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Meloncelli, Nina J L; Young, Adrienne; Christoffersen, Anja; Rushton, Alita; Zhelnov, Pavel; Wilkinson, Shelley A; Scott, Anna M; de Jersey, Susan

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SYSTEMATIC REVIEW

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Co-designing nutrition interventions with consumers: A scoping review

Nina Meloncelli[1,2] | Adrienne Young[3,4] | Anja Christoffersen[5] | Alita Rushton[2,6] | Pavel Zhelnov[7] | Shelley A. Wilkinson[6] | Anna Mae Scott[8] | Susan de Jersey[1,3]

[1]Perinatal Research Centre, Centre for Clinical Research, Faculty of Medicine, University of Queensland, Brisbane, Queensland, Australia

[2]Office of the Chief Allied Health Practitioner, Metro North Hospital and Health Service, Brisbane, Queensland, Australia

[3]Dietetics and Foodservices, Royal Brisbane and Women's Hospital, Metro North Health, HERSTON, Queensland, Australia

[4]Centre for Health Services Research, Faculty of Medicine, The University of Queensland, Herston, Queensland, Australia

[5]Champion Health Agency, Brisbane, Queensland, Australia

[6]School of Human Movement and Nutrition Sciences, The University of Queensland, St Lucia, Queensland, Australia

[7]Independent Researcher, Mtskheta, Georgia

[8]Institute for Evidence-Based Healthcare, Bond University, Robina, Queensland, Australia

Correspondence

Nina Meloncelli, Perinatal Research Centre, Centre for Clinical Research, Faculty of Medicine, University of Queensland, Brisbane, QLD, Australia.
Email: n.meloncelli@uq.edu.au

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Abstract

Background: There is little known about nutrition intervention research involving consumer co-design. The aim of this scoping review was to identify and synthesise the existing evidence on the current use and extent of consumer co-design in nutrition interventions.

Methods: This scoping review is in line with the methodological framework developed by Arksey and O'Malley and refined by the Joanna Briggs Institute using an adapted 2weekSR approach. We searched Medline, EMBASE, PsycInfo, CINAHL and Cochrane. Only studies that included consumers in the co-design and met the 'Collaborate' or 'Empower' levels of the International Association of Public Participation's Public Participation Spectrum were included. Studies were synthesised according to two main concepts: (1) co-design for (2) nutrition interventions.

Results: The initial search yielded 8157 articles, of which 19 studies were included (comprising 29 articles). The studies represented a range of intervention types and participants from seven countries. Sixteen studies were published in the past 5 years. Co-design was most often used for intervention development, and only two studies reported a partnership with consumers across all stages of research. Overall, consumer involvement was not well documented. No preferred co-design framework or approach was reported across the various studies.

Conclusions: Consumer co-design for nutrition interventions has become more frequent in recent years, but genuine partnerships with consumers across all stages of nutrition intervention research remain uncommon. There is an opportunity to improve the reporting of consumer involvement in co-design and enable equal partnerships with consumers in nutrition research.

KEYWORDS

co-design, consumer engagement, diet, nutrition intervention, participatory research

Key points

- Of the approximately 5000 abstracts screened, only 19 studies met the criteria of co-design at the 'Collaborate' or 'Empower' levels of Public

Anna Mae Scott and Susan de Jersey are co-senior authors.

Participation (IAP2 Public Participation Specturm), and there is high variability in co-design approaches and definitions within health research.
- Similarly, there is no singular co-design framework or theoretical approach that is commonly used, although intervention mapping and integrated knowledge translation approaches were most common.
- Co-designing dietary interventions typically occurs after a research question and direction has already been predetermined, and often, researchers 'overrule' consumers' recommendations and decisions.
- Our scoping review included a consumer as a co-author, which was a strength of this paper. Based on our consumer co-author's recommendation, we developed an 'ideal co-design' checklist to capture key elements of co-design that should be considered in research projects – about one quarter of included studies met all or most of these elements.
- Although co-design for dietary interventions has become more common in the past 5 years, consumers are rarely engaged across the entire research process, which could help improve research impact and reduce research waste.

INTRODUCTION

Non-communicable diseases are the greatest contributors to poor health and mortality.[1] Globally, cardiovascular diseases are the leading cause of death,[2] with dietary risk factors the most important contributor to disease burden.[1] Consequently, nutrition interventions aiming to improve dietary behaviours and optimise dietary patterns are a key strategy to prevent and manage poor health.[3]

Although research has demonstrated that nutrition interventions are effective in trial settings,[4] influencing dietary behaviour is complex, with economic, social, environmental and physiological determinants.[5,6] Dietary behaviour changes after nutrition interventions are broadly positive, particularly fruit, vegetable and fat intake.[3] However, these changes are inconsistent across population groups,[3] and long-term adherence to behaviour changes appears challenging.[5] Person-centred care is a paradigm which recognises the uniqueness of individuals and the necessity of healthcare providers and organisations to partner with consumers (and carers) in shared decisions about healthcare and services.[7] Failing to incorporate consumers' shared values, preferences and priorities through person-centred care is likely to limit the effectiveness of healthcare, including nutrition interventions in the short and long term.

Consumer engagement and co-design in healthcare is increasingly being recognised as essential from the outset of planning for any improvement or research programme, due to its potential to align health services with consumer needs, and improving uptake and engagement with healthcare. Furthermore, inclusion of consumers in research is considered morally/ethically necessary, politically justified (in terms of developing policy and allocating funding) and methodologically beneficial (to improve relevance and transferability of research findings).[8] In the context of health and medical research, several definitions of a consumer exist, with most encompassing any or all of the following: (a) a patient (person who is receiving care in a health service organisation); (b) a person who has used, or may potentially use, health services or is a carer for a patient using health services; or (c) a consumer representative (person who provides a consumer perspective; contributes consumer experiences; advocates in the interests of past, current and potential health service users; and takes part in decision-making processes).[9] For this review, the term 'consumer' encompasses all these definitions.

The definition of co-design (and other related 'co-words' such as 'co-production', 'co-creation', 'co-development' and 'co-construct') has been a topic of debate, with a recent scoping review identifying 475 unique definitions used for co-design and co-production.[10] Generally, definitions refer to co-design as a participatory approach that engages all potential end users (e.g., service providers and service users) to design something of 'value' (context dependent),[11] whereas others include the quality of these relationships through principles such as equity, power and trust.[10] Following recent work by two authors (consumer, A. C., and researcher, A. Y.) that included extensive involvement of a broad range of health service consumers, clinicians and researchers and recognising the importance of equity and partnerships,[10,12,13] a 'co-designed' definition is proposed in this review to emphasise the importance of relational considerations within co-design. Here we define co-design as 'a process where people with professional and lived experience partner as equals to improve health services by listening, learning and making decisions together'.[14] The International Association of Public Participation (IAP2) describes the participation of consumers as a spectrum ranging from 'Inform' through 'Empower'[15] (Table 1). It has been designed to provide

TABLE 1 Level of public participation according to the IAP2 Public Participation Spectrum[15] required to be included in the scoping review

IAP2 level	Public involvement goal	Example	Included
Inform	To provide the public with balanced and objective information	Notifying consumers about the availability of a new nutrition intervention	χ
Consult	To obtain public feedback on analysis, alternatives and/or decisions	Conducting a needs assessment or focus groups with consumers, led by a research team	χ
Involve	To work directly with the public throughout the process to ensure that public concerns and aspirations are consistently understood and considered	Consumers involved in an advisory committee for a research project	χ
Collaborate	To partner with the public in each aspect of the decision, including the development of alternatives and the identification of a preferred solution	Consumers making decisions about the design and execution of a research study as part of the research or design team	χ
Empower	To place final decision-making in the hands of the public	Consumers leading the decision-making process about what to research and how to do it, with help from the research team	χ

Abbreviation: IAP2, International Association of Public Participation.

clarity to consumers and professionals about the different levels of consumer participation and to assist in selecting the appropriate level for the goals of engagement activity and setting expectations about the role of the consumer and professional.[15] When considered within this spectrum, co-design sits within the 'Collaborate' and 'Empower' levels[15] (Table 1).

