

Evidence Check

Digital platforms as effective health promotion tools

An **Evidence Check** rapid review brokered by the Sax Institute for Cancer Council NSW.
March 2019

This report was prepared by:

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Disclaimer:

This **Evidence Check Review** was produced using the Evidence Check methodology in response to specific questions from the commissioning agency.

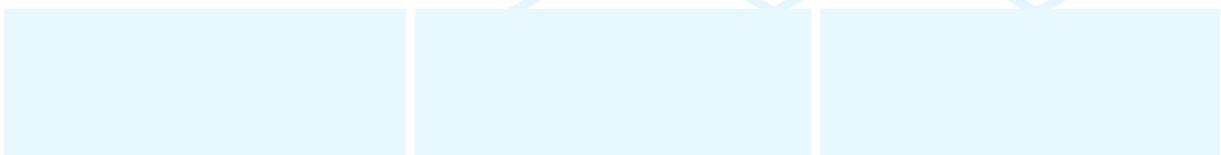
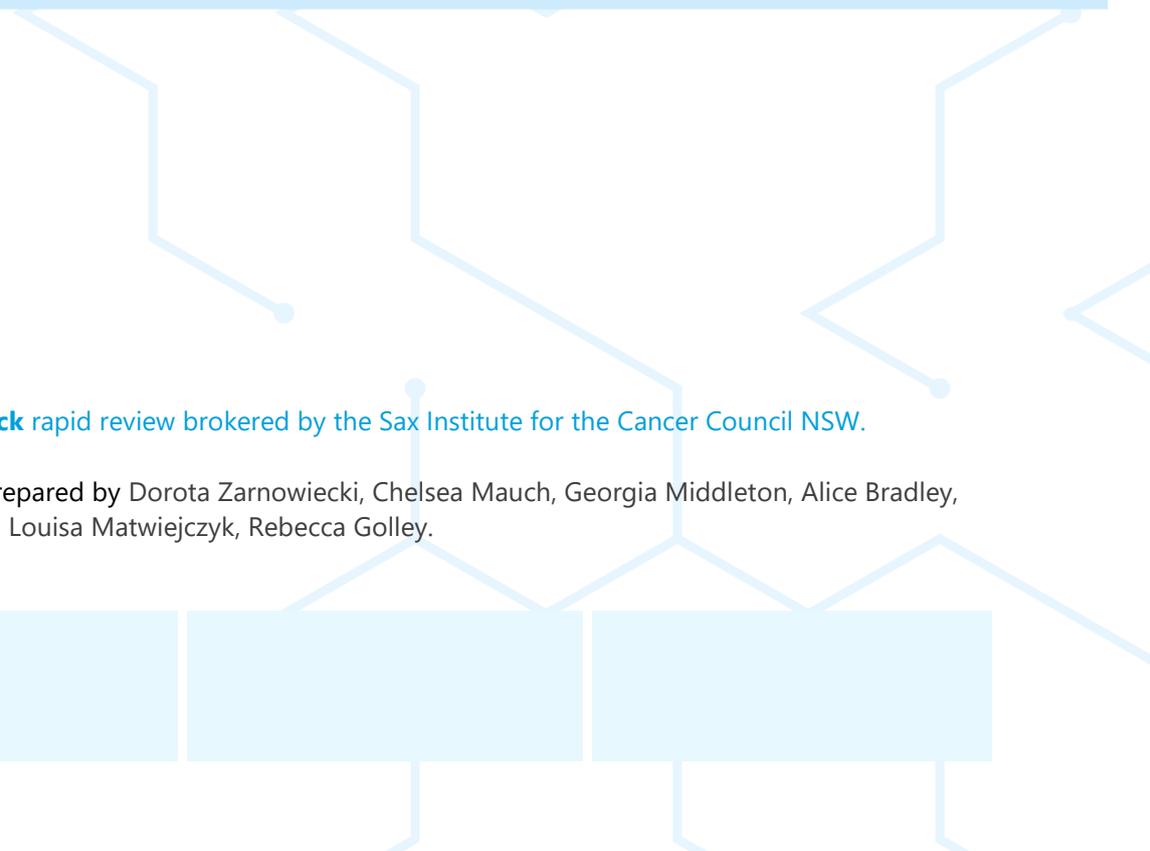
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Digital platforms as effective health promotion tools: An Evidence Check review

An **Evidence Check** rapid review brokered by the Sax Institute for the Cancer Council NSW.
March 2019.

This report was prepared by Dorota Zarnowiecki, Chelsea Mauch, Georgia Middleton, Alice Bradley, Larissa Murawsky, Louisa Matwiejczyk, Rebecca Golley.



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Executive summary

Background

Children consume more than one-third of their total dietary intake at school.^{1,2} Therefore, the school day provides a window of opportunity for improving children's diet quality. In Australia, about 90% of children bring a lunch box to school from home, prepared by parents or primary caregivers.^{1,3} A sandwich is the most common lunch item in an Australian lunch box, with other common lunch box food items including fruit (fresh or in snack tubs), potato crisps, savoury snack foods, cakes, muffins, biscuits and muesli bars.³ In 2005, a study found more than 90% of children have at least one discretionary food in their lunch box, and more than half have two or more discretionary foods, whereas only 12% have vegetables.⁴ Increasing the nutritional value of the food and drinks provided in the school lunch box will support improvements in Australian children's adherence to dietary guidelines.

Digital platforms have the potential to disseminate information rapidly to a large number of people.⁵ The Cancer Council NSW website www.healthylunchbox.com.au is an interactive digital tool that helps parents to increase their child's fruit and vegetable intake by planning and packing a healthy lunch box. The website was launched successfully in January 2018 within the Eat It To Beat It Program, showing good engagement with the target audience, parents of school-age children.⁶ Cancer Council NSW is exploring the potential of this website as a stand-alone resource. This Evidence Check was commissioned by Cancer Council NSW and aims to identify and summarise current evidence, and associated literature, about similar digital health promotion tools for nutrition education with a focus on parents with children.

Review questions

This Evidence Check aimed to address the following questions:

Question 1: What websites and apps are in use as health promotion tools for nutrition education with a focus on parents?

Question 2: How do users wish to engage with health promotion tools delivered by websites and apps?

Question 3: How effective are websites and apps as health promotion tools?

Question 4: What indicators are used to measure the effectiveness, reach and impact of a health promotion website or app?

Summary of methods

To answer Question 1, we conducted searches in the Google Advanced Search function to identify websites and in the Apple Store to identify apps that are targeted at parents as health promotion tools for healthy lunch boxes. Websites and apps were included if they were from Australia or other specified countries of interest, were in English, and if they provided lunch-box-related information targeted at parents. We assessed the quality of websites and apps using the Mobile App Rating Scale (MARS), and included a total of 15 websites and six apps to address Question 1.

To answer Questions 2 and 3, we conducted systematic searches in Medline, Emcare, PsycINFO, Scopus and ProQuest databases to identify studies that conducted user testing of digital platforms with parents (Q2) and evaluated the effectiveness of digital platforms targeting parents (Q3). We included studies if they were published in English, published from 2008 (Q2) or from 2013 (Q3) and conducted in Australia or other specified countries of interest. The quality of included studies was evaluated against the NHMRC evidence grade. Thirty studies met the criteria for inclusion in Question 2 and 21 studies were included in Question 3.

Key findings

Question 1: What websites and apps are in use as health promotion tools for nutrition education with a focus on parents?

- Almost all included websites were developed by government departments or non-government organisations and contained information that was credible and consistent with Australian dietary guidelines, whereas only two of six apps were developed by a government department or in partnership with a dietitian
- Key messages promoted the inclusion of foods from the five food groups in the lunch box, in particular fruit and vegetables
- Websites included more information and fewer interactive features, whereas apps included more interactive features and less information. Other prominent features of both platforms included recipes, links to further information and sharing on social media.

Question 2: How do users wish to engage with health promotion tools delivered by websites and apps?

- User testing showed parents wanted digital platforms to include both informative content and interactive features, with sections that both parents and children could engage with. Users wanted information to be credible, evidence-based, from a trusted source, and relevant to them
- Use of the internet, apps and smartphones was high across all studies, with Facebook, Instagram, Twitter and Pinterest reported as commonly used apps
- Participants were recruited via a combination of traditional and social media approaches, with social media and online recruitment techniques resulting in a wider reach, but being less effective at reaching the target audience.

Question 3: How effective are websites and apps as health promotion tools?

- Overall, digital interventions targeting parents or families achieved significant improvements in parents' and children's dietary intake, nutritional knowledge and self-efficacy, which was equal to or slightly better than face-to-face or online comparison groups
- Findings were mixed for the effects of digital interventions in increasing physical activity and reducing sedentary behaviour, and only one study found a significant effect on body mass index (BMI)
- Visitation and engagement with digital platforms were higher initially and declined over time, with poor repeat visitation and ongoing engagement.

Question 4: What indicators are used to measure the effectiveness, reach and impact of a health promotion website or app?

- Emerging best practice frameworks for evaluation of digital health interventions include the Collaborative Adaptive Interactive Technology framework, Mobile App Rating Scale (MARS), Intervention Principles framework, WHO mHealth Technical Evidence Review checklist and RE-AIM
- Key areas for consideration in the evaluation of digital health interventions are the rapid pace of technological change, determining a sufficient level of engagement to achieve and maintain behaviour change, the advantages of real-time objective data collection, iterative evaluation and the need for health economic evaluation
- Comprehensive evaluation frameworks should include a range of indicators measuring reach (e.g. visitation), impact (e.g. page access and viewing time; content acceptability; fidelity) and effectiveness of target behaviours (e.g. knowledge, attitudes, beliefs, target behaviour).

Gaps in the evidence

There is a lack of literature evaluating lunch-box websites and apps as specific types of digital health platforms. There is no comprehensive evaluation spanning reach, impact and effectiveness. The quality of evidence evaluating the effectiveness of digital interventions is satisfactory to good, with a considerable

proportion of pre–post and quasi-experimental study design. Evaluation research is needed to determine the sufficient level of engagement required to achieve behaviour change. Impact evaluation, such as website acceptability and fidelity, will also help determine what, if any, additional features may be needed.

Discussion of key findings

Question 1: What websites and apps are in use as health promotion tools for nutrition education with a focus on parents?

- Few dedicated lunch-box websites or apps are currently available at scale, for use by parents, children or families to support nutrition promotion efforts to improve children’s diet
- Current websites and apps provide information and practical ‘how to’ support, with varying degrees of interactive engagement.

Question 2: How do users wish to engage with health promotion tools delivered by websites and apps?

- User testing research identified that parents want smartphone-friendly digital platforms that provide factual and practical information, which is credible and endorsed by health professionals or organisations
- Studies reporting on marketing activities used a mix of social media and traditional marketing approaches. Leveraging a combination of social and traditional marketing may be most efficacious for achieving both reach and awareness, as well as specificity to the target audience.

Question 3: How effective are websites and apps as health promotion tools?

- The evidence base suggests health promotion interventions delivered to parents via digital platforms are at least as effective as face-to-face health promotion approaches
- Sufficient or ongoing engagement and adherence to achieve the intended outcomes is a key challenge for the success of digital interventions, with high attrition following initial website/app visitation and reduced time spent on platforms over the duration of interventions.

Question 4: What indicators are used to measure the effectiveness, reach and impact of a health promotion website or app?

- The comprehensive evaluation of digital health interventions is an emerging area. Several frameworks have been published in the past few years; however, consistent indicators or measures are not yet available or in routine use.

Applicability

There are few apps or websites reported in user-testing studies that have all the desired components, specifically credible and evidence-based nutrition information, personalisation, interactive features and practical, ‘how to’ support. The *Healthy Lunch Box* CCNSW website addresses this gap with its unique combination of the interactive lunch box builder, recipes, healthy swaps tips and credible nutrition information. Opportunities exist to optimise the CCNSW website to include features enabling personalisation and interactivity that were desired in user testing. However, evaluating the website in its current form to determine its effectiveness would inform whether additional improvements were required. There is a gap in the market for evidence-based apps to support parental lunch-box provision, which is worth examining as a potential opportunity.

Conclusion

The Evidence Check demonstrated that digital health promotion tools targeting parents can be effective for improving dietary intake, knowledge and self-efficacy. The review team found most websites and apps currently in use as health promotion tools targeting parents to improve children’s lunch box provision do not meet aspects of the desired combination of credentialed nutrition information, interactivity,

personalisation and tailored feedback that was identified from user-testing research. The CCNSW website is unique in the market, as it incorporates credible nutrition information in combination with interactive features. However, there are opportunities for evaluation to understand its effectiveness and inform opportunities for improvement.

Background

Food and nutrition play an important role in health, development and wellbeing at all stages of life. Eating habits developed in childhood tend to track into adulthood, highlighting childhood as a key period for establishing lifelong healthy eating habits.⁷ However, Australian children's food intake does not meet dietary guidelines and poor dietary habits have remained virtually unchanged over the past few decades, despite considerable public health efforts.⁸ Almost all school-age children do not consume enough vegetables, and many fall short against recommendations for grain foods, dairy and meat and alternatives.⁸ Conversely, school-age children obtain about 40% of their energy intake from discretionary choices — nutrient-poor foods and drinks that do not fit into the core food groups.^{8,9} Top sources of discretionary choices include potato crisps or similar savoury snack foods and sweet baked goods such as cakes, muffins and biscuits.^{8,10}

School-age children consume more than one-third of their daily dietary intake at school.^{1,2} Therefore, the school day provides a window of opportunity for improving children's diet quality. In Australia, about 90% of children bring a lunch box to school from home, prepared by parents or primary caregivers.^{1,3} A sandwich is the most common lunch item in an Australian lunch box, with other common lunch box food items including fruit (fresh or in snack tubs), potato crisps, savoury snack foods, cakes, muffins, biscuits and muesli bars.³ A 2005 study found more than 90% of children have at least one discretionary food in their lunch box, and more than half have two or more discretionary foods, whereas only 12% have vegetables.⁴ Improving the nutritiousness of the items provided in the school lunch box will support improvements in Australian children's adherence to dietary guidelines.

Nutrition promotion in Australian schools often targets school policy and food provision on campus, for example via guidelines for food and drinks offered by the school food service. While it is important that school canteens or tuckshops support healthy eating, a recent study shows only 10% of children eat lunch purchased at school.³ The contents of school lunch boxes is a nutrition promotion target with significant reach and potential to improve children's diet quality. While parent, child and broader factors influence the food and drinks provided in a lunch box, parents are critical gatekeepers. As a key target group for improving children's nutrition, parents and caregivers have identified a number of challenges in preparing lunch boxes, including child preferences and convenience.¹¹ Few studies have evaluated interventions to improve children's lunch box food intake; however, results to date have been positive for improving the nutritiousness of lunch box contents.^{11,12}

A key challenge to improving children's lunch boxes will be reaching and engaging parents.¹³ Digital platforms can provide a solution as they have the potential to disseminate information rapidly to a large number of people.⁵ How Australians access health and nutrition information has changed considerably in the past decade. On average, 86% of Australian households, including 97% of households with children under 15 years of age, now have internet access at home¹⁴ and 88% of Australians own a smartphone.¹⁵ As a result, the use of the internet and social media, including as sources of health and nutrition information, has grown rapidly.^{5,15}

The Cancer Council NSW website www.healthy lunchbox.com.au is an interactive digital platform that helps parents to increase their child's fruit and vegetable intake by planning and packing a healthy lunch box. The website was launched successfully in January 2018 within the Eat It To Beat It program, showing good engagement with the target audience, parents of school-age children.⁶ Cancer Council NSW is exploring the potential of this website as a stand-alone resource. This Evidence Check aims to identify and summarise current evidence of similar digital health promotion tools and associated literature to understand both the needs of end users and the effectiveness of digital health tools.

This report was commissioned by Cancer Council NSW to provide a rapid review of the current evidence and associated literature about digital platforms as effective health promotion tools for nutrition education with a focus on parents with school-age children. It will be used as an input in the development of a strategic plan for the digital resource, including an evaluation plan to assess its effectiveness.

Evidence Check: Digital platforms as effective health promotion tools

This Evidence Check was commissioned to provide an evidence base for the strategic plan being developed for the Cancer Council NSW's *Healthy Lunch Box* website and its evaluation framework. The review aims to identify and summarise current evidence of similar digital health promotion tools and associated literature to understand both the needs of end users and the effectiveness of digital health tools. The Evidence Check aimed to answer four key questions:

Question 1: What websites and apps are in use as health promotion tools for nutrition education with a focus on parents?

Question 2: How do users wish to engage with health promotion tools delivered by websites and apps?

Question 3: How effective are websites and apps as health promotion tools?

Question 4: What indicators are used to measure the effectiveness, reach and impact of a health promotion website or app?

Methods

Question 1: What websites and apps are in use as health promotion tools for nutrition education with a focus on parents?

Grey literature

To answer Question 1, we conducted a systematic desktop search to identify relevant websites (October 2018 in Google Advanced Search using 'incognito' mode with browser cache clearing) and apps (October 2018 in the Apple Store on an iPad) targeted at parents as health promotion tools for healthy lunch boxes.

Search strategy

Websites

We used Google Trends to identify frequently used lunch box search terms. We developed and executed a pilot search, which contributed one website to the final research. The pilot search was then adapted to remove population terms. In total, we executed 20 main searches using the 'any of these words' and 'all of these words' functions (Table 1). All searches were limited to English and replicated in each country of interest (Australia, New Zealand, Britain, Canada, the US). We screened the first 10 pages (100 results) of each search. A check against non-government organisation (NGO) and government websites was undertaken for 42 organisations (e.g. state health websites, state and national cancer council websites, academic and NGO organisational websites) using the words 'lunch' and 'lunch box'.

Table 1: Searches executed in Google Advance Search

	'All of these words'	'Any of these words'
Search 1	Lunch box	Ideas, tips, health, school
Search 2	School lunch box	Tips, ideas, healthy
Search 3	Lunch	Health, ideas, tips, school
Search 4	Lunch box	Planner, planning tool

Note: Each search was limited to English and repeated in Australia, NZ, UK, Canada, US (total 20 searches)

Apps

We developed, piloted, refined and executed a search for each of the 18 search terms listed in Table 2. Search terms were limited to a combination of a maximum of two to three words because of the capacity of the search function within the Apple Store. The first 50 results of each search were checked by title and description against inclusion/exclusion criteria. We checked the first search term, 'lunch box', to 100 apps to confirm that searching beyond the first 50 results did not yield any apps fitting the inclusion criteria. Searches were conducted on an iPad using the filter 'iPhone only' as apps designed for iPhones are compatible with iPads.

Table 2: Search terms and number of generated search results within Apple Store

Search term	n	Search term	n	Search term	n	Search term	n	Search term	n
Lunch box	50	Packed lunch	50	Nutrition	50	Family meals	50	Lunch ordering	50
Lunchbox	50	School lunch	50	Nutrition education	50	School meals	38	Canteen	50
Lunch box ideas	50	Lunch	50	Nutrition information	50	Children lunch	12	Tuck shop	9
Healthy lunch box	10			Healthy eating	50			Snacks	50

Screening

We conducted website and app selection in two stages: (1) screening of title and description, and (2) review of full digital platform. Website names and descriptions were screened against inclusion and exclusion criteria (Appendix 1). Eligible website details were entered into a Microsoft Excel spreadsheet and duplicates removed before full screening against review criteria within the website. Similarly, apps were first screened by app name and description against the inclusion criteria (Appendix 1) within the Apple Store, and then reviewed in full following purchase/download. In the case of 'freemium' apps (i.e. available for free but with additional features that can be accessed only after payment), we purchased the paid version, except where subscription was required. Apps that included a subscription upgrade were downloaded and assessed in the 'freemium' state. At each stage, 10% of the search results were selected randomly using a random number generator within Microsoft Excel and were checked by a second reviewer for correct screening.

Data extraction

We used included apps and websites for at least 10 minutes before extracting data. Data were extracted into a purpose-designed Microsoft Excel spreadsheet. Key information was extracted as per summary tables in Appendix 1, including name of platform, developer/author, affiliation, year, purpose, target audience, key messages and features, functionality and technical features, social features (e.g. community forums, links to other social media platforms), personalisation, user feedback, marketing/engagement (promotions, social media following, partnerships) and collection of personal information. We also assessed the credibility of the information based on reference to dietary guidelines and involvement of credentialed experts in the development of the information. Data extraction and assessment was checked and assessed independently by a second reviewer for all included websites and apps.

Quality assessment of websites and apps

App quality was assessed using the Mobile App Rating Scale (MARS).¹⁶ The MARS tool assesses four domains of the app: engagement, functionality, aesthetics and information. Apps were rated between one and five for each criterion, with five indicating the best performing apps. Website quality was assessed using an adapted version of the MARS. Websites were rated between one and five for each criterion, with five indicating the best performing websites. Two reviewers independently conducted quality assessment and checked for discrepancies.

Summary of included websites and apps

Of the 2000 websites and 769 apps screened, 15 websites (0.75%) and six apps (0.78%) met the review criteria (Appendix 1). Of the 15 websites (three international), five were dedicated lunch box websites, while 10 were websites that included a dedicated lunch box section. Four of the six apps focused on lunch boxes

and/or other meals for children, while the remaining apps included a lunch box app targeting adults, and a family meal planning app. All six apps were developed outside of Australia.

Peer review literature (Questions 2–4)

We undertook two systematic searches to answer Questions 2 and 3, described separately below.

Question 2: How do users wish to engage with health promotion tools delivered by websites and apps?

To answer Question 2, we used a systematic review approach to identify peer-reviewed studies that conducted user testing of apps and/or websites with parents to improve children’s nutrition, or with user groups that were translatable to parents. Of most interest was how users wished to engage with websites and apps, what functionality they desired, and what marketing strategies increased access to the target audience.

Search strategy

We searched Medline (Ovid capturing PubMed), Emcare (Ovid), PsycINFO (Ovid), Scopus and ProQuest databases from January 2008 to October 2018 to capture sufficient literature to retain the focus of user testing with parents. The search strategy was designed and tested in Medline and then translated to and executed in all other databases. To ensure all relevant studies were retrieved, we conducted manual searches of the reference lists of included studies and relevant reviews.

The search strategy combined key search terms with database-specific subject headings where available for the population (parent, family, child), intervention (health promotion — nutrition, obesity, physical activity — delivered via digital platforms) and outcomes (user testing, marketing) as shown in Table 2.1. Search results were combined, and duplicates removed in Endnote, before being uploaded into the Covidence web-based platform for systematic reviews.

Table 3: Search terms according to the PICO format

Population	Child, parent, family
Intervention	Nutrition, lunch, healthy eating, obesity, physical activity, healthy lifestyle AND Digital, mhealth, app, mobile phone, smartphone, website, ehealth, online
Outcome	User testing, usability, functionality, acceptability, feasibility, satisfaction, pilot testing, evaluation, appeal, engagement, marketing, access

Study screening

Studies were initially (1) title and abstract screened, then (2) full-text screened by two independent reviewers against agreed inclusion and exclusion criteria, as below (and in more detail in Appendix 2), with discrepancies resolved using a third reviewer:

- *Participants:* Parents of school-age children, families or translatable user groups (e.g. parents of younger children and infants, women responsible for food provision in the home, parent-targeted interventions delivered via schools or healthcare settings)
- *Nutrition promotion via a digital platform:* Testing of website or app platforms, including email and social media if provided in combination with a website/app. Studies evaluating preferences for digital delivery of health information in general were included if they spanned nutrition-related topics

- *User testing and/or marketing*: Qualitative or quantitative data on users' views and opinions of health promotion via digital platforms, including desired functions, features, content, technology, appeal and usability. Marketing outcomes included recruitment strategies to reach the relevant audience (parents), as well as how parents accessed health information on digital platforms.

Studies were excluded if they were conducted in populations with health conditions (e.g. cystic fibrosis, heart disease, diabetes), in populations not transferable to parents (e.g. older adults) and if user testing was conducted with children rather than parents.

Data extraction

Data were extracted by one reviewer and checked for completeness by a second reviewer onto standardised data extraction tables agreed with the commissioning agency. Quantitative data were reported as mean scores or percentages, with effect sizes and p-values reported where possible. Qualitative data were reported as grouped themes/findings, as described by study authors. Results of studies are reported in detail in Appendix 2 and summarised in Tables 7 and 8 in the results chapter.

Evidence grading

The quality of each included study was rated according to the National Health and Medical Research Council (NHMRC) Evidence Hierarchy grading system, and the evidence was summarised overall according to the NHMRC evidence matrix as outlined below:

- I A systematic review of Level II studies
- II A randomised controlled trial
- III-1 A pseudo-randomised controlled trial (i.e. alternate allocation or some other method)
- III-2 A comparative study with concurrent controls (i.e. non-randomised experimental trials, cohort studies, case-control studies, interrupted time series studies with a control group)
- III-3 A comparative study without concurrent controls (i.e. historical control study, two or more single-arm studies, interrupted time series studies without a parallel control group)
- IV Case series with either post-test or pre-test/post-test outcomes

Included studies

A flow chart of the literature selection process is included as Appendix 2. Thirty studies met the inclusion criteria for Question 2, of which 22 measured user-testing outcomes and 16 measured outcomes that could inform marketing strategies to increase access to the target audience. Seventeen studies were conducted in the US, 10 were from Australia, two from Canada and one from Switzerland. Twenty-two of the studies were published in the past five years. For Question 2, the overall level of the evidence according to the NHMRC evidence grade was poor, as is described in more detail in the results.

Question 3: How effective are websites and apps as health promotion tools?

To answer Question 3, we used a systematic review approach to identify peer-reviewed studies that evaluated the effectiveness of websites and apps as health promotion tools for changing health behaviours. The primary focus was to determine the efficacy of digital platforms for health promotion targeting parents to improve child nutrition.

Search strategy

We searched Medline (Ovid incorporating PubMed), Emcare (Ovid), PsycINFO (Ovid), Scopus and ProQuest databases from January 2013 to October 2018 and limited to studies published in English. The search strategy was designed and tested in Medline and then transferred and executed in all other databases.

The search strategy combined variations of key search terms with database-specific subject headings (where available), as shown in Table 4 below. To capture studies that evaluated a broad definition of effectiveness, including behaviour change, knowledge, self-efficacy and attitudes, as well as reach, visitation and awareness, we used broad outcome search terms. To capture all relevant studies conducted with children, parents and adults, the search terms for population were removed from the final search strategy. Search results were combined, and duplicates removed in Endnote, before uploading search results into the Covidence web-based platform for systematic reviews to conduct screening.

Table 4: Search terms according to the PICO format

Population	Child, parent, family
Intervention	Digital, mhealth, app, mobile phone, smartphone, website, ehealth, online
Outcome	Nutrition, lunch, healthy eating, obesity, physical activity, healthy lifestyle, knowledge, attitudes, self-efficacy

Study screening

Studies were initially (1) title and abstract screened, then (2) full-text screened by two independent reviewers against agreed inclusion and exclusion criteria as below (and outlined in more detail in Appendix 3), with discrepancies resolved using a third reviewer:

- *Participants:* Parents or families. Studies were included if the digital intervention was family/parent focused, but outcomes of interest (i.e. food intake) were measured in children. Studies were excluded if the intervention was directed only at children.
- *Health promotion via a digital platform:* Studies evaluating a nutrition or related lifestyle intervention delivered via a website or app, including email and social media interventions if provided in combination with a website/app. Where the intervention had multiple components, studies were included if the digital intervention comprised more than 50% of the entire intervention
- *Effectiveness of digital intervention:* Studies were included if they measured effectiveness in terms of (1) the exposure, reach, visitation, engagement or awareness of the digital platform; or (2) the knowledge, attitudes, self-efficacy or health behaviours of participants.

Studies were excluded if they were published outside of the countries of interest, in populations with health conditions (e.g. cystic fibrosis, heart disease, diabetes) and in populations not transferable to parents (e.g. older adults). To ensure we retrieved all relevant studies, we conducted manual searches of relevant reviews. Additionally, two studies were identified within the search that evaluated large-scale health promotion campaigns in adult populations, which fell outside of the inclusion criteria but were deemed to be of high relevance to CCNSW and were therefore included.

Data extraction

Data were extracted onto standardised data extraction tables by one reviewer and checked for completeness by a second reviewer. Quantitative data were reported as mean scores or percentages, with effect sizes and p-values reported where available. Results of studies are reported in full in Appendix 3 and summarised in Tables 9 and 10 in the results.

Included studies

A flow chart of the literature selection process is included as Appendix 3. Twenty-one studies met the inclusion criteria for Question 3, reporting on 18 different digital interventions. Included studies were

categorised according to whether they measured effectiveness of digital platforms for (1) participant-related outcomes such as behaviour change, weight, knowledge, self-efficacy and attitudes, or (2) platform-related outcomes such as reach, visitation, engagement and awareness. Of the included studies, 15 measured participant-related effectiveness and 10 measured platform-related outcomes. Most studies were conducted in the US (n = 13), three were from Australia, two from Sweden and one each from Canada, Switzerland and Belgium. Ten studies evaluated website interventions, four evaluated an app and three evaluated an intervention that included both a website and an app. The overall level of the evidence was NHMRC evidence grade satisfactory to good, as presented in more detail in the results below.

Question 4: What indicators are used to measure the effectiveness, reach and impact of a health promotion website or app?

Studies looking at the effectiveness of health promotion websites and apps reviewed for Question 3 were examined, and those with stronger evaluation plans across the domains of reach, impact and effectiveness were used to answer Question 4. Nine studies (reporting on seven health promotion websites or apps) had comprehensive measures of effectiveness, reach and impact. They had measures across common domains important for digital health intervention that were consistent with emerging best practice guidance on public health research translation and evaluation. These nine studies were used to answer Question 4.

Findings

Question 1: What websites and apps are in use as health promotion tools for nutrition education with a focus on parents?

Website findings

Most websites were developed by, or in partnership with, a government department (national n = 1, state n = 7 and local n = 2) or NGO (Cancer Council NSW, Healthy Kids Association, WA School Canteen Association, Nutrition Australia). All but one website targeted parents, with some also targeting children (n = 3) or reaching parents indirectly by targeting school policy and curriculum (n = 6). Websites are summarised in Table 5 (see Appendix 1, Table A1.4 for a detailed description). The CCNSW *Healthy Lunch Box* website is used as a reference benchmark in comparisons below.

Key messages and credibility

Key messages promoted the inclusion of all five core food groups in the lunch box (n = 10), with a focus on fruit, vegetables and water, and limiting discretionary foods. Although there was often no explicit evidence of health professional input into website content development (n = 10), all 12 Australian websites contained information that was consistent with the Australian dietary guidelines.

Website features and functions

Most websites provided information about how to pack a lunch box, with three websites providing this information via interactive features such as a lunch box builder. Ten websites provided written information regarding how and what to pack in a lunch box on the web page, or as a downloadable resource or link. In at least three cases, the resource provided similar but less detailed information to an interactive lunch box builder (e.g. the ABCD of lunches, Core 4 + 1 for active kids). Other information (text, downloadable resources and links) was relatively homogenous, consisting of recipes, lunch box tips and ideas, and/or nutrition information. Five websites (three international) included information, resources or a program relevant to supporting healthy lunches in schools, whether through the canteen menu and/or policy, or via the curriculum.

The main type of interactive feature was a lunch box builder, which was included in three websites, including the *Healthy Lunch Box* CCNSW website. The purpose of each lunch box builder was slightly different. The *Go for your life: Weigh up your lunch* builder provided feedback to children and adults regarding the healthfulness of lunch box choices. In comparison, the *Healthy Lunch Box* CCNSW lunch box builder provided more practical and visual educational information regarding how to pack a healthy lunch box. The *Make Healthy Normal: Healthy School Lunch Box* builder was more basic, providing neither feedback, nor recipes or practical lunch box ideas. Three websites included a game and/or quiz that was targeted at children not parents; however, the *Weigh Up Your Lunch* game could be completed by children with assistance from parents or parents on their own.

