breakfast program, established in 2009 to address low breakfast consumption and child food insecurity among disadvantaged students.[52] KickStart For Kids does not receive any Government funding, but relies on non-government organisations and corporate sponsors for financial and product support. The program requires volunteers and co-ordinators at each participating school; it employs a chief operating officer and four staff who co-ordinate the schools and volunteers across the state, as well as administrative and warehousing operations.

Victoria: Victorian SBCs are a partnership between the Victorian Government and Foodbank Victoria. Their aim is to tackle the disadvantage primary school children experience through the effects of hunger when they arrive at school without having had a healthy breakfast. Foodbank Victoria provides non-perishable and long-life food to all schools in the program at the beginning of each term and helps schools to establish and manage their programs.[50]

Tasmania: Tasmanian SBCs were originally started with Government support, which ceased in 2014. Some continue with support from community organisations and the private sector. There are no eligibility criteria

for student access to SBCs which are offered with varying frequency (from once per week to every school day). Coordination of these programs are by teaching staff, school chaplains, school cleaners, community workers or parent volunteers.[50, 51, 60]

4.1.4 Canada

Canadian school meal programs represented in the published literature included studies from Nova Scotia,[55] Quebec[57] and Ontario[57] provinces.

Nova Scotia: Nova Scotia was one of the first Canadian provinces to develop a provincial school nutrition policy in 2006, with increased funds provided for school food programs to increase access for students and a focus on creating healthy school environments.[55]

Quebec: The Quebec Ministry of Education, Leisure, and Sport manages, as part of the action plan for educational success, a food assistance initiative through which breakfasts, snacks, or lunches are distributed to students in underprivileged areas according to the needs identified by the school boards.[57]

Ontario: Pilot school snack and milk provision programs were initiated in Ontario, among Canadian Aboriginal students, as part of a research project.[56]

4.1.5 Greece

The DIATROFI school meal program is offered at eligible Greek public schools and aims to reduce food insecurity and to promote healthy dietary habits. The program, funded by the Greek Ministry of Education and Religious Affairs, offers one free daily meal to all children attending eligible elementary and secondary schools in underprivileged areas of Greece. School eligibility is assessed through household income and food insecurity criteria.[58, 59]

4.1.6 Japan

Japan has a universal school lunch program, which was first implemented in 1947. All children in the same school are served with the same menu, and all children have lunch in the classroom with their teachers and peers.[61, 62]

4.1.7 France

Universal school lunch programs are offered in France.[62]

4.1.8 New Zealand

New Zealand does not have a national Government-funded school meal program. Some schools offer school breakfast programs funded through not-for-profit organisations (e.g. Red Cross Breakfast in Schools with food provided free of charge by local supermarkets) or through the private sector.[63]

4.1.9 South Korea

A South Korean policy to make school-provided lunch available was introduced in 1992 and by 2011 school lunches were served in 99% of all schools.[64] Although initially designed to provide nutritional support to

economically disadvantaged students, the lunch program is now provided universally for elementary and middle schools.

4.2 What types of food are provided to children through school meal programs?

4.2.1 Breakfast programs

Eleven articles provided information on the food and drink items offered within school breakfast programs in Australia, New Zealand, the UK and the US. Food and drink items usually consisted of cereal, milk (fresh, ultra-heat treatment (UHT), milk powder), bread or toast, spreads, yoghurt, fruit (fresh, canned or dried) and juice.[27, 39, 48-51, 54, 66, 67] Programs generally served shelf-stable breakfast items, and the availability of fresh milk, yoghurt, breads and fruit was dependent on donations.[50, 53, 54] Other less frequently reported food and drink items included canned spaghetti or baked beans, muesli bars, vegetables, pancakes, hot cross buns, frittatas, French toast, cheese, Milo and banana smoothies.[39, 50, 51, 53, 54, 66] Australian and New Zealand breakfast programs offered cereal-based products such as Weet-bix, Cheerios, oats and muesli.[50, 54, 66] School breakfast programs in the US and UK were based on nutritional guidelines, which specified low sugar or unsweetened cereals or juice or specific macronutrient and micronutrient requirements. [30, 39, 48, 49, 67]

4.2.2 Lunch programs

Ten articles provided information on the food and drink items offered within school lunch programs in the US, Greece, France and Japan. The National School Lunch Program (US),[25, 26, 43, 44, 68, 69] and the DIATROFI program (Greece),[58-60] were based on nutritional guidelines. The National School Lunch Program had specific requirements to offer a variety of meat/meat alternatives, whole grains, fruits, vegetables, and low-fat dairy options, including macronutrient and micronutrient specifications.[25, 44, 68] Example meals included baked chicken with rice, chicken broccoli alfredo, vegetable stew, turkey loaf, eggplant parmesan and salad.[69] The DIATROFI program was based on age-specific nutritional guidelines and specified inclusion of a whole wheat cereal-based food item, fresh milk or yoghurt with honey and fresh fruit.[58, 59] Recipes exclusively used olive oil and whole wheat flour, had high vegetables, protein or fruit content and no preservatives, added sugars or trans fats.[58, 59] Example meals included sandwiches (wholemeal or Arabic pita bread filled with cheese, vegetables and occasionally turkey), pies (spinach, leek), or other whole-wheat bakery products (sesame seed bagel or raisin bread).[58, 60] In France, the lunch program consisted of an entrée, salad or fruit/vegetable, a main course (grain, meat or meat alternative, vegetable), a cheese/yoghurt and fruit course, bread and water.[62] In Japan the lunch program typically included miso soup, a carbohydrate (rice or bread), meat or fish, vegetables and a carton of milk.[62]

4.2.3 Snack programs

Two articles provided information on the food items offered within school snack programs.[56, 70] A snack program in Canada provided at least one serving from the following food groups: fruit and vegetables; and milk and milk alternatives (milk, cheese, yoghurt, fortified soy beverages). The US *Fresh Fruit and Vegetable Program* offered fresh fruits and vegetables only.

4.3 How effective are school meal programs in addressing important outcomes in socio-economically disadvantaged students?

Several outcomes were addressed in studies included in this rapid review. These are grouped into food security, health, educational, social and process outcomes. The quality of the studies reporting these outcomes was not formally assessed, and the measures used to assess them are not consistent across studies.

4.3.1 Food security outcomes

Ten studies measured food security related outcomes, which included household or child food insecurity[18, 24, 58, 60, 66, 71] or insufficiency (defined as when families can't get enough food for their members),[21] child hunger,[28, 53, 66] and child breakfast skipping amongst vulnerable or food insecure households.[30]

Over half (n=6) of these studies were conducted in the US and analysed cross sectional[18, 28, 30] or longitudinal[21, 24, 71] data to explore associations between participation in the universal School Breakfast Program[18, 19, 28, 30, 71] and/or National School Lunch Program[21, 24, 28] and a food security related outcome. Food insecurity was mostly measured using the United States Department of Agriculture's 18-item food security scale,[18, 24, 71] or an abridged version.[30] Five studies found positive associations between the availability of, or participation in, the school meal program and improved food security, reduced food insufficiency or reduced breakfast skipping amongst vulnerable elementary, middle and high school children.[18, 21, 24, 30, 71]. In contrast, one study conducted in low-income Mexican-origin families, reported National School Lunch Program participation was associated with increased odds for child hunger.[28] This population had very high levels of food insecurity and child hunger, and the National School Lunch Program was regarded as beneficial for some households, but insufficient to prevent child hunger in this high-risk population, whereas Supplemental Nutrition Assistance Program participation was associated with reduced child hunger.

Two studies, one randomised control trial and a pre post evaluation, demonstrated positive impacts of a free daily school lunch program delivered in underprivileged areas in Greece on household food insecurity.[58, 60] Greater effects were reported in those who reported hunger at baseline and those who participated for a longer period.[60]

Only two included studies evaluated the impact of free school breakfast programs on food security-related outcomes in Australia or New Zealand. A small qualitative study explored the impact of a weekly primary school breakfast program *Breaking Bread, Breaking Barriers* is delivered in a socioeconomically disadvantaged area in NSW. Feedback on the program from students, teachers and parents suggest the program addressed food access barriers, for families that were unable to afford food in sufficient quantity and variety.[53] A cluster randomised control trial in New Zealand demonstrated a free daily school breakfast program produced significant positive effects on children's short-term hunger ratings, but no significant effect on child or household food security.[66]

Overall, the studies measuring food security-related outcomes have indicated that free or reduced-price school meal programs have played a role in protecting vulnerable children from food insecurity, insufficiency, child hunger or breakfast skipping.[18, 21, 24, 30, 53, 58, 60, 66, 71]

4.3.2 Health outcomes

Health-related outcomes reported in studies included in this rapid review were primarily related to dietary behaviour and nutritional intake (n=11).[26, 33-35, 37, 44, 48, 56, 61, 65, 67] Two studies reported weight-related outcomes.[31, 41]

Fruit and vegetable consumption: Using a modified self-administered brief diet history questionnaire, primary school-aged children in Japan with low maternal education were found to have lower fruit and vegetable intake compared to those with high maternal education. Fruit and vegetable consumption from school lunch was not associated with socioeconomic status suggesting that school lunch intake improved the socioeconomic-related gradient of total vegetable intake by 9.9% and of fruit intake by 3.4%.[61] A US study also using a self-reported dietary recall survey of elementary school students participating in the School Breakfast Program and National School Lunch Program, found on average students reported consuming 3.6 serves of fruit and vegetables daily. Students consumed over half their daily fruit and vegetable servings within school; students who consumed <5 serves per day consumed a higher proportion of their daily intake at school than students with ≥5 serves per day (39% vs 59%, p=0.002).[33] An English study using a self-reported survey which included a question about whether students had fruit for breakfast, reported that a higher proportion of breakfast club participants ate fruit for breakfast compared to non-participants.[65]

Fruit and vegetable consumption among low socioeconomic elementary and middle school students in the US was measured through observation and weighing of student plate waste. This showed an average daily 15% increase in fruit and vegetable consumption during an intervention implementing setting-level changes to the National School Lunch Program cafeteria environment.[26]

Nutrient intake: Four studies examined nutrient intake (outside of specific fruit and vegetable consumption) and all used self-reported dietary recall survey measures.[34, 37, 48, 56] The overall nutritional intake of 9-11 year old UK students indicated that students from deprived backgrounds consumed significantly lower levels of several vitamins and minerals at breakfast.[48] Following the introduction of a free breakfast program, the nutritional quality of school vs home breakfasts was similar; children who ate breakfast at school and home had higher overall energy intake, but not significantly so.[48] A Canadian study investigating the impact of a school snack program measured calcium, milk and milk-alternative intake through a web-based dietary recall survey.[56] Findings indicated that calcium, milk and milk-alternatives intake increased in the short term, but changes were not sustained after one year among First Nation Grade 6-8 students.[56]

A US study of the relationship between student participation in school meal programs and the nutritional quality of their diets showed an association between school meal participation and reduced prevalence of nutrient inadequacy, but increased prevalence of excessive sodium intake in school meal participants compared to non-participants.[34] A further US study suggested that School Breakfast Program participants were more likely than non-participants to consume milk and fruit, and less likely to consume beverages other than milk and 100% juice.[37]

Dietary behaviour: Overall dietary behaviour was assessed using dietary recall surveys in two studies.[35, 44] A study evaluating the contributions of food in the National School Lunch Program on elementary and middle school US students' eating behaviour found the availability of nutritious foods for school lunch was associated with healthier eating behaviour among students.[44] Furthermore, a large cross sectional study using a nationally representative sample of students from Grades 1-12 found National School Lunch Program participants consumed less energy from sugar-sweetened beverages at school than non-

participants, but more energy from low-nutrient, energy-dense solid foods.[35] School lunch participants' consumption at school was less energy-dense than non-participants consumption at school ($p<0.01$).[35]

Weight: One study included weight status as an outcome in relation to school meal programs in disadvantaged students in the US.[41] The findings of this study provide no evidence that universal free meals increase average body mass index, but indicate participation in school lunch improves weight outcomes for students who are not disadvantaged.