Due to the complexity of behaviour change,[5,6] interventions focused on improving nutrition and health behaviour are likely to benefit from co-design due to the aforementioned reasons; however, little is known about the extent to which consumer co-design is incorporated into nutrition interventions and how this impacts outcomes. A recent integrative review of co-design practices in diet and nutrition research sought to describe the use and effectiveness of techniques that involve consumers in nutrition research across the engagement spectrum.[16] Only three of the included studies[17–19] reached 'collegiate' levels of participation, defined as 'researchers and local people work(ing) together as colleagues with different skills to offer, in the process of mutual learning where local people have control over the process'.[16] Furthermore, key co-design studies were not included in the review,[20–24] and due to the rapid increase in co-design studies, even in the past 2 years, we have identified several recent studies that considerably add to the literature involving co-design for nutrition interventions.

Mapping out where and when co-design has been used in the design, application and evaluation of nutrition interventions is essential to guide future use of co-design in nutrition research, to ensure that it is transformative rather than being tokenistic.[25] An important consideration for future reviews on co-design is the inclusion of consumers in the review itself. There are strong arguments for involving consumers in systematic and scoping reviews, particularly as reviews are often used to drive practice and policy changes.[26–28] Involvement of consumers in systematic reviews has also been poorly reported, but studies have reported improved relevance of data extraction, synthesis and dissemination of key messages from the review.[27,29] A lack of inclusive priority setting from evidence synthesis through the absence of end user engagement can result in a mismatch between research delivered and health service needs and priorities and is ultimately a financial and time waste.[30]

The aim of this scoping review was to synthesise the current use and extent of consumer co-design in nutrition interventions. Here we choose to focus on the methods and theoretical approaches to co-design rather than the effectiveness of nutrition interventions, opting for a scoping review over a systematic review.

METHODS

Approach

This scoping review was conducted based on the methodological framework developed by Arksey and O'Malley[31] and refined by the Joanna Briggs Institute[32] using an adapted 2weekSR approach.[33] It is reported in compliance with the PRISMA-ScR reporting guideline.[34] In the spirit of co-design and recognising the need for genuine inclusion of patient and consumer perspectives in research and evidence synthesis,[27,35,36] we have included an experienced consumer (A. C.: current active user of the health system, person with lived experience, consumer representative and research co-lead) as part of the scoping review team. The aim of involving a consumer in the review was to allow a collaborative definition of co-design and the assessment of its application within the included studies. This involved the consumer's attendance at all team meetings, including a pre-review meeting about the role, time commitment,

payment and acknowledgement. The Guidance for Reporting Involvement of Patients and the Public-Short Form (GRIPP2-SF)[37] was developed to enhance the quality and consistency of reporting consumer engagement in research studies and was used when preparing this manuscript due to the inclusion of a consumer in this research. The protocol for this review was developed prospectively and is available at https://osf.io/dka3m/. Deviations from the protocol are reported in the relevant methods section.

Study eligibility criteria

This review aimed to find, assess and synthesise all study types that used co-design for nutrition interventions delivered within a healthcare, community or academic setting. We included any type of primary study (qualitative or quantitative) with any sample size. Eligible studies are detailed under participant, concept and context.

Participants

Eligible studies must have included consumers (persons with lived experience; their caregivers; past, current or future users of healthcare; or consumer representatives) as participants in the co-design team. The co-design team will also have included other stakeholders (e.g., healthcare workers, researchers or decision-makers), but we excluded articles that were co-designed only with these stakeholders, exclusively. We included studies with participants of any gender, geographic location or health status. Co-design undertaken with children or adolescents below 16 years was excluded.

Concept

We included two concepts: (1) co-design of (2) nutrition interventions with stakeholders. For the scoping review, co-design is defined as a 'process where people with professional and lived experience partner as equals to improve health services by listening, learning and making decisions together'. This definition was developed by authors A. Y. and A. C. after extensive engagement of consumers, health professionals and researchers (total $n = 120$) undertaking co-design in research and health service improvement (manuscript in preparation). We included articles that applied co-design to any of the following research stages in relation to nutrition intervention: determining research need, direction or questions (co-decide); planning and study design (co-plan); design of the intervention (co-design intervention); evaluation (co-evaluate); and dissemination (co-disseminate) or implementation (co-implement). To be eligible, the consumer activities must have fit within the 'Collaborate' and 'Empower' levels from the IAP2 (Table 1).[15] Nutrition intervention could be for any health condition or dietary behaviour. However, nutrition interventions that improved food access (i.e., by focusing on food security) were not included in recognition that this addresses factors separate from the focus of this review. Mixed interventions (that include other components such as physical activity) were included provided the dietary component was included in the co-design process.

This included the following:

- Co-design to formulate the intervention purpose and research questions
- Co-design when described for the design/development of a nutrition intervention
- Co-design in complex or multi-component interventions that include a nutrition component

We excluded the following:

- Formative research conducted with consumers to set a direction for future research recommendations or policy decision-making generally (not focused on a specific intervention or future research to be conducted by the team)
- Studies that mentioned co-design without describing the included participants or a shared partnership co-design process
- Consultation with consumers (through any methods) to adapt, test or pilot an intervention that does not meet the IAP2 levels of 'Collaborate' or 'Empower'
- Co-design of food products (for retail/wholesale) or its packaging
- Co-design of agricultural or food systems (not relating to a nutrition intervention)
- Co-designing solutions to food access or food security (individual's behaviour rather than environment)
- Conceptual development of a co-design process, including proposed frameworks that have not been applied to co-designing a nutrition intervention
- Studies where the purpose of consumer engagement was to explore barriers and enablers (in general) to nutrition-related behaviour change or perceptions/acceptability of an intervention
- Nutrition interventions targeted at children and adolescents (up to age 15 years).

Context

Included studies were set in any healthcare, community or academic setting from any country. We included studies that were peer reviewed; had a quantitative, qualitative or mixed-methods study design; or were study

protocols that detailed co-design as part of the intervention development or to set the direction of the research questions of interest. We excluded review articles, grey literature and non-peer-reviewed publications, including theses and published conference abstracts. Systematic/scoping reviews that directly covered co-designed nutrition interventions but no other concepts about co-design were excluded, but their lists of included studies were searched for any additional studies meeting the inclusion criteria of the present review.

Search strategy

We designed the search strategy as follows: three study authors (N. M., A. R. and A. M. S.) identified three key concepts (diet, co-design and stakeholders) for the search and generated a preliminary list of search terms for each concept based on clinical expertise (N. M. and A. R.). We then conducted a word frequency analysis using the Word Frequency Analyser[33] on the titles, abstracts and keywords of three articles which were considered potentially includible,[24,38,39] and we considered for inclusion the terms identified by the Word Frequency Analyser by consensus. The search strategy was drafted for Medline (PubMed), consulted with the entire author team, and further refinements were made. One author (A. M. S.) then tested the strategy in Search Refinery[33] to ensure it identified the three potentially includible references and used Polyglot Search Translator[33] to translate the strategy for other databases. The search strategy was intentionally broad so as not to unduly limit the articles identified by the search.

We searched PubMed (via NLM), EMBASE (via Elsevier), PsycInfo (Ovid), CINAHL (Ovid) and Cochrane (including CENTRAL) from inception through 23 May 2022 (complete search strings are provided in Supporting Information 1). No restrictions were imposed on the language of publication or publication type. We had intended to use Scopus to conduct the forward and backward (citation) search on articles included in full text; however, the authors used SpiderCite instead (sr-accelerator.com/#/spidercite). Forward and backward searches were conducted on 1 June 2022.

