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Evidence Check

Population-level strategies to support healthy weight

An **Evidence Check** rapid review brokered by the Sax Institute for Queensland Health, October 2019.

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This report was prepared by:

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INSTITUTE FOR HEALTH TRANSFORMATION

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Executive summary

Background

The high prevalence of overweight and obesity is a public health crisis in Australia, with major health and economic consequences. Given the complex determinants of overweight and obesity, tackling this problem requires a comprehensive societal response, including multi-sectoral intervention. This Evidence Check has been commissioned to summarise the effectiveness of potential interventions for preventing obesity and improving population diets and levels of physical activity with relevance to the Australian context. This evidence will inform the development of a national obesity strategy for Australia, and is supported by a companion Evidence Check*Addressing the social and commercial determinants of healthy weight*.

Review questions

This Evidence Check aimed to address the following two questions:

Question 1: What population-level interventions, programs or policy approaches have been shown to be effective in improving healthy eating and/or physical activity?

Question 2: What population-level interventions, programs or policy approaches that may not yet be fully rolled out or evaluated have demonstrated early effectiveness, or are promising, in improving healthy eating and increasing physical activity?

Summary of methods

The foundation for the Evidence Check was the recommendations from the World Health Organization (WHO) Commission on Ending Childhood Obesity (ECHO) released in 2016. The WHO ECHO recommendations were developed over multiple years, based on a detailed evidence synthesis and extensive consultation with experts in the field.

For this Evidence Check, the research team developed a search strategy to assess the latest evidence to supplement and refine the recommendations from the WHO ECHO report, add in consideration of evidence related to adults (the WHO ECHO report focused on childhood obesity), and tailor the global recommendations to the Australian context. We included studies that were systematic reviews and/or meta-analyses (the highest standard of evidence) published between January 2016 and June 2019 that examined the effectiveness of interventions related to obesity prevention at the population level. In addition, we reviewed evidence from authoritative reports related to obesity prevention in Australia, supplemented by information identified from experts in the field.

We classified the interventions identified from the Evidence Check according to their focus area (*food systems; physical activity; society and culture;* and *health systems*) and themes for action (*public policy, regulation and legislation; sector development; social marketing; community action; personal skill development;* and *health surveillance and research*). For each identified intervention, evidence of effectiveness was synthesised separately in relation to each of the following: (1) weight-related outcomes; (2) diet or diet-related outcomes; (3) outcomes related to sedentary behaviour and physical activity-related behaviour. In addition, where available, we summarised the evidence related to the cost-effectiveness and likely equity impact of each intervention in the Australian context.

Interventions showing evidence of effectiveness relevant to the Australian context were then synthesised with the WHO ECHO recommendations to identify Australian-specific recommendations.

Key findings

Question 1:

Eighty-nine systematic reviews met the inclusion criteria. The research team synthesised the evidence from these systematic reviews into 31 distinct interventions, which covered a diverse range of intervention areas and targets. Just over half the interventions related to *food systems* with about a quarter focused on *physical activity*. Approximately half the interventions involved *public policy, regulation and legislation*, with several interventions involving *community action*, *personal skill development* (including capacity building), and *social marketing*.

Almost all the interventions related to ***food systems*** demonstrated promising results in improving diet-related outcomes. This was particularly the case for interventions involving *public policy, regulation and legislation* (such as food labelling, nutrient content of foods and healthy school food policies) and *community action* (including multi-component interventions in supermarkets, remote stores and food-service settings). Moreover, some of the interventions (such as increases in the price of less healthy food and lower prices for healthy food) were also effective in relation to weight-related outcomes. The evidence was typically inconclusive for interventions focused on *personal skill development* and *social marketing*. There were relevant economic evaluations for five of the interventions, with all five shown to be cost-effective (including restrictions on television advertising of unhealthy foods, nutrition labelling interventions and taxes on sugar-sweetened beverages).

All the interventions that targeted ***physical activity*** environments through *public policy, regulation and legislation* showed positive effects on physical activity-related outcomes. Where cost-effectiveness was also assessed, interventions targeting physical activity environments were found to be cost-effective. However, the evidence was inconclusive on the impact of these interventions on weight-related outcomes. The evidence for interventions that focused on changing individual physical activity behaviour was largely inconclusive, although some behavioural change programs were effective in reducing sedentary behaviour. In school and workplace environments, there was evidence that multi-component interventions can have a positive effect on physical activity.

In terms of ***society and culture***, only 'multi-component community-based interventions' demonstrated positive effects on weight-related outcomes. While there is evidence they have no effect on weight, school garden programs and interventions to improve cooking skills have shown promise regarding improvements in some diet-related outcomes. There was mixed evidence of the effectiveness of mass media campaigns aimed at altering health-related behaviours at the population level. However, some campaigns (such as the *Live Lighter* initiative) have been shown to be cost-effective in the Australian context. Interventions that offer direct financial incentives for people to lose weight or improve diet- or physical activity behaviours are likely to improve physical activity, and have been shown as likely to be cost-effective in some contexts.

Interventions related to ***health systems*** focused on support for breastfeeding as well as pre– and antenatal care through both *personal skill development* and *sector development*. These interventions demonstrated positive effectiveness credentials on multiple measures. More broadly, the WHO ECHO report emphasised the importance of interventions targeting pregnancy and the first two years of life. Many of the interventions identified in the Evidence Check were likely to have a positive effect on relevant behaviours of prospective and new parents.

From an equity perspective, the greater the degree of individual agency required for an intervention to be effective, the more likely it is that the intervention will preferentially benefit people with a higher

socioeconomic position compared with those with more limited social and economic resources. Accordingly, interventions focused on education and behaviour change are likely to have a negative overall impact on equity. In contrast, interventions that change the environment and involve broadscale community action are likely to have a positive impact on equity.

Question 2:

The Evidence Check identified 16 additional interventions relevant to the Australian context that have demonstrated effectiveness or delivered promising results in improving healthy eating and/or increasing physical activity. Eight of the interventions related to *food systems*; seven to *physical activity*; and one to *health surveillance and research*. Several of these interventions (e.g. nutrition warning labels and comprehensive marketing restrictions related to unhealthy foods) have been implemented recently in a range of countries. While it is often difficult to isolate the impact of interventions that change food and physical activity environments, there is growing evidence of the importance of these types of interventions for addressing obesity at the population level.

Identified evidence-based interventions

The Evidence Check identified 35 evidence-based actions to prevent obesity and/or achieve related outcomes (e.g. outcomes relating to diet, sedentary behaviour and/or physical activity. The following page contains a summary of these interventions.

Discussion

- There is a great deal of high-quality evidence regarding the effectiveness of a range of interventions likely to contribute to obesity prevention. Almost all interventions included in the Evidence Check demonstrate at least some degree of effectiveness in measures related to obesity prevention.
- A range of different policy instruments (such as regulations, support for community action, and behaviour change and education-based initiatives) have shown evidence of effectiveness and cost-effectiveness.
- In community settings (such as schools, supermarkets, restaurants and workplaces) effective interventions are typically multi-component in nature, involving changes to the environment, behaviour change components and capacity building.
- Due to the complex determinants of obesity, interventions are likely to have a relatively small effect in isolation. This reinforces the need to adopt a comprehensive approach to obesity prevention, incorporating a wide range of interventions.
- Equity considerations are critical. The likely influence of interventions on health equity needs to be considered in the context of a multi-pronged approach to addressing obesity. If an intervention is deemed effective for the general population, but is likely to increase inequities, appropriate complementary interventions may need to be prioritised to prevent the widening of inequities in weight and health. Thus, it is the package of interventions that should ultimately be assessed for equity impact.

Gaps in the evidence

- While there is good evidence for many interventions regarding the likely effectiveness for outcomes related to diet and/or physical activity, the evidence is limited regarding weight-related outcomes. This is due to the complex determinants of obesity, limitations in study designs and lack of real-world evaluation opportunities.
- There is limited evidence of the effectiveness of those interventions that target the systemic drivers of obesity (e.g. economic drivers, and social and commercial determinants of health). These interventions are likely to be more potent and sustainable than some of the more downstream interventions.

- This Evidence Check found limited evidence related specifically to Aboriginal and Torres Strait Islander communities. Evidence of appropriate interventions for these communities could be considered in a separate review, and/or in consultation with Aboriginal and Torres Strait Islander peoples.
- There is global consensus that a comprehensive obesity prevention strategy requires a range of supporting policy infrastructure (e.g. monitoring and surveillance, research and intelligence, capacity building, platforms for interaction). However, due to the nature and complexity of policy infrastructure, there is limited evidence of the effectiveness of these interventions on diet, physical activity or weight-related outcomes.

Conclusion

- There is high-quality evidence supporting a range of interventions likely to contribute to obesity prevention.
- There is strong international and national consensus on the types of policy approaches needed.
- There is evidence of effective interventions across multiple settings, targeting both diet and physical activity. A national co-ordinated approach to implementation is required across different sectors and levels of government.
- Comprehensive monitoring and evaluation of implementation of the interventions is needed, both to track progress and to generate further evidence of effectiveness.

Evidence-based obesity prevention interventions for the Australian context, including promising interventions (*)

	Food systems
1	Establish a whole-of-government policy on healthy food procurement, catering and provision across all government departments and settings under government control *
2	Adopt consistent national regulations on menu energy (kJ) labelling in restaurants and takeaway outlets
3	Mandate implementation of the Health Star Rating labelling system
4	Adopt nutrition warning labels on front-of-pack that indicate products high in nutrients of concern (sodium, saturated fat, added sugar and/or energy content) *
5	Increase the price of sugar-sweetened beverages (SSBs) and other unhealthy foods
6	Increase the price of alcoholic beverages, potentially through a uniform volumetric tax *
7	Explore options for incorporating the cost of greenhouse gas emissions into the price of foods *
8	Restrict temporary price reductions (price promotions) on unhealthy food products *
9	Subsidise healthy food, potentially including transport subsidies to remote communities
10	Reduce the exposure of children to promotion of unhealthy food and beverages on broadcast media (TV and radio)
11	Eliminate marketing of unhealthy foods/brands in publicly owned or managed settings *
12	Remove unhealthy food and beverage sponsorship and related advertising associated with sport and major community events *
13	Enforce regulatory measures such as the International Code of Marketing of Breastmilk Substitutes and subsequent World Health Assembly resolutions
14	Implement a national coordinated approach for healthy food provision in schools, health facilities, sport and recreation facilities, and other settings controlled or managed by Australian governments

15	Develop clear requirements for early childhood settings regarding the healthiness of foods provided and promoted
16	Support multi-component interventions to improve nutrition information and increase accessibility and prominence of healthier options in supermarkets
17	Support multi-component interventions to encourage healthier choices in food-service settings (e.g. restaurants, cafes and takeaway food outlets)
18	Support implementation of nutrition interventions in remote stores
19	Adopt mandatory limits on nutrients of concern (e.g. trans fat, sodium, saturated fat, added sugars) in foods in targeted food categories *
20	Establish clear national targets for reductions in sodium, saturated fat and added sugar in key food categories (including packaged foods and out-of-home meals) *
	Physical activity
21	Enact policy changes to support and enable changes to the built environment to improve walkability, cycling and public transport use *
22	Undertake park and playground renovations and improvements, and increase availability of school playgrounds after regular school hours
23	Support implementation of multi-component school-based interventions to reduce sedentary behaviour and increase physical activity in children *
24	Support implementation of multi-component workplace interventions comprising organisational and individual-level strategies to encourage physical activity, reduce sedentary behaviour and enhance health and wellbeing
25	Support implementation of physical education interventions in schools and early childcare settings
	Society and culture
26	Engage and support local communities to develop and lead their own healthy eating and physical activity initiatives that are multi-component and multi-setting in nature *
27	Develop and fund ongoing mass media campaigns aimed at altering diet-related and physical activity behaviours at the population level, while minimising weight-related stigma
28	Support increased understanding, use and uptake of the Australian Dietary Guidelines among the general public
29	Support improved nutrition education in schools and early childhood settings
30	Identify regulatory measures to further support mothers to breastfeed
31	Establish a consistent national approach to regular measuring of children's height and weight at key stages of primary and secondary schooling *
32	Explore opportunities to provide direct financial and other incentives for weight loss, healthy eating and/or physical activity
	Health systems
33	Ensure all primary and tertiary care settings adopt best-practice breastfeeding policies and practices
34	Provide resources for physical activity promotion, lifestyle and behaviour change programs, and advice on reducing screen time in primary care settings, tailored to different socioeconomic groups
35	Provide pre-conception and antenatal nutrition guidance and support for healthy pregnancy in primary care settings

Background

The problem of obesity

The prevalence of overweight and obesity[1] has risen sharply over the past 40 years. In Australia, approximately 63% of the adult population and 27% of children have either overweight or obesity [3].

Obesity is a major risk factor for diseases such as cardiovascular disease, type 2 diabetes, musculoskeletal conditions and many cancers [4]. In 2015, obesity and dietary risk factors were responsible for 8.4% and 7.3% of the total disease burden in Australia, with a further 2.5% of disease burden related to physical inactivity [5]. In addition to the health impact, obesity also has a substantial economic impact on Australia with the most recent estimates indicating that the direct (medical) costs of obesity are approximately $5.4 billion per year, with indirect costs (related to reduced productivity) an additional $6.4 billion each year [6].

Obesity prevalence varies across population groups, with Australian adults and children who experience greater socioeconomic disadvantage most likely to have overweight or obesity [7]. The Australian Burden of Disease study estimated that obesity explained 14% of the health gap between Indigenous and non-Indigenous Australians [8].

The causes of overweight and obesity are multifaceted and complex. Current evidence indicates that individual, social and environmental factors all contribute to obesity [9]. There is global recognition that the increased supply of relatively cheap, tasty, energy-dense food, and improved food distribution and marketing, alongside strong economic forces driving consumption and growth are key drivers of the obesity epidemic [9]. The changes to the food environment have been accompanied by a shift to more sedentary lifestyles through increased urbanisation, greater use of cars, and more office-based occupations [10].

The 2017–18 National Health Survey revealed only half of all Australians eat the recommended two serves of fruit per day, while only 7.5% meet the guidelines for vegetable consumption [11]. More than one-third of all energy consumed is estimated to come from discretionary foods [12]. Australians aged over 15 years on average spend only 42 minutes exercising per week, with very few meeting recommendations for total physical activity time or muscle strengthening activities (15% for adults, <2% for young people aged 15–17 years) [13].

Figure 1 depicts a framework of obesity determinants and solutions developed by Swinburn and Sacks[9]. The importance of focusing on the systemic and environmental drivers of obesity is clear from this figure, with interventions that target these drivers likely to have the largest effects on population health. Interventions that target individual behaviour patterns are likely to be easier to implement, but have far smaller population impact.

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[1] Overweight and obesity are defined by the World Health Organization (WHO) as abnormal or excessive fat accumulation that presents a risk to health. Overweight and obesity are commonly measured in body mass index (BMI). Adults with a BMI of 25 or greater are classified as overweight, while a BMI of 30 or greater is considered obese 1. World Health Organization. Obesity and overweight. Geneva, Switzerland: World Health Organization; 2018. [Access Date: 12 July]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight. For children, overweight is defined as having a BMI between the 85th and 95th percentile for children and teens of the same age and gender; whereas, obese is defined as having a BMI at or above the 95th percentile for children and teens of the same age and gender 2. Centers for Disease Control and Prevention. Defining Childhood Obesity: BMI for Children and Teens. 2018. [Access Date: 12 July]. Available from: http://cdc.gov/obesity/childhood/defining.html.

While weight gain results from an imbalance between energy intake and energy expenditure, both experimental and population-based research evidence suggest obesity is more strongly related to diet than physical activity [14-18]. Nevertheless, physical activity is important for weight maintenance [19] and the non–weight-related benefits of physical activity are clear and substantial, including reduced risk of heart disease, type 2 diabetes, several cancers, depression and some injuries [20, 21]. Accordingly, there is compelling evidence to suggest that population approaches to reducing overweight and obesity should encompass strategies to improve diet and increase physical activity, but should place an emphasis on the reduction in the drivers of increased energy intake.

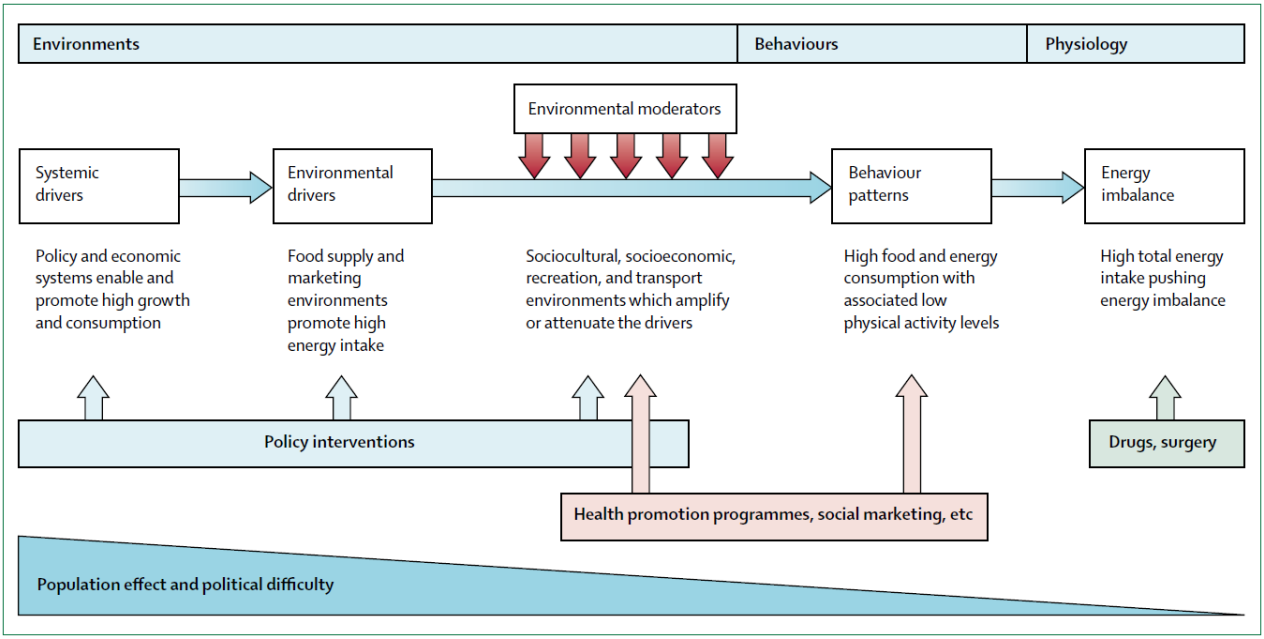


Figure 1: A framework to categorise obesity determinants and solutions [9]

Global recommendations for addressing obesity and related inequities

The World Health Organization (WHO) has consistently identified a range of actions required of governments to address obesity, improve diets and increase physical activity at the population level. These recommendations include government policies (potentially including regulations, taxation/subsidies, programs and infrastructure) across a wide range of sectors, such as health, education, agriculture, transport and finance, as well as widescale action from the private sector and community groups [22].

It is also well documented that a range of complementary policies will be required to reduce inequities in obesity [23]. These include: (i) interventions targeting the upstream social determinants of obesity (e.g. housing, transport and planning); (ii) interventions (e.g. addressing the affordability of a healthy diet) that target socioeconomically disadvantaged individuals to tackle the socioeconomic *gap* in the barriers to healthy diets and physical activity; and (iii) population-wide obesity strategies that act across the entire population to improve dietary intake and increase energy expenditure, thus addressing the socioeconomic *gradient* in obesity. Interventions that empower and inform the individual are important but will only ever have limited impact unless the structural barriers to healthy eating and physical activity, such as cost, accessibility, availability and safety, which are known to be disproportionately faced by socioeconomically disadvantaged people, are also addressed [24].

In 2014, WHO established a Commission on Ending Childhood Obesity (ECHO) to provide international guidance on the interventions required to address childhood obesity [25]. In 2016, the Commission released a comprehensive set of broad-based, multi-sectoral recommendations for actions in six broad areas: (1) promote intake of healthy foods; (2) promote physical activity; (3) pre-conception and pregnancy care; (4) early childhood diet and physical activity; (5) health, nutrition and physical activity for school-age children; and (6) weight management. The recommendations from WHO's ECHO report [25] are provided in **Appendix 1**.

In late 2018, the Council of Australian Governments (COAG) responded to the need for comprehensive action to address obesity in Australia by commissioning the development of a national obesity strategy. A focus of the national obesity strategy is to prevent obesity through public policies, and social and environmental approaches in health promotion.

Aim of the Evidence Check

This Evidence Check provides a summary of the current state of knowledge on population-level interventions, programs and policy approaches shown to be effective in supporting healthy eating and physical activity. The research questions addressed by the review were:

Question 1: What population-level interventions, programs or policy approaches have been shown to be effective in improving healthy eating and/or physical activity?