Overall, the studies measuring health-related outcomes suggest that school meal participation increased daily fruit and vegetable consumption,[33, 61, 65] as well as healthier eating behaviour among students.[35, 44] There was no evidence that universal free meals were detrimental to weight outcomes for disadvantaged students.[41]

4.3.3 Educational outcomes

Educational outcomes addressed in studies included in this rapid review are school attendance (n=6),[8, 13, 23, 27, 42, 63] academic performance (n=7),[13, 27, 41, 42, 57, 63, 65] cognitive performance (n=1)[67] and staff perceptions of students' readiness to learn (n=1).[45]

School attendance: Five studies which explored school attendance were from the US. Three were specifically related to the School Breakfast Program and reported mixed findings. Breakfast in the classroom was linked to greater school attendance among participants compared to students who did not participate,[23] while little or no differences were found in school attendance following the provision of universal free school breakfast in New York City[42] and following a change from universally available breakfast program to an eligibility-based breakfast program in elementary school students in North Carolina.[27] Only one study related to universal school lunch provision in the US, and it found that participation reduced the number of school day absences by about 1.9 days per year among middle school students.[13] One study focused on the free provision of both breakfast and lunch. Free school meal provision was not found to be associated with school attendance in the first year among elementary students, but was associated with a 3.5% reduction in student absence in those with low attendance in the second year.[8] This association was only found in economically disadvantaged students. Only one study from outside the US investigated the association between school attendance and participation in a school meal program. A New Zealand study found no significant effect of a breakfast program on school attendance for primary school students.[63]

Academic performance: Six studies included outcomes related to academic performance and an association with school meal programs. Four of these studies were from the US,[13, 27, 41, 42]one from New Zealand[63] and one from Canada.[57] Two US studies found that universal free lunch programs had positive effects on test scores, with an increase in maths and reading scores for elementary school students,[13] and in English and maths test scores in middle school students.[41] Conversely, two US studies found little or no difference in academic test scores in elementary and middle school students participating in a universal free school breakfast program,[42] or following a change from universally available breakfast program to an eligibility-based breakfast program in elementary school students.[27] A New Zealand study also found no significant effect on literacy and numeracy in primary school students who participated in a free SPB. [63] One of the few studies targeted at adolescents investigated the moderating effect of school meal programs in disadvantaged neighbourhoods on the association between household food security and academic difficulties in Quebec, Canada.[57] Their findings suggest that household food insecurity is strongly associated

with indicators of academic difficulty, but that this association disappeared for adolescents who benefited from school supplementation programs, with the risk of below-average grades decreasing significantly.

Cognitive performance: Only one study included a cognitive outcome (i.e. episodic memory).[67] This UK study evaluated the impact of a national universal school breakfast program and found no impact of the school breakfast program on episodic memory.

Students' readiness to learn: A qualitative analysis of school staff perceptions found that 83% agreed that universal school meals make students more ready to learn.[45]

Overall, the studies measuring educational outcomes were from universal programs and showed mixed findings. Half the studies demonstrated a positive association between school attendance and participation in school meal programs, but these were modest.[13, 23] Similarly, half the studies demonstrated academic performance was positively associated with participation in school meal programs,[13, 41] with promising findings for adolescents in one study.[57] A single qualitative study suggested that students who participated in a school meal program were more ready to learn.[45]

4.3.4 Social outcomes

The social outcomes addressed in included studies were those relating to stigma (n=5),[42, 45, 55, 62, 64] friendship (n=1)[47] and a sense of belonging at school (n=1).[63]

Stigma: A South Korean study investigated the potential stigma effects in free lunch programs. Within schools that had a low proportion of free lunch students, they found participants experienced a stigma effect associated with their eligibility to receive a school lunch for free.[64] While not measured directly, a US study hypothesised that stigma was associated with lower rates of eligibility for free school meals and that where student populations are heterogeneous in income, stigma is likely to increase.[42] A qualitative Canadian study investigated the extent to which school food programs contribute to stigmatisation and social exclusion of elementary school families experiencing food insecurity. The findings indicate that an inclusive (or universal) approach can help to minimise stigma associated with accessing school food programs.[55] A study comparing universal school lunch programs in Japan and France found stigma associated with receiving subsidised meals was reduced when no-one knows which students receive subsidised meals.[62] In France, the charge for school lunch is based on household income and is paid in advance, with the same meal is served regardless of the amount paid. In Japan, each family pays the same price for lunch and students receive meals regardless of their payment status. A similar result presented in a US study found removing payment for a lunch program eliminated the stigma attached to whether students were paying for their meal, thus improving the social climate around school lunch provision.[45]

Friendship: A UK study evaluated the impact of attendance at school breakfast clubs on primary school students' relationship with their best friend and their experiences of peer victimisation.[47] This study used two objective measures (Friendship Qualities Scale and Multidimensional Peer Victimisation Scale) and the findings indicated that after six months, friendship quality improved for participants and peer victimisation declined.[47]

Sense of belonging at school: A New Zealand study found no association between participation on a school breakfast program and a sense of belonging at school.[63]

Overall, the most commonly assessed social outcome of school meal programs was stigma associated with receiving free or reduced cost school meals. A universal approach to school meal provision has been shown to reduce the associated stigma.[55, 62] Only one study explored impacts of school breakfasts on friendship and peer victimisation in primary school students, which showed positive 6-month outcomes,[47] and another reported that school breakfasts were not associated with a sense of belonging at school.[63]

4.3.5 Economic outcomes

We did not find economic evaluations of school meal programs which targeted disadvantaged students.

4.3.6 Process outcomes

Process-related outcomes were reported by 31 of the included studies and mostly included measures of reach, through quantitative program participation and sociodemographic data. Perceived feasibility of program implementation and acceptability were also captured through qualitative data from program or school staff, parents and children. Results are presented by region and program type.

Most of the data available on process outcomes for school meal programs is drawn from 17 studies on the US School Breakfast Program and National School Lunch Program. [12, 15-17, 19, 20, 23, 25, 27, 30-32, 38, 40-42, 68] The following findings relate to these US studies. Providing universal free meals within schools, as opposed to targeted reduced-price meals or full-priced meals, increased overall student participation in school lunch [15, 17, 41] and breakfast.[15, 17, 23, 42] Four studies demonstrated that participation in lunch or breakfast programs increased overall when a provision such as the Community Eligibility Program was introduced by the school to ensure all students received free meals regardless of their individual eligibility for free or reduced-price meals. [15-17, 42] One study showed changing from a universal free breakfast program to an eligibility-based program reduced breakfast participation.[27] A Canadian study reported universal meal programs were recommended by school staff and were preferred to reduced-price or targeted meal programs, as they perceived it reduced stigma for vulnerable students.[45] Studies in which breakfast programs were provided based on free or reduced-price meal eligibility criteria also reported positive impacts of breakfast consumption for food insecure students .[30, 31] Two studies reported low participation in the School Breakfast Program or the National School Lunch Program amongst vulnerable students in greatest need for the programs and argued the universal provision of school breakfast programs does not sufficiently remove barriers to student participation.[19, 28] One study reported school breakfast program participation did not differ between food secure and food insecure middle school children.[19]

There were mixed findings as to whether introducing universal access to free school meals improved school breakfast program and lunch program participation amongst vulnerable students. After introduction of the provision for free universal meals, two studies reported increased breakfast or lunch participation amongst vulnerable students.[41, 42] Another study, however, reported lunch participation increased the most for those that were close to, but did not meet the eligibility criteria for free or reduced-price meals,[15] and another found lunch participation decreased amongst free or reduced-price meal-eligible students, potentially disadvantaging students from lower-income households.[16] In addition, one study reported the largest reduction in breakfast participation following replacement of a universal free breakfast program to an eligibility-based program occurred in students that were not free or reduced-price meal-eligible.[27]

Student School Breakfast Program participation rates were generally reported to be 30-40%, lower than National School Lunch Program participation which was around 50-60% and school-level participation in the NSLP which was more than 25%.[17, 19, 23, 70] One qualitative study reported that school administrators of

elementary, middle and high schools perceived low breakfast program participation was mainly due to family-centred values, feeling breakfast was an opportunity for family time.[14] Similarly, one study reported that parents of middle school students wanted to be involved in their children's breakfast decisions.[40]

The Breakfast In Classroom was introduced by some schools with high proportions of low-income households, in efforts to increase School Breakfast Program participation through addressing barriers to access such as cost and timing.[20, 23] Breakfast In Classroom resulted in increased breakfast participation.[23] A qualitative study found school staff held initially negative perceptions of the Breakfast In Classroom, due to disadvantages related to costs and adjustments to the school schedule, however these perceptions changed over time to be more appreciative of the Breakfast In Classroom.[20] School staff perceived the benefits of Breakfast In Classroom to be were mixed, and a key driver for Breakfast In Classroom participation was students food preferences rather than hunger (observed by staff and parents, and confirmed by student reports).[20] Similarly, one study found students wanted to be involved in taste-testing and menu planning [40] and another found that providing opportunities for students to sample healthier lunch menu items the day prior increased participation of free or reduced-price meal-eligible students.[43]

High school students were 20% less likely to participate in the National School Lunch Program than elementary school children.[38] Barriers to National School Lunch Program participation identified by students included insufficient lunch time and long cafeteria lines, competitive foods available within or near the school, and the lack of lunch item variety and appeal.[12, 32, 38]

Two studies reported different stakeholder perceptions of the changes to school meal provision introduced by the Healthy Hunger-Free Kids Act.[25, 68] One reported food service directors in rural, isolated areas, did not feel the changes were warranted from an obesity-prevention perspective as they did not view overweight and obesity as a problem for their students. They also felt that the changes were burdensome and challenging to implement.[68] The other study reported positive perceptions of school staff, who had observed greater student lunch participation, and that more meals were consumed, compared to the previous year.[25]

In Australia, four qualitative studies described a high level of stakeholder acceptability for Australian school breakfast programs, which were perceived to address an important need in supporting vulnerable students in their community.[50-53] However, two studies reported challenges to implementation regarding the coordination across organisations, food supply and availability, reliance on volunteers and donations, and the sustainability of financial and volunteer support.[50, 54] One study reported staff and parent concerns about shifting the responsibility of providing breakfast from parents to schools.[51] These Australian studies did not report on the reach of these programs.

A daily breakfast program implemented in schools in deprived areas of New Zealand revealed weekly student attendance rates ranged from 4 to 38%.[66] Two studies reported on the acceptability of school meal programs in Greece[58] and England.[5] Parents and educators in Greece valued a free school lunch program more highly than a food voucher program, largely because they believed it alleviated food insecurity whilst minimising social stigmatisation.[59] A subsidised school breakfast program in England was highly valued by staff, parents and children, as they believed it provided children in need with increased opportunities for breakfast, however some staff felt that some families in need were unable to participate as they had to pay.[5] Universal government-subsidised school lunch programs provided in elementary and junior high schools in Japan and France differed in their payment structures. The French program operated on a sliding scale payment system, whereas every child in the Japanese program paid the same fees. Key stakeholders

of both programs regarded them as a good model for government-subsidised programs, as they did not stigmatise vulnerable children in receiving financially accessible school lunch meals, due to their payment structures.[62]

5. Conclusions

While our search identified more than 50 papers relating to school meal programs in relation to disadvantaged students, we found no systematic reviews or meta-analyses. School meal programs which targeted disadvantaged students included breakfast and lunch programs. These programs were universal in some countries, in that they are offered to all students in all schools; some are targeted and are offered in some schools in disadvantaged areas and some are only offered to disadvantaged students. Meal programs in some countries are offered through an umbrella government policy providing government funding (either fully or partially) and support. Other meal programs are made possible through non-government funding (fully or partially) or are funded through a combination of government and non-government means. Disadvantaged students may be offered meal programs free of charge or through a means-tested financial subsidy. Access to school meal programs is variable, and might be before school, during class time or at lunch time. These meals may be provided within school grounds, in the classroom, in a cafeteria or from a school canteen. In Australia, the school meal programs that are represented in the literature reflect a system which seems to rely primarily on the not-for-profit sector for coordination and delivery, and the not-for-profit and private sector for funding. While there has been some government provision of funding in some Australian states, this has now mostly ceased. It is not clear what government policies, if any exist for the provision of school-provided meals for disadvantaged children.