STUDY SCREENING AND SELECTION

Screening

Search results were screened for eligibility in title-abstract by six authors independently in three pairs (N. M., P. Z., A. R., A. M. S., S. d. J., A. Y.). Records without an abstract were screened based on the title only. Open pilot screening of a convenience sample of 50 records was conducted within each pair before the actual screening. After title and abstract screening, full texts were retrieved for the remaining articles. Three authors (N. M., A. M. S. and A. R.) independently reviewed the full texts against the inclusion criteria. Full texts were screened in duplicate. Discrepancies during both title-abstract and full-text screening were resolved by consensus or by referring to a third author. We used Screenatron for the screening process and Disputatron to conduct dispute resolution.[33]

Data charting

Data extraction items were created jointly (N. M., A. Y., A. C., S. d. J.), and an interactive online data extraction form was designed using a custom installation of FormTools (https://formtools.org/) by one author (P. Z.). Data extraction was conducted by four authors (N. M., A. R., A. Y., A. C.). Two authors cross-verified 20% (four articles each) of the data extraction. Any disagreements were resolved by discussion with a third author or consensus.

Data extracted included study design, country and setting. Regarding nutrition intervention, data extracted included intervention aim, target audience, intervention content, intervention delivery method and evaluation. Data relating to the co-design process were framework or method of co-design; participants (co-design team), including recruitment and roles/tasks; methods of engagement; and the 'end product' of the co-design process and evaluation (if relevant) of the co-design process. To understand the degree of co-design (i.e., genuine vs. tokenistic), we developed a novel 'ideal co-design' checklist. The checklist assessed six principles of co-design (elevate lived experience, co-governed, equity-centric, diversity, inclusion and capability building) based on the consumer co-author's experience with, and broad consultation about, co-design, with consideration of the literature.[10,12] The checklist also assessed each stage of the co-design process to determine where collaboration (i.e., an equal partnership between lived and professional experience) was reported (co-decide, co-plan, co-design the intervention, co-evaluate, co-disseminate and co-implement). The definitions for each principle and stage are provided in Supporting Information 2.

Data synthesis

Data were synthesised narratively or quantitatively (frequency counts). We described study locations, types of nutrition interventions and target audiences quantitatively. Data relating to the nutrition intervention and the co-design process are presented in separate tables. For nutrition intervention, we summarised study location, publication time, study name, description and aims, target audience, intervention components and delivery

and evaluation. For the data on the co-design process, we reported on the participants, method of engagement, recruitment, framework or approach and outcomes of the co-design process. We also used the co-design checklist to rank each study on the six elements central to co-design, as well as report on the stages of research that co-design was incorporated. Definitions of co-design stated rationale for co-design, and consumer payments were also summarised.

RESULTS

Selection of sources of evidence

Our search identified 8157 records (comprising 441 records from registers, 6601 from the original database search and 1115 from the forward and backward citation search). A total of 3198 duplicates were removed using Deduplicator software, using the 'cautious' algorithm (https://sr-accelerator.com/#/deduplicator), although all records identified by Deduplicator as duplicates were verified by the authors. We screened 4959 records in title-abstract, excluding 4715 and including 244 records for full-text retrieval. All records were retrieved in full text, and 215 were excluded (reasons indicated in Figure 1). We included 19 studies (29 references) in the review (Figure 1).

Study characteristics

All studies described used either qualitative or mixed-methods design for the co-design process. Studies were

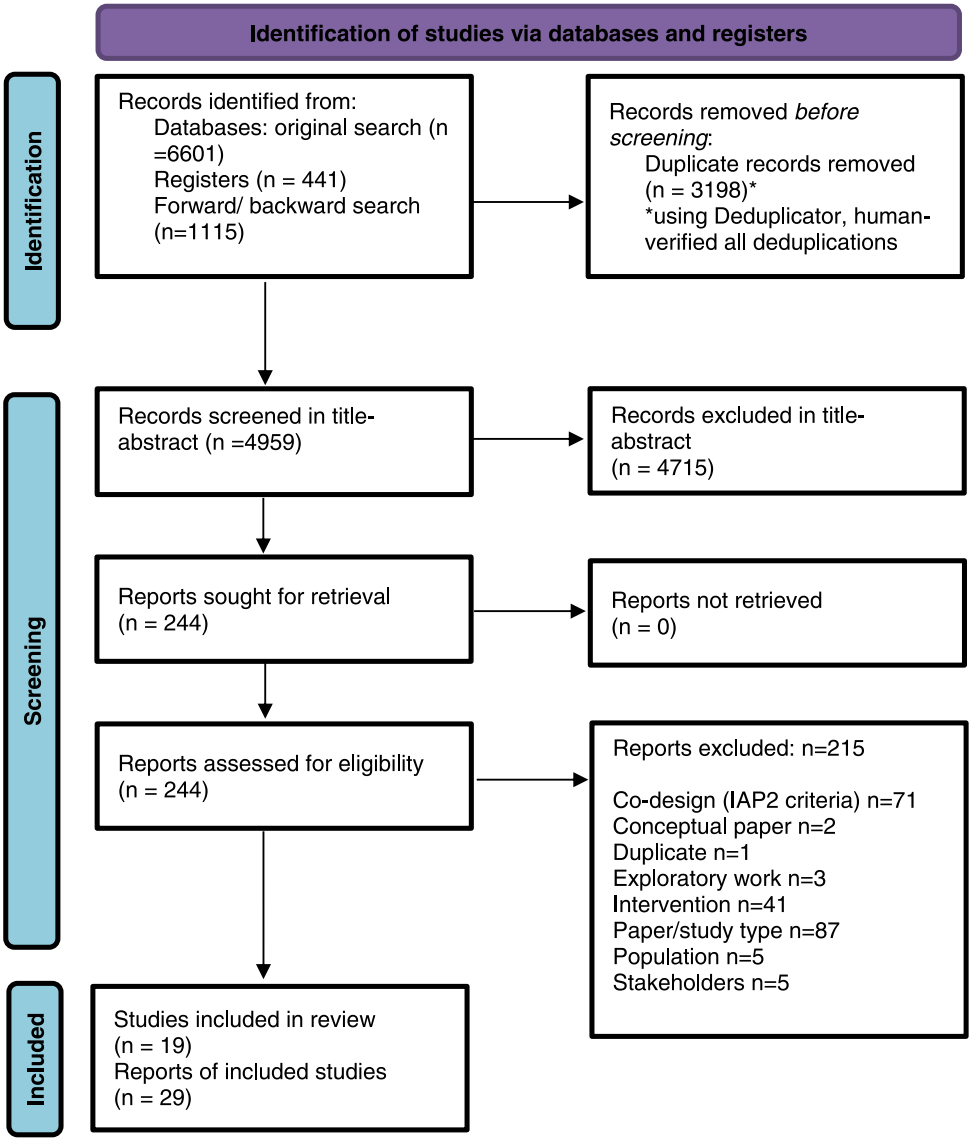

FIGURE 1 PRISMA flowchart[40] for the scoping review process

from a range of countries: the United States,[41–50] Australia,[24,51–55] the United Kingdom and Ireland,[20,56–61] New Zealand,[21,22,62] Canada[63,64] and Iran[23] (Table 2). Although we did not set limits on the publication date for co-designed interventions, 16 of the included studies were published in the past 5 years.[22,24,41,43,44,49,50,52,53,55–57,59,60,63]

Description of nutrition interventions

Participants

Target participants of the intervention were adults with or at risk of chronic disease[23,43,44,55,59,63,64]; stroke survivors[24,43]; low-income households[41,42]; carers or persons with additional needs[56] or intellectual disability[60]; women after breast cancer treatment[47,48,54]; adult hospital inpatients[52,53]; and adults of African-American,[46,49,50] African-Caribbean,[20,57,58,61] Māori and Pasifika[21,22,62] or Appalachian descent.[45]

Types of nutrition interventions

The focus of nutrition intervention was highly varied. Studies focused on improving lifestyle-related risk factors for chronic disease (e.g., type 2 diabetes or stroke),[20–24,43,44,46,49–52,55,57–59,61–64] promoting health and preventing disease after cancer,[47,48,54] improving diet quality or fruit/vegetable intake,[42,45,56] increasing awareness of lifestyle choices and how the body works among adults with intellectual disabilities,[60] or mitigating frailty in recently hospitalised older patients with nutrition support[52] (Table 2).