Question 2: What population-level interventions, programs or policy approaches that may not yet be fully rolled out or evaluated have demonstrated early effectiveness, or are promising, in improving healthy eating and increasing physical activity?

Methods

Question 1

Evidence Check approach

In relation to Question 1, the research team used the rapid review method to assess the relevant evidence. This has been classified as one of the review methods under the systematic review 'family' [26] and aims to generate evidence in a timely manner to inform policy makers' decisions [27]. Even though a rapid review has a significantly shorter time frame, the same systematic review protocol applies to ensure methodological robustness is upheld. This Evidence Check was conducted in accordance with PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines.

For the purposes of the Evidence Check, 'interventions, programs or policy approaches' (hereafter, 'interventions') referred to initiatives aimed at creating and sustaining changes that supported healthy eating and physical activity.

Search strategy

The Evidence Check was underpinned by the recommendations from the World Health Organization (WHO) Commission on Ending Childhood Obesity (ECHO), released in 2016. The WHO ECHO report [25] was developed over two years (2014–2016), with recommendations built on a detailed evidence synthesis and extensive consultation with experts in the field, more than 100 WHO member states and the broader community.

For this Evidence Check, the research team developed a search strategy in consultation with a field expert librarian at Deakin University. The aim of the search was to assess the latest high-quality evidence to supplement and refine the recommendations from the WHO ECHO report, add in consideration of evidence related to adults (as the WHO ECHO report focused on childhood obesity), and tailor the global recommendations to the Australian context.

We searched two online databases, EBSCOhost MEDLINE Complete and Health Policy Reference Center. These databases do not cover the full range of literature likely to be relevant, but were considered a practical limitation based on the short time frame (five weeks) that we had to conduct the Evidence Check and the limited resources available.

Search parameters focused on four identified concepts: (1) interventions, programs and policies; (2) healthy eating and physical activity; (3) effectiveness; and (4) systematic review. Specific keywords used for the search are included in **Appendix 2**. Wildcards and MeSH terms were used to capture any variations of terms. A record of titles and abstracts retrieved in an initial search was screened against the following inclusion and exclusion criteria to identify potential papers for inclusion. These papers were then subject to full-text screening against the inclusion and exclusion criteria.

Inclusion criteria

The Evidence Check included systematic reviews and meta-analyses (considered the highest quality of evidence) that:

- Were published from 2016 (the date of the publication of the WHO ECHO report) to the end of June 2019 (the date the search was conducted)

- Were written in English
- Reported on population-level prevention interventions that:
- Focused on addressing healthy eating related to obesity
- Focused on addressing physical activity related to obesity
- Were applicable to settings amenable to government intervention, such as early childcare centres, schools, workplaces and primary care settings
- Related to a broad range of key life stages (e.g. gestation, childhood, adulthood, older adulthood)
- Reported outcomes related to body weight, body mass index (BMI), waist circumference, diet-related behaviours (e.g. fruit and vegetable purchases or consumption, sugar-sweetened beverage purchases and consumption, energy intake, diet quality), sedentary behaviour and physical activity-related behaviour (e.g. minutes of physical activity, MET (metabolic equivalent of task) minutes, step count).

Exclusion criteria

- Non-systematic reviews
- Studies that focused on interventions:
    - Directed at treatment, including clinical and pharmacological interventions
    - Targeted at individuals rather than population groups
    - Targeted at people or groups with specific diseases, such as asthma and diabetes
    - In home settings, with or without parental involvement.
- Studies that focused on:
    - Implementation strategies, aspects or processes (e.g. barriers to implementation, critical success factors, levels of participation)
    - Determinants of obesity, healthy eating or physical activity.

Additional literature search

We conducted a desktop search for relevant reviews from government and international health organisations to supplement the primary academic literature search. This included a search of the websites of the following organisations:

- World Health Organization (WHO)
- Organisation for Economic Cooperation and Development (OECD)
- World Bank
- Australian departments of health at the federal, state and territory levels
- US Centers for Disease Control and Prevention (CDC) and related agencies
- British Department of Health and Social Care and related agencies
- Health Canada
- New Zealand Ministry of Health
- The Australian Prevention Partnership Centre
- World Cancer Research Fund.

In addition, the research team identified a small number of additional papers relevant to the Evidence Check, based on our expertise and experience.

Data extraction

Two reviewers (EL and MT) extracted data from the included papers into a pro forma Microsoft Excel spreadsheet, which included the following information:

1. Title of the study
2. Authors
3. Published year

4. Study type
5. Population studied
6. Setting
7. Year studied
8. Number of studies
9. Country / countries studied or included
10. Interventions reported
11. Outcome measures
12. Direction / magnitude of effect
13. Authors' conclusion.

Evidence synthesis

Two reviewers (GS and EL) analysed the data, with synthesised results reviewed by the full research team.

Intervention description and characterisation

For the purposes of synthesising the evidence, we defined and specified interventions in a way that maximised policy relevance while reflecting the available evidence. Details of each intervention component were specified as far as possible to match the level of detail provided in the underlying reviews.

We classified interventions identified from the Evidence Check into seven themes for action (**Table 1**) and also into 11 clusters, as provided by Queensland Health (on behalf of the national obesity strategy working group). These included: *food systems* (food markets, food processing, individual food consumption); *physical activity* (physical activity environment, individual activity); *society and culture* (socio-political influences, cultural and societal values, individual psychology, physiology); *health systems* (people-centred health system); and *natural environment*. A description of these clusters is provided in **Appendix 3**.

Table 1: Themes for action

Theme	Description
Public policy, regulation and legislation	Creating sustainable environments that make it easier to lead healthy lives
Sector development	Empowering health and non-health sectors to integrate prevention into their core business, service delivery and initiatives
Social marketing	Raising public awareness, motivating and influencing healthy behaviours
Community action	Community participation, engagement, empowerment and capacity building for social and environmental change
Personal skill development	Empowering people with the individual knowledge, attitudes, confidence and skills to make informed healthy choices (including health literacy)
Risk assessment, early intervention & counselling	Identifying and helping people at greater risk to take early action to improve their health
Health surveillance and research	Providing timely and robust information to inform policy and practice

Evidence of effectiveness

We synthesised evidence of effectiveness separately in relation to each of the following: (1) weight-related outcomes (e.g. BMI, body weight, waist circumference); (2) diet or diet-related outcomes (e.g. fruit and vegetable purchases or consumption, sugar-sweetened beverage purchases and consumption, energy intake, diet quality); (3) outcomes related to sedentary behaviour and physical activity-related behaviour

(e.g. minutes of physical activity, MET-minutes, step count). The heterogeneity in outcome measures reflects the complex determinants of overweight and obesity, and the variety of methods assessed in the included review papers. It was not possible to indicate the likely magnitude of effect for each intervention because of the diverse ways in which outcome measures are reported. The way in which the evidence of effectiveness and strength of evidence was synthesised for each intervention and outcome category is described in **Table 2**.

Table 2: Classification of evidence of effectiveness on weight, diet and physical activity-related outcomes

Level of effectiveness	Description
Positive	The balance of evidence was judged to indicate a ***clear positive (favourable)*** effect, based on consistently positive results showing improvements in the measured outcome, in settings relevant to the Australian context
Indicative positive	The balance of evidence was judged to indicate ***that there was likely to be a positive (favourable)*** effect on the measured outcome, although results from relevant studies were not consistently positive and/or the intervention had not been well evaluated in settings relevant to the Australian context
Inconclusive	The balance of evidence was judged to be ***inconclusive***. Based on the evidence assessed, it was not possible to determine a clear direction of effect because of inconsistent findings
Indicative negative	The balance of evidence was judged to indicate that ***there was likely to be a negative (unfavourable)*** effect on the measured outcome, although results from relevant studies were not consistently negative
Negative	The balance of evidence was judged to have a ***negative (unfavourable)*** effect, based on consistently adverse impacts on the measured outcome, in settings relevant to the Australian context
No effect	The balance of evidence was judged to indicate that there was likely to be ***no effect*** on the measured outcome
Not assessed / not applicable	This outcome had not been evaluated or was not applicable

Cost-effectiveness

Evidence related to the cost-effectiveness of each intervention was drawn from the a recent priority setting study [28] that specifically examined the cost-effectiveness of a wide range of policy options for obesity prevention in the Australian context using consistent methods of evaluation across the range of interventions. The way in which the research team synthesised the evidence of cost-effectiveness for each intervention is described in **Table 3**.

Table 3: Classification of cost-effectiveness of interventions

Cost-effectiveness	Description
Dominant	The intervention results in health gains and is less costly compared with current practice, based on results from a recent Australian priority setting study
Cost-effective	The intervention results in health gains and costs more compared with current practice, based on results from a recent Australian priority setting study. The intervention is considered good value for money using a cost-effectiveness threshold of $50,000 per health adjusted life year gained
Not cost-effective	The intervention results in health gains and costs more compared with current practice, based on results from a recent Australian priority setting study. The intervention is considered not good value for money using a cost-effectiveness threshold of $50,000 per health adjusted life year gained
Dominated	The intervention results in heath loss and is more costly than current practice, based on results from a recent Australian priority setting study
Not assessed / not applicable	This outcome has not been evaluated or is not applicable

Equity impact

The research team classified the likely equity impact of each intervention using a combination of identified reviews, existing theory (whereby the greater the degree of individual agency required for intervention effectiveness, the more likely the intervention would preferentially benefit individuals with a higher socioeconomic position compared with those with more limited social and economic resources) and our knowledge of the existing evidence [24]. The way in which we synthesised the likely equity impact of each intervention is described in **Table 4**.

Table 4: Classification of the likely equity impact of interventions

Equity impact	Description
Potential positive	The balance of evidence, based on direct and indirect evidence (including reviews reporting on lab-based experiments or modelling studies and/or theory), was judged to indicate that the intervention had the potential to reduce the social gradient in health
Inconclusive	The balance of evidence was judged to be inconclusive due to mixed or inconsistent findings
Neutral	The balance of evidence was judged to indicate that the intervention was likely to have a similar effect across the social gradient and therefore a neutral impact on the social gradient in health
Potential negative	The balance of evidence, based on direct and indirect evidence (including reviews reporting on lab-based experiments or modelling studies and/or theory), was judged to indicate that the intervention had the potential to increase the social gradient in weight and health
Not assessed / not applicable	The equity impact of the intervention has not been evaluated or is not applicable

Question 2

In relation to Question 2, the research team undertook a grey literature search of authoritative reports related to obesity prevention in Australia, with findings supplemented by information identified from a broad range of experts in the field, including academics and policy makers with expertise related to obesity prevention, nutrition and physical activity.

The goal of the search was to identify additional interventions (not captured in relation to Question 1) that might not yet be fully rolled out or evaluated, but that had demonstrated early effectiveness or were promising in improving healthy eating and increasing physical activity. We summarised a description of each of the included promising interventions along with the evidence (from academic literature of primary studies or grey literature) indicating its effectiveness or potential.

The list of promising interventions may not be comprehensive because of the short time frame (five weeks) and limited resources available to conduct the Evidence Check.

Synthesis of recommended actions

Based on the findings from Questions 1 and 2, the research team then synthesised interventions that showed evidence of effectiveness relevant to Australia with the relevant WHO ECHO recommendations to identify evidence-based interventions applicable to the Australian context.

Findings

Question 1: What population-level interventions, programs or policy approaches have been shown to be effective in improving healthy eating and/or physical activity?

This Evidence Check appraised 89 systematic reviews. Appendix 4 shows the PRISMA flow chart for the study selection, and full details of each of the included reviews are provided in **Appendix** 5**.**

The majority (58) of the included systematic reviews focused on randomised controlled trials (RCTs), 27 of which included meta-analyses. Studies within the included reviews spanned all continents, with most systematic reviews including studies from the US (55), Australia (47) and Britain (39). Twenty-four of the systematic reviews related to adults and 26 related to the general population (including children, adolescents and adults). Twenty of the included systematic reviews focused exclusively on children while nine focused exclusively on adolescents, with others looking at a combination of groups.

In synthesising the evidence from the included studies, we described 31 interventions. **Table *5*** provides an overview of the identified interventions by cluster and theme for action. Interventions covered a diverse range of intervention areas and targets. Just over half the interventions related to *food systems*, with about a quarter focused on *physical activity*. Approximately half the interventions involved *public policy, regulation and legislation*, with several involving *community action*, *personal skill development* (including capacity building) and *social marketing*. No identified interventions focused on the *natural environment*, perhaps reflecting the distal nature of interventions in that area for outcomes of interest. There were also no identified interventions focused on physiology or treatment — reflecting the focus of the Evidence Check on preventive interventions at the population (rather than individual) level.

Table 6 provides a summary of the effectiveness of identified interventions.

Table 5: Overview of identified interventions by 'cluster' and 'theme for action'

		Themes for action								
Category	***Cluster***	***Public policy, regulation and legislation***	***Sector development***	***Social marketing***	***Community action***	***Personal skill development***	***Risk assessment, early intervention & counselling***	***Health surveillance & research***	**Subtotal**	**Total**
Food systems	***Food markets***	9	0	0	4	0	0	0	**13**	**18**
	Food processing	1	0	0	0	0	0	0	**1**	
	Individual food consumption	0	0	1	0	3*	0	0	**4**	
Physical activity	***Physical activity environment***	3	0	0	0	0	0	0	**3**	**6**
	Individual activity	0	0	0	1	2	0	0	**3**	
Society and culture	***Socio-political influences***	0	0	0	0	0	0	0	**0**	**6**
	Cultural and societal values	0	1	0	1	0	0	0	**2**	
	Individual psychology	1	0	0	0	3	0	0	**4**	
	Physiology	0	0	0	0	0	0	0	**0**	
Health systems	***People-centred health system***	0	1	0	0	0	0	0	**1**	**1**
Natural environment	***Natural environment***	0	0	0	0	0	0	0	**0**	**0**
	Total	**14**	**2**	**1**	**6**	**8**	**0**	**0**	**31**	**31**

* denotes multi-component interventions that consisted of components related to both individual food consumption and physical activity

Table 6: Summary of effectiveness of interventions related to obesity prevention

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int1	Food markets	Public policy, regulation and legislation	Interpretive front-of-pack nutrition labelling (e.g. health star rating, traffic-light labelling, other summary indicators of healthiness)		Positive (healthy option selection) Indicative positive (energy content purchased) Indicative positive (product reformulation)		Dominant (cost-saving and improves health)	Neutral	ECHO1.1, ECHO1.7	A3	1 Cochrane review [29] 1 systematic review of systematic reviews [30] 1 systematic review of RCTs [31] 2 systematic reviews of RCTs and other studies [32, 33] Economic evaluations in the Australian context [28]
Int2	Food markets	Public policy, regulation and legislation	Back-of-pack nutrition labelling (e.g. nutrition information panel)		Positive (energy intake) Positive (decreasing total fat intake) Positive (vegetable consumption) Positive (decreasing unhealthy options)			Potential negative	ECHO1.1, ECHO1.6	n/a	1 systematic review and meta-analysis of RCTs and other studies [34]
Int3	Food markets	Public policy, regulation and legislation	Health and nutrition content claims on packaged food		Inconclusive (healthy choices and dietary outcomes)			Potential negative	ECHO1.1, ECHO1.6	n/a	3 systematic reviews of RCTs and other studies [34-36]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
	Food markets	Public policy, regulation and legislation	Menu energy (kJ) labelling in restaurants and takeaway outlets	Inconclusive (BMI)	Positive (manufacturer product formulation) Indicative positive (healthy option selection) Indicative positive (energy content of fast food purchased)		Dominant (cost-saving and improves health)	Potential negative	ECHO1.1	Int4	2 systematic reviews of systematic reviews [30, 37] 2 systematic reviews of other studies [38, 39] 1 meta-analysis [40] Economic evaluation in the Australian context [28]
Int5	Food markets	Public policy, regulation and legislation	Health levy / tax on sugar-sweetened beverages (SSBs)	Indicative positive (BMI)	Positive (energy intake)		Dominant (cost-saving and improves health)	Neutral	ECHO1.2	A5	1 systematic review of systematic reviews [30] 2 systematic reviews of other studies [41, 42] Economic evaluation in the Australian context [28]
Int6	Food markets	Public policy, regulation and legislation	Health levy / tax on unhealthy foods (e.g. unhealthy snacks, unhealthy takeaway food)		Indicative positive (dietary intake)			Neutral	ECHO1.2	A5	1 systematic review of systematic reviews [30]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int7	Food markets	Public policy, regulation and legislation	Subsidies / price reductions on healthy foods (e.g. fruit and vegetables)	Indicative positive (nutrition and health markers)	Indicative positive (fruit and vegetable consumption, purchase and consumption of healthy food)			Potential positive	N/A	A9	1 systematic review of systematic reviews [30] 1 systematic review of RCTs and other studies [43]
Int8	Food markets	Public policy, regulation and legislation	Restriction of television advertising of unhealthy foods		Indicative positive (dietary intake)		Dominant (cost-saving and improves health)	Potential positive	ECHO1.3, ECHO4.5	A10	1 meta-analysis [44] Economic evaluation in the Australian context [28]
Int9	Food markets	Public policy, regulation and legislation	Multi-component school food environment policies, including: • Standards for school canteens • Direct provision of healthful foods/beverages (e.g. school breakfast programs) • Implementation of water fountains • Restrictions on unhealthy food marketing in schools	Inconclusive (BMI)	Indicative positive (dietary intake in the school setting) Inconclusive (total daily energy intake)			Potential positive	ECHO1.8, ECHO4.9, ECHO5.2, ECHO5.3	A14	1 Cochrane review [29] 1 systematic review of systematic reviews [45] 1 systematic review of RCTs [46] 5 systematic reviews of RCTs and other studies [47-51]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int10	Food markets	Community action	Grocery retail settings (e.g. supermarkets): multi-component interventions to improve nutrition information and increase accessibility and prominence of healthier options, particularly including shelf labelling (using nutrition summary score) as one component		Indicative positive (purchase of healthier food)		Dominant (cost-saving and improves health)	Potential positive	ECHO1.1, ECHO1.9	A16	1 Cochrane review [29] 1 systematic review of systematic reviews [30] 2 systematic reviews of RCTs and other studies [52, 53] Economic evaluation in the Australian context [28]
Int11	Food markets	Community action	Very remote locations: store-based nutrition interventions, including food pricing strategies, combined with community health promotion	Indicative positive (BMI)	Indicative positive (dietary intake)			Potential positive	ECHO1.9	A18	1 systematic review of RCTs and other studies [43]
Int12	Food markets	Community action	Supermarkets: opening of new stores in under-served areas	Inconclusive (BMI)	Inconclusive (dietary intake)			Inconclusive	ECHO1.9	N/A	2 systematic reviews of RCTs and other studies [54, 55]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int13	Food markets	Community action	Food-service settings (e.g. school canteens, restaurants, cafes and takeaway food outlets): multi-component interventions to encourage healthier choices, potentially including: • Labelling of healthier choices and other point-of-purchase interpretive nutrition information • Increasing prominence and appeal of healthier options • Removal of unhealthy products and related marketing • Pricing strategies that favour healthy products and disincentivise less healthy options • Changing default content of children's meals to include healthier options and remove less healthy options	Indicative positive (BMI)	Positive (food-related behaviour)			Potential positive	ECHO1.1, ECHO1.8, ECHO4.5, ECHO5.1, ECHO5.2	A14, A17	1 Cochrane review [29] 2 systematic reviews of systematic reviews [30, 37] 4 systematic reviews of RCTs and other studies [39, 56-58]
Int14	Food processing	Public policy, regulation and legislation	Mandatory limits on nutrients of concern in foods (e.g. sodium, trans fat, saturated fat, added sugars) in targeted food categories		Positive (trans fat intake) Positive (reduction of salt intake)			Potential positive	ECHO4.5	A19	2 systematic reviews of RCTs and other studies [59, 60]
Int15	Individual food consumption	Social marketing	Interventions that aim to use or change hedonic factors (e.g. taste, liking, familiarity) to increase vegetable consumption		Inconclusive (dietary intake)			Neutral		n/a	1 systematic review of pre–post studies [61]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int16	Individual food consumption	Personal skill development	Lunchbox interventions, including guidelines and education to improve quality of foods in school lunchboxes	Inconclusive (BMI)	Inconclusive (overall diet, healthiness of lunchboxes)			Potential negative	ECHO4.6, ECHO4.8, ECHO5.5, ECHO5.6	n/a	1 systematic review of RCTs and other studies [62]
Int17	Individual food consumption and physical activity	Personal skill development	Pre-conception and antenatal nutrition guidance and support for healthy pregnancy	Inconclusive (BMI)	Indicative positive (fruit and vegetable consumption, breastfeeding duration)	Indicative positive (sedentary behaviour)		Potential negative	ECHO3.3, ECHO3.4, ECHO4.3	A35	2 systematic reviews of RCTs [63, 64]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int18	Individual food consumption and physical activity	Personal skill development	Behaviour change programs suitable for delivery in a range of settings including: • Classrooms (early childcare and schools): healthy eating and physical activity lessons, activities, worksheets, prizes/competitions, advice on reducing screen time • Schools: increase exposure to healthy food (e.g. posters), activities to promote healthy lifestyles, peer/social support programs, typically with involvement of teachers and parents • Primary care settings and workplaces: physical activity promotion and advice on reducing screen time, lifestyle behaviour change programs	Inconclusive (BMI)	Inconclusive (dietary intake)	Indicative positive (sedentary behaviour) Inconclusive (physical activity)		Potential negative	ECHO5.4, ECHO5.7	A23, A29, A34	1 Cochrane review [29] 2 systematic reviews of RCTs [65, 66] 6 systematic reviews of RCTs and other studies [51, 67-71]
Int19	Physical activity environment	Public policy, regulation and legislation	Park and playground renovations and improvements, and increased availability of school playgrounds after regular school hours	Inconclusive (weight outcomes)		Indicative positive (physical activity)			ECHO2.2	A22	2 systematic reviews of systematic reviews [30, 45]
Int20	Physical activity environment	Public policy, regulation and legislation	Schools: multi-component interventions to reduce sedentary behaviour and increase physical activity, including implementation of standing desks, physical activity programs and other curriculum-based interventions			Indicative positive (sedentary behaviour) Inconclusive (physical activity)	Dominant (cost-saving and improves health)	Potential positive	ECHO4.11, ECHO5.7	A23	2 systematic reviews of RCTs and other studies [72, 73] Economic evaluation in the Australian context [28]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int21	Physical activity environment	Public policy, regulation and legislation	Workplaces: multi-component interventions comprising organisational and individual-level strategies to encourage physical activity and reduce sedentary behaviour: • Promotion of stair use • Sit/stand desks • Coaching programs • Counselling (e.g. goal setting) • Information sessions	Inconclusive (weight outcomes)	Inconclusive (healthy eating)	Positive (physical activity) Positive (sedentary behaviour)	Cost-effective	Neutral	N/A	A24	3 systematic reviews of RCTs and other studies [74-76] 2 systematic reviews of other studies [77, 78] Economic evaluation in the Australian context [28]
Int22	Individual activity	Personal skill development	Active school travel programs, including: • Walking school bus • Cycle to school • Education and encouragement of physical activity	Inconclusive (BMI)	Inconclusive (healthy eating)	Inconclusive (physical activity) Indicative positive (walking)		Potential negative	ECHO4.11	N/A	1 systematic review of systematic reviews [30] 4 systematic reviews of RCTs and other studies [79-82]
Int23	Individual activity	Personal skill development	Physical education (PE) interventions in schools, potentially including: • Increased allotted PE time • Increased frequency of PE • Teacher education, capacity building and training to increase student on-task time and energy expenditure • Increased focus on developing physical literacy of students • Increased focus on enjoyment of PE	Inconclusive (body composition)		Indicative positive (physical activity) Inconclusive (fitness)			ECHO2.1, ECHO4.11, ECHO5.7	A25	1 systematic review of RCTs and other studies [83]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int24	Individual activity	Community action	Physical activity education interventions targeting rural communities, including: • Exercise and fitness classes • Education sessions • Individualised newsletters • Social support			Inconclusive (physical activity and sedentary behaviour)		Potential negative	ECHO2.1	N/A	2 systematic reviews of RCTs [84, 85] 1 systematic review of RCTs and other studies [86]
Int25	Cultural and societal values	Social marketing	Mass media campaigns aimed at altering the population's health-related and physical activity behaviours		Inconclusive (dietary intake)	Inconclusive (physical activity)	Dominant (cost-saving and improves health)	Potential negative	ECHO1.1, ECHO2.1, ECHO4.6, ECHO4.7, ECHO5.5,	A27	1 systematic review of systematic reviews [30] Economic evaluation in the Australian context [28]
Int26	Cultural and societal values	Community action	Community-based obesity prevention interventions: • Multi-component • Multi-setting • Including healthy eating and physical activity components • Led by local community • Includes capacity building and training of community staff	Indicative positive (BMI)	Inconclusive (dietary intake)	Inconclusive (physical activity)	Cost-effective	Potential positive	ECHO2.1, ECHO4.8, ECHO4.13, ECHO5.5	A26	1 systematic review of systematic reviews [30] 2 systematic reviews of RCTs and other studies [76, 87] 2 systematic reviews of other studies [47, 50] 1 meta-analysis [88] Economic evaluation in the Australian context [28]
Int27	Individual psychology	Public policy, regulation and legislation	School gardening programs	No effect (BMI)	Indicative positive (fruit and vegetable consumption)			Potential negative	ECHO4.10, ECHO5.5	N/A	2 systematic reviews of RCTs and other studies [89, 90]
Int28	Individual psychology	Personal skill development	Cooking classes / skills development in schools or community settings	No effect (BMI)	Indicative positive (dietary intake)			Potential negative	ECHO4.10, ECHO5.5, ECHO5.6	A29	1 systematic review of RCTs and other studies [91]