All school meal programs provided a variety of food groups within breakfast and lunch meals. School meal programs in the US, UK and Greece were based on nutritional guidelines, which specified specific macronutrient and micronutrient requirements. There were no such guidelines for school breakfast programs in Australia or New Zealand, which mostly consisted of shelf-stable items, with some reliance on donations for fresh fruit, milk, bread and yoghurt.

Overall, participation in school meal programs is positively associated with food security for disadvantaged students, protecting vulnerable children from food insecurity. Most of the evidence was from long-established school meal programs in the US, with limited evidence on Australian breakfast programs. Participation in school meal programs based on nutrition guidelines is also positively associated with higher fruit and vegetable consumption and a healthier diet, suggesting that they can enhance children's health. However there is insufficient information to determine whether this translates to healthier weight status, which was not a focus of the review. Universally delivered free school meal programs importantly increase overall breakfast and lunch participation and reduce the risk of stigmatisation associated with reduced-price or free school meal programs for vulnerable students. It seems that visibility is important, and reducing stigma can be through universality of programs, or masking which students are paying for meals and which are not. However the evidence was inconclusive on whether free universal school meal programs reach students most in need, and whether they have positive health and education impacts for these students. Whilst efforts have been made to address stigma and accessibility barriers to school meal participation, there are a number of barriers which have not always been overcome by programs that are offered.

Findings related to school attendance and academic performance were mixed, with some studies indicating improvements and others finding no change. However, there was an association between free school meal

provision and school attendance in economically disadvantaged students suggesting that school meals may support school attendance in this population. For adolescents from food-insecure households, findings of one study suggest a benefit of school meal programs to the risk of below-average academic grades. Although not conclusive, school meal programs hold promise for improving education-related outcomes in disadvantaged students.

Overall, school meal programs were highly valued by school staff, parents, children and volunteers. They were perceived as addressing an important need in the community however, reach of these programs has not been determined. School breakfast programs in Australia faced unique implementation challenges compared to those of government-funded programs in the US, UK, France, Japan and Greece, related to their dependence on funding, volunteers and donations mainly from the not-for-profit and private sector.

6. Limitations of this rapid review

In line with the definition of a rapid review, we used systematic review methods to search and critically appraise existing evidence about interventions investigating the association between healthy eating and/or physical activity and education-related outcomes.[11] We made every effort to conduct a thorough and systematic search, however the completeness of the search was limited by time constraints and it is possible that some relevant studies may have been missed and are therefore not been included in this review. The quantity and/or direction of the effect of interventions has been assessed where possible. The quality of included studies has not been assessed.

Our findings regarding health, educational, social and economic outcomes may be incomplete, as our search strategy did not specifically focus on these outcomes. Rather, the findings relate to the published literature available on school meal programs that addressed food insecurity or targeted socio-economically disadvantaged students through either free or reduced-price meals. We reported on these outcomes when available, and for disadvantaged students only.

This review may be subject to publication bias, in which positive outcomes are overstated. An online search of school meal programs indicated only a small number of school meal programs are evaluated and published in the peer review literature. In addition, a large proportion of the included articles were conducted on free universal meal programs in the US, which may be of limited relevance to the Australian school meal context, particularly for lunch, which is usually brought from home. Findings from Australia were highly relevant but limited to qualitative evaluations of breakfast programs and to the best of our knowledge, there are no organised lunch programs provided to disadvantaged students in Australia.

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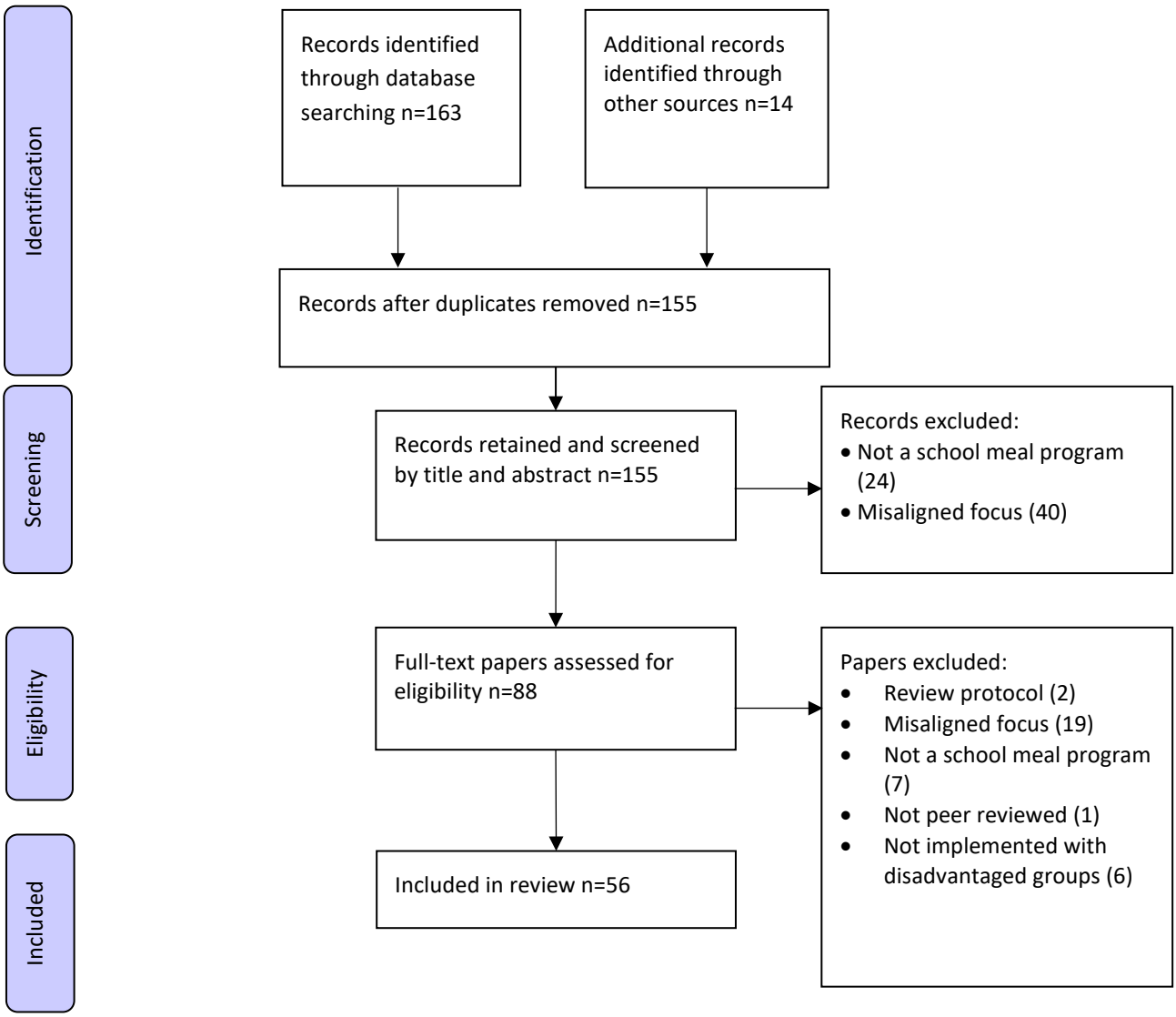
Appendices

Appendix 1: Search Strategy (Medline via Ovid)

	Concept 1 (Population: primary or secondary school aged children)	**Concept 2 intervention (food access programs)**	**Concept 3 (focus on food security or disadvantaged populations)**
MeSH subject headings	Child/ Students/ Schools/		Vulnerable populations/ Health equity/
Keyword searches	Child*.mp Student*.mp Adolescen*.mp School?age*.mp	School* ADJ1 lunch ADJ1 program*.mp School* ADJ1 lunch ADJ1 intervention*.mp School* ADJ1 meal ADJ1 program*.mp School* ADJ1 meal ADJ1 intervention*.mp School* ADJ1 breakfast ADJ1 program*.mp School* ADJ1 breakfast ADJ1 intervention.mp School* ADJ1 food ADJ1 program*.mp School* ADJ1 food ADJ1 provi*.mp	Socioeconomic*.mp Disadvantage*.mp depriv*.mp inequit*.mp Vulnerable.mp Equit*.mp Food ADJ3 access*.mp Food ADJ3 Availab*.mp Food ADJ1 insecurity.mp Food ADJ1 security.mp Food ADJ1 insufficiency.mp

Appendix 2: PRISMA flow diagram of initial evidence review search



Appendix 3: Tabulation of relevant review papers

(Papers are organised alphabetically by year, with the most recent first)

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
Bartfeld, 2020.[8] US.	To estimate the association between the Community Eligibility Provision (CEP) and school attendance among elementary school students. Quasi-experimental study. Economic disadvantage.	CEP-participating schools offered breakfast and lunch free to all students through the School Breakfast Program and the National School Lunch Program beginning in 2014-2015, thus removing barriers of payment and stigma associated with participation for individuals. Elementary school (grades 1 to 5).	Not specified.	School attendance during the first and second implementation years.	Implementing the CEP had no association with attendance in the 1st year. The 2nd year was associated with a 3.5% reduction in student absence in those with low attendance (p=0.045). An association between CEP and attendance was only found for economically disadvantaged students. *Conclusion*: Offering meals free to all students may modestly reduce the risk of low attendance among economically disadvantaged students.
Dalma, 2020.[58] Greece.	To examine the impact of a school program combining healthy meals provision and educational activities to reduce food insecurity. Cluster RCT.	DIATROFI school meal program. Schools deemed eligible if families meet low income and food insecurity criteria. All children in eligible schools can participate. Intervention schools (n=28) received a	'Healthy' meal – based on age-specific nutrition guidelines and provided 30% of students' daily energy needs and ≥ 50% of daily nutrient needs. Daily meal included sandwich, pie or other whole wheat bakery product, fresh milk or	Household food insecurity.	Reduced food insecurity score in the meal intervention group was statistically significantly greater than in the education intervention group (9.8% or -0.31, 95% CI -0.61 to -0.01] FSSM units after adjusting for potential confounders. Meal intervention was significantly

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
	Food insecurity in low SES areas measured by Food Security Survey Module (FSSM).	healthy meal with a nutrition education intervention for students and parents; control schools (n=23) received education only. Primary school.	yoghurt with honey and fresh fruit. Exclusive use of olive oil, whole wheat flour, absence of preservatives and added sugars, variety of vegetables.		more effective compared to education among students in food insecure households (mean-0.44, 95% CI -0.84 to -0.04), students in households facing hunger (mean -1.04, 95% CI -1.91 to -0.17) and overweight/obese students (mean -0.36, 95% CI -0.72 to -0.01). *Conclusion*: Tackling family food insecurity in developed countries should focus on school-based food assistance combined with activities promoting healthy nutrition.
Jose, MacDonald, 2020.[50] Australia.	To identify the perceived benefits, impacts, operational practices, and challenges of running school breakfast clubs (SBCs). Qualitative study (focus groups and interviews). Socio-economic status.	Tasmanian SBCs (originally started with Government support, which ceased in 2014; some continue with support from community organisations and private sector). Victorian SBCs (partnership Victorian Government and Foodbank Victoria) – to tackle the disadvantage children experience through effects of	All Tasmanian programs offered toast, with spreads (jam or Vegemite). Some offered cereals, fresh fruit, muesli bars, yoghurt, and juice or Milo. In Victoria, Foodbank provided schools with Cheerios, oats, wheat biscuits, muesli, baked beans, fruit cups, canned fruit, apples and long-life UHT milk. Some schools provided	Perceived benefits, impacts, operational practices and challenges for students, parents, staff and funders.	No eligibility criteria to attend SBCs - all students were able to attend, regardless of household income. Thus, participation was a choice rather than a consequence of food insecurity. Participants, including children, discussed social benefits of SBCs (i.e., social eating, relationship building, school connection, and engagement) as well as perceived improved classroom behaviour. Challenges for program