Table 5: Summary of features and MARS rating of websites included in Question 1

	Country	Features									Mobile App Rating Scale (0–5)					
		Interactive LB builder	Personalisation ^a	LB recipes/ ideas	Nutrition info (LB or general)	Games and/or quizzes	Video/ audio content	Social/ community ^b	Links to further info	School/ canteen relevant info	Engagement	Functionality	Aesthetics	Information quality	Overall score	
Lunch box-focused websites																
Healthy Lunch Box CCNSW	AUS	✓		✓	✓			✓	✓			3.8	4.7	4.0	4.2	4.2
Go For Your Life – Weigh up your lunch	AUS	✓			✓	✓			✓			4.5	3.7	4.3	3.3	4.0
Healthier Lunches for Children	UK				✓	✓		✓	✓	✓		3.0	4.0	2.3	3.8	3.3
The Zero Waste and Healthy Lunchbox	CAN				✓		✓			✓		2.8	4.0	3.3	3.0	3.3
Healthy Lunch Box	NA			✓	✓	✓		✓		✓		2.3	2.7	3.0	1.3	2.3
Lunch box-focused pages within other websites																
Make Healthy Normal: Healthy School Lunch Box	AUS	✓	✓						✓			4.0	4.0	4.0	3.2	3.8
Healthy Kids Association: Packing a healthy lunchbox	AUS			✓	✓			✓	✓			3.3	4.0	4.0	3.7	3.7
Nutrition Australia: Healthy Lunchbox Week	AUS			✓	✓			✓	✓			3.5	3.7	3.3	4.0	3.6
Healthy Kids NSW: Lunch Box Ideas	AUS			✓	✓				✓			3.0	3.7	3.7	3.7	3.5

	Country	Features									Mobile App Rating Scale (0–5)				
		Interactive LB builder	Personalisation ^a	LB recipes/ ideas	Nutrition info (LB or general)	Games and/or quizzes	Video/ audio content	Social/ community ^b	Links to further info	School/ canteen relevant info	Engagement	Functionality	Aesthetics	Information quality	Overall score
Nestle Healthy Active Kids: What Makes a Balanced Lunchbox?	AUS			✓	✓				✓	✓	3.5	3.7	3.7	3.3	3.5
Healthy Eating Advisory Service: Healthy lunchboxes	AUS			✓	✓			✓	✓		3.0	4.0	3.0	3.7	3.4
Qld Education: A healthy start to school tool kit	AUS			✓	✓			✓	✓	✓	2.3	4.0	3.0	3.8	3.3
WA School Canteens: Packing healthy lunch boxes	AUS			✓	✓			✓	✓	✓	2.3	4.0	2.7	3.5	3.1
TAS Health: Healthy Kids — lunchboxes	AUS			✓	✓			✓	✓		3.0	2.3	3.3	3.7	3.1
SA Health: Healthy lunchboxes	AUS			✓	✓			✓	✓		2.5	3.7	2.3	3.6	3.0

¹ The ability to modify or limit content / recipes / foods according to personal preferences; ^b Includes linked social media pages, and subscriptions / sign-up for further contact
2 AUS = Australia; CAN = Canada; US = United States of America; NA = North America; UK = United Kingdom; V = Vietnam

Collection of personal information

Access to all website content was free and did not require membership or a login. Four websites did include other sections accessible by login only. In three websites, login sections were for professionals (i.e. schools, canteen managers, health professionals) and in one website (*Nutrition Australia*) membership was available for both professionals and the general public. Most websites (11 out of 15) were able to collect contact information through subscriptions to newsletters or through a contact/feedback form. Generally, only an email address (n = 3) or name and email (n = 4) were collected; however, four required further details such as phone number, organisation and/or location.

Marketing and promotion

Websites were not generally promoted on social media, but 11 of the websites were cross-promoted on other websites. Eight of the websites had a social media page of some sort (i.e. Facebook, Instagram, Twitter, YouTube) although they tended to be generic to the government department or NGO that developed the website. Only two websites offered sign-up to a newsletter or mailing list.

App findings

App results are summarised in Table 6 below and a detailed summary table is provided in Appendix 1, Table A1.5. Of six included apps, only one was developed by a government body (*Change4Life Smart Recipes*, British National Health Service). Four apps were free, although two included optional freemium upgrades, while two required purchasing. Parents were the primary target group, except in the *LaLa Lunch Box / Breakfast* apps, which were designed to be used by children with parental support.

Key messages and credibility

Key messages focused on the inclusion of core foods in the lunch box, in particular fruit and vegetables, and preparation of food at home. The *Change4Life Smart Recipes* app was the only one that contained some brief written information about limiting sugar, fat and salt. One app provided explicit evidence of engagement with a credentialed dietitian (*Get Prepd*), while the *Change4Life Smart Recipes* app was developed by Public Health England (presumably with health professional input), and therefore contained messages consistent with British healthy eating guidelines. The remaining two apps that provided some level of nutrition information were not consistent with Australian dietary guidelines or school policies (e.g. nut-free policies).

App features and functions

The most common information contained in apps were lunch box recipes and ideas (n = 5). Four apps provided a small amount of nutrition information. Only one, developed by the British Government, contained substantial and credible nutrition information (including general healthy eating information and recipe nutritional composition). However, the app was broad in focus (i.e. not targeted towards lunch boxes), text heavy, and executed relatively poorly in terms of aesthetics or visual appeal. The remaining apps provided basic text-based nutrition information (n = 2) and recipe nutritional composition (n = 1).

Three apps included more interactive features, such as collaborative lunch box / meal builders (*LaLa Lunchbox / Breakfast*, *The Ultimate Mix-and-Match School Lunchbox*), which encouraged both child and parent involvement in food choices. However, food options were too simple and they lacked recipes or nutrition information. Although personalisation features, that is the ability to modify or limit content according to personal or dietary preferences, were included in all six apps, the extent to which the apps could be personalised was generally minimal. The *LaLa Lunchbox / Breakfast* apps provided the most personalisation, with the ability to create lunch boxes for each child in the family, and parental control over the lunch box items available (selected from a list or entered manually by the parent). Push notifications were used in four of the six apps, and generally provided a reminder to plan lunches or purchase groceries.

Table 6: Summary of features and MARS rating of apps included in Question 1

	Country	Features									Mobile App Rating Scale (0–5)				
		Interactive LB builder	Personalisation ^a	LB recipes/ ideas	Nutrition info (LB or general)	Games and/or quiz	Video/ audio content	Social/ community ^b	Links to further info	School/ canteen relevant info	Engagement	Functionality	Aesthetics	Information quality	Overall score
Lunch box / nutrition apps — children															
The Ultimate Mix-and-Match School Lunchbox	US	✓	✓	✓	✓			✓			3.2	3.8	3.3	3.2	3.4
LaLa Lunchbox	US	✓	✓	✓				✓			3.4	3.8	3.0	3.0	3.3
LaLa Breakfast ^c	US	✓ ^c	✓					✓			3.4	3.8	3.0	3.0	3.3
Kids Food	V		✓	✓	✓						2.4	3.8	2.3	2.8	2.8
Lunch box apps — adults															
Get Prepd	US		✓	✓	✓			✓			2.8	3.8	4.3	3.7	3.6
Family meal planning apps with lunch-relevant content															
Change4Life Smart Recipes	UK		✓	✓	✓		✓	✓			3.0	3.5	2.7	4.0	3.3

^a The ability to modify or limit content / recipes / foods according to personal preferences; ^b Includes linked social media pages, and subscriptions / sign-up for further contact; ^c breakfast-focused version of LaLa Lunchbox;

AUS = Australia; US = United States of America; NA = North America; UK = United Kingdom; V = Vietnam

Collection of personal information

None of the apps required a login, an account or the provision of personal information in order to use them, although in three apps, creating an account or logging in via social media added to functionality of the app (e.g. by allowing syncing between devices).

Marketing and promotion

All but one app had a website where the app and various other products were promoted, while four of the six apps had active social media pages (incl. Facebook, Twitter, Instagram, YouTube and Pinterest). The *Ultimate Mix-and-Match School Lunchbox* app was cross-promoted with a book, the *LaLa Lunchbox / Breakfast* apps were promoted on other social media pages and the *Change4Life* app had promotions with current films and actors.

Website and app quality

According to the adapted MARS, the average overall quality rating of websites was 3.4 (out of 5). For websites, functionality — measuring how well the website worked and how easy it was to use — was the highest scoring (mean rating 3.7) domain, while engagement — measuring how entertaining, interesting, customisable, interactive and targeted the website was, was the lowest scoring (mean rating 3.1) domain. Apps had a similar average overall quality rating compared with websites (mean 3.3 out of 5). Functionality again was the highest scoring domain at 3.8, and engagement the lowest scoring at 3.0. Apps generally had few, if any, reviews in the Apple App Store (between one and three reviews for four of the six apps). *LaLa Lunchbox*, *LaLa Breakfast* and *Get Prepd* had star ratings of mostly 5, whereas *The Ultimate Mix-and-Match School Lunchbox* had an average star rating of 1.7.

Search optimisation

The search term combination 'lunch box AND ideas OR tips OR healthy OR school' found 11 of the 15 included websites (including the *Healthy Lunch Box* CCNSW website). One website was identified only when 'lunch box AND planner OR planning tool' was used, while three further websites were identified using advanced search options and looking specifically for government or non-government organisation (NGO) pages. Review of Google Trends demonstrated that the search terms 'lunch box' and 'lunch ideas' were most used in Australian searches, while 'lunchbox', 'school lunch' and 'healthy lunch' were less used.

Unsurprisingly, there is a peak in the popularity of all these search terms in the lead-up to the beginning of the school year. In the Apple App Store, 'lunch box', 'lunchbox', 'healthy lunch box' and 'family meals' were the terms most likely to identify the relevant apps. Five apps were in the 'food and drink' category and one in the 'lifestyle' category of the App Store.

Comparison of findings for websites and apps

Most included websites were developed by government departments or NGOs without commercial interests, whereas five of the six apps were developed by a commercial organisation. Accordingly, credibility of information was higher for websites, whereas there was more marketing and social media promotion for included apps compared with websites. Digital platforms either provided extensive information or were interactive, rather than effectively combining both elements. The interactive nature of apps meant that personalisation and the provision of 'in time' reminders was commonplace compared with websites, which tended to be relatively passive in their provision of information. Although the interactive lunch box builders included in three of the websites improved their overall engagement, they lacked the personalisation features (e.g. tailoring menu items, producing shopping lists) that was possible in apps. Unique to apps was the targeting of children while allowing parental control over menu content.

Table 7: Summary of user-testing and marketing outcomes measured by included studies

Study	Country	Tool	Design	User-testing outcomes						Marketing outcomes				
				Delivery mode	Features	Content	Technology	Usability	Barriers	Online info seeking	Access to internet	Social media preference	Digital platform use	Recruitment
Biediger-Friedman 2018 ¹⁷	US	A	FG, Q	✓	✓	✓	✓						✓	
James 2018 ¹⁸	US	A	Q								✓		✓	✓
Laws 2018 ¹⁹	US	WA	Q	✓		✓	✓							
Luesse 2018 ²⁰	US	W	FG	✓		✓	✓							
Reynolds 2018 ²¹	AUS	A	Q	✓	✓									
Breitenstein 2017 ²²	US	A	Q	✓	✓				✓			✓		✓
Byrd-Bredbenner 2017 ²³	US	W	FG, Q											✓
Da Costa 2017 ²⁴	CAN	W	Q		✓	✓			✓		✓			
Hull 2017 ²⁵	US	A	Q		✓		✓	✓						
Mackert 2017 ²⁶	US	A	BL/P IV, Q, ST	✓	✓	✓		✓			✓			
Rekhy 2017 ²⁷	AUS	W	Q			✓		✓						
Wyse 2017 ²⁸	AUS	W	Q											✓
Avis 2016 ²⁹	CAN	A	FG	✓	✓	✓		✓						
Biediger-Friedman 2016 ³⁰	US	A	FG		✓		✓				✓		✓	
Laws 2016 ³¹	AUS	WA	Q											✓
Breitenstein 2015 ³²	US	A	AG	✓	✓			✓						
Burrows 2015 ³³	AUS	WA	Q	✓	✓	✓	✓	✓						

Study	Country	Tool	Design	User-testing outcomes						Marketing outcomes				
				Delivery mode	Features	Content	Technology	Usability	Barriers	Online info seeking	Access to internet	Social media preference	Digital platform use	Recruitment
Denney-Wilson 2015 ³⁴	AUS	WA	FG			✓	✓							
Rangelov 2015 ³⁵	SWI	W	FG, Q	✓	✓									
Ball 2014 ³⁶	AUS	A	Q	✓	✓	✓							✓	
Bensley 2014 ³⁷	US	NS	Q	✓	✓		✓			✓			✓	
Swindle 2014 ³⁸	US	FB	Q							✓			✓	
Walker 2012 ³⁹	US	W	Q								✓		✓	
Baghaei 2011 ⁴⁰	US	W	BL/P Q		✓									
Jones 2011 ⁴¹	AUS	W	P Q		✓	✓								
Wen 2011 ⁴²	AUS	W	Q							✓				
Atkinson 2009 ⁴³	US	W	FG, IV		✓	✓		✓					✓	
Jones 2009 ⁴⁴	AUS	W	FG	✓	✓	✓		✓						
Mackert 2009 ⁴⁵	US	W	FG		✓	✓	✓			✓				
Cullen 2008 ⁴⁶	US	W	Q								✓		✓	
			TOTAL	13	18	14	9	10	1	8	3	1	10	2

A= app; NS = nil specified; W = website; WA = website & app.

AUS = Australia; CAN = Canada; SWI = Switzerland; US = United States of America.

AG = advisory groups; BL = baseline; FB = Facebook; FG = focus group; IV = interview; P = post intervention; Q = questionnaire; ST = screen tracking.

Question 2: How do users wish to engage with health promotion tools delivered by websites and apps?

Tables 7 and 8 provides a summary of results for included studies. Tables reporting detailed study characteristics and outcomes are provided in Appendix 2.

Results of studies evaluating user testing

Included studies evaluating user testing with adults were conducted in the US (n = 11), Australia (n = 8), Canada (n = 2) and Switzerland (n = 1). Of these, 11 studies evaluated websites, eight evaluated apps and three evaluated both platforms. One further study evaluated a range of digital health platforms. Most studies measuring user testing employed a qualitative design, via focus groups or interviews. Results were consistent across apps and websites; therefore, findings have been combined for both digital platforms.

Preferred mode of intervention delivery

The preferred mode of delivery of health interventions via digital platforms was evaluated in 13 studies. Overall, websites and apps were both found to be acceptable modes of delivery^{17, 19, 20, 26, 35, 36} and one study found an online education program was preferred over a face-to-face program.⁴⁴ Most participants reported that they owned smartphones, used them almost daily, felt comfortable using smartphones and tablets (e.g. iPads), and liked the portability of apps as they could be used when they were shopping.^{17, 26, 36} One Australian study testing an intervention delivered via an app and website showed more participants accessed the intervention via the app (86.4%) than the website (13.6%).¹⁹ However, another Australian study informing the development of an e-health lifestyle intervention for families found both websites and apps were suitable modes of delivery.³³ Two Australian studies evaluated the use of school canteen ordering websites and apps, finding they were an acceptable platform for delivery of nutrition information to parents²¹ but that barriers were parent internet access and set-up time for the school.²⁸

Preferred features and functionality

Preferred features and functions of health promotion via digital platforms were evaluated in 18 studies (Table 8). Overall, participants wanted digital health platforms to include both informative and themed content and interactive features^{26, 32, 43}, as well as sections that were relevant for and could involve the whole family (parents and children).^{17, 33, 43, 44} Practical information was preferred, such as shopping lists, budgeting, meal planning resources and recipes.^{25, 30, 35, 36, 43} Other types of practical tools were also favoured, for instance as barcode scanners.^{25, 37} Several types of interactive features were preferred including games, quizzes, monitored goal setting with feedback³³ and diet and physical activity trackers.^{17, 30} In addition, features that enabled connection and/or interaction with other users were also favoured across several studies. This included features that enabled interaction (via questions or video chat) with health professionals to ask questions and obtain advice²⁴, discussion forums and connecting with other members via social media pages.^{17, 30, 33, 35, 37, 44}

Preferred content

Aspects related to preferred content of digital health promotion platforms were evaluated in 14 studies (Table 8). Most prominently, participants noted that they wanted information to be tailored, personalised and relevant to them, for example for specific age groups, genders or income groups.^{20, 24, 26, 33} Across several studies, it was noted that information should be credible, evidence-based and from a trusted source such as a relevant health professional (e.g. dietitian) or endorsed by a university or government organisation.^{17, 26, 33, 41, 44} Consistent with preferred features, two studies found users wanted practical information to improve behaviours (i.e. 'how to' guidance)^{35, 44}, and two further studies found users wanted positive and affirming content.^{29, 34} Conversely, a study that evaluated digital interventions more focused on obesity (rather than behaviour change), found users did not want content solely focused on weight, and terminology related to weight management elicited negative reactions.²⁹

Table 8: Summary of the user-preferred content, features and technology of digital platforms from studies included in Question 2

	Number of studies
Target / content	
Tailored/personalised content (incl. for age, gender, low income)	9
Trusted/evidence-based content and source of information (e.g. health professional such as a dietitian, endorsed by a university or government organisation)	8
Information on multiple health behaviours (e.g. diet, physical activity, sedentary, BMI)	3
Specific and relevant ('themed'), rather than general (disliked general/vague)	3
Positive/affirming content, rather than negative content (e.g. disliked terminology and child obesity and weight management) that elicited negative reactions	2
Practical ways to improve behaviours ('how to' guidance)	2
Budget-friendly information	2
Regularly updated content	1
Content that can initiate conversation with paediatrician	1
Not solely focused on weight	1
Features	
Features relevant for/to involve the whole family (e.g. games, area or activities for children, cooking with children, sections for parents)	9
Ability to post questions to health professionals (e.g. via a live chat interface, contact box, video chat) or regular contact with health professionals	8
Ability to connect/interact with other users including via a discussion forum, social media, Facebook chat	7
Practical shopping tools: shopping lists, barcode scanners, produce calculators	6
Recipes (budget-friendly, child-friendly, quick, healthy, linked to seasonal produce)	5
Trackers for diet, exercise (incl. tracking progress and awards for completion)	5
Engaging content (videos, games, quizzes) / interactive components / game-type functions	4
Achievable and monitored goal setting with feedback (via app or website)	4
Informative content (e.g. facts, health benefits, serve sizes, nutritional information)	4
Practical information (e.g. food budgeting, tips to buy/eat more FV, ideas for healthy snacks, meal planning)	3
Videos (e.g. online cooking demonstrations)	3
Resources related to local area (e.g. stores, farmers markets, message board for events)	3
Customisable home page and personal user accounts	2
Technology / other	
Reminders/notifications/messages, including via email or SMS (*but not too many; mixed responses, were disliked by some)	8*
Nil cost	2
Search function	2
Offline access to recipes	1

Preferred technology/other

Fewer studies (n = 9) evaluated user preferences in relation to the technology of digital platforms. Use of push notification, reminders or messaging (via text message or email mailing list) was evaluated, with mixed findings. Most users wanted to receive notifications, reminders or messages^{17, 19}, but it was noted that these should not be too frequent, with no consistency about what frequency was acceptable.³⁴ However, a small number of studies found the participants disliked notifications/emails and disabled push notifications on their apps.^{19, 25} A small number of studies also found users wanted a search function and offline access to recipes.^{26, 30}

Usability and appeal

Ten studies evaluating usability and appeal found a common theme that participants wanted digital platforms to be engaging, useful and easy to use.^{25, 36, 44} Two studies found participants wanted platforms to be low-cost or free^{24, 33} and users in one study noted the images should reflect cultural diversity.²⁹

Results of studies evaluating marketing

Sixteen papers were included (Table 7), measuring four aspects of recruitment and digital platform use that can inform the development of marketing strategies to increase access to the target audience (parents). Of these studies, three were Australian and the remainder were conducted in the US (n = 12) and Canada (n = 1). Participants in the included studies were parents, expectant parents or families, except in two studies where participants were women who were responsible for the household food shopping.^{18, 36}

Recruitment strategies

Two studies, one of which was conducted in Australia, evaluated strategies for recruiting the target audience to the intervention.^{23, 31} Both studies used Facebook as a recruitment technique, alongside other approaches such as advertisements on forums, websites, distribution of information via health practitioners and day care centres, displaying posters, email distribution and handing out flyers.^{23, 31} In both studies Facebook was responsible for 50% of the hits to the website and was the lowest cost recruitment approach.^{23, 31} However, while using social media and online recruiting techniques resulted in wider reach, they provided fewer eligible participants, meaning using these techniques was not reaching the target audience of interest.²³ Byrd-Bredbenner found they recruited most participants by word of mouth from friends, family and co-workers, followed by day care centres, email notices and website postings.²³

Digital platform use

Overall, there was high use of the internet and apps across all studies, and participants felt confident using the internet and apps on smartphones.^{22, 39, 43} Perceived skill in connecting to the internet (79.2%) and confidence logging into websites (84.6%) were high and 68.5% reported finding what they searched for.³⁹ Smartphones were used daily, most commonly to text, email, access social media, play games and watch videos.^{17, 18, 39} In one US study, 85% of participants accessed the internet daily via smartphones.¹⁸ Likewise, an older study found 84% of participants had access at home to a computer with the internet and those who did not accessed the internet at libraries, friends or family's homes, work, school or elsewhere.³⁹

Facebook continues to be the most popular social media app (used by 85% of participants), with nearly all respondents accessing it daily.^{17, 18} Other frequently used apps were YouTube (75% of participants), Google+ (57%), Instagram (44%), Skype/Facetime (36%), Twitter (30%) and Pinterest (30%).¹⁸ Participants aged 18–29 years were more likely to use YouTube and Instagram, and those aged 30–50 years were more likely to use Instagram and Facebook than those aged 51 and older.¹⁸ We identified only one Australian study that evaluated shopping/cooking apps on the market, finding that more than 50% of women reported previously using mobile apps and about one-third reported using apps for budgeting, shopping and cooking.³⁶

Two studies that evaluated the willingness of participants to use digital platforms to access health interventions found mixed results. A 2012 study found only 35.9% of participants expressed 'a lot' of interest in an internet-based weight loss program and were only marginally more interested in receiving parenting advice from the internet (44.8%) than by mail (38.6%).³⁹ James¹⁸ found those aged 18–50 years were more likely to report willingness to use smartphone apps than those aged 51-plus, and that 73% were willing to participate in mHealth research via text messages, 69% via smart watches or fitness trackers, 68% via smartphone app, 49% via website and 33% via online counselling.¹⁸

Access to health information online

Seven studies measured how participants searched for health information online^{18, 24, 26, 30, 37, 38, 45}, including one Australian study.⁴² Australian research from 2011 found only 63% of participants used the internet to access health information, with low-income participants 1.7 times less likely to access health information online.⁴² However, more recent studies conducted in the US found nearly all participants had used electronic devices to access online health information, with Google and WebMD the most commonly searched platforms.^{24, 26} Nutrition and dieting were the most commonly searched health topics on the internet, followed by general health, medication, mental health, diabetes, heart disease and cancer.¹⁸ Of those with smartphones, 31% reported using apps for parent- and health-related information³⁷, with the most common apps used to improve health behaviours being those where you access information, track behaviours, plan/schedule and share content.³⁰

Question 3: How effective are websites and apps as health promotion tools?

Table 9 below provides a summary of findings for included studies. Tables reporting detailed study characteristics and outcomes are provided in Appendix 3.

Effectiveness of studies for improving participant-related outcomes

Overall, digital interventions targeting parents or families achieved significant improvements in parents' and children's dietary intake, nutrition knowledge and self-efficacy, with improvements equal to or slightly better than comparison groups (Table 9). This indicates that the efficacy of digital interventions is similar to face-to-face interventions for these outcomes. In contrast, the results were less conclusive for the efficacy of digital interventions for improving weight, physical activity and sedentary behaviour-related outcomes. Four studies evaluated outcomes related to weight and BMI^{19, 47-49}, with only one study finding a significant effect on reducing BMI, in high users of the intervention only.⁴⁷ Findings were mixed for the effects of digital interventions on increasing physical activity and reducing sedentary behaviour, with studies finding no effect or similar improvements in both comparison and digital interventions.⁴⁷⁻⁵³

Fourteen of the included studies were randomised controlled trials (n = 10) or quasi-experimental studies (n = 4), with comparison groups that provided an alternative online intervention (n = 3); usual care via face-to-face appointments (n = 2); in-person group education (n = 2); written information about healthy eating (n = 1); waitlist control (n = 1); and no intervention (n = 1). The included studies all targeted parents or families with children ranging in age from infancy to adolescents. All interventions included a number of intervention components with little consistency between interventions in the types of components included. For example, components included information or educational modules, assignments or quizzes, instructional videos, interactive games, goal setting, tips and advice, recipes, newsletters or weekly emails, forums, access to health professionals and personalised feedback.

Dietary intake

Thirteen studies examined the effect of digital interventions on fruit and vegetable intake (n = 4), lollies/sweets (n = 3), drinks (n = 2), salt intake (n = 2), breakfast intake (n = 1) and overall diet quality (n = 1). Findings indicate website and app-based interventions can increase fruit and vegetable consumption⁵¹⁻⁵⁴, improve breakfast-related behaviours⁵⁵ and decrease intake of sugar-sweetened

beverages^{48, 49}, lollies/sweets⁵⁴ and salt.^{56, 57} Improvements in dietary intake were small overall and most studies compared the intervention of interest to another online intervention or did not have a comparison group. One study showed the digital intervention was more effective than a face-to-face group education for improving breakfast behaviours⁵⁵, and another study found the digital intervention was more effective than a pamphlet for improving a health behaviour score that included fruit, vegetable and sugar-sweetened beverage intake.⁴⁹

Knowledge

Five studies evaluated website health interventions measuring knowledge in relation to salt intake^{56, 57}, infant feeding¹⁹, breakfast intake⁵⁵ and health.⁵⁸ Findings in three of the five studies indicated that website interventions significantly improved knowledge.^{19, 55-57} Two of the five studies found similar improvements in knowledge related to salt and breakfast intake in both the website intervention and the comparison groups (in-person education groups), indicating the websites were as effective as face-to-face interventions for improving knowledge.^{55, 56} One further study without a comparison group also found significant improvements in knowledge related to practices for lowering salt intake.⁵⁷ Two studies found no improvement in knowledge related to infant feeding¹⁹ and health.⁵⁸

Self-efficacy

Seven studies examined the effects of a website intervention on improving self-efficacy; of these, five studies targeted parents' self-efficacy^{50-52, 55, 56} and two targeted children's self-efficacy.^{47, 57} All studies achieved significant improvements in self-efficacy, suggesting website interventions were effective for increasing parent and child self-efficacy. Greater improvements in parents' self-efficacy were found in two website interventions compared with the online lifestyle information and waitlist control groups.^{50, 52} Two further studies found similar improvements to in-person comparison groups.^{55, 56} Both studies evaluating children's self-efficacy, which did not have comparison groups, found children's self-efficacy in reducing salt intake, healthy eating and weight management behaviours significantly improved following the website intervention^{47, 57}, with larger improvements in high versus low users of the website.⁴⁷

Attitudes/beliefs

Four studies examined the effect of an intervention on attitudes and beliefs.^{55, 57-59} One study found significantly greater improvements in breakfast-related attitudes following the website intervention when compared with face-to-face group education.⁵⁵ No improvements in attitudes were observed in the remaining studies, with no differences between intervention and control groups.⁵⁷⁻⁵⁹

Table 9: Summary of outcomes for studies included in Question 3

Study	Country	Tool	Design	Participant Outcomes						Website Outcomes				
				Diet	PA	Sedentary	BMI/ weight	Knowledge	Self- efficacy	Attitudes/ beliefs	Reach	Visitation	Engagement	Awareness
Delisle Nyström 2018 ^{1 48}	SWE	A	RCT	0 B	0 B	0 B	0 B							
Delisle Nyström 2017 ^{1 49}	SWE	A	RCT	+/0 I/B	+/0 I/B	+/0 I/B	0 B							
Grimes 2018 ⁵⁷	AUS	W	pre-post	+/-				+	+	0		✓		
Knowlden 2018 ^{2 52}	US	W	RCT	+ I	+ B	+ B				+/- B				
Knowlden 2016 ²⁵¹	US	W	RCT	+ I	0	+ B				+/- B				
Laws 2018 ^{3 19}	AUS	AW	QE				0	0				✓		
Russell 2018 ^{3 59}	AUS	AW	QE	0^						0				
Rangelov 2018 ⁵⁴	SWI	W	RCT	+ I								✓		
Au 2017 ⁵⁶	US	W	RCT	+ B				+ B	+ B					
De Lepeleere 2017 ⁵⁰	BEL	W	QE	0	0	0				+ I				
Au 2016 ⁵⁵	US	W	RCT	+ I				+ B	+ B	+ I				
Schwinn 2014 ⁵³	US	W	RCT	+/- I	+/-									
Wilson 2014 ⁶⁰	US	W	pre-post	+										
Delamater 2013 ⁴⁷	US	W	pre-post	+/-	+		+/-		+			✓	✓	
Jogova 2013 ⁵⁸	CAN	W	pre-post					0		0				
Studies evaluating website outcomes only:														
Ullman 2018 ⁶¹	US	W	CS									✓	✓	
Byrd-Bredbenner 2017 ²³	US	W	RCT									✓	✓	✓
Breitenstein 2017 ²²	US	A	RCT										✓	✓
Hull 2017 ²⁵	US	A	pre-post										✓	✓
James 2013 ⁶²	US	AW	QE									✓		✓
Lohse 2013 ⁶³	US	W/FB	CS									✓		
TOTAL				13	7	5	4	5	7	5	4	8	4	1

1,2,3: studies reporting findings from the same intervention; ^Russell et al evaluated infant feeding practices and intentions to offer foods to infant; abbreviations: A = app; W = website; AW = app & website; FB = Facebook; RCT = randomised controlled trial; pre–post = pre-test post-test; QE = quasi-experimental; CS = cross-sectional; US = United States of America; AUS = Australia; SWI = Switzerland; BEL = Belgium; CAN = Canada; SWE = Sweden; Diet = dietary intake; PA = physical activity; abbreviations to denote results: B = significant change in both groups, no difference between groups; I = significant effect in intervention group; C = significant effect in control group; + = positive effect/increase; - = negative effect/decrease, 0 = no effect; +/0 or +/- = mixed results.

Digital platform evaluation outcomes

Ten studies evaluated the reach, awareness, visitation and/or engagement of digital platforms. Seven were conducted in the US and one each in Australia, Sweden and Switzerland. Of these studies, three evaluated a combination of an app and website, three evaluated an app only, two evaluated a website only and one evaluated Facebook as a marketing strategy for a website.

Reach and awareness

Four studies, all in the US, reported on aspects of reach and awareness (Table 9). Three studies examined the effect of Facebook promotion (paid and unpaid) to drive traffic to the digital platform, showing that, overall, Facebook posts and advertisements reached a large audience but generated only a small number of website visits and program enrolments.^{23, 61, 63} For example, Facebook promotion for an obesity prevention website in the US reached 100,603 potential participants, resulting in 2639 website visits (2.6% of audience) and six enrolments in the program.²³ Similarly, another study found 1.4% of the projected audience visited the website following Facebook promotion.⁶³ Comparison of reach generated from a traditional media campaign versus a social media campaign found 60% of visitors entered the website following the traditional media campaign and 40% from the social media campaign.⁶² This study also evaluated awareness of the campaign, finding 24% of those surveyed in social media campaign communities were aware of the campaign, compared with just 1% in the traditional media campaign communities.⁶²

Visitation

Seven studies reported on visitation to the digital platform (i.e. traffic and repeat visitation). Visitation was higher initially and declined over time, with poor repeat visitation.^{19, 25, 57, 61} The highest attrition was seen after the first visit⁶¹, with those who continued to return for study assessments having a higher number of website logins overall.^{19, 47, 57} For instance, an Australian study found app usage declined from more than 90% using the app at least once at enrolment to only 38% using it at study completion.¹⁹ Two studies conducted in the US evaluated visitation throughout the year, both finding the lowest visitation was in August^{23, 61} and the highest visitation was in January and November.²³

Engagement

Five studies evaluated participant engagement with digital platforms, including via return visitation to the platform. As with visitation, engagement decreased over time.²² Two studies of web-based interventions found participants who were higher users were significantly more likely to track their goals, improve their dietary intake and reduce BMI⁴⁷ and were more likely to progress through the intervention compared with less engaged users.²³ Evaluation of an obesity prevention website for parents of young children found individuals who remained engaged throughout the program were more likely to be female, white and have more weight concerns for their child.²³ Another study found program engagement was higher among older parents.²² On average, participants appeared to engage with the digital platforms about once a week.^{22, 25} The features used most varied across studies. In a smartphone app, participants engaged most with the recipe features, followed by shopping tools.²⁵ In another study, the most time was spent viewing videos; however, this was the only component that participants did not revisit.²²

10,000 steps website evaluation⁶⁴

We identified one study that did not fit within the inclusion criteria, but that was highly relevant. The *10,000 Steps Program* was an Australian website promoting physical activity through a website and app-based step challenge.⁶⁴ Evaluation of the program's reach and visitation showed 35,761 people downloaded the app, of whom one-third used it to log physical activity. Approximately 74% of participants heard about the program through their workplace, followed by a friend, other website, health professional or Facebook page. The program was used for between one and 296 days; however, 50% of participants stopped logging their physical activity after 30 days. App users were found to be younger than website users. Comparison of

attrition rates showed it was higher among those who used the website only compared with those who used the app and both the website and app. Lower attrition was also found among those who engaged with a higher number of challenges, logged more steps and were non-Australian.