ID	Cluster	Theme	Intervention	Effectiveness — weight	Effectiveness — diet	Effectiveness — physical activity	Cost-effectiveness	Equity impact	Related WHO ECHO recommendation (Appendix 1)	Related recommendation (Table 8)	Supporting evidence
Int29	Individual psychology	Personal skill development	mHealth / eHealth interventions, including: • Wearable health and movement trackers • Smartphone apps • Messaging services (e.g. SMS) • Video games • Telehealth	Inconclusive (BMI)	Inconclusive (healthy eating)	Indicative positive (physical activity) Indicative positive (sedentary behaviour)			N/A	N/A	2 systematic reviews of RCTs [92, 93] 3 systematic reviews of RCTs and other studies [94-96]
Int30	Individual psychology	Personal skill development	Direct financial and other incentives for weight loss, healthy eating and/or physical activity-related behaviours	Inconclusive (healthy eating)	Inconclusive (healthy eating)	Positive (physical activity)	Cost-effective		N/A	A32	2 systematic reviews of RCTs and other studies [75, 97] Economic evaluation in the Australian context [28]
Int31	People-centred health system	Sector development	Primary care setting: hospital and clinic-based breastfeeding policies and practices	Indicative positive (early-life obesity prevention)					ECHO4.2	A33	1 systematic review of RCTs and other studies [63]

Food markets and food processing

The research team identified 14 interventions concerning food markets and food processing, of which 10 had a public policy, regulation and legislation focus and four a community action focus. Twelve of the 14 identified interventions demonstrated promising results in improving diet-related outcomes. Economic measures, such as a health levy/tax on sugar-sweetened beverages (SSBs), have also been shown to be promising in improving weight-related outcomes and are likely to be cost-effective.

Legislation restricting television advertising of unhealthy foods, and mandatory limits on nutrients of concern (such as sodium, added sugar and trans fatty acids) in foods, are likely to have a favourable effect on the population's dietary intake, are likely to prove cost-effective and are likely to reduce inequities related to obesity.

Nutrition labelling interventions (such as interpretive front-of-pack labelling and menu kilojoule labelling) have good evidence of effectiveness and cost-effectiveness, although there is mixed evidence of the effectiveness of health and nutrition content claims. Findings are inconclusive regarding whether opening new supermarkets in under-served areas is effective, primarily because supermarkets sell a range of both healthy and unhealthy products.

Multi-component interventions in food-service settings, such as school canteens, hospital cafeterias, cafes, restaurants and takeaway outlets, have been found to improve food-related behaviours and could potentially have a favourable effect on weight outcomes. Successful interventions included components such as point-of-purchase interpretive nutrition information, increasing the prominence and appeal of healthier options, the removal of unhealthy products and related marketing, changing the default content of children's meals to include healthier options, and pricing strategies that favour healthy products whilst disincentivising less healthy options. Similarly, multi-component interventions that improve the healthiness of school food environments are likely to have a positive impact.

Individual food consumption and physical activity

The research team identified four interventions that targeted individual food consumption. One intervention, which aimed to increase vegetable consumption through changing hedonic factors (such as taste, liking or familiarity), reported inconclusive findings in improving diet-related outcomes. Lunchbox interventions, which included guidelines and education to improve food quality in school lunchboxes, also reported mixed results in relation to both weight and dietary outcomes.

The evidence relating to interventions targeting pre-conception and pregnancy was largely inconclusive. However, several behaviour change interventions were likely to impact positively on relevant behaviours of prospective and new parents. For example, multi-component interventions that aim to improve behaviour change at an individual level via home visits, group sessions diet and parental responsiveness to infant cues showed promise, with many interventions reporting positive effects on obesity-related behaviours, including fruit and vegetable consumption, breastfeeding duration of infants, and sedentary behaviour. Several of these studies were conducted in the Australian setting.

Multi-component behaviour change programs that are suitable to be delivered (in a tailored way) in various settings, such as early childcare, schools, primary care or workplaces, would likely have a favourable effect on reducing sedentary behaviour and improving physical activity. However, the current evidence is inconclusive regarding the effect of these programs on weight and diet-related outcomes. The evidence indicates that behaviour change programs are likely to worsen existing inequities related to obesity.

Interventions designed to improve physical education in schools, including capacity building for teachers, showed promise for increasing levels of physical activity during school time. However, the effectiveness of physical activity education interventions targeting rural communities was inconclusive. Similarly, evidence

regarding the effectiveness of active school travel, which includes 'walking school buses' (where groups of children walk to school together along a set route under adult supervision) and cycling to school, was inconclusive on all outcomes.

Physical activity environments

Three interventions targeted physical activity environments. All of these interventions have shown potential in improving the population's physical activity and reducing sedentary behaviour, and they are likely to be cost-effective. However, there have been mixed results on their effectiveness on weight-related outcomes.

Individual psychology

Four interventions were classified as targeting individual psychology. One intervention had a public policy, regulation and legislation focus and three focused on personal skill development. Although school garden programs and interventions to improve cooking skills have shown promise regarding improvements to some diet-related outcomes, the evidence from this review indicated these interventions had no impact on weight-related outcomes. Interventions that offer direct financial incentives for people to lose weight or improve diet- or physical activity behaviours have been shown as likely to be cost-effective in some contexts (such as through private health insurance schemes), while improving physical activity.

Cultural and societal values

Two interventions were classified under the cultural and societal values cluster. Community-based obesity prevention interventions have demonstrated highly promising results in improving population weight outcomes. The evidence indicates that effective community-based interventions are multi-component, multi-setting, include healthy eating and physical activity components, are led by the local community, and include extensive capacity building and training of community staff. These interventions are likely to be cost-effective and have a positive equity impact.

There is mixed evidence of the effectiveness of mass media campaigns aimed at altering health-related behaviours at the population level. However, some campaigns (such as the *Live Lighter* initiative) have been shown to be cost-effective.

People-centred health system

Interventions related to health systems focused on support for breastfeeding as well as pre– and antenatal care through both *personal skill development* and *sector development*. These interventions demonstrated positive effectiveness on multiple measures. More broadly, the WHO ECHO report emphasised the importance of interventions targeting pregnancy and the first two years of life. Many of the interventions identified in the Evidence Check were likely to have a positive impact on relevant behaviours of prospective and new parents.

Equity impact

In general, the greater the degree of individual agency required for intervention effectiveness, the more likely it is that the intervention will preferentially benefit individuals with a higher socioeconomic position compared with those with more limited social and economic resources. Accordingly, interventions focused on education and behaviour change are likely to have a negative overall impact on equity. In contrast, interventions that change the environment and involve broadscale community action are likely to have a positive impact on equity.

Question 2

What population-level interventions, programs or policy approaches that may not yet be fully rolled out or evaluated have demonstrated early effectiveness, or are promising, in improving healthy eating and increasing physical activity?

The research team identified 16 additional interventions as having demonstrated effectiveness or delivered promising results in improving healthy eating and/or increasing physical activity. **Table 7** provides details of these additional promising interventions, including a summary of evidence of their effectiveness and/or cost-effectiveness.

Food system interventions

Eight of the 16 additional interventions target food systems (*food markets* and *food processing* clusters). These include:

- Nutrition warning labels on front-of-pack, indicating products high in saturated fat, sugar, salt and/or energy content
- Broad-based regulations to reduce exposure of children and adolescents to marketing of unhealthy products/brands, including on public transport infrastructure and through sports sponsorship
- Government departments and agencies adopting procurement and catering policies specifying criteria related to health
- Policies restricting temporary price reductions (price promotions) on unhealthy products
- Increasing the price of alcoholic beverages, potentially through a uniform volumetric tax
- Incorporating the price of greenhouse gas emissions into the price of foods, through taxes or other mechanisms
- Government-led reformulation targets in relation to manufactured foods, including platforms for interaction with industry and long-term support for implementation
- Mandatory package size caps for sugar-sweetened beverages.

Several of these interventions (e.g. nutrition warning labels, marketing restrictions) have been implemented recently in a range of countries. There are also many examples of healthy food provision initiatives that have been implemented successfully in Australia, predominantly in schools but also in other government settings, such as hospitals and other government facilities. Increases in the price of alcohol were shown to be likely to deliver the greatest health benefits of all potential policy interventions for obesity prevention in Australia — primarily due to the high energy content of many alcoholic drinks and the relatively high levels of alcohol consumption in Australia.

Physical activity-related interventions

Seven of the 16 additional interventions target the built environment, physical activity environments or individual physical activity behaviour. These include:

- Increases in the fuel excise
- Changing the built environment (e.g. through planning policies, infrastructure development) to improve walkability, cycling and public transport use, and decreasing private motor vehicle use
- Congestion pricing schemes
- Temporary closure (e.g. every Sunday) of streets to motorised vehicles
- Group-based walking interventions
- School-based and interlinked community sport initiatives
- Interventions that promote physical activity among children and adolescents with developmental challenges and disabilities.

While it is often difficult to isolate the impact of changes to the built environment on physical activity levels and obesity, there is growing evidence of the importance of these types of interventions for improving physical activity at the population level. Other promising interventions for encouraging physical activity involve community level action and support for increased sport participation.

Health surveillance and research

Several countries have implemented systematic surveillance of body mass index (BMI) in schools, potentially with feedback provided to parents and opt-out consent. While there is no evidence that this has a direct impact on population-level weight outcomes, the intervention provides the necessary data to examine trends over time, inform policy, practice and service delivery, and also to evaluate interventions.

Table 7: **Additional interventions showing promising results from an obesity prevention perspective**

ID	Cluster	Theme	Intervention	Evidence of effectiveness	Related recommendation (Table 8)
Prom1	Food markets	Public policy, regulation and legislation	Nutrition warning labels on front-of-pack, indicating products high in saturated fat, sugar, salt and/or energy content	Experimental evidence suggests the use of warning labels improves dietary choice [98, 99]. Early evaluation of perceptions and use of warning labels in Chile indicates that most people are supportive of front-of-package warning labels on products and considered them useful to inform purchases [100].	A4
Prom2	Food markets	Public policy, regulation and legislation	Broad-based regulations to reduce exposure of children and adolescents to marketing of unhealthy foods/brands, including restrictions related to: • Outdoor advertising, e.g. on public transport infrastructure • Sports sponsorship • Digital and social media • Community events	Systematic reviews of the evidence on food marketing to children, including on non-broadcast media, consistently show that it influences children's food preferences, demand and consumption, and is likely to contribute to poor diets, negative health outcomes, weight gain and obesity in children [101-103]. Several countries have taken steps to reduce food marketing across platforms, e.g. Chile (comprehensive action); Mexico (restrictions on television advertising); London, England (ban on unhealthy food advertising on the public transport network).	A11 & A12
Prom3	Food markets	Leadership and governance	Government departments and agencies adopting procurement and catering policies specifying criteria related to health and nutrition	In Australia, there are several examples of healthy food provision initiatives, predominantly implemented in schools but also other government settings, such as hospitals and other facilities [104]. International evidence suggests this type of intervention is "nearly always effective at increasing availability (and purchasing) of healthier food and decreasing that of less healthy food", with some evidence that it also reduces BMI and blood pressure [105, 106].	A1
Prom4	Food markets	Public policy, regulation and legislation	Policies restricting temporary price reductions (price promotions) on unhealthy products, potentially including: • Legislation to restrict price promotions on unhealthy food and beverages • Legislation to restrict the advertising of price promotions on unhealthy food and beverages (in media, circulars, in-store) • Legislation to restrict placement of price-promoted unhealthy food and beverages in prominent locations in retail outlets (e.g. at end of aisle displays and at checkouts)	In Australia, price promotions are applied far more often on less healthy foods and beverages, and with bigger discounts [107-109]. In an evaluation of the potential cost-effectiveness of mandatory restrictions of price promotions on sugar-sweetened beverages (SSBs) in Australia, the intervention was found to be highly cost-effective, although its impact would depend on how industry and consumers responded [28]. Interventions to restrict price promotions have been proposed in Britain and Scotland.	A8

ID	Cluster	Theme	Intervention	Evidence of effectiveness	Related recommendation (Table 8)
			• Legislated floor price (minimum pricing) per unit of food/beverage • Voluntary industry action to reduce the prevalence of unhealthy food and beverages price promotions		
Prom5	Food markets	Public policy, regulation and legislation	Increasing the price of alcoholic beverages, potentially through a uniform volumetric tax and/or a minimum unit floor price	A 2018 economic evaluation in Australia [28] modelled the effectiveness of introducing two interventions that increased the price of alcoholic beverages. Intervention 1 was a uniform volumetric tax applied to all alcoholic beverages; intervention 2 was a minimum unit floor price equal to $1.30 per standard drink. The study found both interventions to be dominant (cost-saving and improving health) from an obesity-prevention perspective in the Australian context. Furthermore, these interventions offered the most health benefits of 15 potential policy interventions for obesity prevention in Australia.	A6
Prom6	Food markets	Public policy, regulation and legislation	Incorporating the price of greenhouse gas emissions into the price of foods, through taxes or other mechanisms	A study by Springmann, Sacks, Ananthapavan and Scarborough [110] modelled the impact on dietary and weight-related risk factors of a carbon tax applied to foods. The authors found this intervention was likely to improve population health in the Australian context, and could have economic and environmental benefits.	A7
Prom7	Food processing	Sector development	Government-led reformulation targets in relation to manufactured foods, including platforms for interaction with industry and long-term support for implementation	Internationally, government-led initiatives on sodium reduction, including strong setting of targets, have shown promising results over many years [111]. Reviews to inform the design of the Healthy Food Partnership in Australia have indicated the importance and likely benefits of having strong government leadership, clear targets in place, and funding for implementation and independent monitoring of progress using a responsive regulation approach [112].	A20
Prom8	Food processing	Public policy, regulation and legislation	Mandatory package size caps for sugar-sweetened beverages	A study by Crino, Herrera, Ananthapavan, Wu, Nealet al. [113] found introducing a package size cap (e.g. 350ml) on single-serve sugar sweetened beverages (SSBs) was dominant (cost-saving and health promoting) from an obesity prevention perspective in the Australian context. A study by Wang and Vine [114], which evaluated the potential impact of New York City's 2012 proposal to cap portion sizes of SSBs in food service establishments (subsequently overturned), found this would likely reduce excess energy consumption from these beverages.	A19
Prom9	Physical activity environment	Public policy, regulation and legislation	Congestion pricing schemes	Congestion pricing schemes for motorised vehicles have been implemented in various cities worldwide (e.g. Singapore, London) and have the potential to see modal shifts to active transport within the population. A review by Brown, Moodie and Carter [115] found the evidence base to support increased physical activity through modal shift was inconclusive, although a small effect on	A21

ID	Cluster	Theme	Intervention	Evidence of effectiveness	Related recommendation (Table 8)
				physical activity was observed on the introduction of the Stockholm congestion charge [116].	
Prom10	Physical activity environment	Public policy, regulation and legislation	Temporary closure (e.g. every Sunday) of streets to motorised vehicles	A recent systematic review highlighted how the temporary closure of streets to motorised vehicles (also known as Play Streets or Open Streets) such as those in Bogota, Colombia, have been shown to increase overall physical activity [117].	A21
Prom11	Physical activity environment	Community action	Changing the built environment (e.g. through planning policies, infrastructure development) to improve walkability, cycling and public transport use, and decrease private motor vehicle use	Walking and cycling can be used both for recreational and transportation purposes [118]. Urban planning and designs that promote walkable neighbourhoods through connected street networks, mixed-use zoning and higher-density developments have been shown to increase walking for transport [119, 120]. One recent study by Zapata-Diomedi, Boulangé, Giles-Corti, Phelan, Washingtonet al. [121] found improving the walkability of neighbourhoods was likely to be effective at reducing physical inactivity.	A21
Prom12	Individual activity	Community action	Group-based walking interventions	Community-based walking programs (e.g. Heart Foundation Walking and Queensland's 10,000 steps) are low-cost and accessible approaches to increase physical activity. A 2013 systematic review and meta-analysis [122] found interventions that promote walking in groups to be effective at increasing physical activity. An evaluation of the reach, retention and participant characteristics of the Heart Foundation Walking program in Australia by Ball, Abbott, Wilson, Chisholm and Sahlqvist [123] found the program typically engaged the most at-risk participants (e.g. those aged 60 years or older, or on low incomes), and was in operation in every region of Australia. Participant retention was high (>75%) after one year and 70% of participants met the physical activity guidelines and highlighted social components as a key motivator.	A26
Prom13	Individual activity	Community action	School-based and interlinked community sport initiatives	School-based sports development programs with interlinks into national sporting associations and community sports organisations, such as the $200 million Australian Government's *Sporting Schools* initiative, have the potential to increase children's sports and physical activity participation. The effectiveness of the Sporting Schools programs on health outcomes is unknown; however, by the end of 2015, 4000 schools and 32 national sporting organisations had registered for this program [124].	A23
Prom14	Individual activity	Personal skill development	Interventions that promote physical activity among children and adolescents with developmental challenges and disabilities	A recent systematic review and meta-analysis of interventions to increase physical activity among children and adolescents with intellectual disabilities found insufficient evidence of intervention effective in increasing physical activity in the five included studies [125]. However, a recent Australian study involving children with autism spectrum disorder who participated in an 11-week Australian Football League (AFL) Auskick program found non-significant	A23, A26

ID	Cluster	Theme	Intervention	Evidence of effectiveness	Related recommendation (Table 8)
				positive changes in children's objective measured fundamental movement skills [126].	
Prom15	Socio-political influences	Health surveillance and research	Systematic surveillance of BMI in schools	Measured population surveillance programs of excess weight that are high participatory and routine have the ability to determine the prevalence of the condition, examine trends over time, inform policy, practice and service delivery, and also to evaluate interventions [127]. Many jurisdictions, e.g. nationally across England, Sweden, The Netherlands, and Singapore, have implemented routine measurement of height and weight in schools to examine children's BMI and provide parent/guardian feedback letters [128]. Currently, the evidence of effectiveness of BMI feedback on students' weight status is limited. However, there is evidence to suggest parents/guardians find receiving the feedback helpful, that it reduces under-recognition of overweight/obesity, improves enrolment at local weight maintenance clinics for obese children and, importantly, there is no evidence of an effect on child weight-related teasing and self-esteem [129, 130].	A31
Prom16	Cultural and societal values	Public policy, regulation and legislation	Increase in fuel excise	Brown, Ananthapavan 44, [131] evaluated the effect on BMI and physical activity of a 10c per litre increase in fuel tax. The strength of the evidence and likely public acceptability were both rated as low, but feasibility and sustainability were assessed as high. Although the effects were very small, the intervention was likely to be cost-effective.	A21

Identified evidence-based interventions

The Evidence Check identified 35 evidence-based actions to prevent obesity and related behaviours in Australia — see **Table 8**. Twenty of the actions relate to *food systems*, five relate directly to *physical activity*, seven relate to *society and culture*, and three relate to *health systems* (in the primary care setting). All the recommendations from the WHO ECHO report (**Appendix 1**) are reflected in some form as part of the actions in **Table 8**, except for one WHO ECHO report recommendation about reducing cross-border marketing of unhealthy foods and beverages, as it is not directly relevant to the Australian context.