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
		hunger when arrive at school without having had a healthy breakfast. Foodbank Victoria provides non-perishable and long-life food to all schools at the beginning of each term and helped schools establish and manage their programs. Primary schools.	additional food sourced from local businesses and donations or drew from school funds to purchase additional food such as toast, spreads, and Milo.		delivery included resource limitations, particularly, reliance on volunteers and sourcing food. *Conclusion:* SBCs offered a range of benefits beyond their primary goal of addressing food security, and were highly valued by the school community for their social, welfare, well-being, and educational benefits, but program sustainability is constrained by resource limitations.
Jose, Vandenberg, 2020.[51] Australia.	To investigate how schools have responded to the growing expectation that they provide breakfast for students. Qualitative study (focus groups and interviews). Disadvantage according to Occupational Education Needs Index (OENI).	5 Tasmanian schools. No eligibility criteria for access to School Breakfast Programs - offered with varying frequency (once/week to 5 days/week). School Breakfast Program coordination was by teaching staff, school chaplains, school cleaners, community workers or parent volunteers. All School Breakfast Programss relied on volunteers for program delivery. Only	Food provided varied, but included cereal, toast, yoghurt, juice, milk, Milo, fruit.	School response to expectations to provide breakfast for students.	Some staff and parents expressed unease about School Breakfast Programs shifting responsibility for breakfast provision from parents to schools but were committed to supporting vulnerable students as part of the broader school culture. School Breakfast Programs were found to provide an alternative or additional site for breakfast consumption for many children not experiencing food insecurity.

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
		one school collected data on attendance, and none collected background information. Some permitted parents or carers to attend with their children. Funding was a combination of school funds, community groups and donations. Food was sourced from food relief organisations, local businesses and donations from the community as well as food bought by the school. Primary schools.			*Conclusion*: The expectation that schools provide breakfast has created need resolving. Concerns about shifting responsibility and over-consumption could be addressed if schools were given more advice on program management by government and non-government funding bodies.
Gordanier, 2020.[13] US.	To investigate the effect of the Community Eligibility Provision (CEP), a universal free-lunch program on students' academic performance and attendance.	A universal free-lunch program. Schools are eligible to receive subsidies to provide universal free lunch if ≥40% of students qualify for free lunch through categorical eligibility. Eligible schools can provide free lunches to all students, regardless of whether an individual	No specified.	Academic performance (standardised Maths and English scores). School attendance.	CEP leads to about 0.06 of a standard deviation increase in math test scores for elementary school students. Smaller effects on reading scores and on middle school students were found. These effects vary by student poverty, school poverty, and locality. In particular, students previously eligible for free lunches but not on

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	Natural experiment pre/post. Household income.	student qualifies for free or reduced-fee lunch. Elementary and middle school.			other public assistance programs benefit the most from CEP. *Conclusion*: Expansion of access to free lunch may help improve academic outcomes.
Schwartz, 2020.[41] US.	To determine the impact of extending free school lunch to all students, regardless of income, on academic performance. Longitudinal study. Poor=those individually certified as eligible for FRP lunch in any year.	Free school lunch (Universal Free Meals (UFM)). Middle school.	Not specified.	Test scores in English Language Arts (ELA) and mathematics, and school lunch participation, weight.	A positive effect of UFM on the test scores of middle school students—both poor and non-poor—with the largest increases for non-poor students; no evidence that UFM increases the probability that students are obese or overweight. *Conclusion*: UFM increases participation in school lunch, and the increases in participation induced by UFM improve student performance on both ELA and math exams for all eligibility groups; stigma plays a role in participation decisions as well.
Spruance, 2020.[14] US.	To explore school administrators' support for and perspectives on the School Breakfast	School Breakfast Program. Elementary, middle and high school.	Not specified.	Perceptions of the program.	Almost one-third of administrators (n = 56) perceived low state-wide participation was due to family-centred values. Over

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
	Program (in a state with the lowest participation rates). Cross sectional survey. Majority of administrators represented elementary schools, in which 41–60% of their student body was eligible for free or reduced-price lunch.				half (56%) believed there was no need to increase participation. Most reported benefits of the School Breakfast Program included academic performance (81%) and decreasing student hunger (78%). *Conclusion*: Continual efforts to improve administrators' perspectives of School Breakfast Program and particularly, alternative school breakfast models as a way of decreasing childhood food insecurity are needed.
Tan, 2020.[15] US.	To examine associations between Community Eligibility Provision (CEP) and participation among students eligible for free or reduced-price meals (FRPM), possibly eligible (near-cutoff), or ineligible (full-price).	National School Lunch Program and School Breakfast Program. Elementary and middle schools.	Not specified.	School meal participation.	CEP was associated with higher participation in school meals. Lunch participation among near-cut-off students was 12 points higher in CEP versus comparison schools ($p<.05$). Among full-price students, breakfast participation was 20 points higher and lunch participation 19 points higher in CEP than comparison schools ($p<.001$). *Conclusion*: CEP improves access to school breakfast and lunch in high-poverty

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
	Cross sectional survey. Household income level. *Note*: the CEP allows schools to provide breakfast and lunch at no cost to all students, if at least 40% students are certified as free-eligible through participation in other means-tested programs such as SNAP.				schools, particularly for students who are near or above the cutoff for FRPM eligibility.
Taylor, 2020.[45] US.	To determine the degree to which universal school meals benefit multiple domains of childhood development and school efficacy. Case study (mixed methods). No disadvantage reported.	Universal free school meals. Elementary, middle and high school.	Not specified.	Staff perceptions of students' readiness to learn, changes in school climate, and whether they would recommend universal school meals.	83% agreed/strongly agreed that universal school meals make students more ready to learn. Over 72% reported that serving universal school meals has improved social climate. 92% would recommend implementing universal school meals to other schools. *Conclusion*: Universal school meals are beneficial across multiple domains of

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
					childhood development and for school efficacy.
Watson, 2020.[52] Australia.	To explore the perceptions and experiences of key stakeholders involved in the implementation and delivery of the KickStart for Kids school breakfast program. Qualitative case study. School-level: socio-economically deprived areas in Adelaide	KickStart for Kids school breakfast program. Primary school.	Not Specified.	Stakeholder perceptions and experiences of the program: perceived program benefits to children, and perceived strengths and challenges to the program.	Stakeholders believed the program addressed an important need in the community, supported students' academic learning and fostered their life and social skills. They expressed concerns the program might not be reaching the children who need it the most and about the government's lack of recognition of child food insecurity and limited support for KS4K and similar programs. They believed schools should take ownership of the program and ensure adequate food for the children, that issues with food availability and affordability would be ongoing and there was a lack of awareness of childhood food insecurity in some schools. *Conclusion*: Overall, the key stakeholders identified several benefits to the children and strengths of the program. However, there

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					were significant challenges that may impact on the program's ongoing sustainability and delivery of school breakfasts.
Pokorney, 2019.[16] US.	To determine the effect of Community Eligibility Provision (CEP) school implementation on student's National School Lunch Program participation. Quasi-experimental study. Student's eligibility for free or reduced-price meals.	National School Lunch Program. (Note: The federal government provides subsidies to local school districts to provide free or reduced-price (FR) meals to students in households with incomes up to 185% of the federal poverty level. In CEP schools, all students receive free meals, regardless of their individual eligibility). Kindergarten to year 12.	Not specified.	Lunch participation and meals served. The data includes whether the student was eligible for free, reduced-price or paid meals.	School-level implementation of CEP was associated with increases in total school meal participation but lower free & reduced-price lunch participation and meals served. *Conclusion*: CEP has been effective in increasing overall student access to school lunch. But it may have unintended negative consequences for students in lower-income households.
Turner, 2019.[72] US.	To examine school-level adoption of any provision for universal free meals and subsequent changes in student participation rates for the School Breakfast Program	School Breakfast Program and National School Lunch Program. Elementary, middle and high schools.	Not specified.	Student participation in the school meal programs.	When eligible schools adopted provisions, participation rates increased an average of 3.48 percentage points for breakfast and 5.79 points for lunch the following year. By 2016–2017, over half of all eligible schools were using a

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
	and National School Lunch Program in California from 2013–2014 to 2016–2017. Longitudinal School-level poverty was proxied by the percentage of students who were eligible for free or reduced-price meals, grouped as ≤75% and >75%.				provision for universal free meals. *Conclusion*: When eligible schools adopt provisions for universal free meals, student participation rates significantly increase, improving program reach among children most at risk for food insecurity.
Yu, 2019.[64] South Korea.	To investigate potential stigma effects in selective free-lunch programs; Hypothesis - eligibility to receive a school free lunch has negative effects on student educational outcomes, and that this stigma-effect is more severe in schools where a low proportion of students receives a	Selective free lunch program. Middle school.	Not specified.	Proxy measures of stigma: students' average GPA (standardized vertical scales of Korean, Math, and English, ranging from200 to 600), the presence of supportive peer relationships, self-esteem, achievement goal orientation, and their satisfaction with teachers.	Results indicated a potentially strong negative effect of free lunch status on stigma. *Conclusion*: School free lunch policies appear to be an effective way to support low-SES students.

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
	free lunch at school. Longitudinal survey (2010 to 2015). Low-income.				
Dalma, 2018.[59] Greece.	To investigate the optimal intervention to reduce food insecurity and promote healthy eating among low SES school students. Qualitative study (focus groups). Food insecurity in low SES areas – at the school level.	Schools randomly allocated to either food-voucher or free daily meal distribution intervention. Public primary and high schools.	*Daily lunch bag* (different each day): cereal-based food item, milk or yogurt with honey 3x/week, and fresh fruit. Meals met age specific nutritional guidelines. High in fruit, vegetables and protein, with exclusive use of olive oil, no preservatives, trans-fats, or sweetened drink. *Food-voucher* for local supermarkets distributed monthly to parents (value 44 Euro/child). For purchase of food products, but not beverages, sweets or snacks.	Parent, educator and school principal perceptions regarding the program; triggers and barriers of participation; attitudes towards the program, and suggestions for optimising program implementation.	Meal distribution was more favourably perceived. Stigmatisation was minimised in meal distribution compared to voucher participants. Vouchers helped to manage household food insecurity and meal distribution alleviated student food insecurity. The educational and experiential nature of the meal distribution approach intensified healthy eating promotion, while the food-voucher intervention was efficient mainly for conscious parents regarding healthy eating. *Conclusion*: Meal distribution was considered more effective than food vouchers.
Deavin, 2018.[53] Australia.	To explore the acceptability and perceived benefits	Breaking Bread, Breaking Barriers – volunteer-run breakfast	Foods provided varied depending on the foods donated/collected and	Student hunger.	⅕ of children interviewed arrived at school without having breakfast at least

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
	of a free primary school-based breakfast program utilising donated food. Qualitative study (focus groups, analysis of diaries and hunger scale). Area of socio-economic disadvantage.	program addressing poor breakfast consumption before school and food waste. Operated on Friday mornings before school. Meals delivered on-site by not-for-profit organisation (collected and utilised food donated from supermarkets and small local business. Public primary school.	included a variety of fruits and vegetables, cereal-based foods, such as pancakes and hot cross buns, protein-based meals, such as frittatas and French toast, as well as full-cream milk and banana smoothies.	Acceptability of program.	once per week while ⅓ reported being hungry on arrival at school. Benefits of participation in the program included increased willingness to attend school, improved alertness and behaviour, as well as creation of an equitable, supportive environment beneficial for low income or food insecure families. *Conclusion*: The breakfast program based on donated foods was widely accepted by students, teachers and parents.
Ichumar, 2018.[54] Australia.	To assess the School Breakfast Programs in two rural schools with high Aboriginal student populations. Qualitative study. Aboriginal population.	Foodbank WA established the School Breakfast Program to support schools throughout WA to provide free breakfast and emergency meals to students. Primary and high school.	Foodbank WA provides shelf-stable food items at no charge to schools including canned fruit in juice, wheat biscuits, oats, vegemite, UHT milk, canned spaghetti and baked beans. Yoghurt, fresh bread and fresh fruit may be supplied to schools depending on the availability their stocks.	Cereal, toast, spaghetti or baked beans, and milk were supplied by FoodbankWA. A remote school had access to 100% unsweetened UHT orange juice and processed fruit juice with no added sugar owing to their isolation from foodbank's network, and inability to access fresh produce regularly. The regional school purchased	The School Breakfast Programs focussed on serving food rather than building nutritional understanding or on social interactions and support. Systems for delivery and management of the programs relied on staff with limited time. Children enjoyed learning about food when offered a more interactive and social environment.