Delivery

Nutrition interventions were predominately face-to-face delivery[20,23,41,43,44,46,49,50,52,53,56–58,60,61] or delivered via a web page or mobile app.[21,22,42,47,48,59,62–64] One intervention involved text messages only[54] (Table 2). Not all interventions were at the point of evaluation, having completed only the co-design stage in recent years.[24,52,54,55,59,60] No studies had evaluated the co-designed intervention against a non-co-designed intervention.

Evaluation

Eight studies had evaluated nutrition intervention,[22,23,41,49,53,56,59,61] with several more indicating that a randomised control trial (RCT) or other evaluation is planned. Evaluation commonly involved acceptability and feasibility,[49,53,56,61] dietary intake,[23,41] biochemical or anthropometric measures[22,23,41,61] and patient-reported outcome measures.[22,41,56,61]

The co-design process

Defining co-design and rationale

Only ten studies[22–24,42,50,52–55,60] provided a definition for co-design (or related research approach), all of which were from different sources. For those studies that provided a rationale for using a co-design approach, the most common reasons were to ensure the intervention was generally appropriate or met the needs of the end users,[42–44,48,49,53,59,63,64] was culturally appropriate[22,41,49] for its target audience, integrated knowledge of the users,[60] ensured end-user priorities were at the forefront[54] or, to be collaborative, shared power or empowered stakeholders.[24,52,55,61,62]

Participants

As per the inclusion criteria, all studies included consumer representatives (persons with lived or observed experience) as part of the co-design process (Table 3). However, the characteristics of participants were poorly described, whereas the professional experience of other team members (e.g., researchers and healthcare workers) was often included in greater detail.

Recruitment and method of engagement

Focus groups, workshops, meetings and interviews were the most common methods of engagement for co-design (Table 3), and online methods of engagement were rarely used. Recruitment methods and outcomes of co-design are presented in Table 3. Commonly, recruitment was through research registries or based on previous engagement with research[24,41,50,55,56,61,63] and through community groups or networks.[22,23,45,47,48,52,54,63] Three studies did not describe the recruitment process,[43,44,53] and one study was initiated by persons with lived experience who served as part of the co-design team.[60] Furthermore, consumer payment (honorarium or gift vouchers) was reported only in six of the included studies.[41,42,44,50,52,55]

Theoretical approaches and frameworks for co-design

There was variability in the theoretical approaches, methods or frameworks taken for co-design (Table 3). The most common approaches cited were integrated knowledge translation,[24,53,63] community-based participatory research or participatory action research[44,48,55]

TABLE 2 Included studies and details of nutrition interventions

Author (year) Other included papers	Country	Study name/description and aim	Target audience	Intervention components and delivery	Evaluation
Ahmed et al. (2020)[41]	United States	Eat fresh to enhance dietary quality and food sovereignty on the Flathead Reservation by improving access to fresh plant-based foods that are affordable, convenient, desirable and sustainable	Low-income households registered for the Food Distribution Program on Indian Reservations	Intervention components: provision of fresh fruit and vegetable box weekly; education targeting food and nutrition knowledge, attitudes, behaviours and skills focused on preparing meals with fresh fruits and vegetables Delivery: face to face	Pre- and post-surveys: food procurement practices and perceptions, dietary quality, anthropometric measures of body weight, body mass index (BMI) and blood pressure, perceptions of health
Atkinson et al. (2009)[42]	United States	Eat smart; be fit to support/ extend the goals of the Food Stamp Nutrition Education Program for women and their households; web page content for women to enable healthy households	Limited-income adult women with at least one child enrolled in school	Intervention components: web page content for nutrition and physical activity and content for children and local resources Delivery: web page	Not evaluated
Borek et al. (2018)[56]	United Kingdom	Healthy parent carers programme To target both physical health and mental well-being, focusing on parent carers' outcomes and involving a range of behaviours that can be tailored to parents' needs, preferences and opportunities	Primary carer of a child or young person with additional needs and/or disabilities below 25 years	Intervention components: give-and-eat-well session included 'eat well' group brainstorming, video, group activity, group discussion, participant and facilitator manuals and a website for parent carers, with additional resources relevant to the programme Delivery: face to face and web page	Feasibility and acceptability, health utility, depression symptoms, well-being scale
Donald et al. (2019)[63,64]	Canada	My kidneys my health To support self-management of chronic kidney disease (CKD) through an e-health tool	Persons, and caregivers of persons, with CKD	Intervention components: food guide/tool (food database with nutrient content) so users can create a personalised CKD-friendly food list, nutrition label and food ingredient list reading and tips for eating out Delivery: e-health tool	Usability testing only; planned feasibility and acceptability study
Driver et al. (2020)[43]	United States	Diabetes Prevention Program Group Lifestyle Balance (DPP-GLB) for stroke To support maintaining weight loss and increase physical activity for people post stroke	Adults, post stroke, and their caregivers	Intervention components: content relating to healthy food choices, calorie and fat intake, physical activity promotion and goal setting Delivery: face-to-face, optional virtual participation, lifestyle coaching	Planned randomised control trial (RCT)

TABLE 2 (Continued)

Author (year) Other included papers	Country	Study name/description and aim	Target audience	Intervention components and delivery	Evaluation
Driver et al. (2017)[44]	United States	DPP-GLB specific to people with TBI To support maintaining weight loss and increase physical activity for people with a TBI	Adults with moderate–severe TBI, BMI 25 or above and their caregivers	Intervention components: content relating to healthy food choices, calorie and fat intake, physical activity promotion and goal setting Delivery: face to face, alternate Digital versatile disc (DVD) option and lifestyle coaching	Planned RCT
Green et al. (2021)[52]	Australia	Being your best To mitigate frailty through themes of physical exercise, cognitive training, social connectedness and nutritional support	Recently hospitalised older persons	Intervention components: modules titled moving well (physical exercise), thinking well (cognitive training), connecting well (social connectedness) and eating well (nutritional support); limited intervention details in the article Delivery: face to face	Not evaluated
Hallsworth et al. (2021)[59]	United Kingdom	VITALISE (intervention to promote lifestyle change in non-alcoholic fatty liver disease [NAFLD]) To increase knowledge and awareness about NAFLD and the risk of NAFLD progression and to highlight the associations with overweight or obesity to increase motivation or intention to make behavioural changes to promote weight loss	Patients with NAFLD (>18 years) and healthcare professionals (HCPs) responsible for their care	Intervention components: eight online modules and lifestyle coaching support Delivery: web page and telephone coaching	Access to content over 12 weeks; requests for lifestyle coaching Future evaluation planned
Katz et al. (2015)[45]	United States	PEACHES (promoting education in Appalachia on cancer and healthy eating styles) and get behind your health to increase colorectal cancer screening and fruit and vegetable intake	Community members of Appalachian counties (aged 50 years or older)	Intervention components: billboards, posters and newspaper media; the posters featured the same community residents and included a short, personal narrative provided by the residents Delivery: health promotion campaign	Not evaluated

(Continues)

TABLE 2 (Continued)