Table 7: Evidence-based obesity prevention interventions for the Australian context, including 'promising' interventions (*)

	Cluster	Interventions	Theme(s)	Sector / setting	Evidence basis
	Food systems				
A1	Food markets	Establish a whole-of-government policy on healthy food procurement, catering and provision across all government departments and settings under government control. This includes public-sector workplaces and government-owned, funded or managed services *	Leadership and governance	Government-controlled settings	ECHO4.9 Prom3
A2	Food markets	Adopt consistent national regulations on menu energy (kJ) labelling in restaurants and takeaway outlets	Public policy, regulation and legislation	Food standards and labelling	ECHO1.1 Int4
A3	Food markets	Mandate implementation of the Health Star Rating nutrition labelling system	Public policy, regulation and legislation	Food standards and labelling	ECHO1.1, ECHO1.6, ECHO1.7 Int1
A4	Food markets	Adopt nutrition warning labels on front-of-pack, indicating products high in saturated fat, added sugar, sodium and/or energy content *	Public policy, regulation and legislation	Food standards and labelling	ECHO1.1, ECHO1.4, ECHO1.7 Prom1
A5	Food markets	Increase the price of sugar-sweetened beverages (SSBs) and other unhealthy foods (e.g. unhealthy snacks, unhealthy takeaway food)	Public policy, regulation and legislation	Treasury and finance	ECHO1.2 Int5, Int6
A6	Food markets	Increase the price of alcoholic beverages, potentially through a uniform volumetric tax *	Public policy, regulation and legislation	Treasury and finance	Prom5
A7	Food markets	Explore options for incorporating the cost of greenhouse gas emissions into the price of foods *	Public policy, regulation and legislation	Treasury and finance	Prom6
A8	Food markets	Restrict temporary price reductions (price promotions) on unhealthy food products *	Public policy, regulation and legislation	Treasury and finance	Prom4
A9	Food markets	Subsidise healthy foods (e.g. fruit and vegetables), potentially including transport subsidies to remote communities	Public policy, regulation and legislation	Treasury and finance	ECHO1.9 Int7

	Cluster	Interventions	Theme(s)	Sector / setting	Evidence basis
A10	Food markets	Reduce the exposure of children to promotion of unhealthy food and beverages on broadcast media (TV and radio)	Public policy, regulation and legislation	Media / communications	ECHO1.3 Int8
A11	Food markets	Eliminate marketing of unhealthy foods/brands in publicly owned or managed settings e.g. public transport infrastructure *	Public policy, regulation and legislation	Media / communications	ECHO1.3 Prom2
A12	Food markets	Remove unhealthy food and beverage sponsorship and related advertising associated with sport and major community events *	Public policy, regulation and legislation	Media / communications	ECHO1.3, ECHO1.8 Prom2
A13	Food markets	Enforce regulatory measures such as the International Code of Marketing of Breastmilk Substitutes and subsequent World Health Assembly resolutions	Public policy, regulation and legislation	Media / communications	ECHO4.1
A14	Food markets	Implement a national co-ordinated approach for healthy food provision in schools, health facilities, sport and recreation facilities, and other settings controlled or managed by Australian governments	Public policy, regulation and legislation Community action	Schools, community	ECHO1.8, ECHO5.3 Int9, Int13
A15	Food markets	Develop clear requirements for early childhood settings regarding the healthiness of foods provided and promoted, and provide resources to support implementation	Sector development	Early childcare settings	ECHO4.7, ECHO5.1
A16	Food markets	Support multi-component interventions to improve nutrition information and increase accessibility and prominence of healthier options in supermarkets, particularly including shelf labelling (using nutrition summary score) as one component	Community action	Supermarkets	Int10
A17	Food markets	Support multi-component interventions to encourage healthier choices in food-service settings (e.g. restaurants, cafes and takeaway food outlets), potentially including: • Labelling of healthier choices and other point-of-purchase interpretive nutrition information • Increasing prominence and appeal of healthier options • Removal of unhealthy products and related marketing • Pricing strategies that favour healthy products and disincentivise less healthy options • Changing default content of children's meals to include healthier options and remove less healthy options	Community action	Food service settings	ECHO1.1, ECHO1.4, ECHO4.9, ECHO5.2 Int13
A18	Food markets	Support implementation of nutrition interventions in remote stores, including food pricing strategies, combined with community health promotion	Community action	Remote communities	ECHO1.9, ECHO3.4 Int11
A19	Food processing	Adopt mandatory limits on nutrients of concern (e.g. trans fat, sodium, saturated fat, added sugars) in foods in targeted food categories *	Public policy, regulation and legislation	Food standards and labelling	Int14 Prom8
A20	Food processing	Establish clear national targets for reductions in sodium, saturated fat and added sugar in key food categories (including packaged foods and out-of-home meals) *	Sector development	Food manufacturing	Prom7
	Physical activity				

	Cluster	Interventions	Theme(s)	Sector / setting	Evidence basis
A21	Physical activity environment	Enact policy changes to support and enable changes to the built environment (e.g. through planning policies, infrastructure development) to improve walkability, cycling and public transport use, and decrease private motor vehicle use (e.g. increasing fuel price excise, congestion pricing) *	Public policy, regulation and legislation	Transport, planning	Prom9, Prom 10, Prom11, Prom16
A22	Physical activity environment	Undertake park and playground renovations and improvements, and increase availability of school playgrounds after regular school hours	Public policy, regulation and legislation	Community	ECHO2.2 Int19
A23	Physical activity environment	Support implementation of multi-component school-based interventions to reduce sedentary behaviour and increase physical activity in children, including implementation of standing desks, physical activity programs and other curriculum-based interventions *	Public policy, regulation and legislation	Schools and early childcare settings	ECHO4.11 Int20 Prom13, Prom14
A24	Physical activity environment, individual food consumption and physical activity	Support implementation of multi-component workplace interventions comprising organisational and individual-level strategies to encourage physical activity, reduce sedentary behaviour and enhance health and wellbeing	Public policy, regulation and legislation, sector development	Workplaces	Int21
A25	Individual activity	Support implementation of physical education interventions in schools and early childcare settings, potentially including: increased allotted time for physical education; teacher education and capacity building; and increased focus on developing physical literacy of students	Personal skill development, sector development	Schools and early childcare settings	ECHO2.1, ECHO4.12, ECHO5.7 Int23
	Society and culture				
A26	Cultural and societal values	Engage and support local communities to develop and lead their own healthy eating and physical activity initiatives that are multi-component and multi-setting in nature, including a focus on capacity building and training of community staff *	Community action	Community	ECHO4.8. ECHO4.13, ECHO5.5 Int26 Prom12, Prom14
A27	Cultural and societal values	Develop and fund ongoing mass media campaigns aimed at altering diet-related and physical activity behaviours at the population level, while minimising weight-related stigma. Campaigns should be implemented across a wide range of platforms and channels and designed to support related policy initiatives	Social marketing	Health	ECHO1.3 Int25
A28	Cultural and societal values	Support increased understanding, use and uptake of the Australian Dietary Guidelines among the general public	Social marketing	Health	ECHO1.4, ECHO4.6
A29	Cultural and societal values	Support improved nutrition education in schools and early childhood settings, including through integrating practical nutrition and cooking skills into the national curriculum and supporting teachers to be able to provide high-quality nutrition information to students	Personal skill development, sector development	Schools and early childcare settings	ECHO4.10, ECHO5.4, ECHO5.5, ECHO5.6 Int18, Int28

	Cluster	Interventions	Theme(s)	Sector / setting	Evidence basis
A30	Cultural and societal values	Identify regulatory measures to further support mothers to breastfeed, potentially including changes to maternity leave, facilities and time for breastfeeding in the workplace	Public policy, regulation and legislation	Workplaces	ECHO4.4
A31	Socio-political influences	Establish a consistent national approach to regular measuring of children's height and weight at key stages of primary and secondary schooling *	Health surveillance and research	Schools	ECHO6.1 Prom15
A32	Individual psychology	Explore opportunities to provide direct financial and other incentives for weight loss, healthy eating and/or physical activity-related behaviours, potentially through private health insurance schemes	Personal skill development	Health	Int30
	Health systems				
A33	People-centred health system	Ensure all primary and tertiary care settings adopt best-practice breastfeeding policies and practices	Sector development	Primary care	ECHO4.2 Int31
A34	Individual activity	Provide resources for physical activity promotion, lifestyle and behaviour change programs, and advice on reducing screen time in primary care settings, tailored to different socioeconomic groups	Personal skill development	Primary care	ECHO2.1 Int18
A35	Individual food consumption	Provide pre-conception and antenatal nutrition guidance and support for healthy pregnancy in primary care settings	Personal skill development	Primary care	ECHO3.1, ECHO3.2, ECHO3.3, ECHO3.4, ECHO4.3 Int17

Discussion

Summary of evidence

- There is a great deal of high-quality evidence regarding the effectiveness of a range of interventions likely to contribute to obesity prevention. Almost all interventions included in the Evidence Check demonstrate at least some degree of effectiveness in measures related to obesity prevention.
- A range of different policy instruments (such as regulations, support for community action, and behaviour change and education-based initiatives) have shown evidence of effectiveness and cost-effectiveness.
- In community settings (such as schools, supermarkets, restaurants and workplaces) effective interventions are typically multi-component in nature, involving changes to the environment, behaviour change components and capacity building.
- Due to the complex determinants of obesity, each intervention alone is likely only to have a relatively small effect. This reinforces the need to adopt a comprehensive approach to obesity prevention, incorporating a wide range of interventions.

Equity considerations

- The likely influence of interventions on health equity needs to be considered in the context of a multi-pronged approach to obesity. If an intervention is deemed effective for the general population but is likely to increase inequities, appropriate complementary interventions may need to be prioritised to prevent the widening of inequities in weight and health.
- A range of different interventions will be required to address inequities in obesity. Targeted interventions (e.g. targeting low-income groups) are important to reduce the gap in obesity prevalence between the best and worst off in society. However, those targeted interventions may not address the health of those further along the socioeconomic gradient. Universal interventions that act across the entire population (and therefore also across the entire socioeconomic gradient) should also be considered. Universal interventions have the potential to improve health for a large portion of the population and reduce the socioeconomic gradient in health. However, this type of intervention may also widen inequities. Accordingly, balancing equity goals (health gains proportionate to the level of socioeconomic disadvantage) with health maximisation (maximising total health gains in a population), for a given level of financial input, can be challenging.
- From a health equity perspective, it is the package of interventions that ultimately should be assessed for equity impacts. Effective but inequitable single interventions can be complemented with both targeted interventions and more equitable population-level interventions.

Gaps in the evidence

- While there is good evidence relating to the likely effectiveness of many interventions for diet and/or physical activity-related outcomes, the evidence in relation to weight-related outcomes is limited. This is due to the complex determinants of obesity, limitations in study designs and lack of real-world evaluation opportunities.
- There is limited evidence of the effectiveness of those interventions that target the systemic drivers of obesity (e.g. economic drivers and social and commercial determinants of health). These interventions are likely to be more potent and sustainable than some of the more downstream interventions.

- This Evidence Check found limited evidence related specifically to Aboriginal and Torres Strait Islander communities. Evidence of appropriate interventions for these communities could be considered in a separate review and/or in consultation with Aboriginal and Torres Strait Islander peoples.
- There is global consensus that a comprehensive obesity prevention strategy requires a range of supporting policy infrastructure (e.g. monitoring and surveillance, research and intelligence, capacity building, platforms for interaction). However, due to the nature of policy infrastructure, there is limited evidence of the effectiveness of these interventions on diet, physical activity or weight-related outcomes.

Strengths and limitations of the Evidence Check

Strengths

- Systematic in nature.
- Only assessed high-quality evidence (systematic reviews and meta-analyses).
- Assessed a broad range of outcomes, relevant to a range of settings and target groups.

Limitations

- The Evidence Check's extremely tight time frame (five weeks) and very limited budget meant the review could not be performed comprehensively. The research team searched only two academic databases and, for practical reasons, the review was constrained to systematic reviews published in the past four years (2016–2019). There was, by necessity, very limited consultation with experts in the field to inform the review of promising interventions.
- The Evidence Check was not designed to cover a review of current practice in obesity prevention.
- It was not designed to explicitly focus on the social and commercial determinants of health as this is subject to a separate review.
- The Evidence Check did not focus on the strong links and synergies between efforts to address obesity and those designed to tackle environmental sustainability. This is despite compelling evidence of the need to tackle these urgent issues at the same time.[132]

Conclusion

- There is high-quality evidence indicating a range of interventions likely to contribute to obesity prevention.
- There is strong international and national consensus on the types of policy approaches needed.
- There is evidence of effective interventions across multiple settings, targeting both diet and physical activity. A national co-ordinated approach to implementation is required across different sectors and levels of government.
- It will be important to include comprehensive monitoring and evaluation of the implementation of initiatives, both to track progress and to generate further evidence of effectiveness.

References

1. World Health Organization. Obesity and overweight. Geneva, Switzerland: World Health Organization; 2018. [Access Date: 12 July]. Available from: https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
2. Centers for Disease Control and Prevention. Defining Childhood Obesity: BMI for Children and Teens. 2018. [Access Date: 12 July]. Available from: http://cdc.gov/obesity/childhood/defining.html
3. Australian Institute of Health and Welfare. A picture of overweight and obesity in Australia 2017. Canberra: Australian Institute of Health and Welfare; 2017 Cat. no.PHE216.
4. Forouzanfar MH, Afshin A, Alexander LT, Anderson HR, Bhutta ZA, et al. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: A systematic analysis for the Global Burden of Disease Study 2015. The Lancet. 2016;388(10053):1659-724.
5. Australian Institute of Health and Welfare. Australian Burden of Disease Study 2015: Interactive data on risk factor burden. Canberra, Australia: Australian Institute of Health and Welfare; 2019. [Access Date: 22 July]. Available from: https://www.aihw.gov.au/reports/burden-of-disease/interactive-data-risk-factor-burden/contents/overview
6. The Obesity Collective. Weighing in: Australia's growing obesity epidemic. Sydney: The Obesity Collective; 2019. Available from: https://static1.squarespace.com/static/57e9ebb16a4963ef7adfafdb/t/5c9a8961f4e1fc9deceb1ae4/1553631602322/Obesity+Collective_Australias+Growing+Obesity+Epidemic+report+27+03+19.pdf
7. Backholer K, Mannan HR, Magliano DJ, Walls HL, Stevenson C, et al. Projected socioeconomic disparities in the prevalence of obesity among Australian adults. Australian and New Zealand Journal of Public Health. 2012;36(6):557-63.
8. Australian Institute of Health and Welfare. Australian Burden of Disease Study: Impact and causes of illness and death in Aboriginal and Torres Strait Islander people 2011. Canberra, Australia: Australian Institute of Health and Welfare; 2016 Series no. 6. Cat. no. BOD 7. Available from: https://www.aihw.gov.au/getmedia/e31976fc-adcc-4612-bd08-e54fd2f3303c/19667-bod7-atsi-2011.pdf.aspx?inline=true
9. Swinburn BA, Sacks G, Hall KD, McPherson K, Finegood DT, et al. The global obesity pandemic: shaped by global drivers and local environments. The Lancet. 2011;378(9793):804-14.
10. World Health Organization. Diet, nutrition and the prevention of chronic diseases. Geneva, Switzerland: World Health Organization; 2003. Available from: https://apps.who.int/iris/bitstream/handle/10665/42665/WHO_TRS_916.pdf;jsessionid=69BB1373D18CB8EA5C4379BC7D711B4C?sequence=1
11. Australian Bureau of Statistics. 4364.0.55.001 - National Health Survey: First Results, 2017-18: Fruit and vegetable consumption. Canberra, Australia: Australian Bureau of Statistics; 2018. [Access Date: 22 July]. Available from: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/4364.0.55.001~2017-18~Main%20Features~Fruit%20and%20vegetable%20consumption~105
12. Australian Bureau of Statistics. 4364.0.55.012 - Australian Health Survey: Consumption of Food Groups from the Australian Dietary Guidelines, 2011-12. Canberra, Australia: Australian Bureau of Statistics; 2016. [Access Date: 22 July]. Available from: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4364.0.55.012main+features12011-12
13. Australian Bureau of Statistics. 4364.0.55.001 - National Health Survey: First Results, 2017-18: Physical activity. Canberra, Australia: Australian Bureau of Statistics; 2019. [Access Date: 22 July]. Available from: https://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/4364.0.55.001~2017-18~Main%20Features~Physical%20activity~115
14. Johns DJ, Hartmann-Boyce J, Jebb SA, Aveyard P, Group BWMR. Diet or exercise interventions vs combined behavioral weight management programs: A systematic review and meta-analysis of direct comparisons. Journal of the Academy of Nutrition and Dietetics. 2014;114(10):1557-68.
15. Westerterp KR, Speakman JR. Physical activity energy expenditure has not declined since the 1980s and matches energy expenditures of wild mammals. International Journal of Obesity. 2008;32(8):1256.
16. Swinburn BA, Jolley D, Kremer PJ, Salbe AD, Ravussin E. Estimating the effects of energy imbalance on changes in body weight in children. The American Journal of Clinical Nutrition. 2006;83(4):859-63.