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				sweetened jam, white bread and Milo from local stores using their own budget.	*Conclusion*: The realities of pressure on staff to support School Breakfast Programs need to be considered. The lack of volunteer support in disadvantaged schools limits the potential benefits of School Breakfast Programs. Health education resources which exist for use in School Breakfast Programs are not well utilised.
McIsaac, 2018.[73] Canada.	To determine the extent to which school food programs contribute to stigmatization and social exclusion of families experiencing food insecurity. Qualitative study. No measure of disadvantage.	Universal breakfast program; for lunch, some schools offered subsidised lunch programs, others offered those who did not bring lunch leftovers from breakfast.	Not specified.	Social (stigmatization).	The inclusive approach (universality) helped minimise stigma associated with accessing the program. *Conclusion:* Upstream and system-level actions are needed to address food insecurity and families experiencing insecurity need to be engaged in developing solutions. *Limitations:* Small sample of school stakeholders that valued health promotion.
Pope, 2018.[43] US.	To determine whether sampling vegetables the day prior can increase National School	Entrée as part of National School Lunch Program. Kindergarten to Year 8.	Chicken broccoli alfredo, root vegetable stew, savoury turkey loaf, eggplant parmesan.	National School Lunch Program participation.	There was a significant increase in the percentage of students who chose the targeted entrée, and a slight decrease in those who

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	Lunch Program participation. Case study. School located in an underserved rural area. Student's eligibility for free or reduced-price meals.				purchased an alternative option. But there was a slight increase in total National School Lunch Program participation from baseline to post-intervention. *Conclusion*: Sampling may have a positive effect on National School Lunch Program participation rates especially for those eligible for free/reduced-price meals. However increases may be due to acceptance over time rather than sampling. Limitations: Study conducted in one school and does not account for other factors impacting the change.
Yamaguchi, 2018.[61] Japan.	To evaluate whether Japan's universal school lunch programmes contribute to a reduction in the socioeconomic status (SES)-related gradient in fruit and vegetable intakes.	Universal school lunch program. Elementary (6-12 years).	Not specified.	Fruit and vegetable intake.	Compared with children with high maternal education (>15 years), those with low maternal education (<13 years) had less vegetable intake by 22.3 g/1000 kcal (95% confidence interval = 12.5, 32.2) and less fruit intake by 7.5 g/1000 kcal (95% confidence interval =_2.4, 17.3). Fruit and vegetable intakes from

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	Survey of selected schools. SES indicators of children included parental education, annual household income and maternal employment status.				school lunch did not vary by SES, indicating that school lunch intake alleviated the SES-related gradient of total vegetable intake by 9.9% and that of fruit intake by 3.4%. *Conclusion:* Universal school lunch programmes can partially contribute to a reduction in the SES-related gradient in fruit & vegetable intake.
Fletcher, 2017.[18] US.	To examine the relationship between the School Breakfast Program and food insecurity outcomes. Cross-sectional analysis. School-level poverty rates, household food insecurity.	The School Breakfast Program is a federal entitlement program that offers breakfast to any student who attends a school that participates in the program. Student eligibility is according to household income level. Elementary school.	Not specified.	Differences in food insecurity both within states and across states in schools with different requirements to provide breakfast at school.	Estimates suggest that the School Breakfast Program reduces food insecurity rates for elementary school aged children. Results for these children are very large in magnitude. Specifically access to the School Breakfast Program reduces the likelihood of indicating low food security by over 15 percentage points. Lack of effects for older children may reflect a higher perceived stigma of eating breakfast at school for junior high and high school aged children. *Conclusion*: Future policy directions for the School

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					Breakfast Program might include further expansions for elementary school children as a way to reduce food insecurity as well as a need for further experimentation of ways to increase take-up for older children.
Payan, 2017.[12] US.	To explore adolescents' perceived barriers and facilitators to school lunch meals after implementation of updated nutrition standards (Healthy, Hunger-Free Kids Act, 2010). Qualitative. African-American and Hispanic students from identified 'high-poverty schools'.	School cafeteria meals. High school.	Not specified.	Barriers and facilitators to eating school cafeteria meals.	Barriers to National School Lunch Program participation identified: long cafeteria lines, insufficient lunch time, lack of appeal & variety. Facilitators: variety of fresh/freshly prepared foods on offer. *Conclusion:* This qualitative study identifies important barriers and facilitators to healthy eating among low-income African-American and Latino adolescents.
Cornish, 2016.[68] US.	To understand the perceptions of rural food service directors and barriers to	Healthy, Hunger-Free Kids Act of 2010 (HHKA) required schools participating in the National School Lunch	Changes included new calorie ranges for meals, limited sodium and trans-fat contents, and increased amounts	Perspectives of food service directors.	Food service directors mostly perceived the changes as negative, challenging, and burdensome. They believed

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	implementing changes to school meal provision. Qualitative study (phone interview and online survey). Isolated, rural schools.	Program to make significant changes to meals served to students. School level not specified.	of fruits, vegetables, and whole grains served with meals.		that the changes resulted from concern about childhood obesity, which they did not view as a problem for their students. Challenges were: cost, preparation, and student preference. *Conclusion*: Food service directors in isolated, rural areas need support to understand requirements of school meal changes, build professional networks to learn from one another, and communicate with students, families, and other stakeholders. Efforts to change perceptions and support directors may facilitate successful implementation.
Dykstra, 2016.[19] US.	To examine breakfast behaviours of urban students with universal access to the School Breakfast Program and to identify differences in breakfast	School Breakfast Program is a federal initiative to ensure that low-income children gain the benefits of regular breakfast consumption at school. Universal School Breakfast aims to reduce barriers to low-	Not specified.	Breakfast consumption & skipping. Student weight status.	Students participated in the School Breakfast Program 31.2% of possible days, with 13% never participating in the School Breakfast Program. ⅛ (19.4%) of students purchased something from a corner store for breakfast, and 16.9% skipped breakfast.

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	behaviours among children from food-secure compared with food-insecure households. Cross-sectional study. Household income, household food security (abridged USDA scale), student free or reduced-price lunch status.	income students' participation in the School Breakfast Program. Grade 4 to 6 (across n=16 schools).			46% of students were food insecure; few differences in breakfast behaviours were observed across levels of food security. *Conclusion*: Participation in School Breakfast Program is low, skipping breakfast and consuming low nutritional food in the morning is common regardless of food security status.
Folta, 2016.[20] US.	To understand stakeholder perspectives of a Breakfast in the Classroom (BIC) model of the School Breakfast Program. Qualitative data. Schools in low-income areas serving racial/ethnic minority students.	BIC is a delivery model for the School Breakfast Program – making breakfast available free to all students in the classroom at the start of the day. Elementary schools (n=10).	Not specified.	Perceptions of students, parents, teachers, cafeteria managers and principals.	School staff had changed their perceptions of relative disadvantages and costs related to time and effort of BIC over time; the majority of each stakeholder group expressed an appreciation for BIC; student breakfast consumption varied from day to day, related to compatibility of foods with child preferences; and stakeholders held mixed and various impressions of BIC's potential impacts. *Conclusion*: Engaging staff and parents in discussions

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					prior to BIC implementation may address concerns. Positively communicating positive impacts and nutritional value of meals with stakeholders may improve support for BIC.
Harvey-Golding, 2016.[6] UK.	To examine the views and experiences of senior level stakeholders on the processes and potential outcomes on different groups, within the communities served by school breakfast programs. Qualitative study. Program takes place in low SES districts.	Universal free school breakfast implemented by the local authority. Primary school.	Not specified.	Stakeholder perceptions of the positive and negative issues and implications associated with the Universal Free School Breakfast.	Perceived positive outcomes included benefits to children, families, schools, and the community. For instance, alleviating hunger, improving health outcomes, and conferring financial benefits, with the potential to cumulate in overall improvements in educational, social, and behavioral outcomes. Reported negative implications included the absence of an effective communication strategy in implementing the Universal Free School Breakfast program; in addition to concerns about the impacts of “double-breakfasting” on obesity levels among children, particularly in less deprived communities.

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					Conclusion: this study provides a unique qualitative insight into the processes, issues and outcomes of a universal free school breakfast program within a socioeconomically deprived community, according to the perceptions of senior level stakeholders.
Huang, 2016.[21] US.	To examine the association of receiving free/reduced-price lunch from the National School Lunch Program with household food insufficiency. Longitudinal study. Eligibility for National School Lunch Program.	National School Lunch Program. Students aged 5-18 years.	Not specified.	Household food insufficiency across four months, determined by responses to food security survey questions.	Food insufficiency rate is 0.7% (95%CI: .1, 1.2) higher in summer months among National School Lunch Program recipients (low-income families cannot participate in the National School Lunch Program in summer holidays). National School Lunch Program participation is associated with a reduction of food insufficiency risk by nearly 14%. *Conclusion*: The National School Lunch Program plays a significant role to protect low-income children and their families from food insufficiency.