Question 4: What indicators are used to measure the effectiveness, reach and impact of a health promotion website or app?

Drawing on the studies reviewed for Question 3, we identified emerging best practice guidance for the evaluation of digital health interventions. While an article by White et al.⁶⁵ did not meet the Question 3 inclusion criteria, this case study is of particular relevance as it describes the development of an evaluation plan for a breastfeeding promotion app against four digital health evaluation frameworks:

- *The Collaborative Adaptive Interactive Technology* framework, published in 2009, aligns traditional formative/process, impact and outcome evaluation with five key areas: users, content, technology, user–technology interaction and health systems integration (maintenance)⁶⁶
- *The Mobile App Rating Scale (MARS)* tool, published in 2015, was designed to measure a range of factors important in mobile apps: aesthetics, engagement, functionality, information and quality¹⁶
- The trial of *Intervention Principles Framework*, published in 2015, was designed to provide an evaluation alternative to traditional (static) RCTs for testing ‘behavioural intervention technologies’ by focusing on evaluating the digital health intervention aims and strategies using an iterative and dynamic approach⁶⁷
- The *WHO mHealth Technical Evidence Review* checklist, published in 2016, includes 16 criteria spanning content, context and technical features.⁶⁸

Separately, the *Developing and Evaluating Digital Interventions to Promote Behaviour Change in Health and Health Care Recommendations* were published in 2017⁶⁹ and highlight areas for consideration, including the rapid pace of technological change, engagement (prioritising effective over sustained engagement, that is engagement sufficient to achieve change), the advantage of real-time objective data, iterative evaluation and the need for health economic evaluation. Finally, there is consistency between the frameworks described above and current best practice guidance for evaluating public health intervention evaluation that also facilitates research translation, dissemination and scale-up (www.re-aim.org).⁷⁰

Table 10 summarises indicators relating to the reach, impact and effectiveness of digital health promotion initiatives and how they are to be measured.

Reach

- Tended to be within the context of reporting metrics of traditional RCTs such as numbers recruited into the study, intervention completion rates and demographic characteristics to describe the representativeness of the sample and wider generalisability.

Impact

- Measure of fidelity operationalised as exposure to the intervention. Indicators included usage, engagement, satisfaction/acceptability
- Measures were collected using platform analytics, operationalised in a number of ways
- Important to have a clear definition of indicators of interest to ensure necessary data is collected and harvested either in real time or offline as part of working with the platform developer (see Breitenstein 2017).²²

Effectiveness

- Indicators aligned to behaviour targeted in the digital health promotion tool. For example, salt behaviours, dietary intake
- Indicators measuring parent nutrition-related knowledge, attitudes and beliefs were also common. For example, motivation, intention and self-efficacy

- Measures were collected in a variety of ways including online surveys, grocery interviews, website polling function
- Examples of short online tools, including tools developed and validated in the Australian sample, were identified.^{19, 56, 57} While these tended to target different health promotion behaviours (e.g. salt intake), the constructs are relevant and could be adapted to target behaviours using a digital lunch box website.

Table 10: Indicators and tools used to measure the reach, impact and effectiveness of selected health promotion websites and apps targeting parents or children

Study	Country	Digital tool	Design	Reach	Impact	Effectiveness	
						Knowledge, attitudes, beliefs	Nutrition
Grimes 2018 ⁵⁷	AUS	W	pre–post	<p>Indicator: Completers. Demographic characteristics</p> <p>Methods: Online survey</p>	<p>Indicator: Content accessed and viewing time</p> <p>Indicator: Child acceptability. Session liking and interest. Recall of content</p> <p>Indicator: Viewing as a predictor of completing the intervention</p> <p>Methods: Digital platform metric data Online evaluation survey</p>	<p>Indicators: Child salt-specific knowledge (20 items); attitudes (2 items); behaviours (4 items); self-efficacy (3 items)</p> <p>Method: Validated 29-item online multiple choice salt survey (available on request)</p>	<p>Indicator: Child salt intake</p> <p>Methods: 24-hour urine sample (and anthropometry)</p>
Knowlden 2016 ⁵¹ , 2018 ⁵² (see also Knowlden 2015 ⁷¹)	US	W	RCT	<p>Indicator: Number screened, enrolled, retained. Demographic characteristics</p> <p>Method: Survey</p>		<p>Indicator: Maternal social cognitive theory constructs (6 items per behaviour spanning environment, emotional coping, expectations, self-control, self-efficacy)</p> <p>Method: Validated online 24-item Likert scale survey (12-items diet-related)</p>	<p>Indicator: Child obesity-related behaviours. Dietary variables: fruit, vegetable and sugar-free beverage intake</p> <p>Methods: Validated 4-item Likert scale survey</p>
Laws 2018 ¹⁹ ; Russell 2018 ⁵⁹	AUS	AW	QE	<p>Indicator: Demographic characteristics</p>	<p>Indicator: App usage: No. pages viewed/day accessed; no. of days app accessed; no. push notifications opened. Device type</p>	<p>Indicator: Parental feeding practices and beliefs; parental feeding intentions</p> <p>Method: Online 4 or 5-point Likert scale survey (20-item infant</p>	<p>Indicator: Parent-reported infant feeding behaviours; food exposure and food preferences; parent food behaviours (adding sugar and salt to infant foods)</p>

Study	Country	Digital tool	Design	Reach	Impact	Effectiveness	
						Knowledge, attitudes, beliefs	Nutrition
				Method: App analytic metric data	App feasibility, acceptability, ease of use, perceived usefulness, program overall Method: App activity log (hosted Azure cloud). Adapted 25-item online survey (see references in publication)	feeding questionnaire; 20-item baby eating behaviour survey Method: 32-item study-specific tool (22 core foods; 10 non-core foods). Frequency of offering foods, liking and intention to re-offer	Method: Online (\$ for survey completion)
Au 2017 ⁵⁶	US	W	RCT	Indicator: Demographic characteristics Method: Survey	Indicator: Satisfaction Method: 15-item online intervention-specific survey items (unknown source)	Indicator: Parent salt knowledge (2 items) self-efficacy (6 items); parent behaviour change (21 items) Method: Pilot-tested, 40-item online intervention-specific survey items adapted from existing self-efficacy and dietary behaviour scales	Indicator: Salt intake Method: Salt-specific food frequency screener questions (amount and sources of salt)

Study	Country	Digital tool	Design	Reach	Impact	Effectiveness	
						Knowledge, attitudes, beliefs	Nutrition
Delamater 2013 ⁴⁷	US	W	pre-post	<p>Indicator: Demographic characteristics</p> <p>Method: Survey</p>	<p>Indicator: Logins. Low/high use. Behavioural goal selection. Use of behaviour tracking functionality</p> <p>Parent and child satisfaction: perceived engagement, clear and easy to find information, would recommend to others</p> <p>Method: Web metrics not specified. Questionnaire (no details)</p>	<p>Indicator: Child Intrinsic Motivation. Self-efficacy (8 items). Importance (8 items)</p> <p>Method: Validated, 16-item 7-point Likert scale survey (self-determination theory)</p>	<p>Indicator: Composite score of healthy or unhealthy eating habits (also anthropometry and PA)</p> <p>Method: Validated 6-dietary items from Youth Risk Behaviour Survey</p>
Breitenstein 2017 ²²	US	A	RCT	<p>Indicator: Demographic characteristics</p> <p>Method: Survey</p>	<p>Indicator: Parent comfort with technology and usual internet use. App usage: page type (features/context) accessed, date and time used to create range variables (time on page, time on module, visit times, time between visits)</p> <p>Engagement: Overall number of pages viewed. Badges awarded, page clicks)</p> <p>Parent interaction; how and when parents use program and in which context</p> <p>Individual engagement Adherence</p> <p>Method: Digital tracking data. Usage metrics (online/offline time-stamped)</p>		

Study	Country	Digital tool	Design	Reach	Impact	Effectiveness	
						Knowledge, attitudes, beliefs	Nutrition
James 2013 ⁶²	US	AW	QE	<p>Indicator: Reach social media campaign, reach via traditional versus social media</p> <p>Method: Number of recruitment materials distributed; Quantitative: Number Facebook friends, Twitter followers, YouTube views, unique website visits. Qualitative: Comments on social media platforms</p>	<p>Indicator: Comparison traditional versus social media</p> <p>Method: Website URL</p>		<p>Indicator: Target audience awareness (knowledge, behaviours)</p> <p>Method: In-person survey conducted in grocery stores. Website polling questions</p>

Abbreviations: US = United States of America; AUS = Australia; SWI = Switzerland; BEL = Belgium; CAN = Canada; SWE = Sweden; A = app; W = website; AW = app & website; FB = Facebook; RCT = randomised controlled trial; FUQ = follow-up questionnaire; pre-post = pre-test post-test; QE = quasi-experimental; MM = mixed-methods; GA = Google Analytics; CS = cross-sectional.

Gaps in the evidence

The Evidence Check identified the following key gaps in the evidence:

- Lack of evaluation of lunch box websites as a digital health promotion tool reaching an important target to influence children’s diet quality
- Lack of a comparison group (i.e. pre–post study designs) and/or lack of comparison with traditional health promotion approaches such as group education or parent leaflets/newsletters
- Lack of comprehensive evaluation frameworks spanning reach, impact and effectiveness
- Lack of outcomes of interest including effectiveness, acceptability and cost-effectiveness, particularly compared with traditional nutrition promotion approaches.

Quality of evidence

Almost all studies included in Question 2 were not classified within the NHMRC Grades of Evidence, suggesting the quality of evidence for this question is *poor*. However, this should be interpreted with caution as a considerable proportion of these studies (11 of 33) had a qualitative or mixed-methods design and therefore could not be classified within the grading system. Qualitative and mixed-method study designs are relevant for user-testing research to elicit useful insights. More than half the studies included within Question 3 were randomised controlled trials or quasi-experimental studies, indicating that the evidence base and quality of studies was *satisfactory to good*. The overall consistency of evidence within Questions 2 and 3 was good, with few inconsistencies in results between studies.

Table 11: Summary of the grades of evidence of included studies

NHMRC Evidence grade	Question 2	Question 3
Randomised Controlled Trial — Level II	0	10
Quasi-experimental study (non-randomised trials) — Level III-2	0	4
Pre-test / Post-test outcomes — Level IV	3	5
Not classified (i.e. cross-sectional, survey, qualitative)	30	2

Discussion

This Evidence Check reviewed the evidence base for digital health platforms (websites and apps) as health promotion tools, with a focus on supporting parents as a means of improving children's nutrition. We identified websites and apps that were active tools promoting healthy lunch boxes and reviewed published literature examining user testing and effectiveness of digital health promotion tools used with parents. Key findings were:

- Few dedicated websites or apps are currently available at scale for use in the community by parents, children or families to support nutrition promotion efforts to improve children's diet quality by providing nutritious food and drink in lunch boxes
- Current websites and apps provide information and practical 'how to' support, although with varying degrees of interactive engagement
- User-testing research identified that parents want smartphone-friendly, digital platforms that provide factual and practical information, which is credible and endorsed by health professionals or organisations
- User-testing research also identified that parents want digital health platforms to be interactive, in terms of: (1) interactive 'how to' components, such as a lunch box builder, healthy swaps or activities parents and children can do together; (2) information and feedback personalised or tailored to users' needs (e.g. dietary requirements or child age); and (3) allowing for interaction with health professionals via forums or chat features, or other like-minded users via social media or discussion forums
- Studies reporting marketing activities used a mix of social media and traditional marketing approaches. Leveraging a combination of social and traditional marketing may be most efficacious for achieving both reach and awareness, as well as specificity to the target audience
- The evidence base indicates health promotion interventions delivered to parents via digital platforms are at least as effective as face-to-face health promotion approaches
- Sufficient engagement and adherence to achieve the intended outcomes was a key threat to the success of digital interventions, with high attrition following initial website/app visitation and reduced time spent on platforms over the duration of interventions
- Evaluation research is needed to determine the sufficient level of engagement required to achieve behaviour change. Impact evaluation such as website acceptability and fidelity will also help determine what, if any, additional website features may be needed. Examples of measurement tools for indicators of reach, impact and effectiveness have been provided in Table 12. A recent review of methods to assess children's diets in the context of school food may provide further examples of measurement of effectiveness indicators⁷²
- The comprehensive evaluation of digital health interventions is an emerging area. Several frameworks have been published in the past few years; however, consistent indicators or measures are not yet available or in routine use.

Table 12: Examples of evaluation indicators and measurement tools for reach, impact and effectiveness of digital health promotion tools

Reach indicators	Impact indicators	Effectiveness indicators	
<p><u>Visitation:</u> Traffic and repeat visits</p> <p>Where heard about website from</p> <p>Method: Digital platform metric data</p>	<p><u>Engagement:</u> Page/ content accessed and viewing time (see e.g. ¹⁹)</p> <p><u>Acceptability:</u> Session liking and interest (see e.g. ⁵⁷)</p> <p><u>Fidelity:</u> Recall of content (see e.g. ⁵⁷)</p> <p>Method: Digital platform metric data (see e.g. ¹⁹ for variable formulation). Adapted from existing online evaluation surveys or website polling question pop-up: 'Was this feature/content useful?'</p>	<p><u>Knowledge, attitudes, beliefs:</u> Parent lunch box-specific knowledge; attitudes; behaviours; self-efficacy items</p> <p>Method: Online evaluation survey or website polling question. Could be adapted from validated tools ^{73, 74}</p>	<p><u>Nutrition:</u> Lunchbox provision audit ^{72, 75}; School-day food intake ⁷⁴</p> <p>Method: School-day food intake questionnaire measuring intake at recess, lunch and after school ⁷⁴. School food checklist adapted from validated audit tool that could be completed by parents as an online evaluation survey (20 tools) or scored from an uploaded photograph ⁷²</p>

Question1: Emerging products and high-quality evaluation research

The systematic grey and peer-reviewed literature searches undertaken for this Evidence Check identified considerable growth in websites and apps and research relevant to their use as health promotion tools for nutrition education with a focus on parents.

The *Healthy Lunch Box* CCNSW had the highest overall digital tool quality rating score of all reviewed websites and apps at 4.2 (out of 5 using the MARS tool). This reflected its high level of functionality, quality of information and aesthetics. A distinguishing feature of the three websites (including the *Healthy Lunch Box* CCNSW website) that scored highest overall, and highest for engagement, was the inclusion of an interactive lunch box builder. The lunch box builder differed in each of these websites, and each builder included both positive features and opportunities for improvement. Of the three websites, the *Healthy Lunch Box* CCNSW scored slightly lower for engagement when compared with the two alternative web-based interactive lunch box builders (*Go for your life: Weigh up your lunch* and *Make Healthy Normal: Healthy School Lunch Box*) because there was less tailoring of food choices to the user and provision of personalised feedback (e.g. rating the lunch box choices selected). However, it should be noted that rating the lunch box choices selected in the *Healthy Lunch Box* CCNSW, which affected the engagement score, was not a necessary feature as all options for inclusion were based on core foods. Information about non-core foods is provided through an interactive 'healthy swaps' tips section. The *Make Healthy Normal: Healthy School Lunch Box* builder included only core foods but allowed personalisation of the menu options to dietary requirements; however, the options were simple (e.g. single foods, such as peas), included poor combinations of foods that a child would not eat together and lacked guidance with regards to serving suggestions.

While conducting this Evidence Check, we identified research protocols of interest indicating relevant research that is planned or underway in this field.⁷⁶⁻⁷⁸ Of particular relevance, Wolfenden et al.⁷⁹ will be

commencing a project in NSW to promote healthy lunch boxes to parents of primary school-age children via the Skoolbag app, a market leader in app-based communication platforms used by schools to communicate with parents (www.mogproducts.com.au/skoolbag/). While the app was not available for critique, its user-centred development anchored in implementation science and the delivery partnership with Skoolbag signals strong potential for reach and scale.

Question 2: User-centred design research

The importance of understanding the needs of end users through formative research and needs assessment has always been a foundation of the development of effective and fit for purpose health promotion interventions. User testing showed participants wanted digital platforms to include both informative content and interactive features, with sections that both parents and children could use. Users wanted information to be credible, evidence-based, from a trusted source, and relevant to them. There was also a strong theme of users wanting tailored features and information (e.g. to the child's age or family circumstance) and that interaction with health professionals would be valued.

Parent use of the internet, apps and smartphones was high across all studies, with Facebook the most frequently used app. We reviewed qualitative and quantitative research with parents that described how these users wish to engage with websites and apps as nutrition promotion tools. Results suggest both websites and apps are acceptable to parents; in fact, it appears that the ability to engage with a website and/or an app is important. This flexibility may reflect factors such as familiarity or comfort with (rapidly changing) technology, but also the different ways these tools will be used (e.g. ranging from provision of information through to use in the supermarket). Web-based apps, which use an internet browser to run when accessed on a mobile device via a website homepage (rather than an app platform such as Android or Apple), can provide a way of ensuring reach and making tools smartphone/mobile friendly.

Question 2: Marketing and dissemination

This Evidence Check demonstrated mixed findings with regards to identifying effective marketing approaches to reach the target audience. Participant recruitment was conducted via a combination of traditional and social media approaches, with social media (mostly Facebook, but also Instagram and Pinterest) and online recruiting techniques resulting in wider reach, but they were less effective at reaching the target audience. Overall, the findings of studies suggest a combination of marketing via social media and traditional approaches may be most efficacious for achieving both reach and awareness, as well as specificity to the target audience. Marketing, both paid and snowball, via social media platforms such as Facebook and Instagram can achieve wide audience reach for relatively lower cost compared with traditional media marketing; however, it may not reach the target audience.^{23, 31, 62} Conversely, more targeted marketing may have smaller reach and can be more time, labour and cost-intensive, but may be more effective at accessing the target audience.⁶² For example, more targeted marketing can include distribution of information directly to parents via schools, pre-schools and kindergartens, childcare centres, general practitioners, health professionals, or partnering with relevant regulatory or professional association organisations to disseminate links to websites via their networks or as delivery partners to enhance dissemination and scale-up by embedding in places parents are seeking support and resources.

Question 3: Effectiveness of digital health promotion tools

Overall, this Evidence Check found health promotion interventions delivered to parents via digital platforms to be at least as effective as face-to-face health promotion approaches, although more research and evaluation is needed in this field. Ongoing engagement and adherence was a key threat to the success of digital interventions, with high attrition following initial website/app visitation and reduced time spent on platforms over the duration of interventions. Sufficient exposure is needed for digital interventions to be effective in improving behaviours.⁸⁰ For example, an evaluation of a website-based obesity intervention for

families with overweight children found few program effects overall, but sub-group analysis showed significant improvements in high users compared with low users of the program.⁴⁷ Results of user-testing research in Question 2 may be used to inform strategies for supporting engagement, for instance via the provision of sections for the whole family (sections for parents and children), user input and personalised feedback, interactive features, practical information, credibility and opportunities for engaging with other users via social media platforms.

Question 4: Indicators and measures for the evaluation of digital health promotion tools

The majority of indicators used in the evaluation of the digital health promotion tools reviewed relate to targeting parents to improve child nutrition. While there is commonality in the constructs and domains across the best practice guidance frameworks, the definitions to guide measurement of domains or indicators were either not provided or consistent across the studies reviewed. Additionally, while the studies included in Question 3 incorporated measures aligned with domains recommended in the evaluation of digital health interventions, the application of the frameworks mentioned was not consistently comprehensive.

Some key points arising in reviewing studies to inform the development of evaluation plans were:

- A strength was that measures used reflected the target behaviour of the digital health promotion tool (e.g. measure salt knowledge, self-efficacy and intake for a salt reduction tool)
- Examples exist where reach (visitation, recruitment), impact (usage, engagement, exposure) and effectiveness (knowledge, attitudes, beliefs, behaviour) are measured within a digital platform using analytic data and an online survey (or polling option)
- The metrics to measure constructs such as engagement (e.g. frequency of use, module and activity completion, time, and repeat activity) are critical, but lack consensus
- Existing tools to measure dietary intake or behaviours at school can be adopted for use online, either through a survey linked to completion incentives or through omnibus-type questions using website voting buttons. The latter may be more in keeping with an iterative and dynamic evaluation approach desirable in pursuit of technology optimisation to find sufficient, timely and effective engagement to support changes in parental lunch box food provision.

Comprehensive evaluation plans, based on emerging frameworks or checklists, are needed to establish the reach, impact and effectiveness of digital health interventions and ensure the potential of these 'behavioural intervention technologies' are realised.

Applicability

We reviewed a mix of Australian and international research. However, the synthesis of findings is weighted towards the body of higher quality research that has been conducted relevant to the Australian context and with Australian parents. With this in mind, the following are opportunities for the development, dissemination and evaluation of the CCNSW *Healthy Lunch Box* website:

- Overall, we identified few lunch-box-dedicated apps or websites, and fewer still with the desired components, reported in user-testing studies, of interactive elements alongside credible evidence-based nutrition information and practical 'how to' support.
- Websites developed by 'credible' sources tended to be information-heavy with fewer interactive components. In contrast, apps developed by commercial organisations lacked credentials and tended to be more interactive with less passive information. Only one app from Britain was identified that was developed by a credentialled health organisation — Change4Life Smart Recipes.
- The Evidence Check found the CCNSW *Healthy Lunch Box* website was unique in the market as it incorporates credible nutrition information in combination with interactive components such as the lunch box builder. In addition to these components, the CCNSW website already incorporates several user-desired features such as specific themed advice relevant to the target group, some practical 'how to' information (e.g. recipes, food swaps) and demonstration videos. However, the CCNSW may wish to explore the development of more personalisation and interactivity features, identified as desirable in user testing of digital platforms with parents (see also Table 8). In particular, parents wanted features that enabled interactivity both with other like-minded users via social media and discussion forums, and with health professionals (e.g. via chat or question boxes that allowed them to post questions to health professionals). Parents also wanted more tailoring and personalisation of content, for example via personalisation of food options in the lunch box builder to dietary requirements or receiving tailored feedback and goal setting based on chosen lunch options.
- Currently, there is a gap in the app market for apps that provide both credible, evidence-based nutrition information and interactive, collaborative features such as games or lunch box builders. An app could allow for greater personalisation of content and provide 'real time' reminders to perform target behaviours (such as nightly reminders to plan lunch boxes for the next day), both of which are likely to improve the engagement quality of such a program. However, as noted above, a project is about to begin in NSW that will promote healthy lunch boxes to parents via the Skoolbag app.⁷⁹
- How Australians access the internet has changed over recent years, with a shift towards accessing the internet via smartphones and tablets rather than computers, with individuals aged 26–45 years most likely of all age groups to use their smartphones to access the internet ^{14, 81}. Alongside this, there has been a rise in the use of mobile phone apps ¹⁵. Laws and colleagues ¹⁹ offered Australian parents a feeding intervention via an app and website, finding most users (86%) accessed the intervention via the app. Likewise, testing a range of shopping apps with low-income women, Ball and colleagues ³⁶ found the women felt confident using apps and liked the convenience of the app when shopping. Given the rise of internet access via smartphones, the CCNSW website should continue to be optimised for access on a smartphone.

- Despite increased work in the lunch box field, an area that continues to be underserved is the provision of support for parents of children entering childcare and kindergarten, who are preparing lunch boxes for the first time. There is an opportunity for the CCNSW to target this parent group, linking with other organisations working in the field. This could include the Australian Children’s Education & Care Quality Authority (ACECQA) (www.acecqa.gov.au), which provides guidance, resources and services in the children’s education and care sector, including a parent resource portal (<https://www.startingblocks.gov.au/>), and the Department of Education and Training, which provides a portal for educators and parents (<https://studentwellbeinghub.edu.au/resources#/>). Activities of the Commonwealth of Australia Governments (COAG) Health Council should also be monitored (<http://www.coaghealthcouncil.gov.au/>) for partnership and implementation opportunities.
- Overall, the current evidence indicates health promotion interventions delivered to parents via digital platforms can be as effective as face-to-face interventions for improving children’s nutrition. However, more research and comprehensive evaluation is needed in this field. Accordingly, it is recommended that evaluation of the reach, impact and effectiveness of the CCNSW website be undertaken before making any changes to it (see Tables 10 and 12 for indicators and examples of evaluation instruments). Evaluation of the website will contribute to the existing evidence base, provide understanding of the current effectiveness of the website and inform opportunities for changes to the website to optimise reach and effectiveness.

Conclusion

This Evidence Check, commissioned by the CCNSW, provides a rapid review of the current evidence and associated literature about digital platforms as health promotion tools for nutrition education with a focus on parents with children. The review demonstrated that digital health promotion tools targeting parents, with a focus on websites and apps, can be effective in improving children's and parents' dietary intake, knowledge and self-efficacy. However, engagement and adherence were found to be key threats to the success of digital interventions and further research and evaluation is needed in this field to strengthen the evidence base. Websites and apps in use currently as health promotion tools targeting parents for children's lunch boxes did not meet the desired combination of credentialled information provision, interactivity, personalisation and tailored feedback provisions, as was identified from user-testing research. The CCNSW website is unique in the market, as it incorporates credible nutrition information in combination with interactive components. However, there are opportunities for evaluation to understand effectiveness and inform opportunities for improvement. Accordingly, the review team makes the following recommendations for the commissioning organisation:

- Conduct evaluation to determine the effectiveness of the website in its current form and inform opportunities for change
- Investigate opportunities for including features identified as desirable from user testing, such as the provision of personalised feedback and engagement with health professionals
- There is already considerable work being done in the school-day lunch box space, however there is an opportunity to engage parents of children at childcare and kindergarten, partnering with organisations active in the education and early care field to enhance the reach and dissemination of the website through existing parent portals
- Link with social media pages to enable users to share and interact with other users
- Use a combination of social media and traditional marketing approaches to increase the reach to the target audience — using social media and partnering with relevant organisations to share links on their websites.

References

1. Bell A, Swinburn B. What Are the Key Food Groups to Target for Preventing Obesity and Improving Nutrition in Schools? *European journal of clinical nutrition*. 2004;58(2):258.
2. Regan A, Parnell W, Gray A, Wilson N. New Zealand Children's Dietary Intakes During School Hours. *Nutrition & Dietetics*. 2008;65(3):205-10.
3. Zarnowiecki D, Christian M, Dollman J, Parletta N, Evans C, et al. Comparison of School Day Eating Behaviours of 8–11 Year Old Children from Adelaide, South Australia, and London, England. *AIMS Public Health*. 2018;5(4):394-410.
4. Sanigorski A, Bell A, Kremer P, Swinburn B. Lunchbox Contents of Australian School Children: Room for Improvement. *European Journal of Clinical Nutrition*. 2005;59(11):1310.
5. Pollard CM, Pulker CE, Meng X, Kerr DA, Scott JA. Who Uses the Internet as a Source of Nutrition and Dietary Information? An Australian Population Perspective. *Journal of Medical Internet Research*. 2015;17(8):e209-e09.
6. Cancer Council NSW. Healthy Lunch Box Website Campaign - Evaluation Report. (unpublished): 2018.
7. Craigie AM, Lake AA, Kelly SA, Adamson AJ, Mathers JC. Tracking of Obesity-Related Behaviours from Childhood to Adulthood: A Systematic Review. *Maturitas*. 2011;70(3):266-84.
8. Australian Institute of Health and Welfare. Nutrition across the Life Stages. Cat. No. Phe 227. Canberra: AIHW; 2018.
9. National Health and Medical Research Council. Australian Dietary Guidelines Report No.: 1864965754. Canberra: 2013.
10. Johnson BJ, Bell LK, Zarnowiecki D, Rangan AM, Golley RK. Contribution of Discretionary Foods and Drinks to Australian Children's Intake of Energy, Saturated Fat, Added Sugars and Salt. *Children*. 2017;4(12):104.
11. Cooper N, Jones C. Improving the Quality of Packed Lunches in Primary School Children. *Journal of Human Nutrition and Dietetics*. 2011;24(4):384-85.
12. Evans C, Greenwood DC, Thomas JD, Cleghorn CL, Kitchen MS, et al. Smart Lunch Box Intervention to Improve the Food and Nutrient Content of Children's Packed Lunches: Uk Wide Cluster Randomised Controlled Trial. *Journal of Epidemiology & Community Health*. 2010;jech. 2008.085837.
13. Hingle MD, O'Connor TM, Dave JM, Baranowski T. Parental Involvement in Interventions to Improve Child Dietary Intake: A Systematic Review. *Preventive Medicine*. 2010;51(2):103-11.
14. Australian Bureau of Statistics. 8146.0 - Household Use of Information Technology, Australia, 2016-17. Canberra: Australian Bureau of Statistics; 2018. [Access Date: 20th November]. Available from: www.abs.gov.au/ausstats/abs@.nsf/mf/8146.0
15. Drumm J., White N., Swiegers M., Davey M. Smart Everything, Everywhere. Mobile Consumer Survey 2017 the Australian Cut2017 20th November. Available from: http://landing.deloitte.com.au/rs/761-IBL-328/images/tmt-mobile-consumer-survey-2017_pdf.pdf
16. Stoyanov SR, Hides L, Kavanagh DJ, Zelenko O, Tjondronegoro D, et al. Mobile App Rating Scale: A New Tool for Assessing the Quality of Health Mobile Apps. *JMIR mHealth and uHealth*. 2015;3(1)
17. Biediger Friedman L, Silva M, Smith K. A Focus Group Study Observing Maternal Intention to Use a Wic Education App. *American Journal of Health Behavior*. 2018;42(6):110-23.
18. James DCS, Harville C. Smartphone Usage, Social Media Engagement, and Willingness to Participate in Mhealth Weight Management Research among African American Women. *Health Education & Behavior*. 2018;45(3):315-22.
19. Laws RA, Denney-Wilson EA, Taki S, Russell CG, Zheng M, et al. Key Lessons and Impact of the Growing Healthy Mhealth Program on Milk Feeding, Timing of Introduction of Solids, and Infant Growth: Quasi-Experimental Study. *JMIR MHealth and UHealth*. 2018;6(4):e78.
20. Luesse HB, Paul R, Gray HL, Koch P, Contento I, et al. Challenges and Facilitators to Promoting a Healthy Food Environment and Communicating Effectively with Parents to Improve Food Behaviors of School Children. *Maternal and Child Health Journal*. 2018;22(7):958-67.
21. Reynolds R, Sutherland R, Nathan N, Janssen L, Lecathelinais C, et al. Feasibility and Principal Acceptability of School-Based Mobile Communication Applications to Disseminate Healthy Lunchbox Messages to Parents. *Health Promotion Journal of Australia*. 2018;30(1):109-13.
22. Breitenstein SM, Brager J, Ocampo EV, Fogg L. Engagement and Adherence with Ez Parent, an Mhealth Parent-Training Program Promoting Child Well-Being. *Child Maltreatment*. 2017;22(4):295-304.