Author (year) Other included papers	Country	Study name/description and aim	Target audience	Intervention components and delivery	Evaluation
Martin et al. (2021)[60]	Ireland	Don't mention the diet! To increase student awareness of how lifestyle choices affect how the human body works	Adults with mild or moderate intellectual disability	Intervention components: general body structure, body functions, caring for our bodies; specific emphasis was placed on self-awareness, self-identity, self-confidence and decision-making Delivery: face to face	Not evaluated Feedback from participants
Moore et al. (2019),[61] Goff et al. (2019),[57] Goff et al. (2021),[20] Goff et al. (2021)[58]	United Kingdom	HEAL-D (Healthy Eating and Active Lifestyles for Diabetes) to improve diabetes self-management for African-Caribbean adults	Black British community (African-Caribbean) adults	Intervention components: group-based culturally tailored education on nutrition and physical activities with behaviour change support and participatory physical activity Delivery: face to face	Acceptability and fidelity, biomedical measures, patient report outcome measures
Singleton et al. (2021)[54]	Australia	Lifestyle-focused text message intervention for women after breast cancer treatment to support the mental and physical health of women after breast cancer treatment	Women after breast cancer treatment	Intervention components: one-way text messages (130 messages in total) Delivery: text messages	Not evaluated
Smith et al. (2016)[47,48]	United States	Mobile cancer prevention app; to promote health and prevent disease among breast cancer survivors	African-American breast cancer survivors	Intervention components: educational materials with prevention guidelines, a diary and reminders, dietary intake tracker, BMI calculator, links to social media, internet educational videos and flags for lapses Delivery: mobile phone app	RCT planned.
Rattray et al. (2021)[53]	Australia	Improving nutrition practices and dietary intake among patients who undergo colorectal surgery	Adult inpatients undergoing an elective colorectal and/or small bowel surgery	Intervention components: 10 strategies at organisational, HCP and patient level Delivery: multi-factorial (systems and face-to-face education)	Intervention reach and delivery, fidelity, HCP awareness, acceptability
Tay et al. (2021)[55]	Australia	Digital dietary intervention prototype To improve nutrition practices and dietary intake among patients who undergo colorectal surgery	Adults at risk of type 2 diabetes	Undefined – only first of the development process Delivery: mHealth	Future evaluation planned

TABLE 2 (Continued)

Author (year) Other included papers	Country	Study name/description and aim	Target audience	Intervention components and delivery	Evaluation
Te Morenga et al. (2018)[22] Verbiest (2019),[62] Ni Mhurchu (2019)[21]	New Zealand	OL@-OR@ The OL@-OR@ mobile health programme for Māori and Pasifika communities in New Zealand to support healthy lifestyle behaviours	Adults in Māori and Pasifika communities	Intervention components: information on healthy eating and physical activity; culturally relevant information; and links to local activities and services, goal setting, lifestyle trackers, regular culturally tailored tips on eating healthily, being more active, reducing stress, improving sleep and managing weight were sent as app notifications (four to five tips per week) Delivery: mobile app	Self-reported adherence to health-related behavioural guidelines at 4 and 12 weeks, self-reported body weight, holistic health and well-being status and user engagement
Wright et al. (2018)[50] Moss (2019),[46] Wright (2020)[49]	United States	Hypertension health education intervention To promote self-care and reduce blood pressure	Older African-American women	Intervention components: blood pressure monitor, educational group sessions with educational materials from various organisations and companies Delivery: face to face	Acceptability and estimated costs to deliver the intervention
Yazdanpanah et al. (2012)[23]	Iran	Community-based participatory diabetes care programme To improve diabetes control and its risk factors among type 2 diabetes patients	Adults aged 30–65 years (all households in the western suburbs of Yasouj)	Intervention components: screening of all households, nutrition education, and physical activity groups Delivery: face to face	Biochemical markers, dietary intake, exercise
Zacharia et al. (2021),[24] English et al. (2021)[51]	Australia	i-Rebound after Stroke 'Eat for Health' Lifestyle interventions to reduce second stroke risk	Stroke survivors	Intervention components: individual diet counselling, behaviour change techniques; optional text message support, optional Facebook support group Delivery: face to face with a text message/social media support	Future evaluation planned

Abbreviation: DVD, digital versatile disc; TBI, total brain injury.

TABLE 3 The co-design process as described in the included studies

Author (year)	Participants and method of engagement	Recruitment	Co-design framework or approach	Outcomes of co-design
Ahmed et al. (2020)[41]	Community Advisory Board is composed of stakeholders who live and work on the Flathead Reservation (tribal elders, educators, enterprise representatives, clinical practitioners and policymakers, including a member of the Tribal Council) Delphi method Structured surveys Focus groups	Community Advisory Board was decided by the research team based on previous experiences in the community as well as a snowballing approach of consultation with experts in the community in the areas of food and nutrition	Delphi method	An intervention that was tailored to meet the specific needs of community residents and the cultural appropriateness of the programme
Atkinson et al. (2009)[42]	Mothers with limited incomes and at least one child enrolled in school; a trained moderator was used Interviews Focus groups Usability testing	Flyers were posted in key locations and distributed by community service providers, including faith-based leaders. Lists of food stamp recipients were obtained from the Maryland Department of Human Resources to recruit persons directly via the telephone	User-centred design	Website developed through a user-centred design process
Borek et al. (2018)[56]	Intervention was designed with 39 parent carers, who would be the consumers of this intervention. Other stakeholders included NHS health trainers, representatives from the local authority and colleagues from the National Network of Parent Carer Forums and the Council for Disabled Children Working group meetings Emails or phone calls	Existing engaged consumers Advertised online on the research group's website and social media of relevant local organisations for parent carers Personal networks of parent carers involved in the working group	Intervention mapping	A group-based intervention to improve health and well-being through engagement with eight achievable behaviours; research plan including interpretation of results and future directions
Donald et al. (2019)[63,64]	Patients with chronic kidney disease (CKD), caregivers, clinicians, researchers, software developers, graphic designers and policymakers were involved in all steps of this study Focus groups Consensus workshop using personas Heuristic usability testing through in-person 60-min interviews	Participants were recruited via email from the Can-SOLVE CKD Network and from among prior focus groups and interviews with participants Purposive sampling, individuals from CKD and general nephrology clinics in Calgary, Alberta, were invited to participate	Integrated knowledge translation Strategy for Patient-Oriented Research patient engagement principles Knowledge-to-action framework Guidance for Reporting Involvement of Patients and the Public)	Used personas to determine broad topic areas and identify features to support chronic kidney disease self-management through an e-health tool Evaluation of the co-design process
Driver et al. (2020)[43]	Advisory Board of 29 stakeholders, including 6 patients and 1 care partner, 2 board-certified physiatrists, 6 rehabilitation therapists, 1 neuropsychologist, 1 exercise specialist, 2 dietitians, 1 health and wellness practitioner, 1 representative from the American Heart Association and 1	Not described	Community-based participatory research	A modified Diabetes Prevention Program Group Lifestyle Balance (DPP-GLB) programme for people after stroke

TABLE 3 (Continued)

Author (year)	Participants and method of engagement	Recruitment	Co-design framework or approach	Outcomes of co-design
	representative from the University of Pittsburgh Diabetes Prevention Support Center Moderation of group discussion and administrative tasks Meeting with pre-reading			
Driver et al. (2017)[44]	Advisory committee with 10 stakeholders representing TBI professionals (physiatry, therapy, nutrition, neuropsychology and research), former TBI patient and caregiver, representative from the University of Pittsburgh Diabetes Prevention Center, key developer of the DPP-GLB and researchers using the DPP-GLB with individuals with mobility impairments Meeting with pre-reading	Not described	Participatory action research	A modified DPP-GLB programme for persons with TBI
Green et al. (2021)[52]	23 healthcare consumers and 17 healthcare professionals (HCPs); research team members facilitating the co-design process Focus groups and interviews (persona-centred exercises)	Healthcare consumer group coordinators were contacted, and an expression of interest to participate was sent for distribution among their members	Boyd's theoretical framework co-design process – engage, plan, explore, develop, decide and change	Programme developed (limited information on the programme available)
Hallsworth et al. (2021)[59]	16 patients with non-alcoholic fatty liver disease to the prototype intervention; needs assessment with 21 HCPs and 12 patients Interviews Workshops	A commercial provider of digital lifestyle behaviour change programmes enrolled to the prototype intervention	Intervention mapping, Theoretical Domains Framework	Needs assessment Form and information content of the intervention
Katz et al. (2015)[45]	Members of cancer community coalitions Focus groups	Cancer community coalitions identified community members to be featured in the promotion	Social cognitive theory underpinned the campaign strategy	Campaign development, including real-world experiences of community members
Martin et al. (2021)[60]	Three adults with mild or moderate intellectual disability and five intellectual disability nurses Not reported	Self-nominated due to frustration with the current situation	Not reported	Education modules were tailored to specific learning needs
Moore et al. (2019)[61]	3 HCPs, 4 community leaders and 20 patients 3 community advocates and 7 patients Community-based workshops	Letters of invitation were sent to people who had participated in previous diabetes research and to eligible participants identified through general practice database searches	Socio-ecological model, behaviour change wheel	1. Behaviour change techniques 2. Development of intervention and supporting materials