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Moffat, 2016.[62] France & Japan.	To describe commonalities of the Japanese and French school meal programs. Qualitative, case study: interviews with stakeholders (government officials, educators, nutritionists, parents) & observations. French schools from region with higher % low income households than Paris; Japan schools not specified.	School lunch program (universal). 6 elementary & 1 junior high school.	France: entrée, salad or fruit/vegetable, a main course (grain, meat or meat alternative, vegetable), cheese/yogurt and fruit course, bread, water. Japan: miso soup, a carbohydrate (rice or bread), meat or fish, and vegetables, milk.	Governance and financial accessibility; nutritional quality of meals, national public health goals, educational and cultural aspects of meal programs, barriers to social inclusivity.	In both countries programs are universal, and administered by local municipalities, however funding differs. In France a family index is calculated yearly, based on household income and living expenses, and the family is charged accordingly (the government subsidises wealthier districts less than poorer districts). No one knows whether a child receives a subsidised meal. In Japan, the municipal govt contributes to the cost, but families pay the same amount regardless of income. Students receive meal regardless of whether their family paid, but there is a 4-5% non-payment rate. Interviewees in both countries believed their system addressed household food insecurity issues. School meals were regarded as important experiential tools for food literacy and knowledge. *Conclusion:* The Japanese and French school meal programs provide models of

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					financially accessible school lunch meals without the stigma of a subsidised program
Petralias, 2016.[60] Greece.	To determine the impact of a school-based nutritional program on household food insecurity. Pre-post evaluation. Schools were selected from low SES districts.	DIATROFI school meal program. One free daily meal offered to all children attending 162 schools in underprivileged areas in Greece. Elementary and secondary school.	Average 435Kcal: cereal product (with or without vegetables), fresh fruit (and milk/yoghurt 3 times/week). Wholemeal or Arabic pita bread filled with cheese, vegetables and occasionally turkey, spinach pie, leek pie, sesame seed bagel or raisin bread) and a fresh fruit (peach, apple, tangerines (two) or banana).	Household food insecurity	Positive impact on food insecurity (decreased by 6.5%), with a greater effect on those who reported hunger at baseline and those who participated for a longer period. *Conclusion*: Food aid school program can reduce food insecurity for children and their families in a developed country in times of economic hardship. *Limitations*: Study design does not account for secular trend or other factors impacting the change in food insecurity
Anzman-Frasca, 2015.[23] US.	To estimate the impact of a Breakfast in the Classroom (BIC) program on School Breakfast Program participation, school attendance,	BIC delivery model as part of the School Breakfast Program. Elementary school.	Not specified.	School Breakfast Program participation, school attendance, academic achievement (measured by yearly standardised tests)	BIC program was linked with increased breakfast participation (F10,414 = 136.90, P < .001): mean participation rates of 73.7% vs 42.9% in non-BIC group. BIC was also linked with greater school attendance rates (95.5% vs 95.3% in the

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	and academic achievement. Quasi-experimental study. Low-income, racial/ethnic minority students.				non-BIC group; *F*1,2772 = 8.40, *P* = .004). There were no group differences in standardized test performance in maths or reading between the two groups. *Conclusion*: BIC can increase school breakfast participation. BIC has the potential to improve overall school attendance rates.
Defeyter, 2015.[47] UK.	To evaluate the impact of children's attendance at Breakfast Clubs (BCs) and ASC (after-school clubs) on the quality of their relationships with their best friend and their experiences of peer victimisation. Mixed factorial design study. Low SES family.	BCs offer a nutritious breakfast in the company of school staff and peers on the school site, before classes start. Primary schools.	'Nutritious' breakfast.	Social – friendship (BC and ASC attendees), measured by the Friendship Qualities Scale and the Multidimensional Peer Victimisation Scale, 2 months after introduction of school clubs, and 6 months later.	After 2 months, data showed no significant differences between groups on any of the measures. After 6 months, BC attendees showed improved levels of friendship quality, and BC and ASC attendees experienced a decline in victimisation. *Conclusion*: BC attendance facilitates the quality of children's relationships with their best friend over time. The results have implications for utilisation of BCs to aid children's social relationships in school over time.

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Graham, 2015.[5] UK.	To explore what users and key stakeholders think are the advantages and disadvantages of school breakfast clubs. Qualitative study. Participants were recruited from four primary schools based in predominantly White British, low-income areas of the North East of England. Free school meal entitlement used as a proxy for SES.	Breakfast club that was subsidised by the govt. Some entitled to free meals, others had to pay. Included activities (similar to before/after school care). Currently being implemented in England's 'poorest' schools. Primary schools.	Not specified.	School staff, parents and children's perceived advantages and disadvantages of the breakfast club.	Staff, parents and children reported social benefits and opportunities for children to interact with peers and that it helped with punctuality. Both staff and parents reported it was affordable and reliable childcare and a calmer approach to the start of the day than experienced at home. Parents and children valued the club and reported it prevented children skipping breakfast and helped them feel more alert. School staff felt families in need took advantage of the free breakfast for their children, but some who were in need had to pay and so were not able to participate. They believed breakfast clubs allowed children to have a healthier breakfast. Both staff and children reported it allowed children to try a greater variety of foods than available to them at home. *Conclusion*: Findings showed that breakfast clubs have

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					multiple positive factors that have the potential to impact social, behavioural, and educational outcomes for children. The opportunity to consume breakfast at school was viewed favourably by parents, staff, and children because it meant that children who skipped breakfast at home had an additional opportunity to access a breakfast meal before the start of the school day.
Jenkins, 2015.[48] UK.	To examine the nutritional intake of students to assess the rationale for, and potential of, school breakfast initiatives. Cross-sectional observational study. Disadvantage measured by eligibility for free school meals.	Intervention group: Free School Breakfast Program; control group: one-year delay before implementation of School Breakfast Program. Provision of meal before commencement of classes. Children (9–11 years) from n=11 schools.	Option of one item from: non-sugar-coated breakfast cereal; bread; milk-based drinks and milk products; fruit, including unsweetened fruit juice. In practice, the majority of schools offered breakfast cereal with milk, toast and fruit juice and either fresh, dried or tinned fruit.	Nutritional intake.	Before the programme, breakfast skipping rates were low and there was little evidence of nutritional deficiency. A subset of children consumed inadequate levels of a range of vitamins and minerals and 29% of children ate very little for breakfast (<100 kcal). Children from deprived backgrounds consumed significantly lower levels of several vitamins and minerals at breakfast. Following the introduction of the breakfast scheme, the nutritional quality of school

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					versus home breakfasts was similar. Children who ate breakfast at school *and* home had higher overall energy intake, but not significantly so. *Conclusion*: School breakfast schemes could benefit a subset of children who are poorly nourished and consume very little for breakfast.
Arteaga, 2014.[24] US.	To explore the protective effects of National School Lunch Program participation on household food security in the transition to kindergarten. Statistical modelling. Persistent food insecurity.	The National School Lunch Program eligibility determined by household income). From 2012, if >40% of students qualify then free meals are provided to all students. Kindergarten (aged 5 years)	Not specified.	Food security in families eligible for the National School Lunch Program, with children entering kindergarten.	Modelling found that the National School Lunch Program reduced food insecurity among low-income families. *Conclusion*: Findings are consistent with literature documenting the benefits of school lunch programs but is unique for the focus on the school-entry time period.
Moore, 2014.[49] Wales.	To examine the impacts of the Primary School Free Breakfast Initiative in Wales on inequalities in	Free Breakfast Initiative (schools in areas of deprivation were targeted in the initial phases of implementation, after	Breakfasts provided included items from four food types: non-sugar coated cereals, bread, milk products	Dietary recall; cognitive (memory, attention & psychomotor speed); behavioural (conduct problems, emotional problems, hyperactivity	Children in intervention schools ate a greater number of healthy items for breakfast than children in control schools, with larger increases observed in more

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	children's dietary behaviours and cognitive functioning. Cluster-randomised controlled trial (secondary data analysis). Two measures of school level deprivation used: % children in the school entitled to free school meals; within a 'Community First' area (socio-economically deprived).Individual level: entitlement to free school meals.	which it was made available to all schools). Years 5-6 (Primary School) ie aged 9-10).	and fruits, in addition to drinks.	and peer problems/strengths); hyperactivity.	deprived schools. Despite no main effects on breakfast skipping, a significant interaction was observed, indicating declines in breakfast skipping in more deprived schools and households. Conclusion: Universal breakfast provision may reduce socio-economic inequalities in consumption of healthy breakfast items and breakfast skipping.
Turner, 2014.[25] US.	To explore the perceptions of school staff regarding student reactions to updated nutrition standards for school lunches and how perceptions	National School Lunch Program. Elementary school.	Half of grain products offered needed to be whole-grain–rich by 2012–2013, and all by 2014–2015. Both a fruit and a vegetable needed to be offered daily, with a variety of vegetables to be served within a week, including dark	Perceived student reactions to the new meals.	Respondents at socioeconomically disadvantaged schools (> 66% of students eligible for free/reduced-priced meals) perceived that more students were buying lunch and that students were

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	varied across schools (SES). Cross sectional survey. SES based on the % students eligible for the free-reduced-price meals.		green vegetables, red/orange vegetables, legumes, starches, and other vegetables. Milk had to be limited to nonfat or low-fat (1%) milk (sweetened flavoured milk was only allowed if nonfat). Saturated fat requirements did not change, trans fats were limited to zero, and new targets for lower sodium content were established.		eating more of the meal than in the previous year. *Conclusion*: The study offers some encouraging news that schools serving primarily lower-income students may not be seeing disproportionately adverse effects of the new meals standards. in terms of student uptake. *Limitation*: subjective measures used, social desirability bias.
Gates, 2013.[56] Canada.	To assess the impact of simple food provision programs on the intakes of milk and alternatives among youth. Pre-post study. Isolated, remote Canadian First Nation schools.	School snack program with the addition of milk and alternatives. Grade 6-8 (n=2 schools).	≥1 serving from the vegetables and fruit, and milk and alternatives food groups of Canada's Food Guide served daily. '*Milk and alternatives*' include milk, cheese, yoghurt, and alternatives to milk products providing similar nutritional value of calcium and vitamin D (e.g. fortified soy beverage).	Milk and alternative, calcium and vitamin D intake.	After 1 week, calcium intake increased in one school (805.9 ± 552.0 to 1027.6 ± 603.7 mg, p = .044); improvements were not sustained at 1 year; milk and alternatives (1.7 ± 1.7 to 2.1 ± 1.4 servings, p = .034) and vitamin D (2.5 ± 2.6 to 3.5 ± 3.4 mg, p = .022) intakes increased in the second school. Impressions of the programs were positive. Barriers included limited resources, staff, facilities, and funding.

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					Conclusion: Snack programs show potential to address the low intakes of milk and alternatives among remote First Nation youth.
Hakim, 2013.[26] US.	To evaluate an intervention to improve fruit and vegetable consumption among low SES students. Pre-post study. Ethnic minority children.	National School Lunch Program. Introduction of 'choice architecture' balancing 'serve' and 'offer' models for fruit and vegetables, including verbal prompts in the lunch line. Elementary and middle school.	As part of National School Lunch Program, 11 fruit and 4 vegetable options were offered during the intervention period. Students were required to leave the lunch line with a full tray: one milk, one fruit, one vegetable and on entrée.	Fruit and vegetable consumption.	An average daily 15% increase in both fruits and vegetable consumption during the intervention. *Conclusion*: Schools can actively encourage students to take advantage of fruits and vegetables offered through the National School Lunch Program by implementing setting- level changes to the cafeteria environment.
Leos-Urbel, 2013.[42] US.	To examine the impact of the implementation of a universal free school breakfast policy on meals program participation, attendance, and academic achievement.	Universal free school breakfast policy (which increased lunch price for those not eligible for subsidy). Elementary and middle schools.	Not specified.	Trends in school breakfast & lunch participation (average number of meals served per year per student in each eligibility group), school attendance, and standardized test scores on state-wide English and math tests.	The provision of universal free breakfast resulted in a modest increase in participation for all program eligibility groups (including those who were already eligible for free meals). *Conclusion*: Universal provision may alter behaviour through mechanisms other than price, such as reduced stigma, highlighting the

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	Longitudinal study, intervention and comparison groups. Students from families with incomes ≤130% the poverty line pay nothing for lunch or breakfast (''free-meal eligible students''), those with incomes between 130-185% of the poverty level are eligible for reduced-price meals (''reduced-price eligible students'').				potential merits of universal provision over targeted services. There was limited evidence of policy impacts on academic outcomes, however the estimates are limited to the short-term impact.
Mhurchu, 2013.[63] New Zealand.	To determine the impact of a free school breakfast program on children's school attendance, academic achievement, social, behavioural outcomes and food security.	Free daily school breakfast program provided by Red Cross or food industry partners.	Breakfast cereal (Weet-Bix), low-fat milk, bread, spreads, Milo, milk powder and sugar.	Primary: school attendance rate ≥95%. Secondary: academic achievement (numeracy and literacy); sense of belonging; teacher assessment of students' behaviour, emotions and relationships; self-reported short-term	Weekly student program attendance ranged from 4% to 38%. Significant positive effects on children's short-term hunger ratings, but no significant effect on other outcomes. Subgroup of more frequent breakfast attenders significantly improved attendance. *Conclusion:* More frequent programme attendance may be required to influence