23. Byrd-Bredbenner C, Delaney C, Martin-Biggers J, Koenings M, Quick V. The Marketing Plan and Outcome Indicators for Recruiting and Retaining Parents in the Homestyles Randomized Controlled Trial. *Trials*. 2017;18(1):540.
24. Da Costa D, Zekowitz P, Letourneau N, Howlett A, Dennis C-L, et al. Healthydads.ca: What Do Men Want in a Website Designed to Promote Emotional Wellness and Healthy Behaviors During the Transition to Parenthood? *Journal of Medical Internet Research*. 2017;19(10)
25. Hull P, Emerson JS, Quirk ME, Canedo JR, Jones JL, et al. A Smartphone App for Families with Preschool-Aged Children in a Public Nutrition Program: Prototype Development and Beta-Testing. *JMIR MHealth and UHealth*. 2017;5(8):e102.
26. Mackert M, Guadagno M, Lazard A, Donovan E, Rochlen A, et al. Engaging Men in Prenatal Health Promotion: A Pilot Evaluation of Targeted E-Health Content. *American Journal of Men's Health*. 2017;11(3):719-25.
27. Rekhy R, Khan A, van Ogtrop F, McConchie R. Consumer Evaluation of 'Veggycation', a Website Promoting the Health Benefits of Vegetables. *Health Promotion Journal of Australia*. 2017;28(1):21-29.
28. Wyse R, Yoong SL, Dodds P, Campbell L, Delaney T, et al. Online Canteens: Awareness, Use, Barriers to Use, and the Acceptability of Potential Online Strategies to Improve Public Health Nutrition in Primary Schools. *Health Promotion Journal of Australia*. 2017;28(1):67-71.
29. Avis JL, Holt NL, Maximova K, van Mierlo T, Fournier R, et al. The Development and Refinement of an E-Health Screening, Brief Intervention, and Referral to Treatment for Parents to Prevent Childhood Obesity in Primary Care. *Telemedicine Journal & E-Health*. 2016;22(5):385-94.
30. Biediger-Friedman L, Crixell SH, Silva M, Markides BR, Smith KS. User-Centered Design of a Texas Wic App: A Focus Group Investigation. *American Journal of Health Behavior*. 2016;40(4):461-71.
31. Laws RA, Litterbach EKV, Denney-Wilson EA, Russell CG, Taki S, et al. A Comparison of Recruitment Methods for an Mhealth Intervention Targeting Mothers: Lessons from the Growing Healthy Program. *Journal of Medical Internet Research*. 2016;18(9)
32. Breitenstein SM, Shane J, Julion W, Gross D. Developing the Ecpp: Adapting an Evidence-Based Parent Training Program for Digital Delivery in Primary Care Settings. *Worldviews on Evidence-Based Nursing*. 2015;12(1):31-40.
33. Burrows T, Hutchesson M, Chai LK, Rollo M, Skinner G, et al. Nutrition Interventions for Prevention and Management of Childhood Obesity: What Do Parents Want from an Ehealth Program? *Nutrients*. 2015;7(12):10469-79.
34. Denney-Wilson E, Laws R, Russell CG, Ong KL, Taki S, et al. Preventing Obesity in Infants: The Growing Healthy Feasibility Trial Protocol. *BMJ Open*. 2015;5(11):e009258.
35. Rangelov N, Suggs L. Using Strategic Social Marketing to Promote Healthy Nutrition and Physical Activity Behaviors to Parents and Children in Switzerland: The Development of Fan. *Cases in Public Health Communication & Marketing*. 2015;8:27-50.
36. Ball K, Mouchacca J, Jackson M. The Feasibility and Appeal of Mobile 'Apps' for Supporting Healthy Food Purchasing and Consumption among Socioeconomically Disadvantaged Women: A Pilot Study. *Health Promotion Journal of Australia*. 2014;25(2):79-82.
37. Bensley RJP, Hovis AMPH, Horton KDP, Loyo JRD, Bensley KMM, et al. Accessibility and Preferred Use of Online Web Applications among Wic Participants with Internet Access. *Journal of Nutrition Education and Behavior*. 2014;46(3)
38. Swindle TM, Ward WL, Whiteside-Mansell L, Bokony P, Pettit D. Technology Use and Interest among Low-Income Parents of Young Children: Differences by Age Group and Ethnicity. *Journal of Nutrition Education & Behavior*. 2014;46(6):484-90.
39. Walker LO, Im EO, Vaughan MW. Communication Technologies and Maternal Interest in Health-Promotion Information About Postpartum Weight and Parenting Practices. *Journal of Obstetric, Gynecologic, & Neonatal Nursing*. 2012;41(2):201-15.
40. Baghaei N, Kimani S, Freyne J, Brindal E, Berkovsky S, et al. Engaging Families in Lifestyle Changes through Social Networking. *International Journal of Human - Computer Interaction*. 2011;27(10):971.
41. Jones R, Wells M, Okely A, Lockyer L, Walton K. Is an Online Healthy Lifestyles Program Acceptable for Parents of Preschool Children? *Nutrition and Dietetics*. 2011;68(2):149-54.
42. Wen LM, Rissel C, Baur LA, Lee E, Simpson JM. Who Is Not Likely to Access the Internet for Health Information? Findings from First-Time Mothers in Southwest Sydney, Australia. *International Journal of Medical Informatics*. 2011;80(6):406-11.
43. Atkinson NL, Saperstein SL, Desmond SM, Gold RS, Billing AS, et al. Rural Ehealth Nutrition Education for Limited-Income Families: An Interactive and User-Centered Design Approach. *Journal of Medical Internet Research*. 2009;11(2):1-13.

44. Jones RA, Price N, Okely AD, Lockyer L. Developing an Online Program to Prevent Obesity in Preschool-Aged Children: What Do Parents Recommend? *Nutrition and Dietetics*. 2009;66(3):151-57.
45. Mackert M, Kahlor L, Tyler D, Gustafson J. Designing E-Health Interventions for Low-Health-Literate Culturally Diverse Parents: Addressing the Obesity Epidemic. *Telemedicine Journal & E-Health*. 2009;15(7):672-7.
46. Cullen KW, Thompson D. Feasibility of an 8-Week African American Web-Based Pilot Program Promoting Healthy Eating Behaviors: Family Eats. *American Journal of Health Behavior*. 2008;32(1):40-51.
47. Delamater AM, Pulgaron ER, Rarback S, Hernandez J, Carrillo A, et al. Web-Based Family Intervention for Overweight Children: A Pilot Study. *Childhood Obesity*. 2013;9(1):57-63.
48. Delisle Nyström C, Sandin S, Henriksson P, Henriksson H, Maddison R, et al. A 12-Month Follow-up of a Mobile-Based (Mhealth) Obesity Prevention Intervention in Pre-School Children: The Ministop Randomized Controlled Trial. *BMC Public Health*. 2018;18: 658
49. Delisle Nyström C, Sandin S, Henriksson P, Henriksson H, Trolle-Lagerros Y, et al. Mobile-Based Intervention Intended to Stop Obesity in Preschool-Aged Children: The Ministop Randomized Controlled Trial. *American Journal of Clinical Nutrition*. 2017;105(6):1327-35.
50. De Lepeleere S, De Bourdeaudhuij I, Cardon G, Verloigne M. The Effect of an Online Video Intervention 'Movie Models' on Specific Parenting Practices and Parental Self-Efficacy Related to Children's Physical Activity, Screen-Time and Healthy Diet: A Quasi Experimental Study. *BMC Public Health*. 2017;17: 366
51. Knowlden A, Sharma M. One-Year Efficacy Testing of Enabling Mothers to Prevent Pediatric Obesity through Web-Based Education and Reciprocal Determinism (Empower) Randomized Control Trial. *Health Education & Behavior*. 2016;43(1):94-106.
52. Knowlden AP, Conrad E. Two-Year Outcomes of the Enabling Mothers to Prevent Pediatric Obesity through Web-Based Education and Reciprocal Determinism (Empower) Randomized Control Trial. *Health Education and Behavior*. 2018;45(2):262-76.
53. Schwinn TM, Schinke S, Fang L, Kandasamy S. A Web-Based, Health Promotion Program for Adolescent Girls and Their Mothers Who Reside in Public Housing. *Addictive Behaviors*. 2014;39(4):757-60.
54. Rangelov N, Della Bella S, Marques-Vidal P, Suggs LS. Does Additional Support Provided through E-Mail or Sms in a Web-Based Social Marketing Program Improve Children's Food Consumption? A Randomized Controlled Trial. *Nutrition Journal*. 2018;17: 24
55. Au LE, Whaley S, Rosen NJ, Meza M, Ritchie LD. Online and in-Person Nutrition Education Improves Breakfast Knowledge, Attitudes, and Behaviors: A Randomized Trial of Participants in the Special Supplemental Nutrition Program for Women, Infants, and Children. *Journal of the Academy of Nutrition & Dietetics*. 2016;116(3):490-500.
56. Au LE, Whaley SE, Gurzo K, Meza M, Rosen NJ, et al. Evaluation of Online and in-Person Nutrition Education Related to Salt Knowledge and Behaviors among Special Supplemental Nutrition Program for Women, Infants, and Children Participants. *Journal of the Academy of Nutrition & Dietetics*. 2017;117(9):1384-95.
57. Grimes CA, Booth A, Khokhar D, West M, Margerison C, et al. Digital Education to Limit Salt in the Home (Delish) Program Improves Knowledge, Self-Efficacy, and Behaviors among Children. *Journal of Nutrition Education and Behavior*. 2018;50(6):547-54.
58. Jogova M, Song JES, Campbell AC, Warbuton D, Warshawski T, et al. Process Evaluation of the Living Green, Healthy and Thrifty (Light) Web-Based Child Obesity Management Program: Combining Health Promotion with Ecology and Economy. *Canadian Journal of Diabetes*. 2013;37(2):72-81.
59. Russell CG, Denney-Wilson E, Laws RA, Abbott G, Zheng M, et al. Impact of the Growing Healthy Mhealth Program on Maternal Feeding Practices, Infant Food Preferences, and Satiety Responsiveness: Quasi-Experimental Study. *Journal of Medical Internet Research*. 2018;6(4):e77.
60. Wilson DK, Alia KA, Kitzman-Ulrich H, Resnicow K. A Pilot Study of the Effects of a Tailored Web-Based Intervention on Promoting Fruit and Vegetable Intake in African American Families. *Childhood Obesity*. 2014;10(1):77-84.
61. Ullmann G, Kedia SK, Homayouni R, Akkus C, Schmidt M, et al. Memphis Fitkids: Implementing a Mobile-Friendly Web-Based Application to Enhance Parents' Participation in Improving Child Health. *BMC Public Health*. 2018;18(1):1068.
62. James KJ, Albrecht JA, Litchfield RE, Weishaar CA. A Summative Evaluation of a Food Safety Social Marketing Campaign "4-Day Throw-Away" Using Traditional and Social Media. *Journal of Food Science Education*. 2013;12(3):48-55.
63. Lohse B, Wamboldt P. Purposive Facebook Recruitment Endows Cost-Effective Nutrition Education Program Evaluation. *JMIR Research Protocols*. 2013;2(2):e27.
64. Guertler D, Vandelanotte C, Kirwan M, Duncan MJ. Engagement and Nonusage Attrition with a Free Physical Activity Promotion Program: The Case of 10,000 Steps Australia. *Journal of Medical Internet Research*. 2015;17(7)

65. White BK, Burns SK, Giglia RC, Scott JA. Designing Evaluation Plans for Health Promotion Mhealth Interventions: A Case Study of the Milk Man Mobile App. *Health Promotion Journal of Australia*. 2016;27(3):198-203.
66. O'Grady L, Witteman H, Bender JL, Urowitz S, Wiljer D, et al. Measuring the Impact of a Moving Target: Towards a Dynamic Framework for Evaluating Collaborative Adaptive Interactive Technologies. *Journal of Medical Internet Research*. 2009;11(2):e20.
67. Mohr DC, Schueller SM, Riley WT, Brown CH, Cuijpers P, et al. Trials of Intervention Principles: Evaluation Methods for Evolving Behavioral Intervention Technologies. *Journal of Medical Internet Research*. 2015;17(7):e166.
68. Agarwal S, LeFevre A, Lee J, L'Engle K, Mehl G, et al. Who Mhealth Technical Evidence Review Group. Guidelines for Reporting of Health Interventions Using Mobile Phones: Mobile Health (Mhealth) Evidence Reporting and Assessment (Mera) Checklist. *BMJ*. 2016;352: i1174
69. Michie S, Yardley L, West R, Patrick K, Greaves F. Developing and Evaluating Digital Interventions to Promote Behavior Change in Health and Health Care: Recommendations Resulting from an International Workshop. *J Med Internet Res*. 2017;19(6):e232.
70. Glasgow RE, Klesges LM, Dzewaltowski DA, Estabrooks PA, Vogt TM. Evaluating the Impact of Health Promotion Programs: Using the Re-Aim Framework to Form Summary Measures for Decision Making Involving Complex Issues. *Health education research*. 2006;21(5):688-94.
71. Knowlden AP, Sharma M, Cottrell RR, Wilson BRA, Johnson ML. Impact Evaluation of Enabling Mothers to Prevent Pediatric Obesity through Web-Based Education and Reciprocal Determinism (Empower) Randomized Control Trial. *Health Education & Behavior*. 2015;42(2):171-84.
72. Mitchell S, Miles C, Brennan L, Matthews J. Reliability of the School Food Checklist for in-School Audits and Photograph Analysis of Children's Packed Lunches. *Journal of Human Nutrition and Dietetics*. 2010;23(1):48-53.
73. Wilson A, Magarey A, Mastersson N. Reliability of Questionnaires to Assess the Healthy Eating and Activity Environment of a Child's Home and School. *Journal of Obesity*. 2013;2013
74. Wilson AM, Magarey AM, Mastersson N. Reliability and Relative Validity of a Child Nutrition Questionnaire to Simultaneously Assess Dietary Patterns Associated with Positive Energy Balance and Food Behaviours, Attitudes, Knowledge and Environments Associated with Healthy Eating. *International Journal of Behavioral Nutrition and Physical Activity*. 2008;5(1):5.
75. Kremer P, Bell C, Swinburn B. Calibration and Reliability of a School Food Checklist: A New Tool for Assessing School Food and Beverage Consumption. *Asia Pacific Journal of Clinical Nutrition*. 2006;15(4):465-73.
76. Delaney T, Wyse R, Yoong SL, Sutherland R, Wiggers J, et al. Cluster Randomised Controlled Trial of a Consumer Behaviour Intervention to Improve Healthy Food Purchases from Online Canteens: Study Protocol. *BMJ Open*. 2017;7(4):e014569.
77. Helle C, Hillesund ER, Omholt ML, Øverby NC. Early Food for Future Health: A Randomized Controlled Trial Evaluating the Effect of an Ehealth Intervention Aiming to Promote Healthy Food Habits from Early Childhood. *BMC Public Health*. 2017;17(1):729.
78. Kovalskys I, Herscovici CR, Rougier PI, De Gregorio MJ, Zonis L, et al. Study Protocol of Mini Salten: A Technology-Based Multi-Component Intervention in the School Environment Targeting Healthy Habits of First Grade Children and Their Parents. *BMC Public Health*. 2017;17(1):401.
79. NIB Foundation. The University of Newcastle Swap-It. NIB Foundation; 2018. [Access Date: 20th November]. Available from: www.nibfoundation.com.au/Partners/Multi-Year/The-University-of-Newcastle.aspx
80. Schoeppe S, Alley S, Van Lippevelde W, Bray NA, Williams SL, et al. Efficacy of Interventions That Use Apps to Improve Diet, Physical Activity and Sedentary Behaviour: A Systematic Review. *International Journal of Behavioral Nutrition and Physical Activity*. 2016;13(1):127.
81. Murdoch University. Abc's Biggest Smartphone Survey. Murdoch University; 2018. [Access Date: 20th November]. Available from: www.modernlifestudy.com/abc-survey-in-pics

Appendix 1: Review Question 1

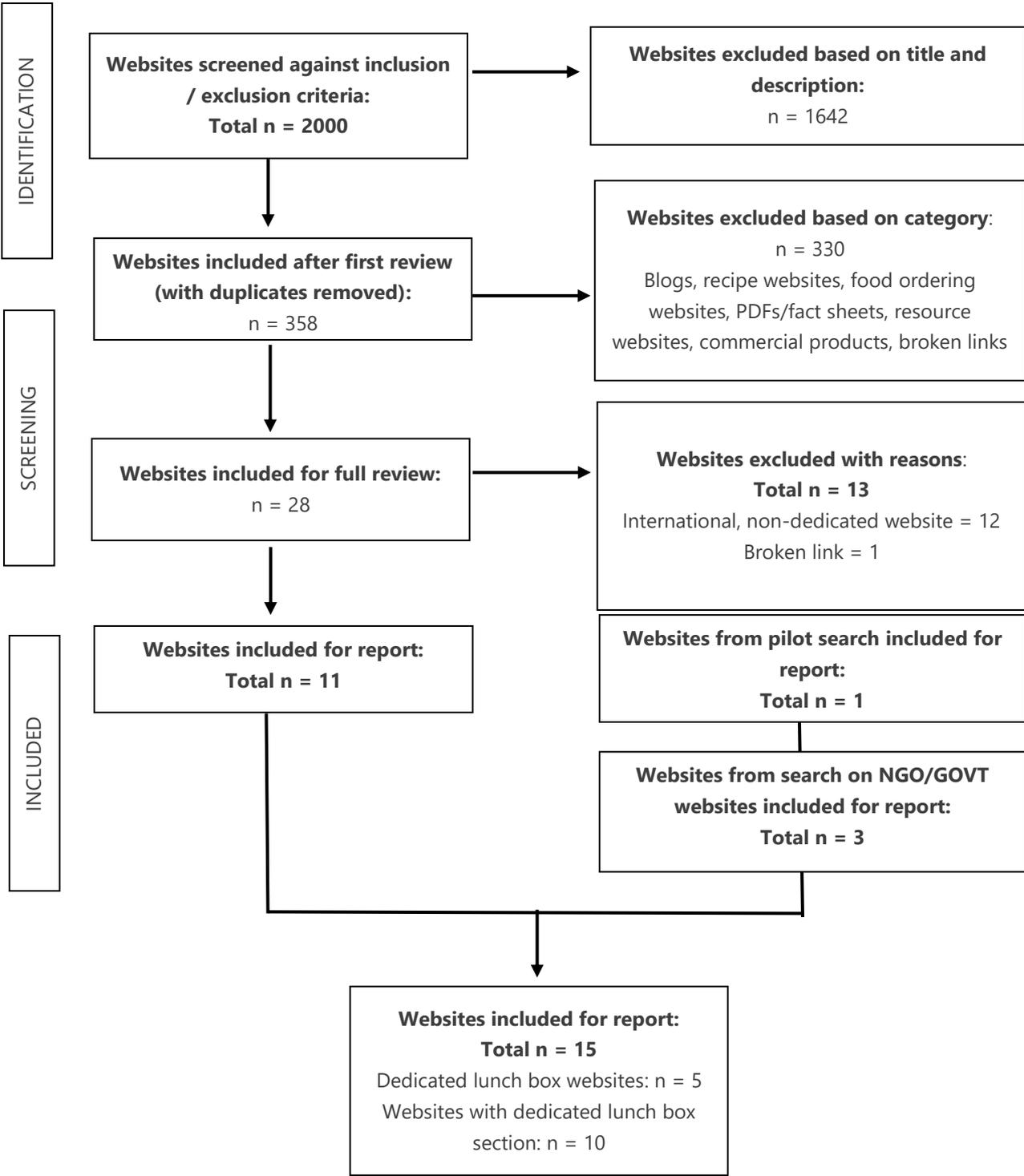


Figure A1.1: PRISMA flow diagram for websites included in Question 1

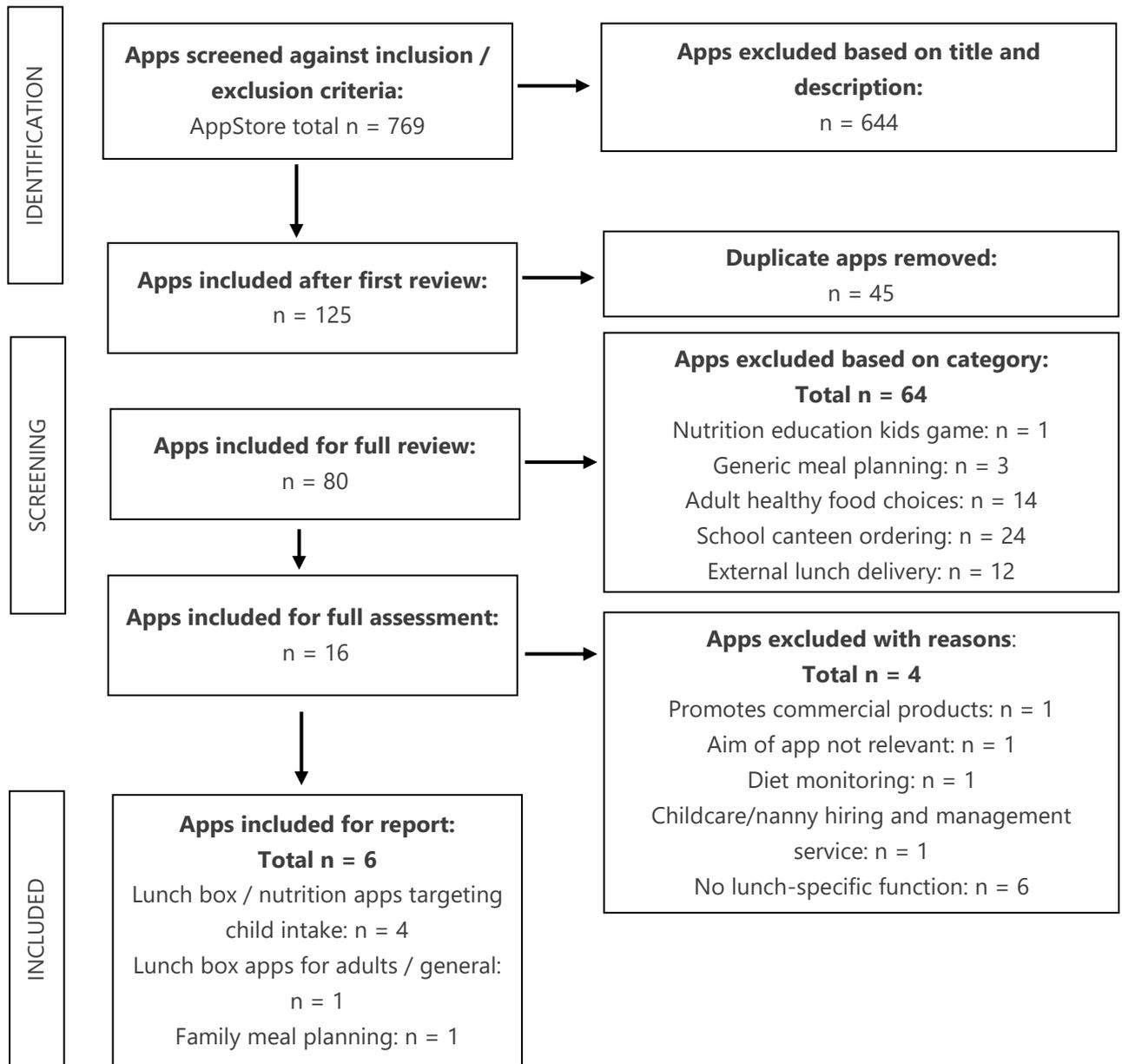


Figure A1.2: PRISMA flow diagram for app selection for Question 1

Table A1.3: Inclusion and exclusion criteria for website and app selection

Inclusion criteria	Exclusion criteria
<ul style="list-style-type: none"> • Targeting parents with school-age children or families • Supports parents to: Pack a healthy lunch box, provide/promote vegetables to children, provide healthy snacks to children, plan lunch meals for the family • Used by children to plan meals/food with support from parents 	<ul style="list-style-type: none"> • Unrelated to food, meals or nutrition • Cannot be accessed, downloaded or used due to tech issues • Blogs, e-books, magazines or news articles • Recipe website or app (with no other function that informs food provision)
<p><u>App</u></p> <ul style="list-style-type: none"> • Used by parents & incorporates meal planner, shopping list or other household functions, where components directly related to provision of lunch are included 	<p><u>App</u></p> <ul style="list-style-type: none"> • Targeting children only (i.e. games) • Targeting health industry professions • Targeting sub-group of adults that excludes parents/families • Targeting nutrition in pregnancy • Targeting infants <12 months • General healthy eating advice to adults (no family involvement) • Meal delivery app • Weight loss app, food or diet monitoring/calorie counting app • Shopping list app (no other function to family planning or child nutrition) • Ordering food from canteen without any nutrition education <p>Access contingent upon involvement in a research study or face-to-face component</p>
<p><u>Website</u></p> <ul style="list-style-type: none"> • Dedicated lunch box website OR contains a significant lunch box section with more than one page of lunch-box information, ideally with links, resources or an interactive component 	<p><u>Website</u></p> <ul style="list-style-type: none"> • General healthy eating website • Supermarket-based website • YouTube, video, audio file or podcast • Brochure published online as PDF • Requires subscription to access content

Table A1.4: Summary of websites included in Question 1

Website Information	Top 3 Key Messages	Functionality	Marketing and PR	
<p>Healthy Lunch Box CCNSW</p> <p>Weblink: www.healthyinbox.com.au</p> <p>Year developed: 2018</p> <p>Last updated: 2018</p> <p>Affiliation: Cancer Council NSW</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Purpose: Assist parents & children to plan & pack a healthy LB</p> <p>Target audience: Parents & children</p> <p>MARS website quality mean score: 4.2/5</p>	<ol style="list-style-type: none"> 1. Healthy LB contains: B&C, V & salads, meat & alt., dairy, F, water 2. F&V have great nutritional value, help kids learn & play, cancer prevention & cheaper than packaged food 3. Planning & preparing ahead saves time & reduces stress <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG & explicitly states based on ADG - No explicit mention of engagement with health professionals 	<p>Key features:</p> <ul style="list-style-type: none"> - LB builder, 6 categories (B&C, V & salads, meat & alt., dairy, water), to fill 6 sections of LB - Nutrition & serve size information - Recipes/ideas: LB examples, sandwiches, healthy swaps/snacks, salads, sauces & dips - Tips: (1) adding F&V; (2) saving time; (3) practical packing tips; (4) starting with small steps (alternatives and swaps); (5) involving children; (6) food safety; (7) recipe & LB videos - Links to further information & videos <p>Usability:</p> <ul style="list-style-type: none"> - Search function — limited - Easy to navigate <p>Social / community features: Share recipes on social media, like, save or share Vimeo videos</p> <p>Technical features: No login required, email/print content</p> <p>User feedback: Email address provided</p> <p>Limitations:</p> <ul style="list-style-type: none"> - No personalisation in LB builder (e.g. serve size/child age, dietary pref./requirements) - LB serve size is large - Some foods not targeted towards children, not LB friendly - Crossover between food groups 	<p>Social media: Nil</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Cross-promotion on blogs, lifestyle websites, other lunch box-related websites (Crunch & Sip; Home Beautiful; & Healthy Eating Advisory Service)</p>
<p>Go For Your Life — Weigh up your lunch</p> <p>Weblink: http://www.goforyourlife.vic.gov.au/hav/articles.nsf/html/index.html</p> <p>Year developed:</p>	<p>Purpose: Demonstrate to children & adults how different foods add up to make a healthy or not so healthy LB</p>	<ol style="list-style-type: none"> 1. Balance needed in LB with 3 snacks, a meal & drink 2. Emphasising 'everyday' foods & minimising 'sometimes' foods in LB for balance 	<p>Key features:</p> <ul style="list-style-type: none"> - LB builder, 3 categories (mains, snacks, drinks), fill 1 section with a main, 3 sections with snacks, 1 section for a drink - Choices include 'everyday' & 'sometimes' foods - Feedback provided on choices made - 'For parents' & 'healthy eating' sections — written information & links 	<p>Social media: Nil</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Cross promotion on other health related websites (Healthy Kids — eat well, get active; Crunch and Sip)</p>

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
<p>Unknown</p> <p>Last updated: Unknown</p> <p>Affiliation: Department of Health, Victoria</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Target audience: Parents and/or children</p> <p>MARS website quality mean score: 4.0/5</p>	<p>3. Emphasis on including foods with good nutritional value</p> <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG - No explicit evidence of engagement with health professionals 	<p>Usability:</p> <ul style="list-style-type: none"> - Click & drag items into LB builder - Simple, visual & interactive <p>Social / community features: Send LB via email to multiple addresses</p> <p>Technical features: No login/account required</p> <p>User feedback: Nil</p> <p>Limitations:</p> <ul style="list-style-type: none"> - Only general advice regarding how to improve lunch box - Lack of information/recipes - 'Go for your life! Victoria' phased out in 2011, no other part of program available on website & links within LB builder broken 	
<p>Healthier Lunches for Children</p> <p>Weblink: http://www.healthylunch.org.uk/</p> <p>Year developed: Unknown</p> <p>Last updated: Unknown</p> <p>Affiliation: Developed in partnership with Healthy Schools Programme in the London Borough of Islington</p> <p>Jurisdiction:</p>	<p>Purpose: Assist schools in improving quality of lunchtime nutrition in their students</p> <p>Target audience: Children through schools</p> <p>MARS website quality mean score: 3.3/5</p>	<p>1. Packed L represents about 1/3 of a child's daily intake, therefore should provide food in line with Eatwell food profile</p> <p>2. Healthy L should contain food from each of the 5 food groups</p> <p>3. Treat foods should be given only occasionally</p> <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with/based on UK DG (Eatwell referenced) - No explicit evidence of engagement with health professionals 	<p>Key features:</p> <ul style="list-style-type: none"> - 3-step program (L audit, check & revise school policy, take practical measures to raise standards) - Research page with information & links to guidelines - Information regarding how to pack a healthy L - Children's LB auditing tool (to be completed by child) - Links to resources, policies, L audit tools, quizzes (can personalise) <p>Usability:</p> <ul style="list-style-type: none"> - Basic website <p>Social / community features: Subscribe to email list</p> <p>Technical features: Login required for parts of the website</p> <p>User feedback: 'Contact us' page</p> <p>Limitations:</p> <ul style="list-style-type: none"> - Children's auditing tool does not function well 	<p>Social media: Nil</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Nil</p>

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
Britain Cost: Nil				
The Zero Waste and Healthy Lunchbox Weblink: http://ecolosante.wixsite.com/ecolosante/home Year developed: 2016 Last updated: 2016 Affiliation: NWRSC Solid Waste Service & various other departments Jurisdiction: Canada Cost: Nil	Purpose: Educate students & parents about how to eat healthy foods, with a focus on environment Target audience: Children & parents through schools MARS website quality mean score: 3.3/5	<ol style="list-style-type: none"> 1. Pack a zero-waste LB to help the environment 2. Pack a healthy LB to help you grow 3. Packing a zero-waste and healthy LB is easy Credibility of information: <ul style="list-style-type: none"> - Messages mostly consistent with Canadian DG (no references/links) - Two public health dietitians involved, contact details provided, credentials unclear 	Key features: <ul style="list-style-type: none"> - Video content — zero-waste LB, composting & packing a healthy LB - Audio content — song to sing in class - Powerpoint presentations describing activities for use in class - PDF resources Usability: <ul style="list-style-type: none"> - Both English and French content Social / community features: Nil Technical features: Nil User feedback: Email addresses for authors of content Limitations: <ul style="list-style-type: none"> - Lacking specific advice regarding what to pack in a LB - Contains broken links 	Social media: Nil Paid: Nil Promotions & partnerships: Nil
Healthy Lunch Box Weblink: http://healthylunchbox.com/ Year developed: 2013 Last updated: 2017 Affiliation: Individual(s) Jurisdiction:	Purpose: Inform & educate parents & teachers regarding healthy eating in children Target audience: Parents & teachers	<ol style="list-style-type: none"> 1. Eat foods from the 5 food groups Credibility of information: <ul style="list-style-type: none"> - Messages somewhat consistent with North American DG, some incorrect - Dietitians/nutritionists developed content; however unclear about credentials 	Key features: <ul style="list-style-type: none"> - 8 children's games incorporating healthy eating concepts (e.g. drag food items onto the 'healthy eating plate') & food safety - Recipes (N=16) - Blog - Lesson plans for teachers Usability: <ul style="list-style-type: none"> - Basic website Social / community features: Twitter / FB pages Technical features: Nil User feedback: Email address provided, 'Contact us' page	Social media: Nil Paid: Nil Promotions & partnerships: Nil