(Continues)

TABLE 3 (Continued)

Author (year)	Participants and method of engagement	Recruitment	Co-design framework or approach	Outcomes of co-design
Singleton et al. (2021)[54]	2 women completed active breast cancer treatment (consumers and citizen collaborators) and 4 health professionals and researchers Workshop	From a local volunteer association	Psychological theory to underpin messages	Development of text message programme and content; evaluation of content
Smith et al. (2016)[47,48]	12 members of SISTAAH Talk (Women of Colour Breast Cancer Support Group), treated for >1 year for stages I–IIIc breast cancer, aged 75 years or younger Discussions Demonstrations (cooking) Focus groups Interviews	Identified by leaders of the support group as good role models to participate in developing mobile cancer prevention app	Community-based participatory research	Content for mobile app
Rattray et al. (2021)[53]	Nutrition Reference Committee members included medical staff (surgeons), dietitians, nurses, food service staff and patient representatives (number not reported)	Not described	Integrated knowledge translation and knowledge to action framework	Ten strategies for intervention, research plan
Tay et al. (2021)[55]	End users (pre-diabetes or risk of type 2 diabetes) or professional experts (2 years of diabetes-related work experience) Online workshops	Convenience and purposeful sampling were used. Participants from the Delphi study were invited via email	Delphi method Participatory action research Persuasive design	Desired app features Evaluation of prototypes
Te Morenga et al. (2018)[22]	The OL@-OR@ project team: European nutrition professor, a Māori nutrition researcher, Pasifika public health researcher and representatives of key Māori and Pasifika community health Meetings Focus groups with end users were organised and facilitated by community coordinators	Via community organisations	Adapted participatory co-design cycle described by Bratteteig et al.[65] Theoretical Domains Framework to select Behaviour Change Techniques and incorporated kaupapa Māori principles (Tikanga) into engagement	Development of an app and web page
Wright et al. (2018)[50]	49 community-dwelling African-American adults aged 60 years and older (mostly women) Focus groups Interviews	Established research participant registry maintained by the principal investigator from previous research conducted in the community	Intervention design based on the information-motivation-behavioural model	Self-management of hypertension intervention for women

TABLE 3 (Continued)

Author (year)	Participants and method of engagement	Recruitment	Co-design framework or approach	Outcomes of co-design
Yazdanpanah et al. (2012)[23]	A 15-member group consisted of 4 academics, 3 local leaders, 5 community members and 3 local healthcare providers Community meeting Focus groups Interviews	Selected by a steering committee Participatory process involving open meetings held in public places (most often a local health centre) Anyone who attends the meeting is invited to join a working committee	Planned approach to community health	Set priorities Guided all aspects of the study and the intervention Proposal for baseline health survey and intervention programme
Zacharia et al. (2021)[24]	A series of stakeholder workshops were held with four stroke survivors, two carers and six specialist disability dietitians. A second series of workshops were held with six stroke survivors and carers and six dietitians to refine and adapt the intervention prototype Workshops	Recruited from a variety of sources: from the initial ENABLE trial co-design process ($n = 4$), utilising professional networks ($n = 6$) and through word of mouth ($n = 2$)	Integrated knowledge translation	Essential elements of the programme Defined research questions Prototype development Prototype adaptations

Abbreviation: TBI, total brain injury.

and intervention mapping.[56,59] Only two studies cited the use of specific co-design frameworks.[22,52] Several studies used the Theoretical Domains Framework,[21,55,56,59,61] COM-B or Behaviour Change Wheel[20,24,58,61] to apply behaviour change techniques to the intervention based on the analyses taken from discussions with consumers. Only one study[64] reported consumer engagement in line with the GRIPP2-SF.

'Ideal co-design': principles and stages

Four studies[22,52,56,63] reported evidence of including five or six principles of 'ideal co-design', whereas further five studies[23,41,43–55] included three or four of the co-design principles, 'sometimes' or 'all of the time' (Table 3). The most common co-design principles reported were 'elevate lived experience', 'equity-centric' and 'inclusion', whereas 'diversity', 'co-governed' and 'builds capability' were the least likely principles to be included or reported (Table 3). Six studies either failed to report against the six principles or included only one principle[45,47,53,54,59,61] (Table 3).

Equal partnership between consumers and researchers was most reported within the stage of 'co-designing the intervention' (Table 3). However, many studies also incorporated co-decision-making, co-planning and co-dissemination (Table 3). Two studies reported an equal partnership across all six stages[56,63] (Tables 3 and 4).

Consumer as a co-author in the present review

A summary of the contributions of the consumer co-author and the reflections on the benefits and challenges from the consumer and researcher perspective is provided in Box 1. Reporting of consumer involvement in accordance with GRIPP2-SF is provided in Supporting Information 3.

DISCUSSION

This scoping review set out to synthesise the current use and extent of consumer co-design in nutrition interventions. We identified 19 studies (29 references) meeting the inclusion criteria. Although co-design is not a new concept, most studies included were from the past 5 years, indicating a shift towards the adoption of consumer-centred design in more recent years. However, very few studies included consumers across the spectrum of research stages, and their inclusion was often limited to co-designing the intervention.

What is not entirely clear from this review is whether the execution or reporting of co-design was poor. However, unclear reporting of participatory research methodology is an issue evident in prior research.[39,66,67]

TABLE 4 Checklist co-designed with consumer representative that captures key elements of co-design

Author (year)	Elevate lived experience	Co-governed	Equity-centric	Diversity	Inclusion	Builds capability	Co-design stages of research[a]
Ahmed et al. (2020)[41]	b	b	NR	b	c	NR	Co-decide[b] Co-plan[c] Co-design intervention[c] Co-implement[b]
Atkinson et al. (2009)[42]	b	NR	b	NR	d	NR	Co-decide[b] Co-plan[d] Co-design intervention[c]
Borek et al. (2018)[56]	c	c	c	b	b	c	Co-decide[c] Co-plan[c] Co-design intervention[c] Co-evaluate[c] Co-disseminate[c] Co-implement[c]
Donald et al. (2019)[63,64]	c	c	c	b	c	c	Co-decide[c] Co-plan[c] Co-design intervention[c] Co-evaluate[c] Co-disseminate[c] Co-implement[c]
Driver et al. (2020)[43]	NR	c	b	c	NR	NR	Co-decide[c] Co-plan[d] Co-design intervention[c]
Driver et al. (2017)[44]	d	b	b	NR	NR	b	Co-decide[b] Co-plan[d] Co-design intervention[c]
Green et al. (2021)[52]	c	NR	c	c	c	c	Co-decide[c] Co-plan[b] Co-design intervention[c]
Hallsworth et al. (2021)[59]	b	e	d	NR	d	e	Co-decide[b] Co-plan[d] Co-design intervention[e] Co-evaluate[d] Co-implement[e]
Katz et al. (2015)[45]	NR	NR	NR	NR	NR	NR	Co-decide[c] Co-plan[b] Co-design intervention[e] Co-evaluate[c] Co-disseminate[c] Co-implement[d]
Martin et al. (2021)[60]	NR	NR	b	NR	NR	b	Co-decide[c] Co-design intervention[c] Co-evaluate[e] Co-disseminate[c]
Moore et al. (2019)[61]	b	d	e	e	d	e	Co-decide[d] Co-plan[e] Co-design intervention[b] Co-evaluate[d] Co-disseminate[e]
Singleton et al. (2021)[54]	b	d	e	e	e	e	Co-decide[e] Co-plan[c] Co-design intervention[c] Co-disseminate[c]
Smith et al. (2016)[47,48]	NR	NR	NR	NR	b	NR	Co-design intervention[b] Co-evaluate[b] Co-disseminate[c] Co-implement[c]