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	Stepped-wedge cluster RCT. School level (not individual)– those in top 4 deciles for disadvantaged students.			hunger; household and child food security.	school attendance and academic achievement.
Ribar, 2013[27] US.	To investigate student outcomes associated with changes in the availability of universal free breakfasts to an eligibility-based School Breakfast Program. Natural experiment, pre post study. Sample included schools with high proportions of economically disadvantaged students.	School Breakfast Program. Elementary. Note: Children are categorically eligible for free meals if they live in a household that receives benefits from the SNAP program or Temporary Assistance for Needy Families program. They are also eligible for free meals if they live in a household with an income below 130 percent of the federal poverty guidelines and eligible for reduced-price meals if they live in a household with an income between 130 and 185 percent of the guidelines.	Choices of milk, juice, and cereal in addition to a fruit serving and a breakfast entrée.	Breakfast and lunch participation, attendance, and reading, math, and science test scores.	The change from a universal free to an eligibility-based School Breakfast Program, reduced breakfast participation substantially with the largest changes occurring among students who were not eligible for free or reduced-price meals. Participation also decreased substantially for students who qualified for free meals. For lunch, participation decreased for paying students only. No differences found for test scores or attendance. *Conclusion*: change from universal to eligibility-based School Breakfast Program reduces School Breakfast Program participation, including those still eligible to receive the program and it

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					may have increased stigma for those children.
Sharkey, 2013.[28] US.	To examine child hunger among 470 Mexican-origin families: determine the prevalence of child hunger and identify protective and risk factors associated with hunger (eg National School Lunch Program, School Breakfast Program). Cross sectional survey. Household income and employment status.	National School Lunch Program . Children 6-17.	Not specified.	Child hunger.	A large % of potentially eligible households did not participate in the School Breakfast Program & National School Lunch Program. 50.8% of child hunger households participated in School Breakfast Program and 51.3% of child hunger households participated in National School Lunch Program. Participation in the National School Lunch Program were associated with increased odds (OR 4.1) for the presence of child hunger. *Conclusion*: there is concern about the level of child hunger and low participation in School Breakfast Program and National School Lunch Program in this community, which may be indicative of meal program accessibility issues.
Van Wye, 2013.[39] US.	To evaluate whether Breakfast in the Classroom	BIC is a program intended to serve those who do not or are	Breakfast items included milk, cereal, fruit or 100% fruit juice,	Prevalence of not eating breakfast, eating	Students offered BIC (n = 1044) were less likely to report not eating in the

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	(BIC) was associated with changes in children's morning food consumption. Cross-sectional survey. High-poverty neighbourhoods.	unable to take advantage of before-school breakfast in the cafeteria. Offering BIC in addition to universal free cafeteria breakfast by making food available to all children in the classroom setting also has the potential unintended consequence of increasing calorie consumption among children who have already eaten breakfast—at home, in a neighbourhood bodega, in the school cafeteria, or in all of these locations. Elementary school.	and 1 additional item, such as carrot bread or string cheese.	locations, estimated calories consumed.	morning (8.7%) than were students not offered BIC (n = 1245; 15.0%) and were more likely to report eating in 2 or more locations during the morning (51.1% vs 30%). Overall, students offered BIC reported consuming an estimated 95 more calories per morning than did students not offered BIC. *Conclusion:* For every student for whom BIC resolved the problem of starting school with nothing to eat, more than 3 students ate in more than 1 location. Offering BIC reduced the percentage of students not eating in the morning but may contribute to excess calorie intake.
Ohri-Vachaspati, 2012.[70] US.	To investigate FFVP participation patterns among schools by demographic and school characteristics and the association between Fresh Fruit and Vegetable	FFVP offers fresh fruits and vegetables as snacks outside the reimbursable meals programs in schools that serve large numbers of low-income children. Elementary schools.	Fresh fruit and vegetables.	FFVP participation; Frequency selected foods were offered in school lunch meals.	>25% of public elementary schools across the United States participated in the FFVP. Schools participating in the FFVP were significantly more likely (OR 2.07) to serve fresh fruit during lunch meals. Conclusion: The FFVP increased the availability of

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	Program (FFVP) participation and availability of fresh fruits, salads, and vegetables at lunch. Cross sectional study. % students eligible for free and reduced cost lunch, divided into three groups: low(<50% eligible), medium (50% to 75% eligible), high (>75% eligible).				healthy options in school meals and snacks. Increased uptake of the program may be a potential strategy to improve the school food environment.
Bailey-Davis, 2011.[40] US.	To understand the discrepancy between access and participation in school breakfast in a low-income, urban school district. Qualitative study (focus groups). Eligibility for free and reduced cost meals.	School breakfast program. Middle school.	Not specified.	Participation in SCHOOL BREAKFAST PROGRAM.	Students and parents agreed across themes (sociocultural beliefs, physical availability, economic accessibility, social stigma), but disagreed on consumption practices. Students commonly purchased food on the way to school. Parents expressed a desire to be more involved in breakfast decisions with their children. Students wanted input to menu planning and taste testing to

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					overcome meal quality concerns. *Conclusion*: Future research should examine student involvement in planning and environmental modifications to reduce social stigma associated with the program.
Bartfield and Ahn, 2011.[29] US.	To examine the relationship between availability of the School Breakfast Program and household food security among low income 3rd-grade students. Statistical modelling. Food security (USDA food security scale), household income, parental education, employment.	School Breakfast Program, funded by the US federal government and administered locally by schools, the program offers all children in participating schools an opportunity to eat a low-cost, or sometimes free, breakfast before or during school. Elementary school.	Not specified.	Household food security.	Availability of school breakfast reduced the predicted probability of marginal food insecurity from 48% to 33% among low-income third-grade children, but there was no difference in food insecurity at the standard threshold. *Conclusion*: Access appeared beneficial in offsetting food-related concerns among at-risk families, although not necessarily in alleviating food insecurity once hardships had crossed the food insecurity threshold. Increasing the availability of school breakfast may be an effective strategy to maintain food security among low-income

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					households with elementary school children.
Bartfield and Ryu, 2011.[30] US.	To examine the association between availability of the School Breakfast Program and breakfast-skipping among elementary school students. Cohort study. Food insecurity (abridged USDA food security scale), household income, use of food pantries, food stamp receipt.	School Breakfast Program. Schools that offer the program must make breakfast available to all interested children. The price of the breakfast varies with family income (full-price, reduced-price or free). Elementary school.	Breakfasts must conform to nutritional requirements. ≤30% of a meal's calories may come from fat, and ≤10% from saturated fat. Each meal must provide ≥¼ of the recommended dietary allowance for protein, calcium, iron, vitamin A, vitamin C, and total calories.	Child breakfast skipping.	Parents of children whose school offers the program are much less likely to report that their child skips breakfast on school days than are the parents of similar children in non-participating schools. Benefits are concentrated among economically vulnerable children. *Conclusion*: Access to the School Breakfast Program is estimated to counter the disproportionate risk of breakfast-skipping among low-income children relative to that among their higher-income peers.
Bevans, 2011.[44] US.	To evaluate the contributions of food offerings and participation in school lunch programs on children's overall eating behaviour.	National School Lunch Program. Access to meals and a la carte items in the school cafeteria according to eligibility – full-fee, reduced fee or free. Elementary and middle school.	Participating schools are required to serve lunches that provide ≥⅓ of recommended daily food and nutrient intake for children, meet specific macronutrient and micronutrient requirements, and include a variety of	Eating behaviour.	The availability of nutritious foods during school lunch periods was associated with healthier eating behaviour among students. However, this was only observed among children who infrequent, and not frequent, purchasers of a la carte food items.

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	Cross sectional observational study. Proportion of school students eligible for free/reduced-fee meal program.		meat/meat alternatives, whole grains, fruits, vegetables, and low-fat dairy options.		*Conclusion*: Increased availability of fruits, vegetables, whole grains, and low-fat dairy products as components of school meals may be an effective strategy to promote healthy eating behaviours among children. Improving the nutrition standards for foods offered in competition with National School Lunch Program meals may enhance student eating behaviour.
Bhatia, 2011.[69] US.	To evaluate a pilot intervention implementing changes to lunch programs. Observational study. Eligibility for National School Lunch Program subsidy (meal card).	National School Lunch Program. Intervention increased the number and diversity of National School Lunch Program full meal choices and eliminated a la carte offerings outside the National School Lunch Program in 3 schools. High school and middle school.	The range of food choices was different for National School Lunch Program meals and those in a` la carte lines. National School Lunch Program: 1 or 2 traditional meals (e.g. baked chicken with rice, salad, bread, fruit, and milk), *a` la carte*: pizza, sandwiches, burritos, hamburgers, bagels, diverse snacks, confections, and drinks.	Percentage of qualified students eating free lunches.	Eliminating competitive a` la carte foods may increase National School Lunch Program participation among qualified low-income students. This may be mediated by reductions in stigma. *Conclusion*: The harmful effects of a` la carte lunch lines and stigma on National School Lunch Program participation deserve further research as well as regulatory attention.
Khan, 2011.[31]	To assess the prevalence of food	Free breakfast was available to all children	Not specified.	Participation in breakfast and lunch	20% of children had food insecurity. No statistically

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US.	insecurity, and its relationship with participation in school meal programs. Cross-sectional study (survey). Food insecurity (household income).	in the study school. Lunch provision (free or reduced-price) was dependent on household income. Grades 6-8 (middle school).		program, exercise and BMI.	significant differences were observed for BMI and food security status. Food insecure (with or without hunger) participants were less likely to eat breakfast at home compared to food secure participants (67.1% vs 81.4%, p=0.007). These differences were not observed between eating school breakfast or lunch. 62% of food insecure (with or without hunger) participants engaged in daily exercise compared to 75.9% food secure participants (p=0.014). *Conclusion*: Children in food insecure households were less likely to be physically active and to eat breakfast at home. School Breakfast Program negated differences between food secure and food insecure groups for eating breakfast at all, a success given the implications of food insecurity in children.
Robinson-O'Brien, 2010.[33]	To examine the proportion of fruits	National School Lunch Program and Universal	Not specified.	Fruit and vegetable (FV) intake	Average reported mean daily FV intake was 3.6 servings

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US.	and vegetables consumed from school meals programs among ethnically diverse, low socioeconomic status children. Cross sectional study. Students from 4 urban schools that served primarily low-income populations.	School Breakfast Program. Elementary (years 4-6).			(80% consumed <5 daily servings of FV). Children consumed over half of their daily FV intake within school. Children with low FV intake (<5 FV servings daily) consumed a higher proportion of their daily intake at school than children with higher FV intake (≥5 FV servings daily) (39% vs 59%; p = .002). *Conclusion*: School meals provide an important contribution to the daily FV intake among ethnically diverse, low socioeconomic status children, particularly among those with the lowest FV intake.
Roustit, 2010.[57] Canada.	To investigate the moderating effect of school food programs in schools in disadvantaged neighbourhoods on the association between household food insecurity and scholastic difficulties among adolescents.	Food assistance initiative which provides breakfast, lunch or snacks to students in underprivileged areas. High school (13-16 year olds).	Not specified.	Scholastic (4 vars): grades in French/English; self evaluation of academic achievement; repeating of a year; school activity limitation (the presence of a condition that limited the child's ability to attend school).	For students attending schools without food assistance, adolescents living in food insecure households were at higher risk for school difficulties than were those living in food-secure families. School food assistance programs were a moderating factor in the association between food insecurity and school-related outcomes.