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
North America Cost: Nil	MARS website quality mean score: 2.3/5		Limitations: - Some games do not function - Minimal information (content delivered via games & lesson plans)	
Make Healthy Normal — Healthy School Lunch Box Weblink: https://www.makehealthynormal.nsw.gov.au/food/healthy-school-lunch-box Year developed: Unknown Last updated: 2018 Affiliation: NSW Government Department of Health Jurisdiction: Australia Cost: Nil	Purpose: Encourage lifestyle changes for better health Target audience: Parents (of school-age children) & children MARS website quality mean score: 3.8/5	1. Balanced LB contains a drink & a variety of everyday foods from core food groups for recess & L 2. Go, Grow & Glow — grain foods to GO, P-rich foods to GROW and V to GLOW 3. Pack F for fibre Credibility of information: - Messages consistent with ADG Content developed by an accredited practising dietitian (not evident on website but evidence found elsewhere)	Key features: - LB builder — 4 categories (GO, GROW, GLOW & FIBRE) to select 5 foods, can personalise or generate random combination - Limit menu items by cuisine / dietary restriction Usability: - Part of a larger website with other pages, resources, tips, menu plans re healthy eating - Search function Social / community features: Share content via social media Technical features: Nil User feedback: Street / postal address & phone no. provided Limitations: - No information/recipes/tips specific to LB provided Foods in LB builder do not make up a cohesive meal	Social media: Nil Paid: Nil Promotions & partnerships: Cross-promotion on other health-related websites (e.g. Healthy Kid NSW, Health Direct, Pregnancy Birth & Baby)
Healthy Kids Association — Packing a healthy lunchbox Weblink: http://healthykids.com.au/parents/packing-a-healthy-lunchbox/0	Purpose: Improve nutritional quality of food in schools & at home for children	1. Important to pack balanced L so children are getting the nutrients they need 2. Pack the core 4 + 1 for active kids (a main L, core snack, F, water + additional small reduced-fat milk)	Key features: - PDF resource — LB guide based on core 4 + 1 concept - Information re. 5 core food groups & how to choose healthy snacks - 10-day lunchbox menu (pictures only) Usability: - Part of a larger website with other pages, blogs, resources, recipes - Search function	Social media: Some advertising via Instagram with #healthykidsassociation (17 posts) Paid: Nil Promotions & partnerships: - Cross-promotion on other websites & blogs (My School)

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
<p>Year developed: Unknown</p> <p>Last updated: Unknown</p> <p>Affiliation: Non-government organisation</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Target audience: Parents</p> <p>MARS website quality mean score: 3.7/5</p>	<p>drink/F juice, +1 extra snack for active kids)</p> <p>3. Keep 'occasional' foods out of the LB, keep for special occasions</p> <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG - No explicit evidence of engagement with health professionals, but partnered with Dietitians Association of Australia 	<p>Social / community features: Subscribe to email list, share 10-day LB menu via social media, email, Twitter, FB, Instagram, Google+, YouTube & Vimeo accounts</p> <p>Technical features: Sign up/create account for access to some content</p> <p>User feedback: Email address & phone number provided</p>	<p>Canteen blog, AEIOU Foundation for Children With Autism, Good Tucker Bakery)</p> <ul style="list-style-type: none"> - Advertising for Tip Top Sandwich Thins throughout Healthy Kids Association website
<p>Nutrition Australia — Healthy lunchbox week</p> <p>Weblink: https://www.healthylunchboxweek.org/</p> <p>Year developed: Unknown</p> <p>Last updated: 2018</p> <p>Affiliation: Nutrition Australia (national initiative)</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Purpose: Inspire & empower healthy eating for all Australians</p> <p>Target audience: Parents of school-age children</p> <p>MARS website quality mean score: 3.6/5</p>	<p>1. Make it healthy 2. Keep it convenient 3. Make it enjoyable</p> <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG - Developed by Nutrition Australia 	<p>Key features:</p> <ul style="list-style-type: none"> - Information about Nutrition Australia Healthy Lunch Box Week - Links to resources for packing a healthy LB, meal ideas, nutrition information, components of a healthy LB <p>Usability:</p> <ul style="list-style-type: none"> - Part of a larger website with healthy eating information, recipes - Search function <p>Social / community features: Share content via social media, email, Twitter, FB, Instagram, LinkedIn, YouTube pages</p> <p>Technical features: Nil</p> <p>User feedback: 'Contact us' page</p>	<p>Social media: Competition on Instagram & FB</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Cross-promotion on other health & government websites (e.g. Health Direct, Vic State Gov Education & Training)</p>

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
<p>Healthy Kids NSW — Lunch Box Ideas</p> <p>Weblink: https://www.healthykids.nsw.gov.au/parents-carers/healthy-eating-and-drinking/lunch-box-ideas.aspx</p> <p>Year developed: 2018</p> <p>Last updated: 2018</p> <p>Affiliation: Joint initiative NSW Ministry of Health, NSW Department of Education, Office of Sport & NSW Division of the Heart Foundation</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Purpose: Support teachers, parents, carers, coaches, health professionals, kids & teens to make healthy choices</p> <p>Target audience: Parents, children & schools/ teachers</p> <p>MARS website quality mean score: 3.5/5</p>	<ol style="list-style-type: none"> 1. Healthy L keeps kids alert & focused, provides them with nutrition they need each day 2. Pack your child's L with a variety of foods from the different food groups 3. Don't forget to drink water <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG - No explicit evidence of engagement with health professionals, but developed in consultation with NSW Ministry of Health and Heart Foundation 	<p>Key features:</p> <ul style="list-style-type: none"> - Information regarding LB ideas, how to manage LB refusal - Interactive infographic — 5 ways to a healthy lifestyle - Links to child-friendly recipes <p>Usability:</p> <ul style="list-style-type: none"> - Part of a larger website with other pages, resources, recipes - Search function <p>Social / community features: Share content via social media / email</p> <p>Technical features: Nil</p> <p>User feedback: 'Contact us' page</p> <p>Limitations:</p> <ul style="list-style-type: none"> - Some broken links 	<p>Social media: Nil</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Cross-promotion on other health-related websites (Pregnancy birth & baby — Health Direct, Get Healthy, Heart Foundation)</p>
<p>Nestlé Healthy Active Kids — What makes a balanced lunchbox?</p> <p>Weblink: https://www.healthyactivekids.com.au/balanced-lunchbox/</p>	<p>Purpose: Encourage Australian primary school students to live a healthy, happy & active lifestyle</p>	<ol style="list-style-type: none"> 1. Children consume 1/3 of their daily nutrients at school so it's important to pack them a balanced L 2. Balanced L includes variety of foods from the 5 food groups 	<p>Key features:</p> <ul style="list-style-type: none"> - PDF resource — LB tips & guide - LB lesson plans for schools (by state) - Recipes for LB & snacks - Link to more recipes, videos & other resources <p>Usability:</p> <ul style="list-style-type: none"> - Part of a larger website with other pages, resources, recipes, separate sections for parents / teachers / kids 	<p>Social media: Promotion of Nestlé Healthy Active Kids 'The Kitchen Kart' competition for schools on Instagram with #nestleyhealthyactivekids Some other promotion of the website by various other</p>

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
<p>Year developed: Unknown</p> <p>Last updated: Unknown</p> <p>Affiliation: Joint initiative between Australian Institute of Sport and Nestlé</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Target audience: Children through schools, parents of school-age children</p> <p>MARS website quality mean score: 3.5/5</p>	<p>3. Variety is important for children's growth, development & energy levels</p> <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG - No explicit evidence of engagement with health professionals 	<ul style="list-style-type: none"> - Search function <p>Social / community features: Nil</p> <p>Technical features: Nil</p> <p>User feedback: 'Contact us' page (broken link)</p> <p>Limitations:</p> <ul style="list-style-type: none"> - Some broken links 	<p>accounts with #nestlehealthyactivekids</p> <p>Paid: Nil</p> <p>Promotions & Partnerships: Cross-promotion on other health-related websites (e.g. Healthy Kids Association and Nutrition Australia)</p>
<p>Healthy Eating Advisory Service — Healthy lunchboxes</p> <p>Weblink: https://heas.health.vic.gov.au/schools/healthy-lunchboxes</p> <p>Year developed: Unknown</p> <p>Last updated: Unknown</p> <p>Affiliation: Healthy Eating Advisory Service & Nutrition Australia Vic division</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Purpose: Support early childhood services, outside school hours care, schools, workplaces, hospitals, sport & recreation centres, tertiary education & parks to provide healthier foods & drinks</p> <p>Target audience: Parents of school-age children</p>	<p>1. Pick & mix something from each of the food groups for a healthy LB</p> <p>2. Include water in LB</p> <p>3. Sweet & savoury snack foods should be limited in LB</p> <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG - Developed by dietitians and nutritionists via Nutrition Australia 	<p>Key features:</p> <ul style="list-style-type: none"> - LB guide — Pick 'n' Mix 1-6 poster (1=F, 2=V, 3=Dairy, 4=Meat/alt., 5=B&C, 6=Water), lists examples of what to include - Links to external sites — CCNSW Lunch Box Builder, Nutrition Australia, Better Health Channel - Links to video content from Décor, Nutrition Aus, Dairy Aus, Better Health Channel <p>Usability:</p> <ul style="list-style-type: none"> - Part of a larger website containing info for early childhood, schools, workplaces, sport, food outlets, food industry and training - Search function <p>Social / community features: Share content via social media/email, Twitter, FB, Instagram, LinkedIn, YouTube pages</p> <p>Technical features: Increase/decrease font size</p> <p>User feedback: 'Contact us' page</p> <p>Limitations:</p> <ul style="list-style-type: none"> - Limited information, mostly external links 	<p>Social media: Nil</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Cross-promotion on other health-related websites (e.g. Nutrition Australia)</p>

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
	MARS website quality mean score: 3.4/5			
<p>QLD Education — A healthy start to school tool kit</p> <p>Weblink: https://education.qld.gov.au/students/student-health-safety-wellbeing/student-health/smart-choices/healthy-start-school-tool-kit</p> <p>Year developed: Unknown</p> <p>Last updated: 2018</p> <p>Affiliation: Queensland Government Department of Education</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Purpose: Provide information to ensure children starting school are given the healthy food they need to keep them active & help them concentrate while learning</p> <p>Target audience: Children via schools, parents of school-age children</p> <p>MARS website quality mean score: 3.3/5</p>	<ol style="list-style-type: none"> 1. Smart Choices traffic light system — Green: have plenty (encourage & promote); Amber: select carefully (don't let dominate the choices, avoid large serves); Red: occasionally (not to be supplied more than twice per term) 2. L & snacks play big role in providing children's daily nutrition 3. Healthy snacks & L give children essential nutrients & energy needed to concentrate <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG <ol style="list-style-type: none"> 4. No explicit evidence of engagement with health professionals but likely 	<p>Key features:</p> <ul style="list-style-type: none"> - Information about healthy eating in the school setting, healthy snacks & L, talking to families - Resources — Smart Choices Healthy Food & Drink Supply Strategy, parent information, toolkits & fact sheets - Links to Department of Education <p>Usability:</p> <ul style="list-style-type: none"> - Part of a larger website with an extensive range of pages & links relevant to schools, parents & children - Search function <p>Social / community features: Twitter, FB, LinkedIn, YouTube pages</p> <p>Technical features: Nil</p> <p>User feedback: Postal / street address, telephone number provided</p>	<p>Social media: FB advertisement for community event</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Nil</p>

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
<p>WA School Canteens — packing healthy lunchboxes</p> <p>Weblink: https://www.waschoolcanteens.org.au/schoolcommunity/packing-healthy-lunchboxes/</p> <p>Year developed: Unknown</p> <p>Last updated: 2018</p> <p>Affiliation: WA School Canteen Association Inc.</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>Purpose: Assist canteens/ other food services to provide & promote healthy choices & operate economically viable & professional businesses</p> <p>Target audience: Parents of school-age children</p> <p>MARS website quality mean score: 3.1/5</p>	<ol style="list-style-type: none"> 1. Choose items from the 5 food groups to give children the nutrition needed to play & learn for the school day 2. LB rewards & treats don't have to be something edible 3. After-school snacks should be just as healthy <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG & refers to AGHE - No explicit evidence of engagement with health professionals 	<p>Key features:</p> <ul style="list-style-type: none"> - General information about LB & healthy eating - PDF resources — The ABCD of packing healthy lunch boxes (A = B&C, B = F&V, C = reduced-fat dairy, meat & alt., & D = snacks), menu planner, top 10 snacks, LB notes & jokes - Links to AGHE and FSANZ (reading food labels) <p>Usability:</p> <ul style="list-style-type: none"> - Other pages regarding canteens, training, the StarCAP2 & Star Choice program for canteens - Search function <p>Social / community features: Share content via social media & email, Twitter/FB pages</p> <p>Technical features: Nil</p> <p>User feedback: 'Contact us' page</p>	<p>Social media: Nil</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Cross-promotion on Government of WA website (e.g. Dept of Health and Dept of Education)</p>
<p>TAS Health — Healthy kids lunchboxes</p> <p>Weblink: https://www.dhhs.tas.gov.au/healthykids/early_childhood/lunch_boxes https://www.dhhs.tas.gov.au/healthykids/blog/waste_free_lunchboxes</p> <p>Year developed: Unknown</p> <p>Last updated:</p>	<p>Purpose: Provide families with information about nutrition & PA</p> <p>Target audience: Parents of school-age children</p>	<ol style="list-style-type: none"> 1. Choose everyday foods from the 5 food groups 2. Make water main drink 3. Leave out 'sometimes' foods (lollies, chips & chocolates) <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG - No explicit evidence of engagement with health professionals but likely 	<p>Key features:</p> <ul style="list-style-type: none"> - Information about packing a LB, food safety, waste-free L, tips/ideas - Links to recipes, booklets <p>Usability:</p> <ul style="list-style-type: none"> - Part of a larger website with content on a broad range of health topics - Search function <p>Social / community features: TAS government Move Well Eat Well FB page</p> <p>Technical features: Nil</p> <p>User feedback: Feedback form provided</p>	<p>Social media: Nil</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Cross-promotion on other health-related websites (Health Direct, Pregnancy, Birth and Baby)</p> <p>NOTE: other parts of website not linked directly https://www.dhhs.tas.gov.au/healthykids/blog/lunchbox_basics</p>

Website Information		Top 3 Key Messages	Functionality	Marketing and PR
<p>Unknown</p> <p>Affiliation: Tas Government, Dept of Health and Human Services</p> <p>Jurisdiction: Australia</p> <p>Cost: Nil</p>	<p>MARS website quality mean score: 3.1/5</p>		<p>Limitations:</p> <ul style="list-style-type: none"> - Navigation difficult, pages not all linked & found in different sections of the website 	<p>https://www.dhhs.tas.gov.au/mwe/families/limit_sometimes_foods/tips_for_a_rubbish-free_lunch</p> <p>https://www.dhhs.tas.gov.au/mwe/families/plant_fruit_and_veg_in_your_lunchbox</p> <p>https://www.dhhs.tas.gov.au/mwe/families/plant_fruit_and_veg_in_your_lunchbox/lunchbox_tips</p>
<p>SA Health — Healthy lunchboxes</p> <p>Weblink: https://www.sahealth.sa.gov.au/wps/wcm/connect/public+content/sa+health+internet/healthy+living/healthy+eating/healthy+eating+tips/healthy+lunchboxes</p> <p>Year developed: 2012</p> <p>Last updated: 2017</p> <p>Affiliation: SA Government, SA Health</p> <p>Jurisdiction: Australia</p> <p>Cost: nil</p>	<p>Purpose: Protect & improve the health of all SA by providing leadership in health reform, public health services, health & medical research, policy development & planning</p> <p>Target audience: Parents of school-age children, adults</p> <p>MARS website quality mean score: 3.0/5</p>	<ol style="list-style-type: none"> 1. Eating a healthy L can help maintain energy levels at work, school or study 2. The best L are the ones you pack at home 3. Packing a healthy L is a great way to boost number of recommended daily serves of the 5 food groups <p>Credibility of information:</p> <ul style="list-style-type: none"> - Messages consistent with ADG - No explicit evidence of engagement with health professionals but likely 	<p>Key features:</p> <ul style="list-style-type: none"> - Information about healthy LB (tips, ideas) - Links to internal & external websites including WA Packed with Goodness resource - Six video links from Flinders Uni about healthy LB <p>Usability:</p> <ul style="list-style-type: none"> - Part of a larger website with content on a broad range of health topics - Search function <p>Social / community features: Share content via social media, email, Twitter, FB, YouTube, LinkedIn account</p> <p>Technical features: Increase/decrease font size</p> <p>User feedback: Email contacts provided</p> <p>Limitations:</p> <ul style="list-style-type: none"> - Some broken links 	<p>Social media: FB ads promoting SA Health initiatives, but not directly linked</p> <p>Paid: Nil</p> <p>Promotions & partnerships: Cross-promotion on Health Direct website</p>

LB = lunch box; F = fruit; V = veg; WG = whole grains; B&C = breads & cereals; P = protein; CHO = carbohydrate; BF = breakfast; L = lunch; D = dinner; T/A = take away; PI = personal information; FB = Facebook; intro = introduction; alt = alternatives; ADG = Australian Dietary Guidelines; DG = dietary guidelines; pref. = preferences; AGHE = Australian Guide to Healthy Eating; FSANZ = Food Standards Australia and New Zealand; SA = South Australians; PA = physical activity

Table A1.5: Summary of apps included in Question 1

App Information		Top 3 Key Messages	Functionality	Marketing and PR
<p>The Ultimate Mix-and-Match School Lunchbox Version 1.2</p> <p>Developer: Trellisys.net https://www.familius.com/52-school-lunches-</p> <p>Year developed: 2013</p> <p>Affiliation: Individual</p> <p>Jurisdiction: US</p> <p>Category^a: Lifestyle</p> <p>Cost: Free; Freemium \$2.99</p>	<p>Platform: iPhone, iPad and iPod touch</p> <p>Purpose: Provide parents with L ideas for children</p> <p>Target audience: Parents & children</p> <p>User rating: Insufficient reviews</p> <p>MARS app quality mean score: 3.4/5</p>	<p>1. Include WG, P, F&V at every L</p> <p>2. Have different combinations of food at L for interest</p> <p>Credibility of information:</p> <ul style="list-style-type: none"> - Provides a link to US Department of Health - Authors not trained dietitians/nutritionists - No evidence of engagement with health professionals 	<p>Key Features:</p> <ul style="list-style-type: none"> - Provides random meal-combination generator or parents choose own combinations by scrolling through recipes - Recipes are sorted by three food groups (WG, P, F&V) - Freemium upgrade required for access to complete bank of recipes - Shopping list automatically generated, ingredients can be added - Notifications to make a new lunch box - Information section with intro to app, nutrition, healthy eating advice <p>Usability:</p> <ul style="list-style-type: none"> - Saves previous lunch boxes for reuse - Bright colours - Easy to navigate <p>Data direction: Two-way</p> <p>Social / community features: 'like' features & leave comments</p> <p>Technical features: Login not required, PI not collected</p> <p>User feedback: A community forum</p>	<p>Linked website: http://www.easylunchboxes.com/blog/easylunchboxes-endorsed-in-the-mix-and-match-lunchbox-book/</p> <ul style="list-style-type: none"> - Website promotes the original book version of the app <p>Social media:</p> <ul style="list-style-type: none"> - No social media platforms <p>Paid: Nil</p> <p>Promotions & partnerships:</p> <ul style="list-style-type: none"> - Promotion of original book version - Can be purchased through other online shopping platforms
<p>LaLa Lunchbox Version 3.8.1</p> <p>Developer: LaLa Lunchbox, LLC http://lalalunchbox.com/</p> <p>Year developed: 2012</p> <p>Affiliation: Commercial</p>	<p>Platform: iPhone, iPod touch, iPad (not optimised)</p> <p>Purpose: Assist children in choosing LB items while giving parents control over food choices available</p>	<p>1. Include F, V, protein & snack with every L</p> <p>2. Encourage independence by allowing children to choose their meals</p> <p>Credibility of information:</p>	<p>Key features:</p> <ul style="list-style-type: none"> - Kids design daily LB by choosing from parent-controlled lists of F, V, P & snacks - Shopping list automatically generated - Parents remove/add food items to lists & create personalised items - Add password for parental control - Pay for lists of food groups for specific dietary needs (gluten-free) - Notifications to design lunch boxes & buy groceries 	<p>Linked website: http://lalalunchbox.com/</p> <ul style="list-style-type: none"> - Website has promotions from external sources e.g. The New York Times - Link to Instagram account - Promotes other app LaLa Breakfast within grocery list <p>Social media:</p> <ul style="list-style-type: none"> - LaLa Lunchbox FB, Instagram, Twitter & Pinterest

App Information		Top 3 Key Messages	Functionality	Marketing and PR
<p>Jurisdiction: US</p> <p>Category^a: Food & drink</p> <p>Cost: Free; Freemium \$2.99–\$5.99</p>	<p>Target audience: Children supported by parents</p> <p>User rating: Insufficient reviews</p> <p>MARS app quality mean score: 3.3/5</p>	<ul style="list-style-type: none"> - No evidence messages based on DG - No evidence of engagement with health professionals 	<ul style="list-style-type: none"> - Personalise child's LB & create favourites for individual children <p>Usability:</p> <ul style="list-style-type: none"> - Easy layout to follow, minimal clicks needed to edit lunch box - Minimal text on screen - Orders lunch boxes alphabetically - Inadequate colour, significant white space <p>Data direction: Mostly user input, minimal information output</p> <p>Social / community features: Nil</p> <p>Technical features: Login optional, web access not required, PI not collected</p> <p>User feedback: Unable to provide through app</p>	<ul style="list-style-type: none"> - ~30,000 followers across all platforms - Features other 'bloggers' & 'social media influencers' to promote app <p>Paid: Nil</p> <p>Promotions & partnerships:</p> <ul style="list-style-type: none"> - With other social media pages (e.g. The FeedFeed and Land O'Lakes)
<p>LaLa Breakfast Version 2.4.1</p> <p>Developer: LaLa Lunchbox, LLC http://lalalunchbox.com/blog/introducing-lala-breakfast</p> <p>Year developed: 2013</p> <p>Affiliation: Individual</p> <p>Jurisdiction: US</p> <p>Category^a: Food & drink</p> <p>Cost: \$2.99</p>	<p>Platform: iPhone, iPod touch, iPad (not optimised)</p> <p>Purpose: Assist children in choosing BF while giving parents control over food choices</p> <p>Target audience: Children supported by parents</p> <p>User rating: Insufficient reviews</p> <p>MARS app quality mean score: 3.3/5</p>	<ol style="list-style-type: none"> 1. Include eggs, F/produce, grains and P at each BF 2. Encourage independence by allowing children to choose their meals 3. Have BF every day <p>Credibility of information:</p> <ul style="list-style-type: none"> - No evidence messages based on DG - Doesn't promote dairy as main food group - No evidence of engagement with health professionals 	<p>Key features:</p> <ul style="list-style-type: none"> - Kids design BF plate by choosing from parent-controlled lists of eggs, produce, grains and P - Parents remove/add food items to lists & create personalised items - Add password for parental control - Shopping list automatically generated - Notifications to design BF & buy groceries - Sync with the LB app have all shopping items combined in one list - Personalise child's BF plate, create favourites for individual children <p>Usability:</p> <ul style="list-style-type: none"> - Easy layout to follow, minimal text on screen - Minimal clicks needed to edit BF - Orders BF plates alphabetically - Inadequate colour, significant white space <p>Data direction: Mostly user input, minimal information output</p> <p>Social / community features: Nil</p>	<p>Linked website: http://lalalunchbox.com/blog/introducing-lala-breakfast</p> <ul style="list-style-type: none"> - Promoted through the LaLa Lunchbox website <p>Social media: Nil LaLa Breakfast social media accounts; only promoted through LaLa Lunchbox</p> <p>Paid: Nil</p> <p>Promotions & partnerships: As per LaLa Lunchbox partners (e.g. The FeedFeed and Land O'Lakes)</p>

App Information		Top 3 Key Messages	Functionality	Marketing and PR
			<p>Technical features: Login optional, sync with LaLa Lunchbox app, web access not required, PI not collected</p> <p>User feedback: Nil</p> <p>Limitations: Some foods in incorrect food groups/crossover of groups</p>	
<p>Kids Food Version 2.0</p> <p>Developer: Huyen Trang Nguyen</p> <p>Year developed: 2015</p> <p>Affiliation: Commercial</p> <p>Jurisdiction: Vietnam</p> <p>Category^a: Food & drink</p> <p>Cost: \$5.99</p>	<p>Platform: iPhone, iPod touch and iPad</p> <p>Purpose: Provide parents with easy meals for children & babies</p> <p>Target audience: Parents</p> <p>User rating: Insufficient reviews</p> <p>MARS app quality mean score: 2.8/5</p>	<ol style="list-style-type: none"> 1. Include variety of foods in child's LB: fresh F, V, P, dairy & CHO foods 2. Make food healthy by cooking rather than T/A 3. Shopping once a week helps to stay organised <p>Credibility of information:</p> <ul style="list-style-type: none"> - No evidence messages based on DG - Recipes not in line with healthy eating guidelines - No references for healthy eating tips - No evidence of engagement with health professionals 	<p>Key features:</p> <ul style="list-style-type: none"> - Child/family recipe categories e.g. kids' snacks, kids' LB ideas - Search categories & save recipes in favourites - Personalise by saving recipes, creating new recipe groups & adding these to calendar <p>Usability:</p> <ul style="list-style-type: none"> - Categories laid out clearly on home page - Navigation around app slightly confusing - Layout of recipes is difficult to read - Photos poor quality <p>Data direction: Mostly information output (recipes)</p> <p>Social / community features: Nil</p> <p>Technical features: Login not required, personal information not collected</p> <p>User feedback: Rate app in App Store, provide feedback via email</p> <p>Limitations: Ads present despite being paid for</p>	<p>Linked website: Nil</p> <p>Social media:</p> <ul style="list-style-type: none"> - Nil social media platforms used by developer - Can share recipes to FB <p>Paid: Nil</p> <p>Promotions & partnerships: Nil</p>
<p>Get Prepd Version 0.8.3</p> <p>Developer: Tastemade, Inc</p>	<p>Platform: iPhone, iPod touch & iPad</p> <p>Purpose: Provide LB ideas for adults</p>	<ol style="list-style-type: none"> 1. Eat L that are balanced and portion-controlled 2. Use nutrient-dense whole foods in recipes 	<p>Key features:</p> <ul style="list-style-type: none"> - Provides various lunch box combinations with recipes - View recipes by dietary restriction or health goal - Select LB & add to 'meal prep' list - Shopping list generated from meal prep list 	<p>Linked website: https://www.getprepd.com/pages/app</p> <ul style="list-style-type: none"> - Link provided to FB to share recipes <p>Social media:</p> <ul style="list-style-type: none"> - FB, Instagram, Twitter & Pinterest

App Information	Top 3 Key Messages	Functionality	Marketing and PR	
<p>https://www.getprepd.com/pages/app</p> <p>Year developed: 2017</p> <p>Affiliation: Individual</p> <p>Jurisdiction: US</p> <p>Category^a: Food & drink</p> <p>Cost: Free; optional purchase of portion-controlled LB for \$69 via app</p>	<p>Target audience: General</p> <p>User rating: Insufficient reviews</p> <p>MARS app quality mean score: 3.6/5</p>	<p>3. L preparation can be easy, use staple ingredients & be specific for individuals</p> <p>Credibility of information:</p> <ul style="list-style-type: none"> - A credentialled dietitian (Australia and US) assists with recipe development & testing — no further evidence of engagement with health professionals - No reference to DG 	<ul style="list-style-type: none"> - Personalisation available by adding LB to favourites, selecting units of measure & number of serves - Nutrient composition of each recipe available <p>Usability:</p> <ul style="list-style-type: none"> - Clear photos of lunch boxes - App easy to navigate <p>Data direction: mostly information output (recipes)</p> <p>Social / community features: Blog and 'community' to join</p> <p>Technical features: Login not required, PI not collected</p> <p>User feedback: Provide feedback through Prepd community</p> <p>Limitations: Nil observed</p>	<ul style="list-style-type: none"> - ~25,000 followers across all platforms <p>Paid: Nil ads apparent; was featured on Oprah</p> <p>Promotions & partnerships: with Tastemade as it is the overarching company</p>
<p>Change4Life Smart Recipes</p> <p>Version 3.0.3</p> <p>Developer: Public Health England</p> <p>https://www.nhs.uk/change4life</p> <p>Year developed: 2013</p> <p>Affiliation: Government</p> <p>Jurisdiction: Britain</p> <p>Category^a: Food & drink</p> <p>Cost: Free</p>	<p>Platform: iPhone, iPod touch and iPad</p> <p>Purpose: Provide parents & families with healthy recipes, nutrition & healthy eating information & advice on meal planning</p> <p>Target audience: General & parents</p> <p>User rating: Insufficient reviews</p> <p>MARS app quality mean score: 3.3/5</p>	<ol style="list-style-type: none"> 1. Aim for 5 serves F&V per day 2. Choose foods low in added sugars, saturated fat & salt 3. Choose home cooking before bought food; healthier & saves money <p>Credibility of information:</p> <ul style="list-style-type: none"> - Information developed from Public Health England's DG ('The Eatwell Guide') - Developed by Government 	<p>Key features:</p> <ul style="list-style-type: none"> - Provides family-friendly recipes for BF, L, D, desserts & snacks - 'Meal-mixer' randomly generates 3 recipes for the day (BF, L, D) - Recipes provide nutrition information & facts - Shopping list automatically generated - Includes healthy eating advice, seasonal tips, cooking advice & cooking terminology - Personalise by making favourites list, editing shopping list & selecting dietary requirements <p>Usability:</p> <ul style="list-style-type: none"> - Easy to navigate, video instructions easy to follow <p>Data direction: Mostly information output (recipes, nutrition information)</p> <p>Social / community features: Share to social media groups or join Change4Life community for additional support</p> <p>Technical features: Not password protected, notifications, PI not collected</p>	<p>Linked website:</p> <p>https://www.nhs.uk/change4life</p> <p>https://registration.change4life.co.uk/change4life</p> <p>Social media:</p> <ul style="list-style-type: none"> - Not linked directly with social media platforms - Available through FB, Twitter, Instagram, YouTube and Pinterest - ~587,000 followers across all platforms <p>Paid: In 2013 had paid radio, TV, online, email and SMS advertisements</p> <p>Promotions & partnerships:</p> <ul style="list-style-type: none"> - Promotions with current films and actors e.g. 'Train like a Jedi' during new Star Wars film release

App Information		Top 3 Key Messages	Functionality	Marketing and PR
		Department of Health (doesn't state which health professionals were consulted)	<p>User feedback: Unable to provide through the app</p> <p>Limitations: One broken link to Change4Life Food Scanner</p>	

^aAppStore category;

LB = lunch box; F = fruit; V = veg; WG = whole grains; P = protein; CHO = carbohydrate; BF = breakfast; L = lunch; D = dinner; T/A = take away; PI = personal information; FB = Facebook; intro = introduction; DG = dietary guidelines

Table A1.6: Other lunchbox websites identified that did not meet inclusion criteria for Question 1

Australia — one page related to lunch boxes within a website	
ACT Nutrition Support Service — Creative lunchbox ideas	http://www.actnss.org/home/nutrition-info-hub/creative-lunchbox-ideas/
Better Health Channel — Lunch box tips	https://www.betterhealth.vic.gov.au/health/healthyliving/lunch-box-tips
Blackmores — Foolproof lunch ideas for fussy kids	https://www.blackmores.com.au/kids-health/foolproof-lunch-box-ideas-for-fussy-eaters
Cancer Council NSW — Healthy lunch box ideas	https://www.cancercouncil.com.au/cancer-prevention/diet-exercise/nutrition-and-diet/healthy-eating-for-parents/healthy-lunch-box-ideas/
Carrington Health — Guide to a healthy lunchbox	https://www.carringtonhealth.org.au/guide-healthy-lunchbox/
DAA — What can I put in my child’s lunchbox?	https://daa.asn.au/smart-eating-for-you/smart-eating-fast-facts/children/what-can-i-put-in-my-childs-lunchbox/
Farmer Health — Fuelling farmers’ lunch boxes	https://www.farmerhealth.org.au/page/health-centre/diet-nutrition-fuelling-farmers-lunch-boxes
The Happy Snack Company — The importance of a healthy lunchbox	https://happysnackcompany.com.au/the-importance-of-a-healthy-lunchbox/
Huggies — Lunch box tips & ideas	https://www.huggies.com.au/toddler/recipes/lunch-boxes-ideas
In the Cove — Back to school: Healthy lunch box ideas	https://inthecove.com.au/2018/02/18/back-to-school-healthy-lunch-box-ideas/
Kelloggs — School lunch box ideas	https://www.kelloggs.com.au/en_AU/articles/lcms-article-2.html
Legendairy — Lunchbox ideas	http://www.legendairy.com.au/health/dairy-and-your-lifestage/children/lunchbox-ideas
Nestle — For Kids: A Balanced Lunch	https://www.nestlechoosewellness.com.au/eating-well/for-kids-a-balanced-lunch/
Raising children — Packing healthy lunches for children	https://raisingchildren.net.au/school-age/nutrition-fitness/breakfast-lunches/healthy-lunches
Women's and Children's Health Network — Kids’ Health: A healthy lunch box	http://www.cyh.com/HealthTopics/HealthTopicDetailsKids.aspx?p=335&np=284&id=1811
Live Lighter — Kids school lunches	https://livelighter.com.au/LiveLighter-for-Families/At-School/Lunchbox
School A to Z — Lunch box	http://www.schoolatoz.nsw.edu.au/wellbeing/food/recipes
Australian Institute of Food Safety	https://www.foodsafety.com.au/blog/back-to-school-lunchbox-food-safety-essentials
Cancer Council SA — 4 ways to an easier, healthier school lunchbox	https://www.cancersa.org.au/information/a-z-index/eating-a-healthy-diet/4-ways-to-an-easier-healthier-school-lunchbox
Cancer Council WA — Kickstart the school year with a full and healthy lunch box	https://www.cancerwa.asn.au/articles/news-2018/kickstart-the-school-year-with-a-full-and-healthy-/
Eltham North Primary School — Healthy Lunch Boxes	http://www.elthamnorthps.vic.edu.au/healthy-lunch-boxes/