17. Dwyer-Lindgren L, Freedman G, Engell RE, Fleming TD, Lim SS, et al. Prevalence of physical activity and obesity in US counties, 2001–2011: A road map for action. Population Health Metrics. 2013;11(1):7.
18. Shaw KA, Gennat HC, O'Rourke P, Del Mar C. Exercise for overweight or obesity. Cochrane Database of Systematic Reviews. 2006(4)
19. Jakicic JM, Powell KE, Campbell WW, Dipietro L, Pate RR, et al. Physical activity and the prevention of weight gain in adults: A systematic review. Medicine and Science in Sports and Exercise. 2019;51(6):1262-69.
20. Reiner M, Niermann C, Jekauc D, Woll A. Long-term health benefits of physical activity–a systematic review of longitudinal studies. BMC Public Health. 2013;13(1):813.
21. Department of Health. Physical activity. Canberra, Australia: The Department of Health; 2019. [Access Date: 22 July]. Available from: https://www1.health.gov.au/internet/main/publishing.nsf/content/phy-activity
22. Sacks G, Swinburn B, Lawrence M. Obesity Policy Action framework and analysis grids for a comprehensive policy approach to reducing obesity. Obesity Reviews. 2009;10(1):76-86.
23. Peeters A, Backholer K. Reducing socioeconomic inequalities in obesity: The role of population prevention. The Lancet Diabetes & Endocrinology. 2015;3(11):838-40.
24. Backholer K, Beauchamp A, Ball K, Turrell G, Martin J, et al. A framework for evaluating the impact of obesity prevention strategies on socioeconomic inequalities in weight. American Journal of Public Health. 2014;104(10):e43-e50.
25. World Health Organization. Report of the Commission on Ending Childhood Obesity. Geneva: 2016. Available from: https://apps.who.int/iris/bitstream/handle/10665/204176/9789241510066_eng.pdf;jsessionid=A6CAB1443F6CB2E1E588F12061297278?sequence=1
26. Tricco AC, Langlois EV, Straus SE, editors. Rapid reviews to strengthen health policy and systems: a practical guide. Geneva: World Health Organization; 2017.
27. Khangura S, Konnyu K, Cushman R, Grimshaw J, Moher D. Evidence summaries: The evolution of a rapid review approach. Systematic Reviews. 2012;1(1):10.
28. Ananthapavan J, Sacks G, Brown V, Moodie M, Nguyen P, et al. Assessing cost-effectiveness of obesity prevention policies in Australia. Melbourne: Deakin University; 2018.
29. von Philipsborn P, Stratil JM, Burns J, Busert LK, Pfadenhauer LM, et al. Environmental interventions to reduce the consumption of sugar-sweetened beverages and their effects on health. Cochrane Database of Systematic Reviews. 2019(6)
30. Roberts S, Pilard L, Chen J, Hirst J, Rutter H, et al. Efficacy of population-wide diabetes and obesity prevention programs: An overview of systematic reviews on proximal, intermediate, and distal outcomes and a meta-analysis of impact on BMI. Obesity Reviews. 2019;20(7):947-63.
31. Allan J, Querstret D, Banas K, de Bruin M. Environmental interventions for altering eating behaviours of employees in the workplace: A systematic review. Obesity Reviews. 2017;18(2):214-26.
32. Cecchini M, Warin L. Impact of food labelling systems on food choices and eating behaviours: A systematic review and meta-analysis of randomized studies. Obesity Reviews. 2016;17(3):201-10.
33. Sacco J, Lillico HG, Chen E, Hobin E. The influence of menu labelling on food choices among children and adolescents: A systematic review of the literature. Perspectives in Public Health. 2017;137(3):173-81.
34. Shangguan S, Afshin A, Shulkin M, Ma W, Marsden D, et al. A meta-analysis of food labeling effects on consumer diet behaviors and industry practices. American Journal of Preventive Medicine. 2018;56(2):300-14.
35. Kaur A, Scarborough P, Rayner M. A systematic review, and meta-analyses, of the impact of health-related claims on dietary choices. International Journal of Behavioral Nutrition and Physical Activity. 2017;14(1):93.
36. Oostenbach LH, Slits E, Robinson E, Sacks G. Systematic review of the impact of nutrition claims related to fat, sugar and energy content on food choices and energy intake. BMC Public Health. In Press
37. Wright B, Bragge P. Interventions to promote healthy eating choices when dining out: A systematic review of reviews. British Journal of Health Psychology. 2018;23(2):278-95.
38. Sarink D, Peeters A, Freak-Poli R, Beauchamp A, Woods J, et al. The impact of menu energy labelling across socioeconomic groups: A systematic review. Appetite. 2016;99:59-75.
39. Hillier-Brown FC, Summerbell CD, Moore HJ, Routen A, Lake AA, et al. The impact of interventions to promote healthier ready-to-eat meals (to eat in, to take away or to be delivered) sold by specific food outlets open to the general public: A systematic review. Obesity Reviews. 2017;18(2):227-46.

40. Zlatevska N, Neumann N, Dubelaar C. Mandatory calorie disclosure: a comprehensive analysis of its effect on consumers and retailers. Journal of Retailing. 2018;94(1):89-101.
41. Backholer K, Sarink D, Beauchamp A, Keating C, Loh V, et al. The impact of a tax on sugar-sweetened beverages according to socio-economic position: A systematic review of the evidence. Public Health Nutrition. 2016;19(17):3070-84.
42. Teng AM, Jones AC, Mizdrak A, Signal L, Genç M, et al. Impact of sugar-sweetened beverage taxes on purchases and dietary intake: Systematic review and meta-analysis. Obesity Reviews. 2019;20(9):1187-204.
43. Gwynn J, Sim K, Searle T, Senior A, Lee A, et al. Effect of nutrition interventions on diet-related and health outcomes of Aboriginal and Torres Strait Islander Australians: A systematic review. BMJ Open. 2019;9(4):e025291.
44. Brown V, Ananthapavan J, Veerman L, Sacks G, Lal A, et al. The potential cost-effectiveness and equity impacts of restricting television advertising of unhealthy food and beverages to Australian children. Nutrients. 2018;10(5):622.
45. Cauchi D, Glonti K, Petticrew M, Knai C. Environmental components of childhood obesity prevention interventions: An overview of systematic reviews. Obesity Reviews. 2016;17(11):1116-30.
46. Black AP, D'Onise K, McDermott R, Vally H, O'Dea K. How effective are family-based and institutional nutrition interventions in improving children's diet and health? A systematic review. BMC Public Health. 2017;17(1):818.
47. Bramante CT, Thornton RL, Bennett WL, Zhang A, Wilson RF, et al. Systematic review of natural experiments for childhood obesity prevention and control. American Journal of Preventive Medicine. 2019;56(1):147-58.
48. Colley P, Myer B, Seabrook J, Gilliland J. The impact of Canadian school food programs on children's nutrition and health: A systematic review. Canadian Journal of Dietetic Practice and Research. 2019;80(2):79-86.
49. Micha R, Karageorgou D, Bakogianni I, Trichia E, Whitsel LP, et al. Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis. PLoS One. 2018;13(3):e0194555.
50. Panter J, Tanggaard Andersen P, Aro AR, Samara A. Obesity prevention: a systematic review of setting-based interventions from Nordic countries and the Netherlands. Journal of Obesity. 2018;2018
51. Ward DS, Welker E, Choate A, Henderson KE, Lott M, et al. Strength of obesity prevention interventions in early care and education settings: A systematic review. Preventive Medicine. 2017;95:S37-S52.
52. Adam A, Jensen JD. What is the effectiveness of obesity related interventions at retail grocery stores and supermarkets?—a systematic review. BMC Public Health. 2016;16(1):1247.
53. Cameron AJ, Charlton E, Ngan WW, Sacks G. A systematic review of the effectiveness of supermarket-based interventions involving product, promotion, or place on the healthiness of consumer purchases. Current Nutrition Reports. 2016;5(3):129-38.
54. Abeykoon AH, Engler-Stringer R, Muhajarine N. Health-related outcomes of new grocery store interventions: A systematic review. Public Health Nutrition. 2017;20(12):2236-48.
55. Olstad DL, Ancilotto R, Teychenne M, Minaker L, Taber D, et al. Can targeted policies reduce obesity and improve obesity-related behaviours in socioeconomically disadvantaged populations? A systematic review. Obesity Reviews. 2017;18(7):791-807.
56. Arno A, Thomas S. The efficacy of nudge theory strategies in influencing adult dietary behaviour: A systematic review and meta-analysis. BMC Public Health. 2016;16(1):676.
57. Broers VJ, De Breucker C, Van den Broucke S, Luminet O. A systematic review and meta-analysis of the effectiveness of nudging to increase fruit and vegetable choice. The European Journal of Public Health. 2017;27(5):912-20.
58. Gordon K, Dynan L, Siegel R. Healthier choices in school cafeterias: A systematic review of cafeteria interventions. The Journal of Pediatrics. 2018;203:273-79.e2.
59. Downs SM, Bloem MZ, Zheng M, Catterall E, Thomas B, et al. The impact of policies to reduce trans fat consumption: A systematic review of the evidence. Current Developments in Nutrition. 2017;1(12):cdn-117.
60. Hyseni L, Elliot-Green A, Lloyd-Williams F, Kypridemos C, O'Flaherty M, et al. Systematic review of dietary salt reduction policies: Evidence for an effectiveness hierarchy? PloS One. 2017;12(5):e0177535.
61. Appleton KM, Hemingway A, Saulais L, Dinnella C, Monteleone E, et al. Increasing vegetable intakes: Rationale and systematic review of published interventions. European Journal of Nutrition. 2016;55(3):869-96.

62. Nathan N, Janssen L, Sutherland R, Hodder RK, Evans CE, et al. The effectiveness of lunchbox interventions on improving the foods and beverages packed and consumed by children at centre-based care or school: A systematic review and meta-analysis. International Journal of Behavioral Nutrition and Physical Activity. 2019;16(1):38.
63. Blake-Lamb TL, Locks LM, Perkins ME, Baidal JAW, Cheng ER, et al. Interventions for childhood obesity in the first 1,000 days a systematic review. American Journal of Preventive Medicine. 2016;50(6):780-89.
64. Redsell SA, Edmonds B, Swift JA, Siriwardena AN, Weng S, et al. Systematic review of randomised controlled trials of interventions that aim to reduce the risk, either directly or indirectly, of overweight and obesity in infancy and early childhood. Maternal & Child Nutrition. 2016;12(1):24-38.
65. Downing KL, Hnatiuk JA, Hinkley T, Salmon J, Hesketh KD. Interventions to reduce sedentary behaviour in 0–5-year-olds: A systematic review and meta-analysis of randomised controlled trials. British Journal of Sports Medicine. 2018;52(5):314-21.
66. Finch M, Jones J, Yoong S, Wiggers J, Wolfenden L. Effectiveness of centre-based childcare interventions in increasing child physical activity: A systematic review and meta-analysis for policymakers and practitioners. Obesity Reviews. 2016;17(5):412-28.
67. Calvert S, Dempsey RC, Povey R. Delivering in-school interventions to improve dietary behaviours amongst 11-to 16-year-olds: A systematic review. Obesity Reviews. 2019;20(4):543-53.
68. Hnatiuk J, Brown H, Downing K, Hinkley T, Salmon J, et al. Interventions to increase physical activity in children 0–5 years old: A systematic review, meta-analysis and realist synthesis. Obesity Reviews. 2019;20(1):75-87.
69. Kornet-van der Aa D, Altenburg T, van Randeraad-van der Zee C, Chinapaw M. The effectiveness and promising strategies of obesity prevention and treatment programmes among adolescents from disadvantaged backgrounds: A systematic review. Obesity Reviews. 2017;18(5):581-93.
70. Owen MB, Curry WB, Kerner C, Newson L, Fairclough SJ. The effectiveness of school-based physical activity interventions for adolescent girls: A systematic review and meta-analysis. Preventive Medicine. 2017;105:237-49.
71. Sisson SB, Krampe M, Anundson K, Castle S. Obesity prevention and obesogenic behavior interventions in child care: A systematic review. Preventive Medicine. 2016;87:57-69.
72. Hegarty LM, Mair JL, Kirby K, Murtagh E, Murphy MH. School-based interventions to reduce sedentary behaviour in children: A systematic review. AIMS Public Health. 2016;3(3):520.
73. Hynynen S, Van Stralen M, Sniehotta F, Araújo-Soares V, Hardeman W, et al. A systematic review of school-based interventions targeting physical activity and sedentary behaviour among older adolescents. International Review of Sport and Exercise Psychology. 2016;9(1):22-44.
74. Chu A, Ng SH, Tan CS, Win A, Koh D, et al. A systematic review and meta-analysis of workplace intervention strategies to reduce sedentary time in white-collar workers. Obesity Reviews. 2016;17(5):467-81.
75. Demou E, MacLean A, Cheripelli LJ, Hunt K, Gray CM. Group-based healthy lifestyle workplace interventions for shift-workers: A systematic review. Scandinavian Journal of Work, Environment and Health. 2018;44(6):568-84.
76. Lassen AD, Fagt S, Lennernäs M, Nyberg M, Haapalar I, et al. The impact of worksite interventions promoting healthier food and/or physical activity habits among employees working 'around the clock'hours: A systematic review. Food & nutrition research. 2018;62
77. Commissaris DA, Huysmans MA, Mathiassen SE, Srinivasan D, Koppes LL, et al. Interventions to reduce sedentary behavior and increase physical activity during productive work: A systematic review. Scandinavian Journal of Work, Environment & Health. 2016;42(3):181-91.
78. Shaw AM, Wootton SA, Fallowfield JL, Allsopp AJ, Parsons EL. Environmental interventions to promote healthier eating and physical activity behaviours in institutions: A systematic review. Public Health Nutrition. 2019;22(8):1518-31.
79. Pang B, Kubacki K, Rundle-Thiele S. Promoting active travel to school: A systematic review (2010–2016). BMC Public Health. 2017;17(1):638.
80. Carlin A, Murphy MH, Gallagher AM. Do interventions to increase walking work? A systematic review of interventions in children and adolescents. Sports Medicine. 2016;46(4):515-30.
81. Jones RA, Blackburn N, Woods C, Byrne M, van Nassau F, et al. Interventions promoting active transport to school in children: A systematic review and meta-analysis. Preventive Medicine. 2019
82. Larouche R, Mammen G, Rowe DA, Faulkner G. Effectiveness of active school transport interventions: A systematic review and update. BMC Public Health. 2018;18(1):206.

83. Errisuriz V, Golaszewski N, Born K, Bartholomew J. Systematic review of physical education-based physical activity interventions among elementary school children. The Journal of Primary Prevention. 2018;39(3):303-27.
84. Cai Y, Richards EA. Systematic review of physical activity outcomes of rural lifestyle interventions. Western Journal of Nursing Research. 2016;38(7):909-27.
85. Cleland V, Squibb K, Stephens L, Dalby J, Timperio A, et al. Effectiveness of interventions to promote physical activity and/or decrease sedentary behaviour among rural adults: A systematic review and meta-analysis. Obesity Reviews. 2017;18(7):727-41.
86. Hayba N, Partridge S, Nour M, Grech A, Allman Farinelli M. Effectiveness of lifestyle interventions for preventing harmful weight gain among young adults from lower socioeconomic status and ethnically diverse backgrounds: A systematic review. Obesity Reviews. 2018;19(3):333-46.
87. Bleich SN, Vercammen KA, Zatz LY, Frelier JM, Ebbeling CB, et al. Interventions to prevent global childhood overweight and obesity: A systematic review. The Lancet Diabetes & Endocrinology. 2018;6(4):332-46.
88. Ananthapavan J, Nguyen PK, Bowe SJ, Sacks G, Herrera AMM, et al. Cost-effectiveness of community-based childhood obesity prevention interventions in Australia. International Journal of Obesity. 2019;43(5):1102.
89. Savoie-Roskos MR, Wengreen H, Durward C. Increasing fruit and vegetable intake among children and youth through gardening-based interventions: A systematic review. Journal of the Academy of Nutrition and Dietetics. 2017;117(2):240-50.
90. Ohly H, Gentry S, Wigglesworth R, Bethel A, Lovell R, et al. A systematic review of the health and well-being impacts of school gardening: Synthesis of quantitative and qualitative evidence. BMC Public Health. 2016;16(1):286.
91. Hasan B, Thompson WG, Almasri J, Wang Z, Lakis S, et al. The effect of culinary interventions (cooking classes) on dietary intake and behavioral change: A systematic review and evidence map. BMC Nutrition. 2019;5(1):29.
92. McCarroll R, Eyles H, Ni Mhurchu C. Effectiveness of mobile health (mHealth) interventions for promoting healthy eating in adults: A systematic review. Preventive Medicine. 2017;105:156-68.
93. Direito A, Carraça E, Rawstorn J, Whittaker R, Maddison R. mHealth technologies to influence physical activity and sedentary behaviors: Behavior change techniques, systematic review and meta-analysis of randomized controlled trials. Annals of Behavioral Medicine. 2016;51(2):226-39.
94. Cotie L, Prince S, Elliott C, Ziss M, McDonnell L, et al. The effectiveness of eHealth interventions on physical activity and measures of obesity among working-age women: A systematic review and meta-analysis. Obesity Reviews. 2018;19(10):1340-58.
95. Klassen KM, Douglass CH, Brennan L, Truby H, Lim MS. Social media use for nutrition outcomes in young adults: A mixed-methods systematic review. International Journal of Behavioral Nutrition and Physical Activity. 2018;15(1):70.
96. Buckingham SA, Williams AJ, Morrissey K, Price L, Harrison J. Mobile health interventions to promote physical activity and reduce sedentary behaviour in the workplace: A systematic review. Digital Health. 2019;5:1-50.
97. Corepal R, Tully MA, Kee F, Miller SJ, Hunter RF. Behavioural incentive interventions for health behaviour change in young people (5–18 years old): A systematic review and meta-analysis. Preventive Medicine. 2018;110:55-66.
98. Arrúa A, Curutchet MR, Rey N, Barreto P, Golovchenko N, et al. Impact of front-of-pack nutrition information and label design on children's choice of two snack foods: Comparison of warnings and the traffic-light system. Appetite. 2017;116:139-46.
99. Khandpur N, de Morais Sato P, Mais L, Martins A, Spinillo C, et al. Are front-of-package warning labels more effective at communicating nutrition information than traffic-light labels? A randomized controlled experiment in a Brazilian sample. Nutrients. 2018;10(6):688.
100. de Morais Sato P, Mais LA, Khandpur N, Ulian MD, Martins APB, et al. Consumers' opinions on warning labels on food packages: A qualitative study in Brazil. PloS One. 2019;14(6):e0218813.
101. Sadeghirad B, Duhaney T, Motaghipisheh S, Campbell N, Johnston B. Influence of unhealthy food and beverage marketing on children's dietary intake and preference: A systematic review and meta-analysis of randomized trials. Obesity Reviews. 2016;17(10):945-59.
102. Sonntag D, Schneider S, Mdege N, Ali S, Schmidt B. Beyond food promotion: a systematic review on the influence of the food industry on obesity-related dietary behaviour among children. Nutrients. 2015;7(10):8565-76.

103. Kraak VI, Story M. Influence of food companies' brand mascots and entertainment companies' cartoon media characters on children's diet and health: A systematic review and research needs. Obesity Reviews. 2015;16(2):107-26.
104. Ananthapavan J. Food provision policy to ensure minimum nutritional standards for foods served in government institutions 2014
105. Raine K, Atkey K, Lee D, Ferdinands A, Beaulieu D, et al. Healthy food procurement and nutrition standards in public facilities: evidence synthesis and consensus policy recommendations. Health promotion and chronic disease prevention in Canada: research, policy and practice. 2018;38(1):6-17.
106. Niebylski M, Lu T, Campbell N, Arcand J, Schermel A, et al. Healthy food procurement policies and their impact. International Journal of Environmental Research and Public Health. 2014;11(3):2608-27.
107. Zorbas C, Gilham B, Boelsen-Robinson T, Blake MR, Peeters A, et al. The frequency and magnitude of price-promoted beverages available for sale in Australian supermarkets. Australian and New Zealand Journal of Public Health. 2019;43(4):346-51.
108. Riesenberg D, Backholer K, Zorbas C, Sacks G, Paix A, et al. Price promotions by food category and product healthiness in an Australian supermarket chain, 2017-2018. American Journal of Public Health. 2019;109(10)
109. Backholer K, Cameron AJ, Sacks G. Food and beverage price promotions: An untapped policy target for improving population diets and health. Current Nutrition Reports. 2019;8(3):250-55.
110. Springmann M, Sacks G, Ananthapavan J, Scarborough P. Carbon pricing of food in Australia: an analysis of the health, environmental and public finance impacts. Australian and New Zealand Journal of Public Health. 2018;42(6):523-29.
111. Webster JL, Dunford EK, Hawkes C, Neal BC. Salt reduction initiatives around the world. Journal of Hypertension. 2011;29(6):1043-50.
112. Jones A, Magnusson R, Swinburn B, Webster J, Wood A, et al. Designing a Healthy Food Partnership: Lessons from the Australian Food and Health Dialogue. BMC Public Health. 2016;16(1)
113. Crino M, Herrera A, Ananthapavan J, Wu J, Neal B, et al. Modelled cost-effectiveness of a package size cap and a kilojoule reduction intervention to reduce energy intake from sugar-sweetened beverages in Australia. Nutrients. 2017;9(9):983.
114. Wang YC, Vine SM. Caloric effect of a 16-ounce (473-mL) portion-size cap on sugar-sweetened beverages served in restaurants. The American Journal of Clinical Nutrition. 2013;98(2):430-35.
115. Brown V, Moodie M, Carter R. Congestion pricing and active transport–evidence from five opportunities for natural experiment. Journal of Transport & Health. 2015;2(4):568-79.
116. Bergman P, Grjibovski AM, Hagströmer M, Patterson E, Sjöström M. Congestion road tax and physical activity. American Journal of Preventive Medicine. 2010;38(2):171-77.
117. Umstattd Meyer M, Perry CK, Sumrall JC, Patterson MS, Walsh SM, et al. Physical activity-related policy and environmental strategies to prevent obesity in rural communities: A systematic review of the literature, 2002-2013. Preventing Chronic Disease. 2016;13:E03-E03.
118. Giles-Corti B, Vernez-Moudon A, Reis R, Turrell G, Dannenberg AL, et al. City planning and population health: A global challenge. The lancet. 2016;388(10062):2912-24.
119. Van Holle V, Deforche B, Van Cauwenberg J, Goubert L, Maes L, et al. Relationship between the physical environment and different domains of physical activity in European adults: A systematic review. BMC Public Health. 2012;12(1):807.
120. Hajna S, Ross NA, Brazeau A-S, Bélisle P, Joseph L, et al. Associations between neighbourhood walkability and daily steps in adults: A systematic review and meta-analysis. BMC Public Health. 2015;15(1):768.
121. Zapata-Diomedi B, Boulangé C, Giles-Corti B, Phelan K, Washington S, et al. Physical activity-related health and economic benefits of building walkable neighbourhoods: A modelled comparison between brownfield and greenfield developments. International Journal of Behavioral Nutrition and Physical Activity. 2019;16(1):11.
122. Kassavou A, Turner A, French DP. Do interventions to promote walking in groups increase physical activity? A meta-analysis. International Journal of Behavioral Nutrition and Physical Activity. 2013;10(1):18.
123. Ball K, Abbott G, Wilson M, Chisholm M, Sahlqvist S. How to get a nation walking: reach, retention, participant characteristics and program implications of Heart Foundation Walking, a nationwide Australian community-based walking program. International Journal of Behavioral Nutrition and Physical Activity. 2017;14(1):161.
124. Hogan A, Stylianou M. School-based sports development and the role of NSOs as 'boundary spanners': benefits, disbenefits and unintended consequences of the Sporting Schools policy initiative. Sport, Education and Society. 2018;23(4):367-80.