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	Cross sectional survey. Family SES, food insecure households				*Conclusion*: The results support targeted school food assistance programs because of the moderating effect of such programs on the association between food insecurity and scholastic difficulties.
Briefel, 2009.[35] US.	To describe eating patterns of National School Lunch Program participants and non-participants. Cross sectional study. Household income.	National School Lunch Program. Grades 1-12.	Not specified separately from food eaten at home or other locations.	Eating patterns (measured by 24-hour recall survey).	National School Lunch Program participants consumed less energy from sugar-sweetened beverages at school than non-participants, but more energy from low-nutrient, energy-dense solid foods. School lunch participants' consumption at school was less energy-dense than non-participants consumption at school ($p<0.01$). *Conclusion*: At school, consumption of low-nutrient, energy-dense foods may be reduced by limiting access to competitive foods and beverages.
Clark, 2009.[34] US.	To explore the relationship between children's	School meal programs (School Breakfast	Not specified.	Nutritional intake (school meal	Most public-school students nutritionally adequate diets, but 80% had excessive

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	participation in the school meal programs and the nutritional quality of their diets. Cross-sectional study. Participation in School Breakfast Program and National School Lunch Program.	Program and National School Lunch Program). Grades 1 to 12.		participants vs non-participants).	saturated fat intake and 92% had excessive sodium intake. School meal program participation was associated with reduced prevalence of nutrient inadequacy but with increased prevalence of excessive sodium intakes. *Conclusion*: School meal programs play an important role in the nutritional adequacy of children's diets. The association between program participation and excessive sodium intakes, along with the high prevalence of excessive saturated fat intakes among all students, suggest areas for improvement in the meals these programs provide.
Condon, 2009.[37] US.	To describe foods offered in school meals and consumed by children at lunch and breakfast. Cross-sectional study.	School meal programs (School Breakfast Program and National School Lunch Program). Grades 1 to 12.	Not specified.	Foods offered and differences in food consumed by children who did and did not participate in school meal programs.	Most school menus offered non-fat or 1% milk, fruit or 100% juice, and vegetables daily. Starchy vegetables were more common than dark green/orange vegetables or legumes. National School Lunch Program participants were significantly more likely than

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	Participation in School Breakfast Program and National School Lunch Program.				nonparticipants to consume milk, fruit, and vegetables, and significantly less likely to consume desserts, snack items, and beverages other than milk or 100% juice. School Breakfast Program participants were significantly more likely than non-participants to consume milk and fruit, and significantly less likely to consume beverages other than milk or 100% juice. *Conclusion*: Consumption of school meals is positively related to children's intakes of key food groups at lunch and breakfast. Offering more fresh fruit, whole grains, and a greater variety of vegetables could lead to additional health benefits.
Mirtcheva, 2009.[38] US.	To examine the effect of school-level stigma, the neighbourhood food environment, and demographic factors on overall National School Lunch Program	National School Lunch Program Elementary & high school.	Not specified.	Outcome = school lunch participation. Determinants (exposure variables) examined = stigma (proxy is school-level free lunch eligibility rate), food environment	Findings for free/reduced-price National School Lunch Program participation are included here: Lower levels of stigma were associated with an increased likelihood of participation. High school students were 20% less likely to participate

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	participation and on free/reduced-price school lunch take-up. Cross sectional survey. Low income students (those from families with income at most 185% of the federal poverty level).			& demographic characteristics.	than elementary school children. Availability of fast food restaurants was significantly associated with a lower probability of high school students participating. *Conclusion*: Stigma can reduce school lunch participation, especially for lower income high school students and anonymity for students should be ensured.
Shemilt, 2004.[65] UK.	To measure the health, educational and social impacts of breakfast club provision in schools serving deprived areas across England. Cluster RCT, observational analysis. Free school meal status.	School breakfast club Primary and secondary schools.	Not specified.	Teacher and student reported nutrition, health, psychological, behavioural, social, and educational outcomes; concentration.	improved concentration amongst the intervention group at 3 months. Fewer pupils within the intervention group reported having skipped classes within the last month and fewer pupils within the intervention group reported having skipped 1 or more days of school within the last month at 1 year. Observational analysis at 1 year showed a higher proportion of primary-aged breakfast club attendees reported eating fruit for breakfast in comparison to non-attendees. A higher

First author, Year / Country	Aim/ Study design/ Measure of disadvantage	Type of meal program addressing the problem of children not bringing food to school / Target age group	Types of food provided through school meal program	Outcomes of school meal program measured	Main findings/ Conclusions
					proportion of breakfast club attendees had borderline or abnormal conduct and total difficulties scores (primary-aged pupils) and prosocial score (secondary-aged pupils). *Conclusion*: Analyses revealed a mixed picture of benefit and apparent disbenefit.

Appendix 4: Internet search for school meal programs in high-income countries

Location	Program name/ organisation	Description	Population	URL
SA, Australia	School Breakfast Program School Lunch Program. Foodbank South Australia.	Breakfast foods are delivered to all registered schools in SA. Foods include cereal, long-life milk, canned fruit, Vegemite, jam, fresh fruit, and bread. Program also helps provide fruit bowls in classrooms and common areas around the school. Students who attend breakfast club can make a sandwich for lunch and also pick up fruit/muesli bars for snacks.	Disadvantaged students. The lunch program is available to all students who don't have lunch. School teachers can encourage students to go to breakfast club and make lunch.	Breakfast program: https://www.foodbank.org.au/SA/schoolbreakfast/?state=sa Lunch program: https://www.foodbank.org.au/SA/schoollunchprogram/?state=sa
NSW and ACT, Australia	School Breakfast for Health Program. Foodbank.	Available in 100 registered schools across NSW and ACT. Provide a nutritious breakfast.	Disadvantaged students.	https://www.foodbank.org.au/homepage/who-we-help/schools/?state=nsw-act
VIC, Australia	School Breakfast Club. Foodbank in partnership with the Victorian Government.	Available in 1000 Victorian Government schools. Provide nutritious breakfast to students. Lunches and take-home holiday supply packs have been added to the program.	Disadvantages students in Government schools.	https://www.foodbank.org.au/homepage/who-we-help/schools/?state=vic
QLD, Australia	School Breakfast Program. Foodbank.	Available in over 300 schools. Program supplies cereal, bread, milk, spreads and fresh fruit.	Disadvantaged students. Schools register to participate.	https://www.foodbank.org.au/homepage/who-we-help/schools/?state=qld

WA, Australia	School Breakfast Program. Foodbank.	Provides a nutritious breakfast to students.	Disadvantaged students.	
NT, Australia	School program. Foodbank.	More than a meal program as it incorporates cooking classes and can also supply personal care items. They provide fresh food and groceries for schools to provide breakfast, morning tea and lunch.	Disadvantaged students.	https://www.foodbank.org.au/homepage/who-we-help/schools/?state=nt
Australia	School Lunch Program. Eat up.	Service 250 schools around Australia. Make and deliver fresh sandwiches to registered schools.	Disadvantaged students.	https://eatup.org.au/
VIC, Australia	School Lunch Program. Carevan.	Provides local primary schools with a school lunch pack which is prepared by VCAL students.	Disadvantaged primary school students.	https://www.carevan.com.au/what-we-do/school-lunch-program/
NSW, Australia	School breakfast program. YMCA.	Provides cereal toast and fruit. Run by YMCA staff and volunteers 4 mornings per school week.	Disadvantaged students.	https://www.ymcansw.org.au/community-services/youth/breakfast-program/
SA, Australia	School Breakfast & Lunch Program. Kickstart for Kids.	Provide breakfast and lunch (sandwich) to 350 schools.	Focus on disadvantaged students.	https://kickstartforkids.com.au/breakfast/
VIC, Australia	The Tribe School Lunches Program. Salvation Army.	Provide freshly packed lunches.	Disadvantaged students.	https://www.facebook.com/salvos100thoUSndmeals/posts/the-tribe-school-lunches-program-is-a-new-initiative-run-by-the-salvos-in-ballar/1020597454790028/
Finland	Finnish School Meal System Government.	Free school meals are provided each day. Providing school meals is mandatory for municipalities. The	All students between 6-16 years.	https://www.oph.fi/en/statistics-and-publications/publications/school-meals-all

		free school lunches encourage students to have a balanced diet.		https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-school-food-policy-factsheet-finland_en.pdf
Sweden	School lunches. Government.	Free school meals are provided each day. Providing school meals is mandatory for municipalities. The free school lunches must be nutritious. Meals are hot and salad, bread, butter and milk are on the menu.	Every child between 7-16 and most students aged 16-19 years. .	https://www.livsmedelsverket.se/en/food-habits-health-and-environment/maltider-i-vard-skola-och-omsorg/skola https://ec.europa.eu/jrc/sites/jrcsh/files/jrc-school-food-policy-factsheet-sweden_en.pdf
New Zealand	School Lunch Program. NZ Government.	A new initiative providing free and healthy school lunch daily.	Year 1-8 students in schools with high levels of disadvantage.	https://www.education.govt.nz/our-work/overall-strategies-and-policies/wellbeing-in-education/free-and-healthy-school-lunches/
New Zealand	Food for Kids KidsCan.	Food (bread, baked beans, muesli bars, yoghurt, spreads) are provided to schools weekly or fortnightly so students have access to food at school everyday.	Disadvantaged students,	https://www.kidscan.org.nz/our-work/food-for-kids
Canada	School Breakfast Program. Breakfast Club of Canada.	Provides daily nutritious breakfasts at 1887 schools across Canada.	All students in elementary and high school.	https://www.breakfastclubcanada.org/#
Canada	School Nutrition Program. Alberta Government	Students receive a daily nutritious meal.	Students at participating schools in Alberta.	https://www.alberta.ca/school-nutrition-program.aspx
Canada	Student Nutrition Program Ontario Government.	Students have access to nutritious food through breakfast, lunch and snack programs. Program differs	School-aged children and youth across Ontario.	https://www.ontario.ca/page/student-nutrition-program https://studentnutritionontario.ca/programs/

	Various organisations take lead in different municipalities.	based on location because different agencies are responsible.		
US	National School Lunch Program. United States Department of Agriculture.	Free or reduced-price lunches are available at participating schools.	All students can participate in meal program. Household income determines eligibility of child for free or reduced-price lunch.	https://www.ers.usda.gov/topics/food-nutrition-assistance/child-nutrition-programs/national-school-lunch-program/
US	The school breakfast program. United States Department of Agriculture.	Federally funded breakfast program.	Not specified.	https://www.fns.usda.gov/sbp/school-breakfast-program https://www.cdc.gov/healthyschools/npao/schoolmeals.htm
England	Free school meals. Government.	Free school lunches. Food must be nutritious.	Children whose parents receive benefits.	https://commonslibrary.parliament.uk/research-briefings/sn04195/ https://www.gov.uk/school-meals-healthy-eating-standards
Ireland.	School Meals Scheme. Government	Breakfast/Snack, Lunch or Dinner may be provided. Providers apply to government for funding.	School-aged students at schools in disadvantaged areas.	https://www.gov.ie/en/service/29a3ff-school-meals-scheme/?referrer=https://www.welfare.ie/en/Pages/School-Meals-Programme.aspx
Scotland	School meals. Government.	Free nutritious lunch provided.	Every primary school student in years 1-3. Other students are eligible if they or their parents are on benefits.	https://www.mygov.scot/school-meals/
Wales	Free school meals. Government.	Free nutritious meals provided.	Disadvantaged students.	https://gov.wales/free-school-meals-coronavirus-guidance-schools

Greece	National School Lunch Program. Government	Nutritious lunch provided.	School students from eligible families.	https://www.greececsd.org/Page/525

Note: Due to COVID-19 many schools around the world are closed and many of their websites have been updated to provide information about what they are doing for students during COVID-19. This information is not reflected in this table. For many high-income countries, information regarding school meal programs was not clearly available through this internet search.

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