HRI — Easy school lunch ideas for kids (and big kids!)	https://www.hri.org.au/latest-news/march-2017/easy-school-lunch-ideas-for-kids-and-big-kids
CSIROscope — Back to school lunch tips	https://blog.csiro.au/back-school-lunch-tips-make-healthy-eating-easy/
Hunter Primary Care — What a dietitian packs for school lunches	https://hunterprimarycare.com.au/healthy-back-to-school-lunch-tips-from-a-dietitian/
Nestlé — Preschool lunch ideas	https://www.nestlechoosewellness.com.au/eating-well/preschool-lunch-ideas/
Nutrition Australia — What's for lunch	http://www.nutritionaustralia.org/national/resource/whats-lunch
Better Health Channel — School lunch menu planner	https://www.betterhealth.vic.gov.au/health/healthyliving/lunch-boxes-menu-planner
Central Coast Australia — Healthy lunch box inspiration	https://www.centralcoastaustralia.com.au/news/healthy-lunch-box-inspiration-at-hand-for-central-coast-parents/
Lane Cove out of School Hours — Healthy back to school lunches	http://www.lcoos.com.au/2014/10/healthy-back-school-lunches/
Nutrition Australia — Packing a school lunchbox	http://www.nutritionaustralia.org/national/resource/packing-school-lunchbox
Vegie Smugglers — lunchbox	https://vegiesmugglers.com.au/tag/lunchbox/page/1/
Weight Watchers — Lunchbox planner	https://www.weightwatchers.com.au/util/art/index_art.aspx?tabnum=1&art_id=44911
Australia — blogs and blog posts	
Brisbane Kids — Lunchbox ideas and mum hacks for hot Brisbane days	https://www.brisbanekids.com.au/cool-summer-lunchbox-ideas-for-hot-brisbane-days/
Essential kids — 101 lunch box ideas	http://www.essentialkids.com.au/food/nutrition/101-lunch-box-ideas-20101222-19592
Her Canberra — School lunch box ideas	https://hercanberra.com.au/cpfood/school-lunch-box-ideas/
Kidspot — Lunch box ideas	https://www.kidspot.com.au/kitchen/galleries/lunch-box-ideas
Life Education — Easy, pressure-free, lunchbox ideas for busy parents!	https://www.lifeeducation.org.au/parents/easy-pressure-free-lunchbox-ideas-for-busy-parents
BUPA Blue Room — Five non-sandwich lunchbox ideas	https://theblueroom.bupa.com.au/families/raising-children/five-non-sandwich-lunchbox-ideas
Westpoint — 5 school lunchbox hacks	https://www.westpoint.com.au/articles/school-lunchbox-hacks
Australian Unity Health Insurance — The healthy school lunchbox	http://www.australianunity.com.au/health-insurance/existing-members/wellplan-online/childrens-health/the-healthy-school-lunchbox
Medibank — Healthy kids' lunchbox ideas	https://www.medibank.com.au/livebetter/be-magazine/food/healthy-kids-lunchbox-ideas/

Ellalist — Back to School! Here are ellalist’s best lunch box tips	https://www.ellalist.com.au/articles/back-to-school-here-are-ellalists-best-lunchbox-tips
Healthy Eating Hub — Make school lunches like a pro	https://www.healthyeatinghub.com.au/make-school-lunches-like-pro/
Kidspot — Lunch box tips from healthy little foodies	https://www.kidspot.com.au/kitchen/articles/family-eating/seven-ways-to-beat-the-lunch-box-monotony?gclid=EAlaIqobChMIgpumw9f63QIViggqCh0imgyhEAMYAyAAEglpC_D_BwE
NT Christian Schools — Quick & healthy lunch box ideas your children will love	http://www.ntchristianschools.com.au/index.php/healthy-lunch-box-ideas/
Planning with kids — Lunch box ideas you can freeze	https://planningwithkids.com/2015/01/19/lunch-box-ideas-can-freeze/
QUT — The ABCs of healthy school lunch box preparation	https://www.qut.edu.au/news?news-id=101519
Well Nourished — How to pack a nutritious lunch for your kids	https://www.wellnourished.com.au/healthy-lunchbox-ideas/
Goodie Goodie Lunchbox — Easy school lunch ideas	http://www.goodiegoodielunchbox.com.au/easy-school-lunch-ideas/
Practical Parenting — School lunch ideas	https://www.practicalparenting.com.au/how-to-pack-the-perfect-school-lunch
Sinchies — lunchbox ideas	https://www.sinchies.com.au/lunchbox-ideas/
HBF Insurance — 5 day kids lunch box plan	https://www.hbf.com.au/living-well/eat-well/articles/5-day-lunch-box-plan
Stawell Regional Health — Love your lunch box	http://srh.org.au/school-lunch-box/
Australia — PDFs and fact sheets	
ACT Government — healthy lunchboxes fact sheet	https://www.education.act.gov.au/support-for-our-students/student-health-and-wellbeing/healthy-food-and-drink-choices/healthy-lunchboxes-factsheet
Crunch & Sip — Healthy lunchboxes	http://www.crunchandsip.com.au/food-and-nutrition/healthy-lunchboxes/
Diabetes Queensland — School lunch box tips	https://www.diabetesqld.org.au/healthy-shopping/modules/healthy-kids/school-lunch-box-tips.aspx
Australian Indigenous Health Bulletin: Healthy, deadly lunch boxes	http://healthbulletin.org.au/articles/healthy-deadly-lunch-boxes/
Health.gov.au — Get Up & Grow	http://www.health.gov.au/internet/main/publishing.nsf/content/E1D19E4956B3411CCA257BF0001EDA84/\$File/HEPA%20-%20DL%20Brochure%20-%20Lunchbox%20Ideas%20-%20LR.pdf
Monash Children’s Hospital — School lunch box ideas	http://www.monashchildrenshospital.org/wp-content/uploads/2016/06/25-11-2013School-Lunch-Box-IdeasPDF-Document-119-kB.pdf
Nestlé — What goes into a balanced lunch box?	https://www.nestle.com.au/nhw/featuredarticles/whatgoesintoabalancedlunchbox
Tasmanian Government — Lunchboxes	https://www.dhhs.tas.gov.au/healthykids/early_childhood/lunch_boxes

Nutrition Australia — Healthy lunch ideas for busy adults	http://www.nutritionaustralia.org/national/resource/healthy-lunch-ideas-busy-adults
Cancer Council NSW — Healthy lunch box planner	https://www.cancercouncil.com.au/wp-content/uploads/2014/11/CCN10398-Lunch-box-planner-Web.pdf
Deer Park North Primary School — Healthy eating: School lunches	http://www.deerparknthps.vic.edu.au/app/webroot/uploaded_files/media/Healthy_eating_school_lunches.pdf
Eat for health — Healthy meal and snack ideas	https://www.eatforhealth.gov.au/eating-well/tips-eating-well/healthy-meal-and-snack-ideas
Goodie Goodie — Lunchbox planner	http://www.goodiegoodielunchbox.com.au/easy-school-lunch-ideas/lunchbox-planner/
Love in a lunchbox — Acquittal report	https://documentcentre.education.tas.gov.au/Documents/Student-Health-Initiative-LOVE-in-a-LUNCHBOX-Acquittal-Report-Clarendon-Vale.pdf
The Government of Western Australia — Lunch Right Project	https://www.healthway.wa.gov.au/wp-content/uploads/Lunch-Right-Project.pdf
International — Main pages with links	
Health info Canterbury — Healthy school lunches	https://www.healthinfo.org.nz/index.htm?healthy-school-lunches.htm
Change 4 life Wales — Lunchboxes	http://www.change4lifewales.org.uk/recipes/lunchboxes/?lang=en
Food a fact of life — Make a healthy lunchbox!	http://www.foodafactoflife.org.uk/Activity.aspx?siteId=1&sectionId=61&contentId=56
Flora UK — Five day lunchbox plan	http://www.flora.com/article/detail/1239845/five-day-lunchbox-plan
Flora UK — Lunchbox tips	http://www.flora.com/article/detail/1097393/lunchbox-tips
NHS Change 4 life — Healthier lunchboxes	https://www.nhs.uk/change4life/recipes/healthier-lunchboxes
Freddy Fit — Lunch box maker: How healthy can you make a lunch box?	https://www.freddyfit.co.uk/kids/games/lunch-box-maker.php
BBC iWonder — What makes a great packed lunch?	http://www.bbc.co.uk/guides/zgr4kqt
Flora UK — Healthy lunch ideas	http://www.flora.com/article/detail/1104226/healthy-lunch-ideas
Food a fact of life — the amazing lunchbox	http://www.foodafactoflife.org.uk/Sheet.aspx?siteId=15&sectionId=101&contentId=436
City of Lacombe Recreation & Culture — Operation lunch box	http://lacombe.ca/living/recreation-culture/chooswell/operation-lunch-box
Health Unit — The ABCs of packing a school lunch	https://healthunit.org/health-information/healthy-eating/learn-work-play/packing-school-lunch/

Appendix 2: Review Question 2

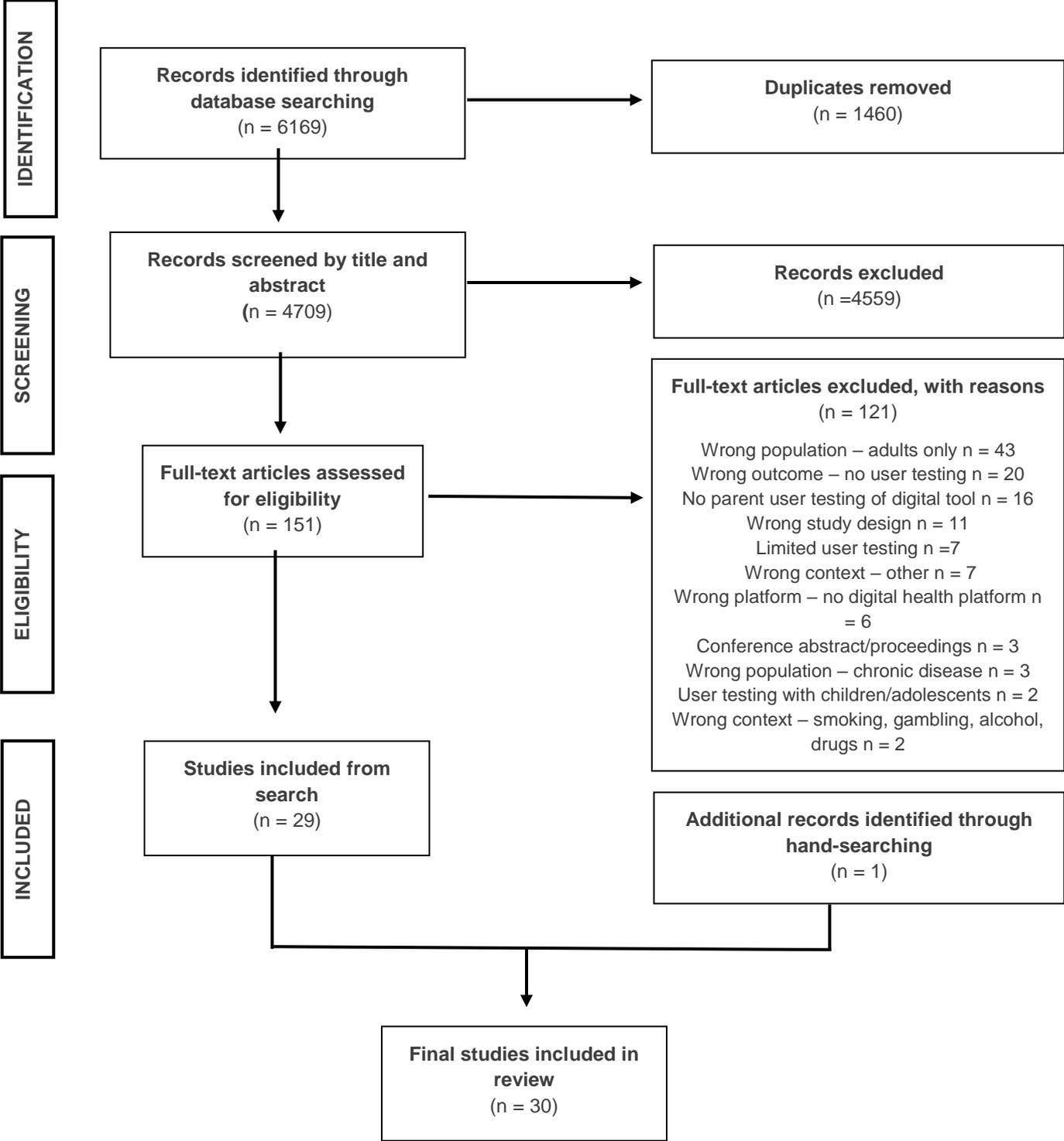


Figure A2.1: PRISMA flow diagram of article selection for Question 2

Table A2.2: Inclusion and exclusion criteria for studies in Question 2

Inclusion	Exclusion
<ul style="list-style-type: none"> English language 	<ul style="list-style-type: none"> Language other than English
<ul style="list-style-type: none"> Published since 1 January 2008 	<ul style="list-style-type: none"> Published before 2008
<ul style="list-style-type: none"> Studies from Australia, New Zealand, Britain, the US, Canada & Western Europe (including Scandinavia) 	<ul style="list-style-type: none"> Studies outside of specified countries of interest
<ul style="list-style-type: none"> Study design: RCT, cohort study, cross-sectional/survey, case study, pilot study, feasibility study, qualitative study, study protocols (if reporting relevant results) 	<ul style="list-style-type: none"> Study design: letter to editor, note, comment, editorial, newspaper article, reviews, conference abstracts/ proceedings
<ul style="list-style-type: none"> User testing conducted with parents, adults, school settings, teachers, childcare, healthcare professionals 	<ul style="list-style-type: none"> User testing conducted with children/adolescents or older adults
<ul style="list-style-type: none"> Studies that seek users' views about features/functions desired from digital health promotion platforms 	
<ul style="list-style-type: none"> Studies that pilot and examine reliability, feasibility, functionality, acceptability, engagement, aesthetics/visual appeal, marketing strategies & information quality of digital health promotion platforms 	
<ul style="list-style-type: none"> User profile from whom views/ attitudes/ information is relevant, comparable, translatable to parents 	<ul style="list-style-type: none"> User profile that is not relevant, comparable, translatable to parents
<ul style="list-style-type: none"> User testing of digital health promotion tools (apps, websites, email, tele-health, text message, wearable devices) that support child nutrition 	<ul style="list-style-type: none"> User testing conducted in relation to non-transferrable areas of health (e.g. smoking cessation, secondary prevention of chronic diseases, eating disorders, cancer)
<ul style="list-style-type: none"> User testing conducted in relation to nutrition, physical activity, obesity, pregnancy & preconception (if intervention is providing general healthy eating advice), infant feeding 	<ul style="list-style-type: none"> User testing conducted in relation to measurement of dietary intake or implementation/use of e-health records

Table A2.3: Characteristics and outcomes of user-testing studies included in Question 2

Study	Intervention	Study Characteristics	Results	
<p>Biediger-Friedman et al. 2018¹⁷</p> <p>US</p> <p>Jurisdiction: State</p>	<p>Platform: App — WIC</p> <p>Purpose: Collect preferences from WIC participants regarding nutrition education app</p> <p>Components: Tracking/locating, accessing information, chatting/texting, gaming, planning/scheduling, sharing</p> <p>Target audience^a: Mothers involved in WIC program</p>	<p>Study design: Focus groups, survey</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 48 mothers at WIC clinics in South-Central Texas</p> <p>OUTCOMES:</p> <p>User testing: Preferred mode of delivery, preferred features, content & technology</p> <p>Marketing: Digital platform use</p>	<p>USER TESTING</p> <p>Preferred mode of delivery:</p> <ul style="list-style-type: none"> - All had smartphone and predicted app usage would be frequent (few times/wk or /day) <p>Preferred features:</p> <ul style="list-style-type: none"> - Self-explanatory and easy to use - Targeting multiple behaviours - Receiving nutrition education through videos - Logging and tracking features - Live interface (staff chat options for support) - Sharing information through social media - Sharing milestones, ideas, achievements, challenges - Games to engage children - Features that engaged whole family <p>Content:</p> <ul style="list-style-type: none"> - Trusted, beneficial, accurate and relevant <p>Technology:</p> <ul style="list-style-type: none"> - Motivational prompts (challenges, pings, reminders, celebratory signals) 	<p>MARKETING</p> <p>Digital platform use:</p> <ul style="list-style-type: none"> - Used social media daily (frequently to connect with others) - FB most popular
<p>James et al. 2018¹⁸</p> <p>US</p> <p>Jurisdiction: N/A</p>	<p>Platform: App/smartphones</p> <p>Purpose: Examine smartphone usage, social media engagement & willingness to participate in mHealth program</p> <p>Components: N/A</p> <p>Target audience^a:</p>	<p>Study design: Survey</p> <p>Quality rating^b: N/A</p> <p>Participants: n=425 African American females</p> <p>OUTCOMES:</p> <p>User testing: Nil measured</p>	<p>USER TESTING</p> <p>Nil measured</p>	<p>MARKETING</p> <p>Digital platform use:</p> <ul style="list-style-type: none"> - 85% used smartphones daily for internet - Smartphones commonly used daily to text, followed by email and FB - 51% used nutrition/fitness app in past 30/d; 18–29 ($\beta=0.99$; $OR=2.67$; $p<.001$) & 30–50 ($\beta=0.87$; $OR=2.42$; $p=.003$) more likely than 51+

Study	Intervention	Study Characteristics	Results
	African American women	Marketing: Digital platform use, use of online health information, social media use/preference	<ul style="list-style-type: none"> - 73% willing to participate in mHealth via text message, 69% smart-watches/fitness trackers, 68% smartphone app, 68% website, 33% online counselling - 18–29 ($\beta=1.70$;OR=5.45;$p<.0001$) & 30–50 ($\beta=1.14$;OR=3.14;$p<.0001$) more willing to use smartphone app than 51+ <p>Use of online health information:</p> <ul style="list-style-type: none"> - Past 12/mth 67% searched nutrition/dieting, followed by general health & medication - 18–29 more likely than 51+ to search for mental health ($\beta=1.19$;OR=3.27;$p=.003$) and general health ($\beta=0.93$;OR=2.53;$p=.003$) - 18–29 ($\beta=-1.19$;OR=0.30;$p=.001$) & 30–50 ($\beta=-0.85$;OR=0.43;$p=.014$) less likely to search for diabetes than 51+ - Those with \downarrowBMI (28.82 ± 8.34) more likely to search for general health (30.56 ± 7.86; $F_{1,402}=4.40$;$p=.034$) <p>Social media use/preference:</p> <ul style="list-style-type: none"> - 85% used FB, followed by YouTube, Google+, Instagram, Skype, Twitter, Pinterest, blogs - 18–29 more likely to use YouTube ($\beta=0.92$;OR=2.52;$p=.017$) & Instagram ($\beta=2.39$;OR=10.90;$p<.0001$) & less likely to use Google+ ($\beta=-0.91$; OR=0.40;$p=.009$) than 51+

Study	Intervention	Study Characteristics	Results
			- 30–50 more likely to use Instagram ($\beta=1.28$; $OR=3.61$; $p=.014$) and FB ($\beta=1.04$; $OR=2.84$; $p<.006$) than 51+
Laws et al. 2018 ¹⁹ US Jurisdiction: N/A	Platform: Website & app — Growing Healthy Purpose: Intervention promoting infant feeding & parenting behaviours to promote healthy weight gain Components: Push notifications, SMS, tailored messages, links to more information Target audience^a: Parents of infants	Study design: Quasi-experimental, surveys: BL, infant 6 mths, infant 9 mths Quality rating^b: III-3 (?) Participants: n = 645 pregnant women (30+ weeks) or parent of infant <3mths OUTCOMES: User testing: Preferred mode of delivery, content & technology Marketing: Nil measured	USER TESTING Preferred mode of delivery: - 86.4% accessed via app, 13.6% via website Content: - 86.1% reported app provided trustworthy information Technology: - 20% reported disabling push notifications - Majority receiving push notifications, found them helpful & appropriately timed - 40% unsure how to retrieve push notifications - <5% concerned about data use when using app MARKETING Nil measured
Luesse et al. 2018 ²⁰ US Jurisdiction: N/A	Platform: Text messaging linked to website Purpose: Determine if text messaging is a suitable way to reach parents with food & dietary information Components: N/A Target audience^a: LI urban minority families	Study design: Focus groups Quality rating^b: N/A Participants: n = 16 LI parents of elementary school children OUTCOMES: User testing: Preferred mode of delivery, content & technology Marketing: Nil measured	USER TESTING Preferred mode of delivery: - Emails, website, text messages, social media - Provided across platforms (link to website in message) - Infrequent (monthly) written information as adjunct to website - Provided from a figure outside of the family Content: - Tailored and personalised messages - Preferred themed over general advice - Pictures for low-literacy parents MARKETING Nil measured

Study	Intervention	Study Characteristics	Results	
			<ul style="list-style-type: none"> - Visual and written content preferred <p>Technology:</p> <ul style="list-style-type: none"> - Some didn't like idea of receiving text messages, others thought would be helpful - Evening most preferred time to receive texts 	
<p>Reynolds et al. 2018²¹</p> <p>Australia</p> <p>Jurisdiction: N/A</p>	<p>Platform: App</p> <p>Purpose: Evaluation of school-based mobile app to deliver messages to parents on how to pack a healthy lunch box</p> <p>Components: N/A</p> <p>Target audience^a: Parents of primary school children</p>	<p>Study design: Survey</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 196 primary school principals</p> <p>OUTCOMES:</p> <p>User testing: Preferred mode of delivery, preferred features</p> <p>Marketing: Nil measured</p>	<p>USER TESTING</p> <p>Preferred mode of delivery:</p> <ul style="list-style-type: none"> - 60% currently used app - >80% agree appropriate for schools to provide information though app - Most considered at least 1/month as acceptable frequency for messages to be sent - 73% agreed it would be acceptable for these messages to be provided by a third party - 3 ceased use of apps as they didn't enhance communication with parents <p>Preferred features:</p> <ul style="list-style-type: none"> - Of those who had not previously used a school-based app, 33% were likely to use in future - Cost & communication most influential features 	<p>MARKETING</p> <p>Nil measured</p>
<p>Breitenstein et al. 2017²²</p> <p>USA</p> <p>Jurisdiction: N/A</p>	<p>Platform: App — ezPARENT</p> <p>Purpose: Provide strategies for promoting positive parenting behaviour & decreasing child misbehaviour</p> <p>Components:</p>	<p>Study design: 3-mth RCT BL survey</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 42 parents of child 2–5 years (1 group only)</p> <p>OUTCOMES:</p>	<p>USER TESTING</p> <p>Nil measured</p>	<p>MARKETING</p> <p>Digital platform use:</p> <ul style="list-style-type: none"> - 76% felt very comfortable using apps on smartphone/tablet, 7% somewhat comfortable, 7% a little comfortable, 7% uncomfortable and didn't use <p>Internet use:</p>

Study	Intervention	Study Characteristics	Results	
	<p>6 modules; videos, questions, activities, practice assignments/ checklist, documents, badges for completion, encouraging text messages</p> <p>Target audience^a: Parents of young children</p>	<p>User testing: Nil measured</p> <p>Marketing: Digital platform use, internet use</p>		<ul style="list-style-type: none"> - 86% reported using internet daily, 14% used it weekly
<p>Byrd-Bredbenner et al. 2017²³</p> <p>US</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website — HomeStyles</p> <p>Purpose: Program helping parents shape home environments and practices to support optimal child health</p> <p>Components: Instructional guides (12) delivered online to help parents and children make changes to their home environments</p> <p>Target audience^a: Parents, their preschool children and family unit</p>	<p>Study design: RCT, formative focus groups, post-intervention survey, observational data</p> <p>Quality rating^b: N/A</p> <p>Participants: Parents who have child 2–6 years, n = 139 focus groups, n = 5494 observational data, n = 112 survey</p> <p>OUTCOMES:</p> <p>User testing: Nil measured</p> <p>Marketing: Recruitment strategies</p>	<p>USER TESTING Nil measured</p>	<p>MARKETING</p> <p>Recruitment strategies:</p> <ul style="list-style-type: none"> - Strongly dislike terms ‘obesity’, ‘overweight’, ‘get things under control’ - Prefer colours, diverse photos - Used FB page, Pinterest page, flyers, webinars, listservs, websites, social media, paid FB ads, magazines, newspapers, radio, television & community events to recruit - 5494 screener website hits, 5277 completers - 39% screener completers eligible for RCT - Unable to discern contribution of individual recruitment methods - FB ads generated 48% website visits - 27.7% heard about website from friends/family/co-worker, followed by day care provider, email notice, website posting, not sure, social media, home visitor, flyer/poster, WIC office, researchers

Study	Intervention	Study Characteristics	Results	
<p>Da Costa et al. 2017²⁴</p> <p>Canada</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website — Healthydads.ca</p> <p>Purpose: Needs assessment of website designed to enhance mental health and healthy behaviours for expectant first-time fathers</p> <p>Components: N/A</p> <p>Target audience^a: Expectant first-time fathers</p>	<p>Study design: Survey (5-point Likert)</p> <p>Quality rating^b: N/A</p> <p>Participants: 174 expectant first-time fathers (or first-time fathers)</p> <p>OUTCOMES:</p> <p>User testing: Preferred features, content & usability/appeal</p> <p>Marketing: Use of online health information</p>	<p>USER TESTING</p> <p>Preferred features:</p> <ul style="list-style-type: none"> - Posting questions to health professionals <p>Content:</p> <ul style="list-style-type: none"> - Parenting/infant care most highly rated topic followed by partner-oriented issues & psychosocial topics - Healthy eating/PA rated as less important - Personally relevant - Easy to understand, useful, credible - Liked new content provided regularly <p>Usability/appeal:</p> <ul style="list-style-type: none"> - Easy navigation - Created by experts - Attractive - Free of charge 	<p>MARKETING</p> <p>Use of online health information:</p> <ul style="list-style-type: none"> - Most accessed internet from home to obtain information on pregnancy
<p>Hull et al. 2017²⁵</p> <p>US</p> <p>Jurisdiction: State</p>	<p>Platform: App — Children Eating Well (CHEW)</p> <p>Purpose: Home-based nutrition education intervention to reinforce Special Supplemental Nutrition Program for WIC</p> <p>Components: Shopping tools (barcode scanner, calculator), nutrition education (yummy snack gallery, recipes, snacking tips)</p> <p>Target audience^a:</p>	<p>Study design: Questionnaire</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 63 mothers of African-American & Hispanic children 2–4 years</p> <p>OUTCOMES:</p> <p>User testing: Preferred features, technology & usability/appeal</p> <p>Marketing: Nil measured</p>	<p>USER TESTING</p> <p>Preferred features:</p> <ul style="list-style-type: none"> - Snack gallery was helpful, loved by children, easy, affordable - Shopping tools - Tips to help buy/eat more F&V <p>Disliked features:</p> <ul style="list-style-type: none"> - Not enough recipes <p>Technology:</p> <ul style="list-style-type: none"> - Some disliked notification delivery schedule or information provided through notifications <p>Usability/appeal:</p>	<p>MARKETING</p> <p>Nil measured</p>

Study	Intervention	Study Characteristics	Results	
	LI mothers of children <5		<ul style="list-style-type: none"> - Yummy snack gallery/healthy snack tips rated high for ease of use, helpfulness, usefulness, satisfaction - Barcode scanner & produce calculators rated high for ease of use and helpfulness - Shopping tools rated high for satisfaction 	
Mackert et al. 2017 ²⁶ US Jurisdiction: N/A	Platform: App Purpose: E-health application for prenatal health Components: Home page & modules (slide shows on foetal development, nutrition, financial preparation) Target audience^a: Expectant fathers	Study design: B interview, screen tracking, survey post-app Quality rating^b: N/A Participants: n = 23 men OUTCOMES: User testing: Preferred mode of delivery, preferred features, content & usability/appeal Marketing: Use of online health information	USER TESTING Preferred mode of delivery: <ul style="list-style-type: none"> - Most felt comfortable using tablets (M = 6.4; SD = 0.9) - Mixed about using an app like this in the future (M = 4.8;SD = 1.6) Preferred features: <ul style="list-style-type: none"> - Personalised, tailored experience - Links or drop-down content - External links to reputable websites - Engaging content (videos, games, quizzes) Content: <ul style="list-style-type: none"> - Nutrition & financial preparation most accessed Usability/appeal: <ul style="list-style-type: none"> - Most engaged with app - Enjoyed graphics & overall feel of app 	MARKETING Use of online health information: <ul style="list-style-type: none"> - All stated using mobile phones, tablets or laptops to access health information - Google, WebMD most common
Rekhy et al. 2017 ²⁷ Australia Jurisdiction: N/A	Platform: Website — Veggycation Purpose: Website designed to educate and promote vegetable consumption Components: Static & dynamic (interactive) components and	Study design: Survey (5-point Likert) Quality rating^b: N/A Participants: n = 1000 adults OUTCOMES: User testing: Content & usability/appeal	USER TESTING Content: <ul style="list-style-type: none"> - Rated at 4.08/5 - <avg. income respondents gave lower scores ($p < 0.05$) Usability/appeal: <ul style="list-style-type: none"> - User friendliness = 3.80/5 - Likelihood of revisiting = 3.91/5 - Attractiveness = 4.02/5 	MARKETING Nil measured

Study	Intervention	Study Characteristics	Results	
	informational content (facts, health benefits, serve sizes) Target audience^a: Children & adults	Marketing: Nil measured	<ul style="list-style-type: none"> - Men rated attractiveness, content and user friendliness ($p < 0.001$) sig. ↓ - ≤29 y/o rated user friendliness ↑ than 30–65 y/o ($p < 0.001$) - Non-metro rated likelihood of revisiting ↑ ($p < 0.05$) - Those who viewed V as extremely important rated all outcomes sig. ↑ ($p < 0.001$) 	
Wyse et al. 2017 ²⁸ Australia Jurisdiction: N/A	Platform: Canteen website Purpose: Evaluate online canteen ordering systems Components: N/A Target audience^a: Parents and students	Study design: Survey Quality rating^b: N/A Participants: n = 123 primary school principals OUTCOMES: User testing: Perceived barriers to implementation Marketing: Nil measured	<p style="text-align: center;">USER TESTING</p> <p>Perceived barriers to implementation:</p> <ul style="list-style-type: none"> - Parent internet access (63%) - Set-up time (52%) - Canteen internet access (41%) - Difficulty of use for parents (39%) - Difficulty of use for canteen manager (35%) 	MARKETING Nil measured
Avis et al. 2016 ²⁹ Canada Jurisdiction: N/A	Platform: App (iPad) — Resource Information Program for Parents on Lifestyle and Education (RIPPLE) Purpose: E-health program for parents to prevent childhood obesity in primary care Components: Screening (weight status), brief intervention (tailored	Study design: Focus groups Quality rating^b: N/A Participants: n = 20 paediatric healthcare professionals, n = 10 parents, n = 8 researchers and graduate trainees OUTCOMES: User testing: Preferred mode of delivery, preferred features, content & usability/appeal	<p style="text-align: center;">USER TESTING</p> <p>Preferred mode of delivery:</p> <ul style="list-style-type: none"> - Usability of iPad was straightforward <p>Preferred features:</p> <ul style="list-style-type: none"> - Quick, informative, tailored feedback - Alleviates barriers & motivates to make changes - Relevant resources - Awareness of child weight status, dietary, PA & sedentary behaviours - Initiates conversation with paediatrician <p>Disliked features:</p>	MARKETING Nil measured