125. McGarty A, Downs S, Melville C, Harris L. A systematic review and meta-analysis of interventions to increase physical activity in children and adolescents with intellectual disabilities. Journal of Intellectual Disability Research. 2018;62(4):312-29.
126. May T, Rinehart N, Barnett L, Hinkley T, McGillivray J, et al. 'We're Doing AFL Auskick as Well': Experiences of an Adapted Football Program for Children With Autism. Journal of Motor Learning and Development. 2018;6(1):130-46.
127. Stubbs JM, Achat HM. Individual rights over public good? The future of anthropometric monitoring of school children in the fight against obesity. Medical Journal of Australia. 2009;190(3):140-42.
128. Falconer CL, Park MH, Croker H, Skow Á, Black J, et al. The benefits and harms of providing parents with weight feedback as part of the national child measurement programme: A prospective cohort study. BMC Public Health. 2014;14(1):549.
129. Thompson HR, Madsen KA. The report card on BMI report cards. Current Obesity Reports. 2017;6(2):163-67.
130. Sallis A, Porter L, Tan K, Howard R, Brown L, et al. Improving child weight management uptake through enhanced National Child Measurement Programme parental feedback letters: A randomised controlled trial. Preventive Medicine. 2019;121:128-35.
131. Brown V, Moodie M, Cobiac L, Herrera AM, Carter R. Obesity-related health impacts of fuel excise taxation-an evidence review and cost-effectiveness study. BMC Public Health. 2017;17(1):359.
132. Swinburn BA, Kraak VI, Allender S, Atkins VJ, Baker PI, et al. The global syndemic of obesity, undernutrition, and climate change: The Lancet Commission report. The Lancet. 2019;393(10173):791-846.

Appendices

Appendix 1: Recommendations from World Health Organization's Report of the Commission on Ending Childhood Obesity [25]

ID	Strategies / interventions	Related recommendation (Table 8)
1. Promote intake of healthy foods		
ECHO 1.1	Develop and disseminate appropriate and context-specific nutrition information for both adults and children in a simple, understandable and accessible manner to all groups in society	- A2, A3, A4, A17
ECHO 1.2	Implement an effective sugar-sweetened beverages (SSBs) tax	1. A5
ECHO 1.3	Implement the Set of Recommendations on the Marketing of Foods and Non-alcoholic Beverages to Children to reduce the exposure of children and adolescents to, and the power of, the marketing of unhealthy foods	2. A10, A11, A12, A27
ECHO 1.4	Develop nutrient profiles to identify unhealthy foods and beverages	3. A4, A17, A28
ECHO 1.5	Establish cooperation between member states to reduce the impact of cross-border marketing of unhealthy foods and beverages	n/a
ECHO 1.6	Implement a standardised global nutrient labelling system	4. A3
ECHO 1.7	Implement front-of-pack labelling, supported by public education of both adults and children in nutrition literacy	5. A3, A4
ECHO 1.8	Require settings such as schools, childcare centres, children's sports facilities and events to create healthy food environments	6. A12, A14
ECHO 1.9	Increase access to healthy foods in disadvantaged communities	7. A9, A18
2. Promote physical activity		
ECHO 2.1	Provide guidance to children and adolescents, their parents, caregivers, teachers and health professionals on healthy body size, physical activity, sleep behaviours and appropriate use of screen-based entertainment	8. A25, A34
ECHO 2.2	Ensure that adequate facilities are available on school premises and in public spaces for physical activity during recreational time for all children (including those with disabilities), with the provision of gender-friendly spaces where appropriate	9. A22
3. Pre-conception and pregnancy care		
ECHO 3.1	Diagnose and manage hyperglycaemic and gestational hypertension	• A35
ECHO 3.2	Monitor and manage appropriate gestational weight gain	• A35
ECHO 3.3	Include an additional focus on appropriate nutrition in guidance and advice for both prospective mothers and fathers before conception and during pregnancy	10. A35
ECHO 3.4	Develop clear guidance and support for the promotion of good nutrition, healthy diets and physical activity, and for avoiding the use of and exposure to tobacco, alcohol, drugs and other toxins	11. A18, A35
4. Early childhood diet and physical activity		

ID	Strategies / interventions	Related recommendation (Table 8)
ECHO 4.1	Enforce regulatory measures such as the International Code of Marketing of Breastmilk Substitutes and subsequent World Health Assembly resolutions	12. A13
ECHO 4.2	Ensure all maternity facilities practise in full the Ten Steps to Successful Breastfeeding	13. A33
ECHO 4.3	Promote the benefits of breastfeeding for both mother and child through broad-based education to parents and the community at large	14. A35
ECHO 4.4	Support mothers to breastfeed through regulatory measures, such as maternity leave, and facilities and time for breastfeeding in the workplace	15. A30
ECHO 4.5	Develop regulations on the marketing of complementary foods and beverages in line with WHO recommendations, to limit the consumption of foods and beverages high in fat, sugar and salt by infants and young children	16. A11, A12
ECHO 4.6	Provide clear guidance and support to caregivers to avoid specific categories of foods (e.g. sugar-sweetened milks and fruit juices or energy-dense, nutrient-poor foods) for the prevention of excess weight gain	17. A28
ECHO 4.7	Provide clear guidance and support to caregivers to encourage the consumption of a wide variety of healthy foods	18. A15
ECHO 4.8	Provide guidance to caregivers on appropriate nutrition, diet and portion size for children aged 2–5 years old	19. A26
ECHO 4.9	Ensure only healthy foods, beverages and snacks are served in formal childcare settings or institutions	20. A1, A17
ECHO 4.10	Ensure food education and understanding are incorporated into the curriculum in formal childcare settings or institutions	21. A29
ECHO 4.11	Ensure physical activity is incorporated into the daily routine and curriculum in formal childcare settings or institutions	**22.** A23
ECHO 4.12	Provide guidance on appropriate sleep time, sedentary or screen time and physical activity or active play for children aged 2–5 years old	23. A24
ECHO 4.13	Engage the whole community to support caregivers and childcare settings to promote healthy lifestyles for young children	• A26
5. Health, nutrition and physical activity for school-age children		
ECHO 5.1	Establish standards for meals provided in schools, or foods and beverages sold in schools, that meet healthy guidelines	24. A15
ECHO 5.2	Eliminate the provision or sale of unhealthy foods, such as SSBs and energy-dense, nutrient-poor foods, in the school environment	• A17
ECHO 5.3	Ensure access to potable water in schools and sports facilities	25. A14
ECHO 5.4	Require inclusion of nutrition and health education within the core curriculum of schools	26. A29
ECHO 5.5	Improve the nutrition literacy and skills of parents and caregivers	27. A26, A29
ECHO 5.6	Make food preparation classes available to children, their parents and caregivers	28. A29
ECHO 5.7	Include quality physical education in the school curriculum and provide adequate and appropriate staffing and facilities to support this	29. A25
6. Weight management		
ECHO 6.1	Develop and support appropriate weight management services for children and adolescents who are overweight or obese that are family-based, multi-component (including nutrition, physical activity and psychosocial support) and delivered by multi-professional teams with appropriate training and resources, as part of universal health coverage	• A31

Appendix 2: Search terms or keywords used as part of the rapid review process

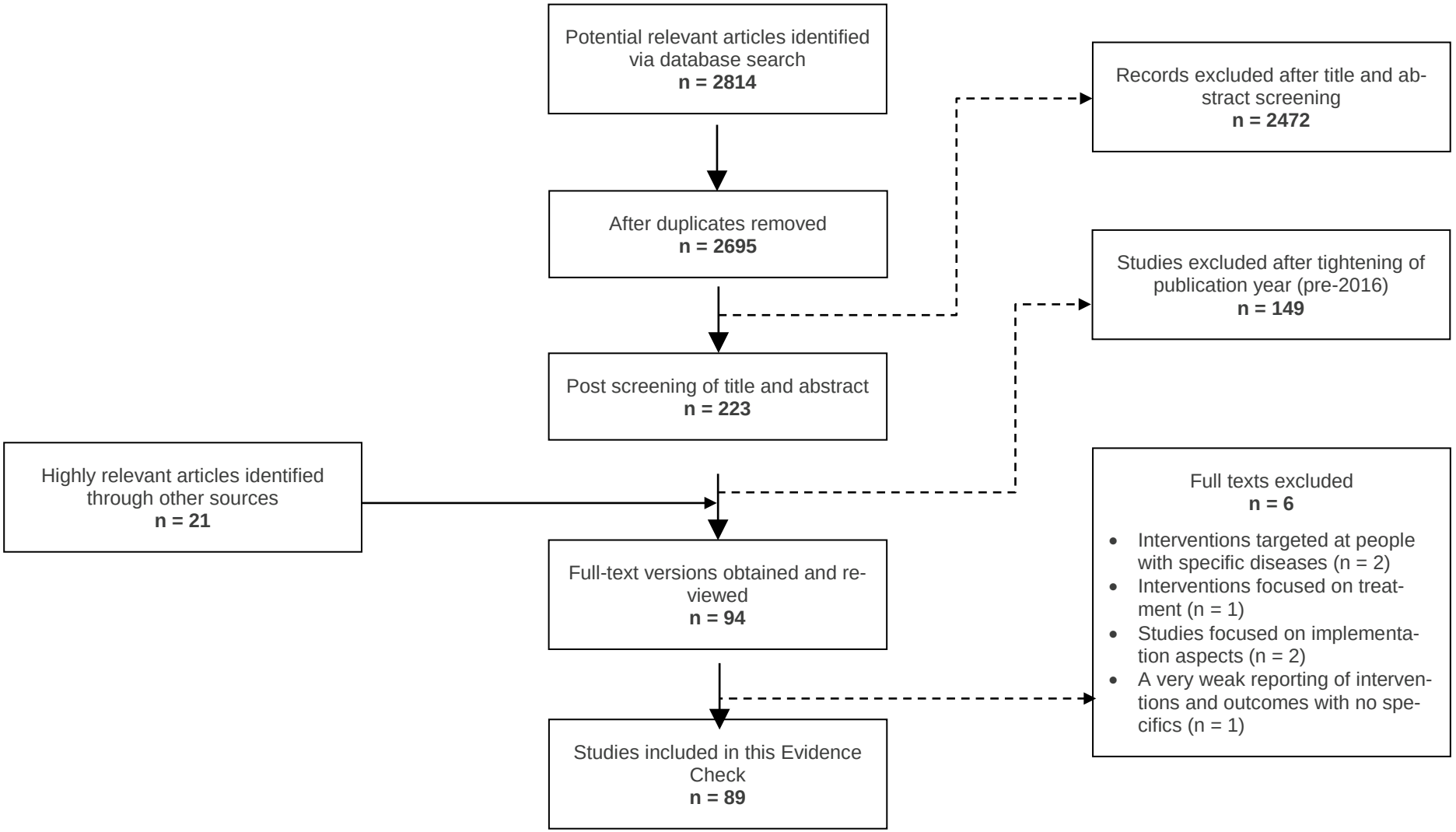
Concept 1	*And*	Concept 2	*And*	Concept 3	*And*	Concept 4
• intervention* • program* • policy • policies		• healthy eating • exercis* • physical* activ* • obes*		• effective*		• systematic review*

*Note: wildcard characters like **

Appendix 3: Description of proposed clusters, as provided by Queensland Health (on behalf of the national obesity strategy working group)

Category	Cluster	Description
Food systems	Food markets	Distribution, transport and trade; food industry drivers such as profitability; food retail including advertising, labelling, availability and consumer demand
	Food processing	Agriculture, production, manufacturing systems, food formulation, flavour science, nutritional quality and product design
	Individual food consumption	Food acquisition, food preparation, food intake (nutrition, energy, portion size) and dietary habits
Physical activity	Physical activity environment	Includes 'cost of physical exercise', 'perceived danger in the environment', safety and 'walkability of the living environment', 'reliance on labour-saving devices', walking, cycling or recreation infrastructure, sports facilities, public open spaces, public transport, access to bikes, urban design and density, building design, speed and volume of traffic, presence of cyclists, driver behaviour, cost/convenience of driving, proximity to destinations, , development regulations, zoning codes, public transport costs
	Individual activity	Recreational, occupational, incidental and transport activity level; historical and learned activity patterns; perceptions of fitness level, safety and risk of injury
Society and culture	Socio-political influences	High-level mechanisms including governance and leadership, macro-economic, social and public policy, national guidelines and monitoring systems
	Cultural and societal values	Weight norms and attitudes; cycling, walking, food and media-viewing cultures; cultural background values and norms
	Individual psychology	Attributes such as self-esteem, stress, demand for indulgence and health literacy; peer and family support; and, for children, parental control and modelling
	Physiology	Biological characteristics such as gender, age, health status, genetic predisposition to obesity, metabolic rate and level of satiety; intergenerational effects
Health systems	People-centred health system	Lifestyle management services; person-centred primary healthcare, clinical guidelines and capacity building
Natural environment	Natural environment	The biological system including diversity, land, air and water; and environmental interactions such as farming processes, land-use systems, energy and pollution

Appendix 4: PRISMA flow chart for study selection in relation to Question 1



Appendix 5: Data extracted from included reviews in relation to Question 1

No.	Title	Authors	Published year	Study type	Population studied	Years studied	N (number of studies)	Country(ies) studied or included	Interventions	Outcome measures	Direction/magnitude of effect	Authors' conclusion
1.	Health-related outcomes of new grocery store interventions: A systematic review	Abeykoon, AM Hasanthi; Engler-Stringer, Rachel; Muhajarine, Nazeem	2017	Systematic review	Adult	1995-2015	11 (*7 interventions*)	Britain, US	Opening of a new supermarket in a low-income deprived area	Fruit and vegetable consumption Body mass index (BMI) and self-rated health Perceptions of food access Neighbourhood satisfaction Psychological health	**Positive:** Significant improvements shown in the perception of food access, neighbourhood satisfaction and psychological health **Inconclusive:** Fruit and vegetable consumption **Neutral:** Insignificant improvements found in BMI and self-rated health	Inconsistent results found for fruit and vegetable consumption Insignificant improvements found for BMI and self-rated health Significant improvements shown in the perception of food access, neighbourhood satisfaction and psychological health "Food price is one of the major limiting factors for low-income households when it comes to purchasing healthy food. Further, healthy food costs more than less healthy options and literature indicates that price reductions and monetary incentives are interventions that

												might work for low-income populations. Although food access is improved with grocery store interventions, the concomitant impact on food price might be limited" (p. 2245)
2.	What is the effectiveness of obesity related interventions at retail grocery stores and supermarkets? -A systematic review.	Adam, Abdulfatah; Jensen, Jørgen D	2016	Systematic review	General	2003-2015	42	US, NZ, Britain, Ireland, Australia	*Single-strategy interventions:* (1) Increased accessibility / availability — opening of a supermarket in an area previously lacking a retail infrastructure (2) Price / affordability — price reductions of fruit and vegetables (3) Information — information displayed in the form of shelf and product labels, posters, flyers and the distribution of educational brochures *Multi-component interventions:* (1) Combined information and access / availability elements (2) Combined monetary	Increase purchase or consumption of healthy food	*Single strategy interventions:* (1) **Neutral:** Increased accessibility / availability had no significant effect on consumption of fruit and vegetables (2) **Positive:** Price reductions have a positive effect on the purchase and consumption of healthy food. Results indicated that the higher the discount, the higher and more significant the intervention effect (3) **Inconclusive:** Information only intervention *Multi-component intervention:* (1) **Positive** (in one	Authors found efficacy for in-store/point-of-purchase healthy food interventions in terms of increased purchase of healthy foods Interventions that combine price, information and easy access to and availability of healthy foods with interactive and engaging nutrition information could help customers of food stores to buy and consume more healthy foods

									incentives and information (3) A mix of affordability and availability of healthy foods at store settings (4) A combination of all three aforementioned interventions		or more outcome measures): Combined information and access / availability elements (2) **Inconclusive:** Combined monetary incentives and information (3) **Positive:** A mix of affordability and availability of healthy foods at store settings (4) **Positive:** A combination of all three aforementioned interventions	
3.	Environmental interventions for altering eating behaviours of employees in the workplace: A systematic review	Allan, J; Querstret, D; Banas, K; de Bruin, M	2017	Systematic review	Adult	1946-2014	22	US, Denmark, The Netherlands, Brazil, Japan	*Environmental interventions:* • Introduction of fruit basket • Healthy meal options • Introduction of health promotional materials • Healthy changes to food contents and size • Reduction of price of healthy options • Increase availability of healthy food • Food labelling	*Primary outcomes:* (1) Objective measures of change in eating behaviour (e.g. point-of-purchase analysis of food content and objective measures of fruit and vegetables consumed) (2) Subjective measures of change in eating behaviour (e.g. self-reported amount of fruit	**Inconclusive:** More than half of included studies (13/22) reported significant changes in primary measures of eating behaviour (increased fruit/veg consumption, increased sales of healthy options and reduction in calories purchased) Only one study pro-	"More rigorous, well-reported studies that account for compensatory behaviours are needed to fully understand the impact of environmental interventions on diet and importantly on weight/body mass index outcomes"

										and vegetables consumed, sugary foods/drinks consumed, high-fat/low-fat food consumed, high-fibre/low-fibre food consumed) *Secondary outcomes:* (1) Objective measures of changes in weight-related indices *(*e.g. BMI, body fat percentage and body weight) (2) Subjective measures of change in weight-related indices (e.g. self-reported weight, BMI and body fat percentage)	duced a small significant improvement in weight/BMI	
4.	Effectiveness of intervention strategies exclusively targeting reductions in children's sedentary time: A systematic review of the literature	Altenburg, Teatske M; Kist-van Holthe, Joana; Chinapaw, Mai JM	2016	Systematic review	Child Adolescent (*0–18 y/o*)	Inception until 2015	21	Did not specify	Interventions targeting sedentary behaviours (e.g. TV viewing, computer use, reading, playing board games)	Reduction in sedentary time	**Inconclusive**	No convincing evidence for the effectiveness of existing interventions targeting solely sedentary behaviour