TABLE 4 (Continued)

Author (year)	Elevate lived experience	Co-governed	Equity-centric	Diversity	Inclusion	Builds capability	Co-design stages of research[a]
Rattray et al. (2021)[53]	NR	NR	NR	NR	NR	NR	Co-decide[e] Co-plan[e] Co-design intervention[d] Co-evaluate[d] Co-disseminate[d] Co-implement[d]
Tay et al. (2021)[55]	b	e	c	b	b	NR	Co-decide[b] Co-plan[e] Co-design intervention[c] Co-evaluate[e] Co-disseminate[e]
Te Morenga et al. (2018)[22]	c	c	c	NR	c	c	Co-decide[c] Co-plan[c] Co-design intervention[c] Co-evaluate[c] Co-disseminate[c]
Wright et al. (2018)[50]	NR	e	c	e	c	e	Co-decide[e] Co-plan[e] Co-design intervention[b] Co-evaluate[e] Co-disseminate[e]
Yazdanpanah et al. (2012)[23]	NR	c	b	NR	c	c	Co-decide[c] Co-plan[c] Co-design intervention[b] Co-evaluate[c] Co-disseminate[e] Co-implement[b]
Zacharia (2012)[24]	NR	NR	b	e	e	NR	Co-plan[b] Co-design intervention[c] Co-evaluate[e] Co-disseminate[c]

Note: Rankings were determined by two authors and cross-checked by a third author.

Abbreviation: NR, not reported.

[a]Item not included if the study did not report.

[b]Sometimes.

[c]Always.

[d]Rarely.

[e]Not at all.

Although there are no reporting guidelines for co-design, the GRIPP2 guidelines[37] provide guidance on reporting patient and public involvement in research. These guidelines were cited in only one of the included papers in this review. The GRIPP2 guidelines[37] aim to cover consumer involvement in all its forms, and although they prompt authors to report on the level and nature of involvement, direction about the terminology and definitions are lacking. As also suggested by other authors, adaption of existing reporting guidelines for co-design may be warranted.[39,68] We suggest that the use of a well-known consumer engagement spectrum such as IAP2[15] in reporting may provide clarity regarding the level and nature of engagement and allow co-design (or collaboration) to be more specifically named as the engagement method. The reporting issue was also evident in data extraction where studies published one or more companion articles that described the co-design process and outcomes of the intervention separately. The authors found that articles describing both the co-design process and intervention description/outcomes were often lacking detail on one part of the study. This may be due to a lack of co-design reporting guidelines or strict word limits imposed by some journals, hindering the ability to fully describe the engagement principles of co-design at each stage of the process. Many of the studies published only the co-design process with limited details on the intervention. However, these studies often indicated that further research was planned, including a full description and evaluation of the intervention.

'Ideal co-design' includes an equal partnership at all research stages that embraces the principles of elevating

BOX 1 Consumer contribution to the review process

Role and influence in the review:
- Contributed to the definition of co-design used: reviewed existing definitions in the literature, nominated key aspects for inclusion in definition (i.e., power sharing, partnership between lived and professional experience) and developed final definition used in review (based on previous consultation about co-design with >100 consumers, health professionals and researchers)
- Suggested additional search terms based on previous consultation about co-design (e.g., user-centred design)
- Contributed to the refinement of protocol: changed inclusion criteria (based on lived experience with transitions to adult services between ages 16 and 18 years) and reviewed protocol before publication
- Resolved conflicts during full-text review: provided judgement related to inclusion/exclusion based on the co-design criteria
- Led the development of an 'ideal co-design checklist' (based on lived experience and previous consultation about co-design), with review by co-authors N. M. and A. Y.
- Completed data extraction on half of the included papers using the checklist (performed in partnership with A. Y.)
- Contributed key points for inclusion within the discussion: need for researchers to *listen* to the lived experience when undertaking co-design (rather than prioritising the research evidence), misreporting of 'consultation' or 'involvement' as co-design
- Drafted paragraph in the discussion related to co-design principles and process
- Reviewed final manuscript before submission

Team reflections on consumer involvement in the review process:Benefits:
- Ensured our definition and inclusion criteria were true to the key principles of co-design
- Initiated the co-design of a new tool to assess the degree to which co-design is reported, based on extensive experience working alongside other persons with lived experience across multiple projects
- Provided an alternative (lived experience) perspective on engaging throughout the co-design process, data extraction, and contributing significantly to the methods and discussion
- Increased confidence in full-text review based on consumer interpretation of the reported co-design process
- Continued learning for research team members about what is important in co-design through discussions at team meetings, the co-design checklist and interpretation of study findings

Challenges:
- Time pressures in the speed of the review presented limited opportunities for building capability. This was mitigated by regular meetings and engagement between the research team; however, if given additional time, the benefits could have been maximised.
- Online engagement: A. C. completed the entirety of the review through online engagement, which limited informal and casual discussion about papers during data extraction. Although online engagement provided inclusive participation benefits, completing initial data extraction in the same room as other researchers would boost consumer confidence in competency and accuracy and shared learning.
- Issues related to access to different file sharing and communication channels.
- Changes to role/expectations mid-way through review to include data extraction.

lived experience, co-governance, equity-centric, diversity, inclusion and capability building.[10,12] Regardless of reporting, co-design was incorporated to varying degrees across all research stages and principles, with challenges presented by lack of consistent reporting of a co-design definition or approach, consumer involvement and adherence to principles. Indeed, fewer than half of the studies included for this scoping review defined co-design (or similar method used), and there was no unifying definition across any of the studies. McGill et al. in their scoping review of 71 co-produced interventions for the prevention of chronic disease highlighted the interchangeable use of co-words such as 'co-design', 'co-create' and 'co-develop' when describing the involvement of end users or intermediaries.[69] In this review we chose to include studies that demonstrated a partnership with consumers (as aligned with the final two levels on the IAP2 Public Participation Spectrum[15]) to provide consistency in our definition. When considering this approach alongside the three main arguments of public involvement in research as outlined in Greenhalgh et al., genuine co-design should acknowledge that consumers have the right to input into researching their condition, increase its relevance to consumers and dissemination beyond academic audiences and form alliances with consumers (knowledge co-constructed with researchers and the public) to increase accountability and transparency.[12]

Lack of consistency in terms and definitions used for co-design suggests there may be limited awareness of principles to incorporate or how to co-design from beginning to end of the research process. It was also evident that co-design theoretical models or frameworks varied greatly, and there appear to be limited approaches to specifically guide co-design processes. This has implications for future research. Although several proposed co-design models and frameworks exist,[70–72] these tend to focus on the process (steps involved) rather than the measures or determinants of genuine co-design. They also fail to incorporate co-design across the research spectrum. For example, in

this scoping review we found that research direction and methods were rarely co-designed, demonstrating lack of engagement with consumers from research inception. Planning research and priority setting with consumers is an important strategy to reduce research waste.[73] In this review we found that an equal partnership between professional and lived experience was most commonly reported in the co-design of the intervention. Other co-design research stages (i.e., co-deciding, co-planning, co-implementation and co-evaluation) were underreported and rarely included consumers in equal partnership. However, even with this occurring, the evidence base or researcher perspective was often given greater emphasis than lived experience perspectives. Examples of this were observed where consumers suggested an intervention idea that was then not followed through to design due to the emphasis on evidence-based interventions. Instances where there was a conflict between lived experience perspectives and existing literature created the opportunity for researchers to 'elevate lived experience'. Rarely did the research team incorporate lived experience expertise in the final product, even when there was not a competing existing evidence base for the intervention.