Study	Intervention	Study Characteristics	Results	
	<p>feedback), referral to treatment (resources, community services)</p> <p>Target audience^a: Parents and paediatric healthcare professionals</p>	<p>Marketing: Nil measured</p>	<ul style="list-style-type: none"> - Eliciting negative reactions (fear, guilt, shame) - Content in email report was vague <p>Content:</p> <ul style="list-style-type: none"> - Want additional resources - Improve weight related terminology - Appropriate language, suitable in length <p>Usability/appeal:</p> <ul style="list-style-type: none"> - More clarity re. instructions, descriptions, terms - Images should reflect cultural diversity 	
<p>Biediger-Friedman et al. 2016³⁰</p> <p>US</p> <p>Jurisdiction: State</p>	<p>Platform: App</p> <p>Purpose: User-centred design of app to improve health behaviours among participants in the Special Supplemental Nutrition Program for WIC</p> <p>Components: N/A</p> <p>Target audience^a: WIC participants</p>	<p>Study design: Focus groups</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 64 WIC/WIC-eligible women</p> <p>OUTCOMES:</p> <p>User testing: Preferred features & technology</p> <p>Marketing: Digital platform use, use of online health information</p>	<p>USER TESTING</p> <p>Preferred features:</p> <ul style="list-style-type: none"> - Connecting with other mothers for support - Sharing health-related data (exercise logs) - Access to professionals for assistance - Online support with live chat option - Games for child engagement - Trackers for diet, exercise & breastfeeding - Shopping lists - Customisable home page - All features in one place <p>Technology:</p> <ul style="list-style-type: none"> - Library feature with search function - Locators for farmers markets 	<p>MARKETING</p> <p>Digital platform use:</p> <ul style="list-style-type: none"> - Expressed dependence on immediate access to information through internet browsers & social media <p>Use of online health information:</p> <ul style="list-style-type: none"> - Apps used to improve health behaviours: texting/chatting, accessing information, tracking/locating, planning/scheduling, sharing, gaming
<p>Laws et al. 2016³¹</p> <p>Australia</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website & app — Growing Healthy</p> <p>Purpose: Intervention promoting infant feeding & parenting behaviours to promote healthy weight gain</p> <p>Components:</p>	<p>Study design: Quasi-experimental, BL surveys</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 300 expectant parents (+30 weeks gestation) or parent of infant <3mths</p> <p>OUTCOMES:</p>	<p>USER TESTING</p> <p>Nil measured</p>	<p>MARKETING</p> <p>Recruitment strategies:</p> <ul style="list-style-type: none"> - 50% of responders recruited online via ads on popular Australian parenting websites & forums, FB pages, paid FB ad - Ads on FB pages recruited most participants at lowest cost - Paid FB ad less successful

Study	Intervention	Study Characteristics	Results	
	<p>Push notifications, SMS, tailored messages, links to more information, FB group</p> <p>Target audience^a: Parents of infants</p>	<p>User testing: Nil measured</p> <p>Marketing: Recruitment strategies</p>		<ul style="list-style-type: none"> - 29.3% recruited via practitioners handing out brochures, displaying posters, EOI forms - 7.3% recruited via researchers - 12.7% recruited through family/friends - Snowball effect of social media continued to promote program - No sig. difference in participant characteristics by recruitment method - First-time parents more likely to be recruited by practitioner or researchers
<p>Breitenstein et al. 2015³²</p> <p>US</p> <p>Jurisdiction: N/A</p>	<p>Platform: App — Chicago Parent Program (CPP)</p> <p>Purpose: Adaption of face-to-face parent training program to tablet-based delivery format</p> <p>Components: 6 modules based on CPP weekly topics</p> <p>Target audience^a: Parents of pre-schoolers</p>	<p>Study design: Meetings with parent advisory group & content experts</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 10 LI, ethnic minority parents, n = 3 CPP developers</p> <p>OUTCOMES:</p> <p>User testing: Preferred mode of delivery, preferred features & usability/appeal</p> <p>Marketing: Nil measured</p>	<p>USER TESTING</p> <p>Preferred mode of delivery:</p> <ul style="list-style-type: none"> - 2-week interval between sessions desired to complete module & practice exercises <p>Preferred features:</p> <ul style="list-style-type: none"> - Interactive components, game-type functions - Multiple reinforcement of content - Tracking progress & awards for completion <p>Usability/appeal:</p> <ul style="list-style-type: none"> - Exciting and colourful - Visually pleasing, engaging and easy to use 	<p>MARKETING</p> <p>Nil measured</p>
<p>Burrows et al. 2015³³</p> <p>Australia</p>	<p>Platform: Website & app</p> <p>Purpose: Development of an e-health family healthy lifestyle program</p>	<p>Study design: Survey</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 75 parents of children 4–18 years</p>	<p>USER TESTING</p> <p>Preferred mode of delivery:</p> <ul style="list-style-type: none"> - 90% interested in online lifestyle program - Website in addition to app <p>Preferred features:</p> <ul style="list-style-type: none"> - Personal user accounts to access information 	<p>MARKETING</p> <p>Nil measured</p>

Study	Intervention	Study Characteristics	Results
Jurisdiction: N/A	Components: N/A Target audience^a: Parents of children 4–18 years	OUTCOMES: User testing: Preferred mode of delivery, preferred features, content, technology & usability/appeal Marketing: Nil measured	<ul style="list-style-type: none"> - Informal program with no scheduled sessions - Information from dietitian (face-to-face or online) - Interaction with members & staff (social network or forum) - Inclusive of child with games & activities - Achievable and monitored goals/goal setting - Not solely focused on weight - Endorsed by university or govt website Content: <ul style="list-style-type: none"> - Specific information & education on portions for different ages, recipes, nutrition - Relevant for all family members - Budget-friendly ideas using everyday foods Technology: <ul style="list-style-type: none"> - Enter goals via website or smartphone - Reminders via email or SMS Usability/appeal: <ul style="list-style-type: none"> - Easy to use, low-cost, simple, streamlined
Denney-Wilson et al. 2015 ³⁴ Australia Jurisdiction: N/A	Platform: Website & app — Growing Healthy Purpose: Intervention promoting infant feeding & parenting behaviours to promote healthy weight gain Components: Push notifications, SMS, tailored messages, links to more information, FB group Target audience^a: Parents of infants	Study design: Focus groups Quality rating^b: N/A Participants: n = 24–32 pregnant women (30+ weeks) or parent of infant <3mths OUTCOMES: User-testing: Content & technology Marketing: Nil measured	<p style="text-align: center;">USER TESTING</p> Content: <ul style="list-style-type: none"> - Desire to receive tailored information (milestone-based, reminders about immunisation) - Did not want to receive messages not related to them or their situation - Preferred positive, affirming and personalised messages Technology: <ul style="list-style-type: none"> - Preferred receiving notifications 2–3/week <p style="text-align: center;">MARKETING</p> <p style="text-align: center;">Nil measured</p>

Study	Intervention	Study Characteristics	Results	
<p>Rangelov et al. 2015³⁵</p> <p>Switzerland</p> <p>Jurisdiction: State (collaboration with Department of Health and Social Affairs)</p>	<p>Platform: Website — Family, Physical Activity, Nutrition (FAN)</p> <p>Purpose: Describe the development process of the 8-week program providing tailored information to parents and children about importance of healthy eating and PA</p> <p>Components: N/A</p> <p>Target audience^a: Families of elementary and middle-school children</p>	<p>Study design: Focus groups, co-creation activities, post-intervention survey</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 26 parents, n = 38 children (focus groups, co-creation activities), n = 389 parents, n = 370 children (survey)</p> <p>OUTCOMES:</p> <p>User testing: Preferred mode of delivery, preferred features</p>	<p>USER TESTING</p> <p>Preferred mode of delivery:</p> <ul style="list-style-type: none"> - Internet, email, SMS preferred channels - 86.7% interested in health-related programs delivered via website <p>Preferred features:</p> <ul style="list-style-type: none"> - Printed materials for children (81% parents and 83.1% children liked the letters) - Info delivered no more than 1/week - Easy access to tailored information - Ways to improve and maintain behaviours - Practical tips (not just theoretical information) - Access to dietary consultant - Quick, cheap, child-friendly, healthy recipes - Videos (94% parents, 64.5% children) - Forum (65.9% parents) - Receiving email and SMS prompts <p>Disliked features:</p> <p>Questionnaires, cursive font, heavy theory</p>	<p>MARKETING</p> <p>Nil measured</p>
<p>Ball et al. 2014³⁶</p> <p>Australia</p> <p>Jurisdiction: N/A</p>	<p>Platform: Apps — Fresh Right Now, Pennies, ShopShop, Epicurious, Traxitall, Coles, Woolworths</p> <p>Purpose: Evaluate 7 apps addressing barriers to healthy eating</p> <p>Components: N/A</p> <p>Target audience^a:</p>	<p>Study design: Pre & post survey</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 19 women with low education or low household income</p> <p>OUTCOMES:</p> <p>User testing: Preferred mode of delivery, preferred features of apps & content</p> <p>Marketing: Digital platform use</p>	<p>USER TESTING</p> <p>Preferred mode of delivery:</p> <ul style="list-style-type: none"> - Felt confident using apps - Liked portability (for apps on iPods) <p>Preferred features of apps:</p> <ul style="list-style-type: none"> - Easy to use - Recipes, shopping lists, weekly specials <p>Disliked features of apps:</p> <ul style="list-style-type: none"> - Goal setting - Time-exhaustive - Complex to use 	<p>MARKETING</p> <p>Digital platform use:</p> <ul style="list-style-type: none"> - >50% reported using app before - ~32% reported using grocery, budgeting, shopping or cooking app before

Study	Intervention	Study Characteristics	Results	
	Socioeconomically disadvantaged women		Content: <ul style="list-style-type: none"> - Recipes linked to seasonal produce - Offline access to recipes - Recipes with nutrition information 	
Bensley et al. 2014 ³⁷ US Jurisdiction: State	Platform: Nil specified Purpose: Examine current & preferred technology use of clients in Special Supplemental Nutrition Program for WIC Components: N/A Target audience^a: Clients in Western WIC region	Study design: Survey Quality rating^b: N/A Participants: n = 8144 WIC clients or caregivers OUTCOMES: User testing: Preferred mode of delivery, preferred features & desired technology Marketing: Digital platform use & use of online health information	USER TESTING Preferred mode of delivery: <ul style="list-style-type: none"> - Interest in receiving education using internet - Decreased interest in receiving one-on-one education via nutritionist or WIC staff - ↑Education preferred internet classes ($p < .05$) - 25% interest in receiving via social media - 57% would join an online or virtual WIC group Preferred features: <ul style="list-style-type: none"> - Useful to use video chat to interact with nutritionists (76%;M = 2.20;SD = 0.79), WIC staff (72%;M = 2.13;SD = 0.79) - ↑Education more likely to want video chat ($p < .05$) - Interest in discussion forums on WIC site (46%), or FB group (38%), or other social media (1%); 32% not interested in discussion forums - Online groups for range of developmental ages Desired technology: <ul style="list-style-type: none"> - Appointment scheduling, food scanning, online recipes, cooking demos, online store locator 	MARKETING Digital platform use: <ul style="list-style-type: none"> - 70% used internet to schedule appointments - Two-thirds indicated it would be 'useful' to schedule WIC appointments online Use of online health information: <ul style="list-style-type: none"> - 31% with smartphones reported using apps for parent- and health-related information - 21% reported accessing WIC-related nutrition content via internet, 75% via one-on-one direct contact with WIC staff - 59% interested in receiving WIC-related nutrition education via the internet

Study	Intervention	Study Characteristics	Results	
Swindle et al. 2014 ³⁸ US Jurisdiction: State	Platform: Nil specific Purpose: Determine interest in receiving nutrition information via technology among target group Components: N/A Target audience^a: LI parents & caregivers	Study design: Survey Quality rating^b: N/A Participants: n = 806 low-income parents & caregivers OUTCOMES: User testing: Nil measured Marketing: Digital platform use & use of online health information	USER TESTING Nil measured	MARKETING Digital platform use: <ul style="list-style-type: none"> - >50% used most technologies daily - Phones for internet daily (68.4%), FB daily (57%), internet daily (69.9%) - Most didn't access Twitter or blogs - Email preferred technology to receive information, followed by text messaging, FB and phone calls - Where group differences were observed ≥45 used technology least frequently - 26–35 (M = 5.1;SD = 1.6) more likely to use FB than 17–25 (M = 4.9; SD = 1.6), 36–45 (M = 4.5;SD = 2.0) & 45–55 (M = 3.7; SD = 2.2) (<i>p</i>= .02) - 17–25 (M = 5.5; SD = 1.1), 26–35 (M = 5.4; SD = 1.3), 36–45 (M = 5.5;SD = 1.2) more likely to use internet than 45–55 (M = 4.6; SD = 2.0) (<i>p</i><.001) - 17–25 (M = 5.2;SD = 1.7), 26–35 (M = 5.1; SD = 1.9) more likely to use smartphone for internet than 36–45 (M = 4.5; SD = 2.3) & 45–55 (M = 3.2; SD = 2.4) (<i>p</i> = .03) Use of online health information: <ul style="list-style-type: none"> - Email preferred to receive information on healthy eating (64.5%) followed by text message, FB, phone calls - Email preferred to receive information on parenting help (62.2%) followed by text message, phone calls, FB

Study	Intervention	Study Characteristics	Results	
<p>Walker et al. 2012³⁹</p> <p>US</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website</p> <p>Purpose: Evaluation of e-health information program about postpartum weight & parenting</p> <p>Components: N/A</p> <p>Target audience^a: New mothers</p>	<p>Study design: Survey</p> <p>Quality rating^b: N/A</p> <p>Participants: New mothers</p> <p>OUTCOMES:</p> <p>User testing: Nil measured</p> <p>Marketing: Digital platform use & internet use</p>	<p>USER TESTING</p> <p>Nil measured</p>	<p>MARKETING</p> <p>Digital platform use:</p> <ul style="list-style-type: none"> - Cell phone used daily (97.1%), followed by Internet, e-mail, text messaging - High SES ↑interest receiving 'a lot' of information re. weight loss program via internet (44% vs. 21.6%) (χ^2 20.91; $p < .001$) - High SES ↑interest receiving 'a lot' of information re. parenting/safety via internet (54.3% vs. 27.5%) (χ^2 20.91; $p < .001$) - High SES ↓interest receiving 'a lot' of information on parenting/safety via mail (31.2% vs. 51.9%) (χ^2 7.74; $p = < .05$) - 'A lot' of interest in weight loss program by internet (25.9%), by mail (33.9%); Parenting advice by internet (44.8%) by mail (38.6%) <p>Internet use:</p> <ul style="list-style-type: none"> - 84.1% had access to computer with internet - 79.2% rated skill connecting to internet high - 68.5% always found what they searched for - 84.6% confident logging on - High skill connecting to internet ↑in HI women (85.9% vs 67.3%) (χ^2 6.94; $p = < .01$) - Always find what looking for ↑in HI women (79.6% vs. 48%) (χ^2 15.03; $p = < .001$)

Study	Intervention	Study Characteristics	Results
			<ul style="list-style-type: none"> - Very confident logging on internet ↑ in HI women (92.5% vs. 70%) (χ^2 12.62; $p = <.001$) - Home computer ↑ in HI women (97.8% vs. 59.6%) (χ^2 36.53; $p = <.001$) - Use of internet daily ↑ in HI women (89.1% vs. 56.9%) (χ^2 19.67; $p = <.001$)
Baghaei et al. 2011 ⁴⁰ US Jurisdiction: N/A	Platform: Website — SOcial FAmilies (SOFA) Purpose: Online social network and space for health-related educational content for families Components: Content component (info, recipes, menu plans etc.), social component (user-profile page, discussion forum, commenting etc.) Target audience^a: Families	Study design: Pre- & post-task questionnaires Quality rating^b: N/A Participants: n = 96 families OUTCOMES: User testing: Preferred features Marketing: Nil measured	USER TESTING Preferred features: <ul style="list-style-type: none"> - Forum most liked (69%), followed by presence of family members on platform (64%), activity diary (52%) and blog features (37%) - Photo gallery least liked feature (7%) MARKETING Nil measured
Jones et al. 2011 ⁴¹ Australia Jurisdiction: N/A	Platform: Website — Time2bHealthy Purpose: Child obesity program targeted at parents Components: 5 modules with solutions for common questions,	Study design: Pilot trial, post intervention survey Quality rating^b: N/A Participants: n = 47 dyads of parent and child 2–5 years who is (or is at risk of) overweight	USER TESTING Preferred features: <ul style="list-style-type: none"> - 80% found goal setting helpful - 80% found 10 goals was appropriate Content: <ul style="list-style-type: none"> - Evidence-based advice MARKETING Nil measured

Study	Intervention	Study Characteristics	Results	
	personalised interactive activities, discussion forums, goal setting Target audience^a: Australian families	OUTCOMES: User testing: Preferred features & content Marketing: Nil measured		
Wen et al. 2011 ⁴² Australia Jurisdiction: N/A	Platform: Websites Purpose: Explore inequities in access to online health information and inform development of the use of internet for health promotion Components: N/A Target audience^a: First-time mothers at 24–36 weeks' gestation	Study design: Survey Quality rating^b: N/A Participants: n = 664 first-time mothers at 24–36 weeks' gestation OUTCOMES: User testing: Nil measured Marketing: Use of online health information	USER TESTING Nil measured	MARKETING Use of online health information: - 63% used internet for health information - ≤School Certificate 1.5x less likely to use internet for health information (ARR 1.50; 95% CI 1.06–2.12; <i>p</i> <0.03) after adjusting for household income & computer at home - LI 1.7x less likely to use internet for health information (ARR 1.66; 95% CI 1.24–2.12; <i>p</i> <0.001) after adjusting for education level & computer at home - No computer at home 1.8x less likely to use internet for health information (ARR 1.80; 95% CI 1.49–2.18; <i>p</i> <0.001) after adjusting for education & household income
Atkinson et al. 2009 ⁴³ US Jurisdiction: N/A	Platform: Website — Food Stamp Nutrition Education Program (FSNEP) Purpose: Development of website about nutrition, physical activity and food budgeting Components: N/A	Study design: Focus groups and interviews Quality rating^b: N/A Participants: n = 44 (focus groups), n = 8 (interviews) LI mothers OUTCOMES:	USER TESTING Preferred features: - Interactive components - Area for children, e.g. activities, games - Drop-down menus with catchy names Disliked features: - Difficulty remembering names and passwords - Security of personal information - Logging in each time website visited - Suggestion box feature	MARKETING Digital platform use: - 75%–78% of participants used the internet

Study	Intervention	Study Characteristics	Results	
	<p>Target audience^a: LI mothers</p>	<p>User testing: Preferred features, content & usability/appeal</p> <p>Marketing: Digital platform use</p>	<ul style="list-style-type: none"> - Graphic-to-text ratio - Small font size <p>Content:</p> <ul style="list-style-type: none"> - Food budgeting, or 'smart shopping' - Cooking with children, keeping children active - Tailored content for LI families - Local resources, e.g. message boards for events - Cooking and meal planning - Motivation for exercise - Exercise tracking - Nutrition information - Wide applicability <p>Usability/appeal:</p> <ul style="list-style-type: none"> - Clear, representative website name - 6th grade reading level, easy to understand 	
<p>Jones et al. 2009⁴⁴</p> <p>Australia</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website</p> <p>Purpose: Informing development of online education program for parents of children who are (or are at risk of) overweight</p> <p>Components: N/A</p> <p>Target audience^a: Parents of preschool children who are (or are at risk of) overweight</p>	<p>Study design: Focus groups</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 27 parents of preschool children</p> <p>OUTCOMES:</p> <p>User testing: Preferred mode of delivery, preferred features, content & usability/appeal</p> <p>Marketing: Nil measured</p>	<p style="text-align: center;">USER TESTING</p> <p>Preferred mode of delivery:</p> <ul style="list-style-type: none"> - Online education program over face-to-face <p>Preferred features:</p> <ul style="list-style-type: none"> - Preferred 10-week program with 5 modules, new modules accessed fortnightly - Ability to revisit modules - Regular contact with health professional - Online discussion forum - Family involvement (recipes, colouring sheets) - Personalised programs <p>Disliked features:</p> <ul style="list-style-type: none"> - Excessive information 	<p style="text-align: center;">MARKETING</p> <p>Nil measured</p>

Study	Intervention	Study Characteristics	Results	
			<p>Content:</p> <ul style="list-style-type: none"> - Highly credible, reputable & accurate - Desired 'how to' guidance <p>Usability/appeal:</p> <ul style="list-style-type: none"> - Easy to use & navigate 	
<p>Mackert et al. 2009⁴⁵</p> <p>US</p> <p>Jurisdiction: N/A</p>	<p>Platform: Websites</p> <p>Purpose: Formative research guiding design of health interventions for low-health-literate parents</p> <p>Components: Animated health providers, images and audio</p> <p>Target audience^a: Low-literate parents</p>	<p>Study design: Focus groups</p> <p>Quality rating^b: N/A</p> <p>Participants: n = 43 parents with ≤ median income</p> <p>OUTCOMES: User testing: Preferred features, technology & content Marketing: Use of online health information</p>	<p>USER TESTING</p> <p>Preferred features:</p> <ul style="list-style-type: none"> - Fast-paced animations, especially for children and/or parents to use with children <p>Disliked features:</p> <ul style="list-style-type: none"> - Animations — esp. if slow and by those who preferred reading health information - Some negative opinions of animated doctors providing health information <p>Content:</p> <ul style="list-style-type: none"> - University researchers a trusted source of information - Lack of trust in government health information - Desired more content in general <p>Technology:</p> <ul style="list-style-type: none"> - Noted importance of search function 	<p>MARKETING</p> <p>Use of online health information:</p> <ul style="list-style-type: none"> - Most with internet access had searched for health information online - Most commonly used website: WebMD - Other sources: Health organisations, diet programs
<p>Cullen et al. 2008⁴⁶</p> <p>US</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website — Family eats</p> <p>Purpose: Web-based nutrition intervention</p> <p>Components: Photo novellas, activities, goal setting, problem solving poll,</p>	<p>Study design: 8-week intervention, BL survey</p> <p>Quality rating^b: N/A</p> <p>Participants: n =67 African American parents and their 9–12 y/o daughters</p> <p>OUTCOMES:</p>	<p>USER TESTING</p> <p>Nil measured</p>	<p>MARKETING</p> <p>Digital platform use:</p> <ul style="list-style-type: none"> - 42% >1 computer at home - 31% extensive computer experience - 9% none/very limited computer experience <p>Internet use:</p> <ul style="list-style-type: none"> - 85% using internet >3 years

Study	Intervention	Study Characteristics	Results
	information pages, grocery lists, recipes & links to recipes, parenting tips & other websites Target audience^a: African American families	User testing: Nil measured Marketing: Digital platform use & use of internet	- Older ($p < 0.05$) or those with \leq high school education ($p < 0.001$) less likely to log on

^a Target audience of tested platform(s); ^b Level of evidence NHMRC grade — N/A indicates that study not classified within NHMRC level of evidence grade, indicating weak evidence.

Abbreviations: US = United States of America; WIC = Women Infants and Children; PA = physical activity; Avg. = average; Sig. = significantly/significant; V = vegetables; F = fruit; Govt = government; FB = Facebook; † = higher; ‡ = lower; BL = baseline; -ve = negative; +ve = positive; M = mean; SD = standard deviation; CI = confidence interval; I = intervention; C = control; /d = days; /wk = week; /mth = month; HI = high-income; LI = low-income; SES = socioeconomic status; RCT = randomised controlled trial; ad = advertisement; EOI = expression of interest

Appendix 3: Review Question 3

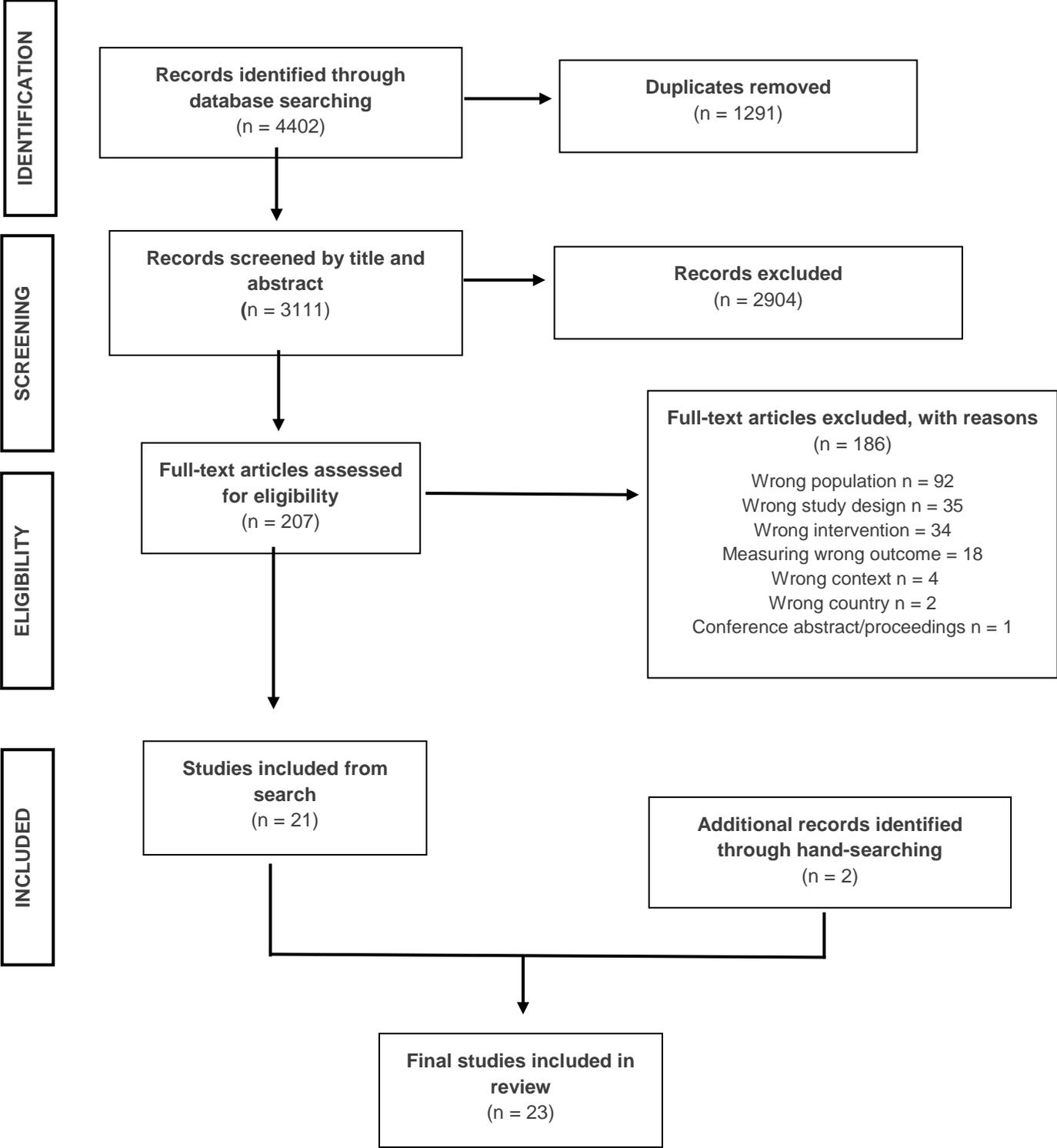


Figure A3.1: PRISMA flow diagram for article selection for Question 3

Table A3.2: Inclusion and exclusion criteria for studies included in Question 3

Inclusion	Exclusion
<ul style="list-style-type: none"> English language 	<ul style="list-style-type: none"> Language other than English
<ul style="list-style-type: none"> Published since 1 January 2013 	<ul style="list-style-type: none"> Published before 2013
<ul style="list-style-type: none"> Studies from Australia, New Zealand, Britain, US, Canada & Western Europe (including Scandinavia) 	<ul style="list-style-type: none"> Studies outside of specified countries of interest
<ul style="list-style-type: none"> Study design: RCT, cohort study, cross-sectional/survey, meta-analysis, epidemiological, descriptive quantitative studies 	<ul style="list-style-type: none"> Study design: letter to editor, note, comment, editorial, newspaper article, reviews (if no meta-analysis), conference abstracts/proceedings, qualitative studies
<ul style="list-style-type: none"> Studies evaluating effectiveness of digital platforms supporting nutrition, physical activity or obesity intake in children/parents 	<ul style="list-style-type: none"> Studies conducted in relation to non-transferrable areas of health (e.g. smoking cessation, primary or secondary prevention of chronic diseases, eating disorders, pregnancy, cancer)
<ul style="list-style-type: none"> Studies conducted with parents, school settings, teachers, childcare, health professionals 	<ul style="list-style-type: none"> Studies conducted with children/adolescents only with no parent involvement Studies conducted with older adults
<ul style="list-style-type: none"> Studies evaluating efficacy of health promotion websites & apps 	<ul style="list-style-type: none"> Studies evaluating efficacy of other digital platforms (text messages, telemedicine, wearable devices)
<ul style="list-style-type: none"> Studies reporting behaviour change outcomes, exposure/reach, visitation, engagement, awareness, knowledge, attitudes, beliefs, self-efficacy or behaviour change in children and/or parents 	<ul style="list-style-type: none"> User testing conducted in relation to measurement of dietary intake or implementation/use of e-health records

Table A3.3: Data extraction table for studies evaluating effectiveness of digital health platforms for improving behavioural, knowledge, attitude and self-efficacy outcomes

Study	Intervention	Study Design	Outcomes		
			Knowledge / Attitudes	Self-efficacy	Behaviour and Anthropometric
<p><u>Study 1:</u> Delisle Nyström et al. 2017⁴⁹</p> <p><u>Study 2:</u> Delisle Nyström et al. 2018⁴⁸</p> <p>Sweden</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: II</p>	<p>Platform: App</p> <p>Description: 6-mth MINISTOP app — information to support healthy eating/PA in preschool-age children, to prevent obesity</p> <p>Components: Information, push notifications, parent tracking of child behaviours, feedback on behaviours, access to dietitian and psychologist</p>	<p>Participants: Parents of 4yo children (S1 n = 315, S2 n = 263)</p> <p>Study design: RCT</p> <p>I: MINISTOP app</p> <p>C: Pamphlet on healthy eating/ PA</p> <p>OUTCOMES (child):</p> <ul style="list-style-type: none"> - Fat mass index (FMI) - PA and sedentary time (accelerometer) - FV, lollies, SSB intake (questionnaire) - Composite score: Total FMI, PA, sedentary time, FV, lollies, SSB 	---	---	<p>Overall effectiveness: Mixed results; Not maintained at 12 months</p> <p>Study 1 (6 months):</p> <ul style="list-style-type: none"> - I vs. C improved 7-item composite score ($p = 0.021$) [I: +0.36 units, C: -0.07 units; greater ↑ if higher FMI] - I vs. C ↑ odds for improving 6 behaviours [OR: 1.99; 95%CI: 1.20–3.30; $p = 0.008$] - I vs. C sig. ↓ mean intake of SSB ($p = 0.049$) [I: 12, C: +8] - I vs. C no difference change in FMI, PA, sedentary time, FV, lollies <p>Study 2 (12 months):</p> <ul style="list-style-type: none"> - No maintained effect for difference in composite score I vs. C - I vs. C no difference change in FMI, PA, sedentary time, FV, lollies, SSB
<p>Grimes et al. 2018⁵⁷</p> <p>Australia</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website</p> <p>Description: DELISH (Digital Education to Limit Salt Intake in the Home) — web-based nut ed to ↓ salt intake in schoolchildren</p>	<p>Participants: Child & parent (n = 83), Child mean age 9.2y</p> <p>Study design: Pre–post</p> <p>I: 5 week DELISH nut ed</p> <p>C: Nil</p> <p>OUTCOMES (child):</p>	<p>Overall effectiveness: Improved knowledge; no effect on attitudes</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - ↑ Overall knowledge (13.6 units, $p < 0.001$; Cohen's $\delta = 1.16$) 	<p>Overall effectiveness: Improved self-efficacy</p> <ul style="list-style-type: none"> - ↑ Overall self-efficacy (10.9 units, $p < 0.001$; Cohen's $\delta = 0.64$) 	<p>Overall effectiveness: Mixed results</p> <ul style="list-style-type: none"> - No sig change in salt intake from pre (5.4 g/day) to post (5.3 g/day) ($p > 0.05$) or % exceeding UL (pre 61%, post 67%, $p > 0.05$) - Improvement in salt behaviour (use) score (pre 5.2, post 4.7, $p < 0.001$, Cohen's $\delta = 1.08$).