5.	Cost-effectiveness of community-based childhood obesity prevention interventions in Australia	Ananthapavan, Jaithri; Nguyen, Phuong K.; Bowe, Steven J.; Sacks, Gary; Herrera, Ana Maria Mantilla; Swinburn, Boyd; Brown, Vicki; Sweeney, Rohan; Lal, Anita; Strugnell, Claudia; Moodie, Marj	2019	Literature review Meta-analysis Economic evaluation	Child (*5–18 y/o*)	2011-2016	6	Australia	*Community based interventions (CBI) included 6 components:* (1) Capacity building (2) Awareness raising (3) Physical activity and nutrition strategies implemented in schools (4) Infrastructure changes to school (5) Changes to food (6) Changes to physical activity environments within the broader community	BMI z-score Cost	Meta-analysis showed a small but significant difference in BMI z-score (mean difference of − 0.07 (95% UI: − 0.13 to − 0.01)) favouring the CBI community compared with the control **Cost effective:** The estimated net cost of implementing CBIs across all local government areas in Australia was $A426m (95% UI: $A3m to $A823m) over 3 years. This resulted in 51,792 health-adjusted life years (HALYs) gained (95% UI: 6816 to 96,972) over the lifetime of the cohort The mean ICER (incremental cost-effectiveness ratio) was $A8155 per HALY gained (95% UI: $A237 to $A81,021), with a 95% probabil-	Economic evaluation of CBIs found these are likely to be cost-effective obesity prevention initiatives. The best available evidence relates to the effectiveness of CBIs in school-aged children Implementation across Australia will be (relatively) expensive when compared with current investments in preventive health

											ity of being cost-effective at a willingness-to-pay threshold of $A50,000 per health-adjusted life year (HALY)	
6.	Increasing vegetable intakes: Rationale and systematic review of published interventions	Appleton, Katherine M; Hemingway, Ann; Saulais, Laure; Dinnella, Caterina; Monteleone, Erminio; Depezay, Laurence; Morizet, David; Armando Perez-Cueto, FJ; Bevan, Ann; Hartwell, Heather	2016	Systematic review	Child Adult	All years until 2015	77 studies (Total 140 interventions — 133 conducted in children)	Did not specify	Interventions aiming to change or use hedonic factors (e.g. changing or using the taste or familiarity of a vegetable/ vegetable product) Interventions based on changing the environment (*e.g.*, increased provision of vegetables, improved presentation, *etc.*) Interventions based on changing or using cognitive factors (*e.g.*, providing information and education on nutrition or nutrition-related skills, *etc.*)	Increased consumption of fruit and vegetables	**Inconclusive:** Small effect and inconsistent	Environmental, educational and multicomponent interventions are shown to be promising but publication bias was likely
7.	The efficacy of nudge theory strategies in influencing adult dietary behaviour: A systematic review and meta-analysis	Arno, Anneliese; Thomas, Steve	2016	Systematic review Meta-analysis	Adult (*18–65 y/o*)	2004-2014	42	US, Belgium, Japan, Britain, The Netherlands, Australia	Alterations to choice architecture (e.g. olfactory or social), perception (e.g. emotional priming), availability of food (e.g. convenience and portion size), or	Changes in calories, kilojoules, grams or purchases (either quantity purchased or a monetary amount)	**Positive:** Nudge strategies resulted in an average 15.3% increase in healthy nutritional choices	Nudge holds promise as a public health strategy to combat obesity

									knowledge-based change (e.g. labelling)			
8.	Interventions targeting sedentary behavior in non-working older adults: A systematic review	Aunger, Justin Avery; Doody, Paul; Greig, Carolyn Anne	2018	Systematic review	Adult (*Above 45 y/o*)	1946-2017	6	Did not specify	*Interventions focused on decreasing sedentary behaviours*, such as: • Goal-setting • Individualised feedback • Motivational sessions and phone calls designed to inspire behaviour change	Sitting time (min/day, min/week, min/weekday, min/weekend-day, percentage change) Standing time (min/day) Stepping time (min/day) Number of breaks in sitting time and standing time in bouts > 30 min	**Inconclusive**	The overall quality of included was poor
9.	The effectiveness of sedentary behaviour interventions for reducing body mass index in children and adolescents: Systematic review and meta-analysis	Azevedo, Liane B; Ling, Jonathan; Soos, Istvan; Robalino, Shannon; Ells, Louisa	2016	Systematic review Meta-analysis	Child Adolescent (*0–17 y/o*)	1980-2015	67	Did not specify	Interventions targeted at sedentary behaviours (SB) while sitting or lying down, such as screen-based activities	Changes in BMI or BMI z-score	**Neutral:** SB interventions are associated with a very small and clinically irrelevant effect on BMI or BMI z-score when applied to the general population or normal weight population **Positive:** Effect of SB interventions on BMI might be clinically effective at population	Multi-component interventions (SB and other behaviours) delivered to children from 5–12 years old in a non-educational setting appear to favour BMI reduction

											level for children who are overweight or obese	
10.	The impact of a tax on sugar-sweetened beverages according to socioeconomic position: A systematic review of the evidence	Backholer, Kathryn; Sarink, Danja; Beauchamp, Alison; Keating, Catherine; Loh, Venurs; Ball, Kylie; Martin, Jane; Peeters, Anna	2016	Systematic review	General	Inception until 2015	11	US, NZ, Britain, Ireland, Australia	Sugar-sweetened beverages tax	Price elasticities Size and types of taxes Reduction in SSB consumption Reduction in energy intake Reduction in weight or BMI Obesity prevalence Tax burden (the main outcome of this paper)	**Positive:** Studies that reported on changes in weight outcomes for the total population following an increase in SSB price, all reported either similar reductions in weight across socioeconomic position (SEP) groups or greater reductions for lower compared with higher SEP groups All included studies that examined the average household amount paid in tax reported that an SSB tax would be regressive, but with small differences between higher and lower-income households (0·10–1·0% and 0·03%–0·60% of annual household income paid in SSB tax	A tax on SSB will deliver similar population weight benefits across socioeconomic strata or greater benefits for lower SEP groups An SSB tax is shown to be consistently financially regressive, but to a small degree

											for low and high-income households, respectively)	
11.	How effective are family-based and institutional nutrition interventions in improving children's diet and health? A systematic review	Black, Andrew P; D'Onise, Katina; McDermott, Robyn; Vally, Hassan; O'Dea, Kerin	2017	Systematic review	Child *(0–12 y/o)*	1980-2014	39	High-income countries as defined by the World Bank	*School / preschool programs:* 1. Fruit and/or vegetable snacks (free/paid) 2. School lunch program 3. School garden 4. Improvements in school meals/ tuckshop/ canteen facilities 5. School breakfast program 6. Nutrition education — classroom 7. Meal preparation sessions child (and/or parent) 8. Physical activity sessions 9. Change agent to support healthy nutrition/physical activity 10. School food policy changes 11. Observation/rewards eating healthy foods at lunch/in class 12. School-wide promotion messages 13. Multimedia activities promoting healthy lifestyles	Nutritional intake (measured by validated dietary assessment techniques, food purchasing, or biomarkers) Health status (e.g. mortality, morbidity rates; child growth and development outcomes) Longer-term effects following program completion Adverse outcomes — stigmatisation, dependency, increase in high-fat/ high-sugar foods (including takeaway food)	**Positive:** The family-based programs, which provided simple positive dietary advice to parents and regular follow-up, reduced fat intake significantly School and family-based studies, if designed and implemented well, increased F&V intake, particularly fruit Effective school-based programs have incorporated role models including peers, teachers and heroic figures, rewards and increased access to healthy foods **Positive:** School nutrition programs in disadvantaged com-	Family and school nutrition programs can improve dietary intake but evidence of long-term sustainability of these interventions is limited The modest overall impact of even these successful programs suggests complementary nutrition interventions are needed to build a supportive environment for healthy eating generally

									14. Teacher modelling healthy eating 15. Homework activities/ newsletter *Family programs:* 1. Individual and/or group nutrition education 2. DVDs / newsletters / workbooks 3. Non-residential camp 4. Practical nutrition and/or physical activity sessions 5. Internet education/ activities 6. Phone call from program staff		munities were as effective as programs in other communities	
12.	Interventions for childhood obesity in the first 1000 days. A Systematic Review	Blake-Lamb, Tiffany L; Locks, Lindsey M; Perkins, Meghan E; Woo Baidal, Jennifer A; Cheng, Erika R; Taveras, Elsie M	2016	Systematic review	Child (*Conception to 24 months*)	1980-2014	34 (*26 interventions*)	Australia, Denmark, Belarus, Finland, Dominican Republic, Germany, US, Belgium, Brazil, Canada, Britain, Italy, Poland, Spain	*Interventions during pregnancy:* • Systems: Clinical treatment of GDM (gestational diabetes mellitus) • Individual: Maternal diet and physical activity *Interventions starting in pregnancy and continuing after birth:* • Systems: Hospital and clinic-based breastfeed-	*Childhood overweight or obesity* measures: Weight-for-length BMI or age and sex-specific BMI ≥ 85th percentile collected between age 6 months and 18 years	**Positive:** Effective interventions focused on individual or family behaviour changes through home visits, individual counselling or group sessions in clinical settings, a combination of home and group visits in a community setting, and using hydrolysed protein formula	Interventions that operate at systems levels and are grounded in salient conceptual frameworks hold promise for improving future models of early-life obesity prevention Protein-enriched formula increased childhood obesity risk

									ing policies and practices • Family: Maternal diet and physical activity, infant/child feeding and activity/sedentary time, sleep, general infant care, family nutrition and activity • Biologic: Maternal and/or infant supplement *Interventions starting after birth:* • Individual: Infant sleep, infant feeding and activity/sedentary time • Family: Maternal diet and physical activity, infant feeding, family diet • Biologic: Maternal and/or infant supplement			
13.	Interventions to prevent global childhood overweight and obesity: A systematic review	Bleich, Sara N; Vercammen, Kelsey A; Zatz, Laura Y; Frelier, Johannah M; Ebbeling, Cara B; Peeters, Anna	2018	Systematic review	Child (*2–19 y/o*)	2013-2017	56	Did not specify	School-based interventions Preschool-based interventions	BMI, BMI z-score Waist circumference Body fat percentage	**Positive:** Results suggested that school-based interventions with combined diet and physical activity components and a home element had greatest effectiveness	The effectiveness of school-based interventions that combined diet and physical activity components suggests these hold promise for childhood obesity prevention worldwide

									Home-based interventions Community-based interventions	Skinfold thickness Prevalence of overweight or obesity	**Inconclusive:** Evidence in support of the effect of preschool-based, community-based and home-based interventions was limited by a paucity of studies and heterogeneity in study design	
14.	Promoting active travel to school: A systematic review (2010–2016)	Pang, Bo; Kubacki, Krzysztof; Rundle-Thiele, Sharyn	2017	Systematic review	Child	2010-2016	40 (*18 interventions*)	Britain, Canada, The Netherlands, Belgium, Norway, NZ, Australia, US, Sweden, Denmark	*Active School Travel interventions (AST), e.g.:* • Walking school bus • Ride2School • Cycle to school	Changes in physical activity Changes in attitudes towards physical activity BMI Changes in policy	**Inconclusive:** Six interventions reported some positive effects on AST, two mixed effects on AST, and five reported no effect	Positive attitude change was reported in four interventions Positive change in BMI was reported in two Positive policy change was reported in two Knowledge and long-term infrastructure improvement were each reported in three interventions Positive healthy eating and general physical activity changes were reported in one intervention each

15.	Systematic review of natural experiments for childhood obesity prevention and control	Bramante, Carolyn T; Thornton, Rachel L J; Bennett, Wendy L; Zhang, Allen; Wilson, Renee F; Bass, Eric B; Tseng, Eva	2019	Systematic review	Child	2000-2017	33	US, Canada, Australia	*School-based interventions*: • The implementation of water jets in the school • Reducing unhealthy foods and beverages available in vending machines and school stores • Creating a healthful food environment in the school and surrounding neighbourhood • School breakfast program and national school lunch program • Competitive food laws *Community-based interventions*: • SSB taxation • Built environment (i.e. urban park development)	BMI Fruit and vegetable intake SSB intake	**Positive:** Natural experiments evaluating school-based policies focusing on both the food/beverage and physical activity environments (versus targeting only one) consistently showed improvement in BMI	School-based policies focusing on both the food/beverage and physical activity environments (versus targeting only one) consistently showed improvements in BMI Most selected studies reported a high risk of bias
16.	A systematic review and meta-analysis of the effectiveness of nudging to increase fruit and vegetable choice	Broers, Valerie J; De Breucker, Celine; Van den Broucke, Stephan; Luminet, Olivier	2017	Systematic review Meta-analysis	General	2000-2015	20 (*Qualitative*) 12 (*Quantitative*)	Did not specify	Nudging as a strategy to encourage healthy behaviour by way of triggering automatic processes through altering environmental cues	Selection of fruit and vegetables (grams / cups of servings) Consumption of fruit and vegetables (grams)	**Positive:** Nudging interventions that aim to increase fruit and/or vegetable choice/ sales/ servings have a moderately significant effect (d = 0.30), with the	The meta-analysis returned a moderately significant effect on nudging interventions that aimed at increasing fruit and/or vegetable choice/ sales/ servings

										Weekly sales of healthy foods (fruit and vegetables)	largest effect for altering placement (d = 0.39) and combined nudges (d = 0.28)	Nudging is a promising strategy
17.	The potential cost-effectiveness and equity impacts of restricting television advertising of unhealthy food and beverages to Australian children	Brown, V.; Ananthapavan, J.; Veerman, L.; Sacks, G.; Lal, A.; Peeters, A.; Backholer, K.; Moodie, M	2018	Meta-analysis Economic evaluation	Child *(5–15y/o)*	N/A	N/A	Australia	Legislation to implement time-based restrictions of unhealthy food and beverage marketing to children under 16 years of age on free-to-air TV until 9:30pm	Cost-effectiveness	An intervention restricting HFSS (high fat, sugar, salt) TV advertising would cost $A5.9m (95% UI $A5.8m–$A7m), resulting in modelled reductions in energy intake (mean 115 kJ/day) and BMI (mean 0.352 kg/m2). **Cost-effective:** The intervention is likely to be cost-saving, with 1.4 times higher total cost-savings and 1.5 times higher health benefits in the most disadvantaged socioeconomic group (17,512 HALYs saved (95% UI 10,372–25,155); total cost-savings $A126.3m (95% UI $A58.7m–196.9m) over the lifetime) compared with the least disadvantaged socioeconomic group (11,321 HALYs	Legislation to restrict HFSS TV advertising is likely to be cost-effective, with greater health benefits and healthcare cost-savings for children with low SEP

											saved (95% UI 6812–15,679); total cost-savings $A90.9m (95% UI $A44.3m–136.3m))	
18.	Food and nutrition programs for Aboriginal and Torres Strait Islander Australians: An overview of systematic reviews	Browne, Jennifer; Adams, Karen; Atkinson, Petah; Gleeson, Deborah; Hayes, Rick	2017	Overview of systematic reviews	General	No date limits	12 (total articles; 11 reviews)	Australia	Food, nutrition or dietary interventions / programs with / without co-interventions	Nutrition-related impacts or outcomes of programs or interventions (e.g. nutritional status, weight, chronic disease, risk factors, growth, breastfeeding, dietary behaviour, nutrition knowledge)	**Positive:** Community-based food and nutrition programs	"Community-directed food and nutrition programs, especially those with multiple components that address the underlying causes of nutrition issues, can be effective in improving nutrition-related outcomes" (p. A)
19.	Mobile health interventions to promote physical activity and reduce sedentary behaviour in the workplace: A systematic review	Buckingham, Sarah Ann; Williams, Andrew James; Morrissey, Karyn; Price, Lisa; Harrison, John	2019	Systematic review	Adult	2007-2018	30	US, Australia, India, Singapore, NZ, Canada, Finland, Belgium, Norway, The Netherlands	*mHealth (Digital interventions):* • Wearable activity monitor and smartphone app *Multi-component, including:* • PA or workplace programs • Educational programs	*Primary outcomes*: • Daily steps, daily active minutes • Walking distance and duration • MVPA (moderate-to-vigorous physical activity) minutes per week • Sitting time (min/day) *Secondary outcomes*: • Anxiety (state and trait) • Sleep quality • Workday diet	**Inconclusive**	Methodological quality of selected studies was generally weak Reasonable evidence for mHealth in a workplace context as a feasible, acceptable and effective tool to promote PA The impact in the longer term and on sedentary behaviour is less clear

										(F&V intake, saturated fat and sugar intake) BMI • Systolic BP • Resting pulse rate		
20.	Systematic review of physical activity outcomes of rural lifestyle interventions	Cai, Yun; Richards, Elizabeth A	2016	Systematic review	Adult (*above 18 y/o*)	1990-2015	8	US	*Physical activity interventions*, including: • Exercise and fitness classes • Education sessions • Individualised newsletters • Multi-component obesity CCM • Social support intervention program	*Physical activity measures, such as:* • Recreational exercise by MET (metabolic equivalent) hr/week • Average daily step counts for consecutive days • EE/kcal per day or per week	**Inconclusive:** Interventions that are very personalised or tailored and/or include many interventions and contacts appear to be the most effective	A small number of studies, mixed findings and the risk of bias limited the authors' ability to draw conclusion
21.	Delivering in-school interventions to improve dietary behaviours among 11- to 16-year-olds: A systematic review	Calvert, Sian; Dempsey, Robert C; Povey, Rachel	2019	Systematic review	Adolescent (*11–16 y/o*)	No date limits	29	US, Australia, Canada, Britain, Norway, Denmark, Greece, China, Tunisia, Taiwan, Israel, Belgium, Spain, The Netherlands	*Interventions targeting behaviours:* In the classroom — healthy eating lessons, activities (role play quizzes), worksheets, handbooks, self-evaluation diary, prizes/competitions, educational media, practical lessons In the school — increased exposure to healthy food (e.g. posters), increased availability of healthy foods in	Changes in F&V, SSB intake Changes in snacking behaviours (decrease in the intake of energy-dense nutrient-poor snacks)	**Indicative positive:** Of the 29 studies identified for review, 24 reported significant improvements in dietary behaviour. Interventions appeared more effective when they involved peers, used educational media to deliver health messages, increased availability of healthy foods in school, and	Interventions that aim to improve dietary behaviours in 11–16-year-olds within a school setting should potentially consider the following components: • Involve peers in the delivery of the intervention • Include educational media to

									school Peer involvement Teacher involvement Parent involvement School canteen staff — food provided revision		incorporated computer-based individualised feedback with normative information on eating behaviours	deliver intervention messages • Increase the availability of healthy foods in the school environment •Incorporate computerised tailored feedback that includes normative behaviours
22.	A systematic review of the effectiveness of supermarket-based interventions involving product, promotion, or place on the healthiness of consumer purchases	Cameron, Adrian J.; Charlton, Emma; Ngan, Winsfred W.; Sacks, Gary	2016	Systematic review	General	No date limits	50	Global (US, The Netherlands, Australia, Canada, Britain, Japan, Norway)	Changed the in-store environment to influence consumer nutrition / diet	Store sales data Self-reported food purchase data Consumer food consumption Physical measures (e.g. BMI)	Successful interventions: (1) A shelf label intervention supported by posters and information booklets (sales of healthier milk, refried beans, cream cheese and peanut butter increased, but healthier mayonnaise and salad dressing decreased) (2) A multi-component healthy eating program including shelf labels, brochures, posters and a mass media campaign (estimated intervention effects ranging from 3.2% to	Most high-quality studies targeting the supermarket food environment reported improvements in the healthiness of consumer purchases in response to the intervention Shelf labelling (particularly using nutrition summary score) stands out as being particularly promising