As observed with the stage of research planning/direction setting, co-design within the evaluation of the intervention process was notably missing. Only two of the studies in this review included sufficient details of co-designed evaluation measures.[22,23] In both studies, consumer co-designers were included in decisions about evaluation measures. In their systematic review of frameworks supporting patient and public involvement in research, Greenhalgh et al.[12] proposed that study-focused frameworks enable consumer involvement to be woven into every stage of research, including monitoring and evaluation. In the present scoping review, it was our consumer author (A. C.) who proposed and co-developed the checklist, which enabled us to describe 'ideal' co-design across all research stages.

The lack of 'capability building' between professional and lived experience presented missed opportunities for different perspectives to be challenged and shared learning (un-learn, co-learn, re-learn). At times, it was not clear whether the input from the consumers with lived experience was integrated into the co-design and occasions where input from people with lived experience was asked for but not incorporated. Consumers had to repeat the same requests in consultations, only to receive an intervention prototype that did not meet their needs or reflect the lived experience expertise provided. Incorporating 'capability building' could enable lived experience to be elevated throughout the co-design process rather than 'tokenistic' engagement. The need for guidance around capability building for the entire co-design team has been identified as a barrier to authentic co-design in previous research.[74] A focus on capability building using emerging models[74,75] would support stronger relationships between researchers and consumers.

An additional key consideration in consumer co-design is adequate compensation for their contributions. Inadequate resources to remunerate consumers for their time and expenses incurred, while expecting voluntary contributions, impact on recruitment of co-design participants[76] and compromise the principle of equal partnership.[60] Only a third of studies included in this review reported compensation for consumer involvement, questioning the genuine commitment to valuing the contribution of consumers to the co-design process. Reimbursement of expenses and remuneration for time are important; however, it may be that this needs to be individualised to each consumer and context.[77] In developing the approach to consumer co-design, asking participants their preferences for reimbursement and acknowledgement may help facilitate engagement[77] and, therefore, enhance the outcomes of co-design.

Interestingly, the 19 studies included in this scoping review did not appear in a recent integrative review[39] that aimed to describe co-design in nutrition research. The authors of the integrative review included 22 studies that met collegiate, collaborative or consultative levels of participation[78] and found that only 3 met the collegiate level.[39] More commonly, included studies were used to assess background knowledge and user needs to inform an intervention, whereas we excluded studies that appeared to 'consult' participants or explore general barriers/enablers and perceptions.[39] To be considered for this scoping review, we applied strict criteria of consumer participation that required researchers to 'Collaborate' with or 'Empower' consumers in line with the IAP2 spectrum.[15] In addition, we note that many of the studies included in this scoping review were published in 2021, which would have meant they were unavailable during screening for the 2021 integrative review.

This study was not without its limitations. Through excluding co-design studies that aimed to improve food access by addressing food security, we limited the breadth of studies reporting co-design with nutrition interventions. However, the authors felt that this was a topic that warranted closer examination under a separate review and recommend this for future scoping reviews. Further, it is possible that many co-design papers were excluded as they did not meet the IAP2 criteria. Although not a major focus of this review, we may have overlooked learnings that encompassed a transition from no consumer involvement to 'partial-but not-quite-there' consumer involvement. The 'ideal co-design' checklist was developed for this study to subjectively assess the co-design as it was reported in the included papers. Given the poor reporting of co-design, it is likely that some co-design principles were not reported and therefore not assessed. This novel tool may be useful to guide the planning and reporting of future co-design studies but

requires further use, refinement and potentially validation. The exclusion of grey literature where co-design work may be more commonly published is another limitation of this review.

The strengths of this review are the broad and complementary expertise of the reviewers and the systematic methodology applied to the review. Authors' expertise ranged from experienced content experts (dietitians, behaviour change experts), systematic review methodologists and, importantly, a consumer as an integral and equal part of the team. This unique combination allowed skilled refining of search terms, the inclusion of a definition and checklist aligned with a genuine co-design approach and application of automated tools to expedite the process. This review adapted an accelerated (2weekSR) process[33] and used multiple communication channels (Microsoft Teams, Slack and email) and real-time queries ensuring decisions were able to be shared, addressed and documented for clarity of processes. Despite more rapid reviews of this type emerging, the novelty of this approach is a study strength. Furthermore, it continues to contribute to the body of knowledge on time taken and processes and tools required in the rapid scoping review, extending the potential to realise considerable time and efficiency savings. Additional strengths included the use of five scientific databases, with studies independently screened by three pairs of two reviewers, and data were extracted by four co-authors, with cross-verification processes applied. We also did not impose restrictions on time periods for publication or language.

This review demonstrates that although there is an appetite for and obvious benefits of consumer co-design in nutrition interventions, it is not performed systematically or rigorously. Improvements in understanding the definitions of and methods to enable, enhance and honour true and authentic consumer co-design are much needed, as is reporting of processes undertaken.

AUTHOR CONTRIBUTIONS

Nina J. L. Meloncelli, Susan de Jersey and Adrienne Young conceived the study; Anna Mae Scott developed the methodology with input from all authors; screening was undertaken by Nina J. L. Meloncelli, Anna Mae Scott, Alita Rushton, Susan de Jersey, Adrienne Young and Pavel Zhelnov; data extraction and interpretation were performed by Nina J. L. Meloncelli, Alita Rushton, Adrienne Young and Anja Christoffersen; verification was performed by Pavel Zhelnov, Alita Rushton and Nina J. L. Meloncelli. All authors contributed to drafting the manuscript, reviewing or editing. All authors have read and agreed to the submitted version of the manuscript.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

Data sharing is not applicable to this article as no new data were created or analysed in this study.

TRANSPARENCY DECLARATION

The lead author affirms that this manuscript is an honest, accurate and transparent account of the study being reported. The reporting of this work is compliant with PRISMA-ScR guidelines. The lead author affirms that no important aspects of the study have been omitted and that any discrepancies from the study as planned have been explained.

ORCID

Nina Meloncelli https://orcid.org/0000-0002-8990-9709
Adrienne Young https://orcid.org/0000-0002-4498-4342
Alita Rushton https://orcid.org/0000-0003-4133-0754
Pavel Zhelnov https://orcid.org/0000-0003-2767-5123
Shelley A. Wilkinson http://orcid.org/0000-0003-3365-3473
Anna Mae Scott https://orcid.org/0000-0002-0109-9001
Susan de Jersey https://orcid.org/0000-0001-6321-8558

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AUTHOR BIOGRAPHIES

Nina Meloncelli, APD PhD, is a post-doctoral research fellow with Metro North Health and the University of Queensland. Her research aims to improve prevention and management of gestational diabetes.

Adrienne Young, PhD, is a dietitian researcher from Royal Brisbane and Women's Hospital and University of Queensland. Her research aims to co-design nutrition care improvements with older people and caregivers.

Anja Christoffersen, MBA, is a passionate disability advocate and founder of Champion Health Agency which takes an innovative approach to sustainable co-designed or consumer-led transformation in health, society and beyond.

Alita Rushton, BHlthSc(Nutr), is an MPhil candidate who combines clinical nutrition assistant experience and research skills to explore opportunities for delegation, with a focus on improving malnutrition care for patients.

Pavel Zhelnov, MD, is an independent researcher originally from Pavlov University. His research interests encompass evidence synthesis advocacy, automation tools and spine surgery.

Shelley A. Wilkinson, PhD, is associate professor from the University of Queensland. Her research aims to ensure women receive the best nutritional care and programmes before, during and after pregnancy.

Anna Mae Scott, PhD, is assistant professor and epidemiologist at Bond University. Her research focuses on the development of automation tools and accelerated processes (e.g., 2weekSR) for evidence syntheses.

Susan de Jersey, PhD, is Advanced APD at Metro North Health and associate professor at the University of Queensland. Her research focuses on the delivery of person-centred nutrition care for women.

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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