Study	Intervention	Study Design	Outcomes		
			Knowledge / Attitudes	Self-efficacy	Behaviour and Anthropometric
Quality rating^b: III-3	Components: Weekly web-based interactive sessions: games, videos, goal setting, access to website, newsletters, text messages	Salt knowledge, attitudes, self-efficacy (questionnaire) Salt intake (questionnaire, urinary excretion)	<ul style="list-style-type: none"> - ↑ Awareness of daily salt intake (pre 44%, post 72%, $p = 0.001$) - ↑ Correct identification of sodium content on food label (pre 52% post 91%, $p < 0.001$). Attitudes: <ul style="list-style-type: none"> - No change in attitudes to salt (pre 2.2, post 2.0, $p > 0.05$) 		<ul style="list-style-type: none"> - 19% ↓ placing salt shaker on table during meals ($p < 0.002$). - 8% ↓ use of salt at the table ($p > 0.05$)
<p><u>Study 1</u> Knowlden et al. 2016⁵¹</p> <p><u>Study 2</u> Knowlden et al. 2018⁵²</p> <p>US</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: II</p>	<p>Platform: Website</p> <p>Description: EMPOWER — Maternal childhood obesity prevention program</p> <p>Components: 5 modules (one for each behaviour outcome): audiovisual presentation, interactive worksheets, discussion board posts</p>	<p>Participants: Mothers of 4–6 yo child (S1 n = 57, S2 n = 37)</p> <p>Study design: RCT</p> <p>I: EMPOWER website (n = 22)</p> <p>C: Healthy lifestyle information delivered online (n = 22)</p> <p>OUTCOMES: Online questionnaire:</p> <ul style="list-style-type: none"> - Mother's self-efficacy - Child PA (mins) - Child screen time (mins) - Child intake of FV & sugar-free beverages (SFB) 	---	<p>Overall effectiveness: Overall no effect on self-efficacy at 1 year</p> <p>Study 1 (1 year):</p> <ul style="list-style-type: none"> - I & C sig. ↑ maternal self-efficacy for child screen time ($p < 0.006$) at 4 wks and 8 wks - No other sig. effects on self-efficacy in I or C <p>Study 2 (2 year):</p> <ul style="list-style-type: none"> - I & C sig. ↑ maternal self-efficacy for child PA and screen time ($p < 0.001$) 	<p>Overall effectiveness: Sig. intervention effect on FV, increase in SFB in both groups; decrease in screen time in both groups, no effect on PA. All maintained at year 2, except significant effect on PA in both groups at year 2.</p> <p>Study 1 (1 year):</p> <ul style="list-style-type: none"> - <u>FV intake:</u> I vs. C sig ↑ of 1.84 cups FV (95% CI: 1.20–2.49; $p < 0.001$); small group x time effect ($p = 0.012$; Cohen's $f = 0.210$) - <u>SFB intake:</u> Sig. ↑ in both groups of moderate effect size ($p = 0.002$; Cohen's $f = .275$) - <u>Physical Activity:</u> No sig. effect on ↓ PA in I or C - <u>Screen Time:</u> Sig. ↓ in both groups ($p = 0.003$): total ↓ of 27.64 mins <p>Study 2 (2 years):</p>

Study	Intervention	Study Design	Outcomes		
			Knowledge / Attitudes	Self-efficacy	Behaviour and Anthropometric
					<ul style="list-style-type: none"> - <u>FV intake</u>: I vs. C sig ↑ 1.690 cups FV (95% CI: 1.11–2.25, $p < 0.01$). Small group x time effect ($p = 0.033$; Cohen's $f = 0.139$) - <u>SFB intake</u>: Sig. ↑ in both groups of moderate effect size ($p < 0.001$; Cohen's $f = 0.321$) - <u>Physical activity</u>: Sig. ↑ in both groups of small effect size ($p = 0.024$; Cohen's $f = 0.124$) - <u>Screen Time</u>: Sig. ↓ in both groups of moderate effect size ($p < 0.001$; Cohen's $f = 0.303$). Sig. ↓ of 31.95 min (95% CI: 6.73–57.16, $p = 0.05$) from 1 year
<p><u>Study 1</u>: Laws et al. 2018¹⁹</p> <p><u>Study 2</u>: Russell et al. 2018⁵⁹</p> <p>Australia</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website & app</p> <p>Description: Growing Healthy: Infant feeding and parenting behaviours promoting healthy weight gain</p> <p>Components: Information, videos, advice, personalised notifications & text messages tailored to</p>	<p>Participants: Parents of infants <3mth old (n = 645)</p> <p>Study design: Quasi-experimental — non randomised control</p> <p>I: Growing Healthy mHealth</p> <p>C: Usual care (face-to-face appointments)</p> <p>OUTCOMES (Online qus at BL, 6mth, 9mth):</p>	<p>Overall effectiveness: No effect</p> <p>Study 1: <u>Knowledge:</u></p> <ul style="list-style-type: none"> - I vs. C: ↑ odds of preparing formula correctly at 6 mth & 9 mth (<i>not sig.</i>) <p>Study2: <u>Attitudes:</u></p> <ul style="list-style-type: none"> - I vs. C: no difference for any outcomes ($p > 0.05$) at 6 mth except: less concern about infant overeating or 	---	<p>Overall effectiveness: No effect on BMI z-score, parent intentions to offer food, feeding practices</p> <p>Study 1: <u>BMI:</u> I vs. C: no difference in BMI z-score, weight or length ($p > 0.05$).</p> <p>Study2: <u>Parent intentions to offer food:</u></p> <ul style="list-style-type: none"> - I vs. C: no differences ($p > 0.05$) at 9 mth (offering infant non-core foods, % core foods tasted & liked; adding salt/sugar to infant food)

Study	Intervention	Study Design	Outcomes		
			Knowledge / Attitudes	Self-efficacy	Behaviour and Anthropometric
Quality rating^b: III-2	infant age/feeding, weekly email, Facebook group	<u>Study 1:</u> Child BMI z-score, weight, length; mother's knowledge: formula feeding, solids introduction <u>Study 2:</u> Parent infant food offering & exposure, parental feeding practices & beliefs	becoming overweight in I vs. C (mean difference 0.30; 95% CI: 0.01–0.59, $p = 0.004$) - I vs. C: no sig dif for any outcomes ($p > 0.05$) at T3		- I vs. C: no differences ($p > 0.05$) at 9 mth (frequency offer core & non-core foods, core/non-core food variety score, no. of foods parent will offer again) <u>Feeding practices:</u> - I vs. C: no dif for any outcomes ($p > 0.05$) at 6 mth or 9 mth
Rangelov et al. 2018 ⁵⁴ Switzerland Jurisdiction: N/A Quality rating^b: II	Platform: Website Description: 'Famiglia, Attività fisica, Nutrizione' (FAN) social marketing program to promote healthy food consumption & regular physical activity Components: 8wk program: parents receive via website, children receive letter via post. Website: advice, recipes, videos, forum with dietitian, email/SMS weekly reminders	Participants: Children in grades 1–2 & parents (n = 608) Study design: RCT I1: Web + SMS (G3) I2: Web + email (G2) C: Web only (G1) OUTCOMES: Child intake of FV, sweets (7-day food diary)	---	---	Overall effectiveness: Mixed/positive effect on fruit, vegetables, sweets in all groups Fruit intake - ↑F from BL to 8 wks in all groups, but sig. only for G1 (regression coefficient=0.17; $p < 0.05$) Sweets intake - ↓ sweets from BL to 8 wks in all groups, but sig. only for G1 (regression coefficient = -0.11, $p < 0.05$) Vegetable intake - ↑V from BL to 8 wks in G3 (regression coefficient=0.12; $p < 0.05$) No change G1, G2

Study	Intervention	Study Design	Outcomes		
			Knowledge / Attitudes	Self-efficacy	Behaviour and Anthropometric
<p>Au et al. 2017⁵⁶</p> <p>US</p> <p>Jurisdiction: State & Federal</p> <p>Quality rating^b: II</p>	<p>Platform: Website</p> <p>Description: Online nut ed for Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) participants</p> <p>Components: Online salt lessons: written & audio presentation, interactive components, goal setting</p>	<p>Participants: n = 514 WIC participants (women)</p> <p>Study design: RCT</p> <p>I: Online nut ed (n = 257)</p> <p>C: In-person group nut ed (n = 257)</p> <p>OUTCOMES</p> <p>Questionnaire at 2–4 (T1) 9 mth (T2): Salt knowledge, self-efficacy for salt use & preparation, salt behaviours, salt intake (FFQ)</p>	<p>Overall effectiveness: Improved knowledge both groups, maintained at T2 in I only</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - I & C ↑ salt knowledge (sources dietary salt, intake requirements) at T1 ($p < 0.01$) - I only sig. ↑ salt knowledge (sources dietary salt) maintained at T2 ($p < 0.01$) <p>Attitudes: ---</p>	<p>Overall effectiveness: Improved self-efficacy both groups</p> <ul style="list-style-type: none"> - I & C ↑ self-efficacy at 2–4 mth ($p < 0.05$) for: add <u>less</u> salt in cooking & at table, purchase low-salt foods - C only ↑ self-efficacy at 2–4 mth ($p < 0.05$) for: add <u>no</u> salt in cooking & at table - I & C sig. ↑ at 9 mth for ($p < 0.05$): add <u>less</u> salt at table, read nutrition label for sodium, add no salt in cooking - I sig. ↑ at 9 mth for ($p < 0.05$): add <u>less</u> salt in cooking - C sig. ↑ at 9 mth for ($p < 0.05$): add <u>less</u> salt at table 	<p>Overall effectiveness: Improved salt behaviours and intake of high-salt foods in both groups</p> <p>Salt behaviours:</p> <ul style="list-style-type: none"> - I & C improve ($p < 0.001$) at all F/UP: less salt added in cooking & table, read nutrition label for salt, purchase less high-salt food, add herbs/spices instead of salt - I vs. C greater improvement at T2 ($p < 0.05$): ↓ salt added at table, food with added salt, pizza intake, freq. fast food <p>Intake foods high in salt:</p> <ul style="list-style-type: none"> - I & C ↓ intake ($p < 0.05$) processed meat, (T2), canned soups (T2), snack foods (T2), mean of all high-salt foods <p>I&C ↓ intake ($p < 0.05$) at T1 and T2 any food with salt added at table or during cooking</p>
<p>De Lepeleere et al. 2017⁵⁰</p> <p>Belgium</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website</p> <p>Description: Movie Models — health promoting online video intervention</p> <p>Components:</p>	<p>Participants: Parents of primary school children (n = 238)</p> <p>Study design: Quasi-experimental</p> <p>I: Movie Models</p> <p>C: Waitlist control</p>	<p>---</p>	<p>Overall effectiveness: I vs. C positive effect improved self-efficacy</p> <ul style="list-style-type: none"> - I vs. C ↑ in self-efficacy being active at T1 ($F = 4.05, p = 0.046$) - I vs. C: ↑ self-efficacy motivating child to eat V ($F = 4.95, p = 0.03$), giving child freedom to drink 	<p>Overall effectiveness: No effect on behaviours, some +ve effects on parenting practices at T2</p> <p>Child behaviours:</p> <ul style="list-style-type: none"> - I vs. C no sig. effect on child intake, PA, ST at any time points <p>Parenting practices:</p>

Study	Intervention	Study Design	Outcomes		
			Knowledge / Attitudes	Self-efficacy	Behaviour and Anthropometric
Quality rating^b: III-2	22 videos on difficult parenting situations (PA, ST, healthy diet — water, BF).	OUTCOMES: Parent questionnaires at BL, 1 mth (T1), 3 mth (T2): Parent self-efficacy; Parenting practices & feeding strategies; Child FV, water, SSB, snack intake (FFQ), PA, ST (parent-reported)		water ($F = 6.07, p = 0.003$), ↓ for having V available ($F = 4.79, p = 0.03$). Only sig. effects shown among parents of younger children (6–9yo): - At T1: I vs. C: ↑ self-efficacy for letting child choose different F ($F = 8.38; p = 0.005$), and V availability ($F = 5.80, p = 0.02$) At T2: I vs. C: ↑ self-efficacy for involving children in buying V ($F = 5.56; p = 0.02$).	- I vs. C no sig. effect on parenting practices concerning food intake at T1 or T2, except: small effect I vs. C on 'motivating child to eat fruit' at T2 ($F = 8.00; p = 0.006$) - I vs. C sig. effect in parents of older children (10–12yo): ↑ permissiveness of how much V child allowed to eat b/w meals at T2 ($F = 11.70; p < 0.001$)
Au et al. 2016 ⁵⁵ US Jurisdiction: State & Federal Quality rating^b: II	Platform: Website Description: Online nut ed for Special Supplemental Nutrition Program for Women, Infants and Children (WIC) participants Components: Online BF lessons: importance of daily BF, health outcomes of skipping BF, BF preparation, goal setting	Participants: WIC participants — mothers of 1–5yo children ($n = 590$) Study design: RCT I: Online nut ed ($n = 231$) C: In-person group nut ed ($n = 359$) OUTCOMES: Parent questionnaire at 2–4 mth: BF knowledge; attitudes (skipping BF); self-efficacy (BF intake & preparation); BF intake (child & parent)	Overall effectiveness: Intervention effect on improved attitudes (barriers), improved knowledge both groups Knowledge: I & C both sig. ↑ knowledge ($p < 0.05$); Greater magnitude change in C vs. I for sugar on cereal knowledge) Attitudes: I vs. C ↓ barriers for skipping BF ($p \leq 0.02$): lack of time, not enough food at home, hunger, difficulty with preparation	Overall effectiveness: Improved self-efficacy both groups, slightly greater effect in I vs. C - I & C ↑ self-efficacy for F at BF ($p < 0.05$) I sig ↑ self-efficacy ($p < 0.05$) for child BF each day, offering WIC foods at BF, but not sig. greater ↑ compared with C	Overall effectiveness: Significant Intervention effect on BF intake Parent BF intake: - I vs. C sig. greater ↑ freq BF ($p = 0.0007$); no effect freq. intake BF with child Child BF intake - I vs. C sig. greater ↑ freq eat something at BF ($p = 0.01$); no effect freq. intake BF with child - I & C sig. ↑ eat breakfast of WIC foods, eat breakfast at childcare ($p < 0.05$); no sig. diff. b/w groups

Study	Intervention	Study Design	Outcomes		
			Knowledge / Attitudes	Self-efficacy	Behaviour and Anthropometric
<p>Schwinn et al. 2014⁵³</p> <p>US</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: II</p>	<p>Platform: Website</p> <p>Description: Web-based family health promotion program for drug use, PA & nutrition</p> <p>Components: 3 mother–daughter sessions: maintaining healthy relationships, bodies & minds</p>	<p>Participants: Mother–daughter dyad (n = 36)</p> <p>Study design: RCT</p> <p>I: Web-based program</p> <p>C: No intervention</p> <p>OUTCOMES (at post-test and 5 mth):</p> <p>Mothers & teens FV intake (FFQ) and PA (Kaiser PA survey)</p>	---	---	<p>Overall effectiveness: Mixed effect</p> <p>Physical activity:</p> <ul style="list-style-type: none"> - I vs. C ↑ PA mothers at post-test ($p < 0.05$) - No other sig. effects <p>FV intake:</p> <ul style="list-style-type: none"> - I vs. C ↑ V mothers at post-test ($p < 0.05$) - I vs. C ↑ F teens at 5 mths ($p < 0.05$): <p>No other sig. effects FV intake</p>
<p>Wilson et al. 2014⁶⁰</p> <p>US</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: IV</p>	<p>Platform: Website</p> <p>Description: Web-based tailored parenting intervention to increase FV intake</p> <p>Components: Tailored online feedback & messages based on survey data</p>	<p>Participants: Parents & adolescents (n = 41)</p> <p>Study design: Pre–post</p> <p>I: Website/ tailored feedback</p> <p>C: Nil</p> <p>OUTCOMES (at 1 wk):</p> <p>Behaviour: (FV intake [un-named screening tool])</p>	---	---	<p>Overall effectiveness: Significant positive effect on FV intake</p> <p>Fruit intake (serves per day)</p> <ul style="list-style-type: none"> - Parents ↑ F (1.76±1.02 vs. 2.32±1.23 serves; $p < 0.01$) - Adolescents ↑ F (1.71±0.93 vs. 2.27±0.92 serves; $p < 0.05$) <p>Vegetable intake (serves per day)</p> <ul style="list-style-type: none"> - Parents ↑ V (3.68±1.47 vs. 4.39±2.07 serves; $p < 0.05$) - Adolescents ↑ V (3.34±1.46 vs. 4.07±1.47; $p < 0.05$)
<p>Delamater et al. 2013⁴⁷</p> <p>US</p> <p>Jurisdiction: N/A</p>	<p>Platform: Website</p> <p>Description: FIT-4-Health (Families Interacting Together for Health) — family</p>	<p>Participants: Families with overweight children aged 8–12yo (n = 24)</p> <p>Study design: Pre–post</p> <p>I: FIT-4-Health for 4 wks</p> <p>C: N/A</p>	---	<p>Overall effectiveness: Positive effect on self-efficacy</p> <ul style="list-style-type: none"> - Sig. ↑ in self-efficacy at F/UP ($p = 0.025$). - High users ↑ more over time vs. low users (F = 2.86, $p = 0.06$). 	<p>Overall effectiveness: Positive effect on PA & healthy lifestyle score. Positive effect on food intake & BMI for high users only</p> <p>Intake</p> <ul style="list-style-type: none"> - No sig. ↑ food intake at F/UP

Study	Intervention	Study Design	Outcomes		
			Knowledge / Attitudes	Self-efficacy	Behaviour and Anthropometric
Quality rating^b: III-3	program for overweight children Intervention: Obesity/healthy lifestyle information, Ax of diet/PA, interactive game, goal setting	OUTCOMES (child): Self-efficacy: Intrinsic Motivation Inventory (IMI) BMI z-score (measured), Food intake, PA & sedentary behaviour (questionnaire) Healthy lifestyle score (based on food intake, PA, sedentary)			- High users sig. ↑ over time relative to low users (F= 3.37, <i>p</i> = 0.04) Physical Activity - Sig ↑ in PA at F/UP (<i>p</i> = 0.005) - High users sig. ↑ over time relative to low users (F= 7.58, <i>p</i> = 0.005) Healthy lifestyle score - Sig ↑ in score at F/UP (<i>p</i> = 0.001) - High users sig. ↑ over time relative to low users (F =16.61, <i>p</i> = 0.001) BMI - No sig. change in z-BMI at F/UP High users ↓ z-BMI, low users ↑z-BMI over time (F = 6.36, <i>p</i> = 0.02)
Jogova et al. 2013 ⁵⁸ Canada Jurisdiction: N/A Quality rating^b: III-3	Platform: Website Description: LiGHT (Living Green, Healthy & Thrifty) — virtual obesity management program for children with parent support Intervention: Ax of diet/PA + feedback, health, environment & economic info, goal setting, interactive activities, facts/tips	Participants: n = 17 children 10–17yo & parents Study design: Pre–post (4 wk pilot study) I: LiGHT — 4 wk pilot C: N/A OUTCOMES: Knowledge: health, environment, economy Attitudes: readiness to change)	Overall effectiveness: Non-significant small improvement in knowledge & readiness to change Knowledge: - Pre-intervention mean scores close to maximum in all areas – small differences b/w pre- & post-evaluations Readiness to change: Most parents & children reported they were ready to change at program outset — further non-sig ↑ on program completion	---	---

^b Level of evidence NHMRC grade — N/A indicates study not classified within NHMRC level of evidence grade, indicating weak evidence. Abbreviations: Ad = advertisement; Avg. = average; Ax = assessment; b/w = between; B = baseline; C = control; CI = confidence interval; F/UP = follow-up; FFQ = food frequency questionnaire; freq = frequency; F = fruit; FB = Facebook; Govt = government; HI = high-income; I = intervention; LI = low-income; M = mean; No. = number; nut ed = nutrition education; PA = physical activity; RCT = randomised controlled trial; SB = sweetened beverage; SD = standard deviation; SES = socioeconomic status; SFB = sugar-free beverage; Sig. = significantly/significant; SSB = sugar-sweetened beverage; ST = screen time; UL = upper limit; US = United States of America; V = vegetables; WIC = Women Infants and Children; YO = years old; ↑ = higher; ↓ = lower; -ve = negative; +ve = positive; /d = days; /wk = week; /mth = month

Table A3.4: Data extraction table studies evaluating effectiveness of website reach, visitation and engagement outcomes

Study	Intervention	Study Design	Outcomes		
			Reach and Awareness	Visitation	Engagement
<p>Grimes et al. 2018⁵⁷</p> <p>Australia</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: III-3</p>	<p>Platform: Website</p> <p>Description: DELISH (Digital Education to Limit Salt Intake in the Home) — nut ed to ↓ salt intake in schoolchildren</p> <p>Components: Weekly interactive sessions: games, videos, goal setting, newsletter, text messages</p>	<p>Participants: n = 83 child–parent dyads</p> <p>Study design: Single-arm pre-test/post-test</p> <p>I: 5-week DELISH nut ed</p> <p>C: N/A</p> <p>OUTCOMES: Engagement</p>	---	<ul style="list-style-type: none"> - Most children viewed majority of weekly sessions, but visitation ↓ over time: ¾ viewed wk 1 sessions, 60% wks 2–4, 1/3 wk 5 - Among children who viewed sessions, completion rates very high <p>---</p>	---
<p>Laws et al. 2018¹⁹</p> <p>Australia</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: III-2</p>	<p>Platform: Website & app</p> <p>Description: Growing Healthy: Infant feeding and parenting behaviours promoting healthy weight gain</p> <p>Components: Information, videos, advice, personalised notifications & text messages, weekly email, Facebook group</p>	<p>Participants: Parents of infants <3mth (n = 645)</p> <p>Study design: Quasi-experimental</p> <p>I: Growing Healthy</p> <p>C: Usual care (face-to-face appointments)</p> <p>OUTCOMES: Engagement: No. pages viewed/opened per session, push notifications opened</p>	---	<ul style="list-style-type: none"> - App usage ↓ over time — 92% used at least once at enrolment, 38.2% at study completion - Similar decline in number of sessions across study duration - Average of 8% of push notifications were opened <p>---</p>	---
<p>Rangelov et al. 2018⁵⁴</p>	<p>Platform: Website</p> <p>Description: FAN — social marketing program to promote</p>	<p>Participants: Children in grades 1–2 & parents (n = 608)</p> <p>Study design: RCT</p>	---	<ul style="list-style-type: none"> - Website total 22,559 visits over 8 wks of intervention - Website visited by 195 parents with 261 children, similar <p>---</p>	---

Study	Intervention	Study Design	Outcomes		
			Reach and Awareness	Visitation	Engagement
Switzerland Jurisdiction: N/A Quality rating^b: II	healthy food consumption & PA Components: Parents receive via website, children receive letter via post. Website: advice, recipes, videos, forum with dietitian, email/SMS weekly reminders	I1: Web + SMS (G3) I2: Web + email (G2) C: Web only (G1) OUTCOMES: Website visitation		visitation across groups: G1: 44% parents, 44% children, G2: 39% parents, 40% children, G3: 46% parents, 45% children - Website visited by children themselves — G1: 31%, G2: 30%; G3: 39%	
Ullman et al. 2018 ⁶¹ US Jurisdiction: N/A Quality rating^b: N/A	Platform: Website Description: Memphis FitKids — website for parents to assess child's obesity risk & provide tailored recommendations on making healthy changes Components: Print materials, incentives, community-based activities, FitCheck tool, coupons for local business or community activities. Access via personal device or at 5 FitKids kiosks	Participants: Parents with children Study design: Cross-sectional analysis I: N/A C: N/A OUTCOMES: Reach and visitation — via analysis of Google Analytics & FB posts	Reach: - July 2014 – Dec 2016: 33,505 users completed 38,429 sessions (6763 at kiosks) - Parents more likely to use iPads, complete FitCheck survey & explore resources at health fairs/family events in schools than at big fairs - 1168 FB posts placed b/w Oct 2014 & Dec 2016 — reaching 23,767 unique FB users Awareness: ---	- Many did not return to website (after comparing no. website sessions with no. of uses) - Decline in website traffic in Q3 (about August)	---
Breitenstein et al. 2017 ²²	Platform: App Description: ezPARENT — strategies for	Participants: Parent of 2–5yo child (n = 42) Study design: RCT	---	- Mean visits = 13.6 (Range 2–49) - Mean time of visit = 14.1 min (Range 0.10–140 min)	- Average 82% of modules completed - Mean 37.1 s/page (range 0–107.6)

Study	Intervention	Study Design	Outcomes		
			Reach and Awareness	Visitation	Engagement
<p>US</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: II</p>	<p>promoting positive behaviour & ↓ child misbehaviour</p> <p>Components: 6 modules: videos, knowledge questions, interactive activities, assignments, practice checklist, documents</p>	<p>I: CHEW app for 3 mth</p> <p>C: N/A — only 1 group included in this study</p> <p>OUTCOMES: Visitation Engagement Adherence index (AI): Sum no. of modules completed, no. of unique visits & max time b/w visits</p>		<ul style="list-style-type: none"> - Program visited more than 69.5 days on avg (range 2–99) - Mean days b/w visits = 5.5 (range 0.01–86.3) - On average program used every 5–6d for mean 14 min 	<ul style="list-style-type: none"> - Of those accessing module, mean time per module ranged from 26.4–47.9min - Time /module ↓ over time (F = 9.44, $p < 0.001$) - Most time on viewing videos (m = 91.5s), least time on bag of tricks page (m = 8.6s) - On average, participants revisited all pages except video pages (viewed once) - Adherence Index — sig. correlation b/w AI & parent age (r = 0.36, $p = 0.019$) — ↑ parent age = ↑ adherence
<p>Byrd-Bredbenner et al. 2017²³</p> <p>US</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: II</p>	<p>Platform: Website</p> <p>Description: HomeStyles program — help parents develop home environments & practices protective against child obesity</p> <p>Components: Series of instructional guides (12) delivered online focused on weight management-related topics (diet, PA, sleep)</p>	<p>Participants: Parents of 2–6yo child (n = 489)</p> <p>Study design: RCT</p> <p>I: HomeStyles program</p> <p>C: Information about home safety topics</p> <p>OUTCOMES: (Surveys at BL, midpoint, F/UP, long-term F/UP) Reach Visitation Engagement</p>	<p>Reach:</p> <ul style="list-style-type: none"> - FB ads: 3,800,985 impressions & 100,603 potential participants generated 2639 visits to website (48%) & 6 enrollers - 39% of those screened met inclusion criteria — recruitment materials not specific enough to target audience <p>Awareness: ---</p>	<ul style="list-style-type: none"> - Highest visitation to website in January (n = 1200), then November - Lowest visitation June and August 	<ul style="list-style-type: none"> - Attrition rate: 46% BL to midpoint, 35% midpoint to F/UP, 12% F/UP to long-term F/UP (similar both groups) - Active progressed faster ($p < 0.05$) than passive participants - Passive participants ↓ after midpoint <p>Factors associated with ongoing engagement:</p> <ul style="list-style-type: none"> - Midpoint completers more likely to be ($p < 0.034$): female (OR 4.21, 95% CI 1.88–9.89), white (OR 1.58, 95% CI 1.09–2.29), have more weight concerns for child (OR 1.23, 95% CI 1.02–1.48) - F/UP survey completers ($p < 0.044$) more likely to perceive better child

Study	Intervention	Study Design	Outcomes		
			Reach and Awareness	Visitation	Engagement
					health status (OR 1.48, 95% CI 1.12–1.98) and less likely to restrict child’s food intake (OR 0.80; 95% CI 0.64–0.99)
Hull et al. 2017 ²⁵ US Jurisdiction: State & Federal Quality rating^b: III-3	Platform: App Description: CHEW (Children Eating Well), nut ed to reinforce Supplemental Nutrition Program for Women, Infants & Children’s in-clinic nut ed Components: Shopping tools (barcode scanner, calculator tools), nut ed on healthy snacks & drinks, yummy snack gallery (recipes)	Participants: n = 63 WIC-participating mothers of 2–4yo Study design: Pre–post I: CHEW app for 3 mth C: N/A OUTCOMES: Visitation Engagement	---	- 90% opened at least 1 app session	- Mean engagement = 12.58 sessions (~1/wk over 3 mth) - 36% used >12 times (>1/wk), 52% used >6 times (>twice/mth) - >20% used app once/not at all - Mean duration of sessions = 4.67 min (range 0–22 min) - Engaged in shopping session (selected store) mean 5.14 times, 52% selected store >3 times - 36% opened calculator >3 times - Snack gallery had highest mean use: 12.76 times 40% opened recipe ≥6 times
Delamater et al. 2013 ⁴⁷ US Jurisdiction: N/A Quality rating^b: III-3	Platform: Website Description: FIT-4-Health (Families Interacting Together for Health) — family program for overweight children Components: Obesity/healthy lifestyle information, Ax of diet/PA, interactive game, goal setting	Participants: Families with overweight children aged 8–12y (n = 24) Study design: Pre–post I: FIT-4-Health for 4 wks C: N/A OUTCOMES: Visitation Engagement	--	- Mean no. logins = 11.42 (range 1–34) - Mean no. logins for those who returned for F/UP Ax = 14.30	- Low users: tracked (mean) dietary goals 11.1d, PA goals 8d, step goals 8.78d High users: tracked (mean) dietary goals 20.2d, PA goals 16.3d, step goals 22.5d

Study	Intervention	Study Design	Outcomes		
			Reach and Awareness	Visitation	Engagement
<p>James et al. 2013⁶²</p> <p>US</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: III-2</p>	<p>Platform: App + website</p> <p>Description: '4 Day Throw Away' campaign designed to provide information about food safety & leftovers</p> <p>Components: 3 communities received traditional & social media recruitment strategies, 3 communities received no marketing or recruitment</p>	<p>Participants: Adults with children ≤10 years (n = 6 communities)</p> <p>Study design: Quasi-experimental</p> <p>I: Social marketing (n = 3)</p> <p>C: No marketing (n = 3)</p> <p>OUTCOMES: Reach Awareness</p>	<p>Reach:</p> <ul style="list-style-type: none"> - Traditional media campaign: 3008 website visits, reach of 28,508 - Social media campaign: 1976 website visits, reach of 53,463 - 60% of website visitors entered via traditional media vs. 40% via social media <p>Awareness: 24% surveyed in 1 community aware of campaign vs. 1% in C (p = 0.0001)</p>	---	---
<p>Lohse et al. 2013⁶³</p> <p>US</p> <p>Jurisdiction: N/A</p> <p>Quality rating^b: N/A</p>	<p>Platform: Website/ Facebook</p> <p>Description: Examined FB as recruitment strategy to an online nutrition education program — 'Eating Together as a Family is Worth It' (WI) OR 'Everyone Needs Folic Acid' (FA)</p> <p>Components: N/A</p>	<p>Study design: Cross-sectional</p> <p>Participants: Adults / families</p> <p>Group 1: WI (n = 59)</p> <p>Group 2: FA (n = 77)</p> <p>OUTCOMES: Reach</p>	<p>Reach:</p> <ul style="list-style-type: none"> - FB posted 4,278,732 WI & 4,192,197 FA ads - 807 clicked on WI ad, 73 unique site visits, 47 completed evaluation (5.8% of clickers, 64% of visitors) - 795 clicked on FA ad, 110 unique site visits, 73 completed evaluation (9.2% of clickers, 66% of visitors) - Survey initiation: most after 6pm (38%–47%) vs. noon–6pm (30%–38%) <p>Awareness: ---</p>	---	---

^b Level of evidence NHMRC grade — N/A indicates study not classified within NHMRC level of evidence grade, indicating weak evidence.

Abbreviations: Ad = advertisement; Avg. = average; Ax = assessment; b/w = between; B = baseline; C = control; CI = confidence interval; F/UP = follow-up; FFQ = food frequency questionnaire; Freq = frequency; F = fruit; FB = Facebook; Govt = government; HI = high-income; I = intervention; LI = low-income; M = mean; No. = number; nut ed = nutrition education; PA = physical activity; RCT = randomised controlled trial; SB = sweetened beverage; SD = standard deviation; SES = socioeconomic status; SFB = sugar-free beverage; Sig. = significantly/significant; SSB = sugar-sweetened beverage; ST = screen time; US = United States of America; V = vegetables; WIC = Women Infants and Children; ↑ = higher; ↓ = lower; -ve = negative; +ve = positive; /d = days; /wk = week; /mth = month