											5.7% for canned vegetables, dried beans and dried fruits) (3) A shelf label intervention identifying low-cholesterol and low-fat products, supported by information booklets (market share of tagged products increased in 8 of 16 product categories ($p < 0.05$) with a 12% average increase) (4) A complex RCT testing the effect of display space, newspaper advertising, display location quality and price on 16 types of fruit and vegetables (shelf space increased sales for all categories of products — hard fruit 44%, cooking vegetables 59%, salad vegetables 28% and soft fruit 49%) (5) A cluster RCT incorporating shelf tags, cross-promotion of products,	

											taste tests and prominent placement (sales of 1% milk, 2 of 3 types of frozen meals and water in checkout fridges increased (all $p < 0.05$), but no significant differences in sales of targeted cereals or in-aisle beverages)	
23.	Do interventions to increase walking work? A systematic review of interventions in children and adolescents	Carlin, Angela; Murphy, Marie H; Gallagher, Alison M	2016	Systematic review	Child Adolescent (*5–18 y/o*)	Inception until 2015	12	US, Britain, Australia, Taiwan	Walking school bus School-based active travel Aerobic walking	*Physical activity measures, including:* • Distance walked • Daily step count • Minutes / day MVPA	**Inconclusive**	Walking interventions, particularly those conducted in the school environment, have the potential to increase PA in children and adolescents The short-term effectiveness of the majority of included studies on levels of walking in this population is promising Conclusions as to which interventions most effectively increased walking behaviours in this population were hindered by the limited number of identified

												interventions and the short duration of interventions evaluated
24.	Environmental components of childhood obesity prevention interventions: An overview of systematic reviews	Cauchi, D; Glonti, K; Petticrew, M; Knai, C	2016	Overview of systematic review	Child Adolescent *(5–18 y/o)*	1995-2015	79	Did not specify	*Environmental interventions:* • Improvement of overall school food environment • Purchase of new PE/sport equipment • Daily formal PA session organised after school • Provision of free or low-cost fruit • Availability of school playgrounds for structured/unstructured PA after regular school hours • Provision of free/low-cost water in school • Provision of a healthy breakfast at school • Substitution of sweetened beverages • Reduction in screen time	*Anthropometric measures:* • BMI, BMI z-score • Waist circumference • Skin fold thickness • Percentage body fat • Prevalence of overweight or obesity	Most interventions had at best a small to modest impact on childhood anthropometric outcomes Single-level interventions that focus on reducing screen time or increasing time spent performing MVPA may also be beneficial	Results show modest impact of a broad range of environmental strategies on anthropometric outcomes
25.	Impact of food labelling systems on food choices and eating behaviours: A systematic review and meta-	Cecchini, M; Warin, L	2016	Systematic review Meta-analysis	Child Adult	2008-2015	9	Germany, Britain, US, Australia, France, Canada	Guideline Daily Amount (GDA) Traffic light schemes	Number of people switched to a healthier product	**Positive:** Traffic light schemes are marginally more effective in	Food labelling schemes would have a statistically significant effect in steering consumers' choice towards healthier

	analysis of randomized studies								Other food labelling	Change in calorie intake	increasing the selection of healthier options	products Interpretive nutrition labels, such as traffic light schemes, may be more effective than other approaches
26.	A systematic review and meta-analysis of workplace intervention strategies to reduce sedentary time in white-collar workers	Chu, AHY; Ng, SHX; Tan, CS; Win, AM; Koh, D; Müller-Riemenschneider, F	2016	Systematic review Meta-analysis	Adult	2003-2015	26 (*Qualitative*) 21 (*Quantitative*)	Finland, Australia, US, Belgium, Switzerland, Britain, Spain, Portugal, The Netherlands	*Workplace interventions*: • Sit–stand workstation • Counselling (goal-setting; theories and health-related benefits of PA) • Screen-based point of choice prompt intervention to stand every 30 min for 5 work days • Verbal and pamphlet education • Coaching program	*Physical activity outcomes, such as*: • Sitting time min/workday	**Positive:** The pooled intervention effect showed a significant workplace sitting reduction of –39.6 min/8-h workday (95% confidence interval [CI]: –51.7, –27.5), favouring the intervention group **Positive:** Multi-component interventions reported the greatest workplace sitting reduction (–88.8 min/8-h workday; 95% CI: –132.7, –44.9), followed by environmental (–72.8 min/8-h workday; 95% CI: –104.9, –40.6) and educational/behavioural strategies –15.5 min/8-h workday (95% CI: –22.9, –8.2)	The review found consistent evidence for intervention effectiveness in reducing workplace sitting, particularly for multicomponent and environmental strategies

27.	Effectiveness of interventions to promote physical activity and/or decrease sedentary behaviour among rural adults: A systematic review and meta-analysis	Cleland, V; Squibb, K; Stephens, L; Dalby, J; Timperio, A; Winzenberg, T; Ball, K; Dollman, J	2017	Systematic review Meta-analysis	Adult	1996-2016	13 (*Qualitative*) 12 (*Quantitative*)	North America, Europe, Australia	*Interventions focused on increasing PA and/or decreasing sedentary behaviour, including:* • Information provision and dissemination and support for healthy behaviours • Physical activity sessions (dancing or walking) • Village seminars • Study groups • Goal setting • Faith-based behavioural weight loss program • Radio, newspaper and television promotions	*Physical activity outcomes, such as:* • MET hours • Steps/day • Sitting time hours/ day	**No effect**	The examined interventions were not effective in improving physical activity in the selected population
28.	The impact of Canadian school food programs on children's nutrition and health: A systematic review	Colley, Paige; Myer, Bronia; Seabrook, Jamie; Gilliland, Jason	2019	Systematic review	Child	1990-2017	11	Canada	Healthy eating and nutrition policies Education Food provision Family, peer and community involvement	Improvement in nutritional knowledge Changes in F/V preference or intake	**Positive:** The multi-component school nutrition programs identified in this systematic review positively influenced children's nutritional knowledge, dietary behaviours and food intake	The multi-component school nutrition programs identified in this systematic review positively influenced children's nutritional knowledge, dietary behaviours and food intake Barriers associated with intervention duration, intensity and availability of re-

												sources may have influenced the extent to which these programs impacted children's diets and overall health
29.	Interventions to reduce sedentary behavior and increase physical activity during productive work: A systematic review	Commissaris, Dianne ACM; Huysmans, Maaike A; Mathiassen, Svend Erik; Srinivasan, Divya; Koppes, Lando Lj; Hendriksen, Ingrid JM	2016	Systematic review	Adult	1992-2015	40	Did not specify	*Workplace interventions*: • Alternative workstations • Interventions promoting stair use • Personalised behavioural interventions	Sedentary behaviour: • Overall and at work Physical activity: • Overall and at work Work performance Metabolic and physiologic outcomes: • Lipid and metabolic outcomes • Haemodynamic measures and cardiorespiratory fitness • Anthropometric measures	**Positive:** Alternative workstations were found to decrease overall sedentary behaviour, with strong evidence **Positive:** Interventions promoting stair use were found to increase physical activity at work while personalised behavioural interventions increased overall physical activity (both with moderate evidence)	Alternative workstations were found to decrease overall sedentary behaviour, with strong evidence Interventions promoting stair use were found to increase physical activity at work while personalised behavioural interventions increased overall physical activity (both with moderate evidence) Moderate evidence to show alternative workstations did not influence either haemodynamic or cardiorespiratory fitness and personalised behavioural interventions did not influence anthropometric measures

												Insufficient or conflicting evidence for intervention effects on workplace performance and lipid and metabolic profiles
30.	Behavioural incentive interventions for health behaviour change in young people (5–18, years old): A systematic review and meta-analysis	Corepal, Rekesh; Tully, Mark A; Kee, Frank; Miller, Sarah J; Hunter, Ruth F	2018	Systematic review Meta-analysis	Child Adolescent (*5–18 y/o*)	Inception until 2016	22 (*Total*) 19 (*Quantitative)*	US, Singapore, Canada, Britain, Germany, Ireland, Italy, The Netherlands, Finland	*Interventions incorporating behavioural incentives*, such as: • Material incentives • Self-incentives • Non-material incentives (social incentives and non-specific incentives)	Number of days/week did at least 60 min MVPA Pedometer step count over 8 school days Fruit/veg (% portion, grams, cups, servings)	**Positive:** Strong evidence that behavioural incentives may encourage healthier eating behaviours **Positive:** Some evidence that behavioural incentives were effective in encouraging physical activity behaviour	Promising evidence that behavioural incentives may be effective in encouraging physical activity behaviour change and healthy eating in young people
31.	The effectiveness of eHealth interventions on physical activity and measures of obesity among working-age women: A systematic review and meta-analysis	Cotie, LM; Prince, SA; Elliott, CG; Ziss, MC; McDonnell, LA; Mullen, KA; Hiremath, S; Pipe, AL; Reid, RD; Reed, JL	2018	Systematic review Meta-analysis	Adult female (*18–65 y/o)*	Inception until 2016	40 (*Qualitative*) 20 (*Quantitative*)	High-income OECD countries	*Digital (eHealth), including:* • Wearable health and movement trackers • Websites • Smartphone applications • Messaging services (i.e. SMS, emails and voicemails) • Video games • Tele health	*Primary outcome:* • MVPA measured either objectively (e.g. accelerometers) or subjectively (e.g. questionnaires) *Secondary outcomes:* • Body mass (kg) • BMI (kg m-2) • Waist circumference (WC; cm) • Blood pressure (mmHg)	**Positive:** eHealth interventions improved moderate-to-vigorous physical activity; an increase of ~25 min week-1 **Neutral:** No changes were observed in obesity-related outcomes, waist circumference, body mass and BMI	eHealth interventions are effective at increasing min week-1 of moderate-to-vigorous physical activity among working-age women from high-income countries

										• Serum lipids (mmol L-1) • Blood glucose concentrations (mmol L-1) • Quality of life and mental health parameters (anxiety and depression)		
32.	Interventions to improve physical activity among socioeconomically disadvantaged groups: An umbrella review	Craike, Melinda; Wiesner, Glen; Hilland, Toni A; Bengoechea, Enrique Garcia	2018	Umbrella review	General (*All age groups*)	Until 2017	17	Did not specify	*Wide range of interventions targeted at improving physical activity*, including: • School policies and government policies targeting children in school settings • Enhancement to physical education • Additional physical activity opportunities • School self-assessments • Education about physical activity • Policies in improving physical activities and reducing inequalities	Changes in physical activity	**Positive:** For preschool children, parent-focused, group-based interventions were effective in improving physical activity **Positive:** For children, school-based interventions and policies were effective **Inconclusive:** For adults, there was mixed evidence of effectiveness but characteristics such as group-based interventions and those that focused on physical activity only were associated with effectiveness	Interventions can be successful at improving physical activity among children from socioeconomically disadvantaged groups, with evidence for other age groups weak or inconclusive Across all ages, interventions that were more intensive tended to be more effective

33.	Dietary interventions among university students: A systematic review	Deliens, Tom; Van Crombruggen, Rob; Verbruggen, Sofie; De Bourdeaudhuij, Ilse; Deforche, Benedicte; Clarys, Peter	2016	Systematic review	Adult	2000-2014	20	US, Canada, Britain, Peru	*Media-based intrapersonal interventions:* (1) Motivational dietary guideline messages via different media (SMS, emails, websites) (2) Educational lessons (3) Online cooking programs *Non-media-based intrapersonal interventions:* Behaviour change interventions (e.g. self-monitoring, action planning, time management) *Multi-component* (media and non-media intrapersonal approaches) *Environmental interventions:* (1) Multi-component, point-of-purchase marketing campaign (2) Food price reduction of 33% in a university cafeteria	Self-reported dietary intake (e.g. F&V intake, percentage of fat intake, energy from SSBs)	**Inconclusive:** 1 intervention using 10 web-based lessons, based on non-diet principles and focused on eating competence and size acceptance to promote healthy eating, was found to be effective (positive) in the long term	Nutrition education, enhancing self-regulation components towards dietary intake (often facilitated by the worldwide web or other media devices), and point-of-purchase messaging strategies may improve university or college students' dietary intake
34.	Group-based healthy lifestyle workplace interventions for shift	Demou, Evangelia; MacLean, Alice; Cheripelli, Lismy J;	2018	Systematic review	Adult (*18–70 y/o*)	2000-2018	17	US, Canada, Denmark, Britain, The Netherlands,	*Interventions targeting weight:* • Group education sessions	*Objective health measures:* • Blood pressure • Resting heart rate	**Positive:** Moderate evidence for effectiveness on weight and physical activity	Current evidence demonstrates that group-based workplace interventions

	workers: A systematic review	Hunt, Kate; Gray, Cindy M						Finland, Norway, Ireland, Australia, Brazil	• One-to-one information/ counselling sessions/ individualised support and feedback • Financial incentives • Environmental components — healthy options and portion sizes served in cafeterias *Interventions targeting physical activity:* • Exercises offered to workers • Use of free resources (i.e. pedometers/ fitness trackers, feedback from an instructor) *Interventions targeting healthy eating:* • Free access to health clubs, personal training, food logs, cookbooks, etc	• Body fat • Fasting lipids • VO2 max (maximal oxygen uptake during incremental exercise) *Subjective health measures:* • Perceived health status •Self-reported mental health • Work ability	outcomes **Inconclusive:** Insufficient evidence for healthy eating outcomes	can be effective in supporting shift workers to lose weight and increase physical activity Our findings offer decision support on organisational-level adaptations and intervention components that are important for making interventions that promote healthy lifestyles for shift workers
35.	mHealth technologies to influence physical activity and sedentary behaviors: Behavior change techniques — Systematic review and meta-analysis of randomized controlled trials	Direito, Artur; Carraça, Eliana; Rawstorn, Jonathan; Whittaker, Robyn; Maddison, Ralph	2017	Systematic review Meta-analysis	General	Inception until 2015	21 (*Qualitative*) 19 (*Quantitative*)	Britain, Australia, Austria, Portugal, Ireland, Canada	*Use of mHealth technology-based interventions*: Medical and public health practice supported by mobile devices, such as mobile phones, patient monitoring devices,	*Measures of total physical activity:* • Total PA duration • Total energy expenditure • MET • MVPA duration • Measure of sedentary behaviour	**Indicative positive:** Current mHealth interventions have small effects on physical activity/ sedentary behaviour	Current mHealth interventions have small effects on PA/SB

									personal digital assistants (PDAs) and other wireless devices	(e.g. sitting duration, TV viewing duration) • Reported walking (walking duration, step count)		
36.	Interventions to reduce sedentary behaviour in 0–5-year-olds: A systematic review and meta-analysis of randomised controlled trials	Downing, Katherine L; Hnatiuk, Jill A; Hinkley, Trina; Salmon, Jo; Hesketh, Kylie D	2018	Systematic review Meta-analysis	Child	No limit	31 (Qualitative) 17 (Quantitative)	US, Australia, Belgium, Britain, Canada, Germany, Switzerland, The Netherlands, Israel, Turkey	Decreasing screen time in various settings Decreasing sedentary time in various settings	Changes in sedentary behaviour	**Positive:** Interventions to reduce screen time and overall sedentary behaviour in early childhood have a significant overall effect of 17 and 19 min/day, respectively	Early childhood may be an opportune time to intervene to reduce sedentary behaviour Future interventions would benefit from being longer in duration (>6 months) and having high parent involvement *NB: Heterogeneity present in both study methods and results*
37.	The impact of policies to reduce trans fat consumption: A systematic review of the evidence	Downs, Shauna M; Bloem, Milan Z; Zheng, Miaobing; Catterall, Elise; Thomas, Beth; Veerman, Lennert; Wu, Jason HY	2017	Systematic review	General	2000-2012	32 articles (31 studies)	Denmark, US, Canada, South Korea, Costa Rica, The Netherlands, Denmark, Iran	*Trans Fat Acids (TFA) policies, such as*: • Voluntary self-regulation • Mandatory TFA labelling on packaged food • Voluntary TFA limits • Mandatory TFA limits in restaurants • Mandatory TFA limits in foods	Dietary intake (e.g. TFAs as a percentage of total fats) Biological outcomes (e.g. plasma TFA concentration, breastmilk TFA concentration, %TFAs of total fats)	**Positive:** Trans fat bans had a larger impact (TFAs virtually eliminated) than did voluntary (range: 20%–38% reduction in TFA intakes) or labelling (range: 30%–74% reduction in TFA intakes, plasma serum, or breastmilk	All types of TFA policies led to their reduction "Policies aimed at reducing TFAs in the food supply are effective and will likely reduce the burden of diet-related disease, particularly among the most vulnerable

									• National bans or local bans	Health outcomes (e.g. mortality rate, mobility rate — stroke and MI (myocardial infarction) rates) Saturated fatty acids (SFA) contents	concentrations) approaches to reducing TFA amounts in the food supply **Inconclusive:** Product reformulation to reduce TFAs had variable effects on saturated fatty acid (SFA) contents in these foods **Positive:** Modelling studies indicated that TFA bans would reduce heart disease risk, benefit socioeconomically disadvantaged populations the most, and be cost-saving	socioeconomic groups" (p. 1) "… TFA bans are likely the most effective, economical and equitable policy approach to reducing TFAs in the food supply" (p. 1)
38.	Systematic review of physical education-based physical activity interventions among elementary school children	Errisuriz, EL; Golaszewski NM; Born K; Bartholomew JB	2018	Systematic review	Child *(6–11 y/o)*	Not specified	12	US, Europe, South America	PE interventions to increase PA/fitness, e.g. through changing the allotted time for PE classes or employing teaching strategies	Behavioural outcomes: • % PE class time spent in MVPA • Time (min) spent in MVPA during PE class • Time in MVPA outside of school	Behavioural outcomes: **Indicative positive:** Interventions consistently showed an increase in time spent in MVPA or VPA during PE class. Interventions were less consistent with regards to their	"There is clear evidence that interventions targeting PA in schools are sufficient to increase time spent in MVPA during PE. The evidence is mixed with regards to PA outside of school and changes in body

										• Daily min of MVPA Body composition: BMI, body fat percentage, skinfold thickness Fitness outcomes: • FITNESSGRAM test • EUROFIT test • Timed runs • Flexibility • Endurance Psychosocial outcomes: Knowledge, self-efficacy, attitude and perceived support	impact on outside-class activity Body composition: **Inconclusive:** PE interventions affected body composition differentially, depending on the assessment used (i.e. body mass index or skinfold thickness) Fitness: **Inconclusive:** Approx. half the studies assessing fitness showed there was a significant impact, while the other half showed no impact on fitness Psychosocial: **Inconclusive:** 2 studies found improvement in PA knowledge; no studies found a sig-	composition and fitness. To realize greater impact, future work should strengthen methodological approaches and consider an expanded theoretical basis for this research"

											nificant effect for attitude, self-efficacy or perceived support	
39.	Effectiveness of centre-based childcare interventions in increasing child physical activity: A systematic review and meta-analysis for policymakers and practitioners	Finch, M; Jones, J; Yoong, S; Wiggers, J; Wolfenden, L	2016	Systematic review Meta-analysis	Child	Inception until 2014	17 (Qualitative) 16 (Quantitative)	US, Switzerland, Belgium, Germany, Israel, Australia, Britain, Scotland	Interventions that included structured active lessons, with and without environmental enhancement strategy, with and without parent strategy, interventions delivered by experts and were based on a theory or framework	*Physical activity outcome measures:* • Counts per minute • Percentage of time in sedentary and light activity and MVPA • Step count	**Positive:** Overall, interventions significantly improved child physical activity (SMD 0.44; 95% confidence interval [CI]: 0.12–0.76) **Positive:** Significant effects were found for interventions that included structured activity, were delivered by experts and used theory	Despite aiming to generate practice-relevant information, our findings indicate the current evidence base for childcare-delivered physical activity interventions provides limited direction for policymakers and practitioners The results showed pragmatic interventions are not likely to be effective and that information on cost and adverse effects is almost universally lacking Positive effect sizes were identified for a number of intervention characteristics, such that structured activity, environmental enhancements and use of theory should continue to be recommended for

												childcare-based interventions broadly
40.	Healthier choices in school cafeterias: A systematic review of cafeteria interventions	Gordon, Katelyn; Dynan, Linda; Siegel, Robert	2018	Systematic review	Child (*Grades K–12*)	2012-2017	48 (Qualitative) 48 (Quantitative)	Did not specify	*System 1 (fast and intuitive thinking) interventions:* (1) Emoticon labelling of healthier choices (2) Incentives such as small prizes (3) Making healthier choices easier or more convenient to purchase (4) Convenience (e.g. food placement, healthy food line) (5) Increased attractiveness or appeal (e.g. naming) (6) Associating healthy choices with positive images such as cartoon characters *System 2 (slow and cognitively demanding) interventions:* (1) Classroom nutritional education (2) Nutritional information posting (3) Educational programs outside the classroom	Change in BMI status Change of at least 30% in food-related behaviour	**Positive:** By defining success as a 30% improvement in a desired outcome or statistically significant reduction in body mass index, 89% of system 1 and 67% of mixed (had both system 1 and 2 elements) were successful	This review found successful system-1 type school cafeteria interventions to be more common than system-2 type interventions and system-2 type interventions are less effective than system 1 "When faced with point-of-purchase system 1, appealing emoticon labels, and/or system 2, appealing calorie labels, adult food selection is influenced positively by emoticons and even more significantly when both labels are present" (p. 276)

									Mixed interventions (Systems 1 & 2)			
41.	Effect of nutrition interventions on diet-related and health outcomes of Aboriginal and Torres Strait Islander Australians: A systematic review	Gwynn, Josephine; Sim, Kyra; Searle, Tania; Senior, Alistair; Lee, Amanda; Brimblecombe, Julie	2019	Systematic review	General	Until 2017	35	Australia	*Dietary Interventions:* (1) Nutrition education and promotion programs (2) Store-based intervention with community health promotion (3) Return to traditional diet (4) Fruit and vegetable subsidy (5) Store environment and/or policy, included store/ organisation/ government policy, food price discounts, and the effect of store manager on diet (6) Preschool meal program	*Nutrition and health outcome measures:* • Biochemical and/or haematological markers of dietary intake and/or health status • Food, diet, and/or nutrient intake measures • Anthropometric measures • Other outcomes	**Positive:** Store-based interventions, including a food price strategy, combined with community health promotion demonstrated most promise in very remote locations, with all describing improvements in diet-related outcomes, although only one was tested for statistical significance. Statistically significant improvements in some health outcome measures including BMI and biochemical/ haematological markers of good nutrition and health **Positive:** In a regional area, the fruit and vegetable subsidy program showed encouraging results with statistically significant improvements in children's	Statistically significant improvements were reported in 14 studies, of which eight reported improvements in biochemical/ haematological markers and either anthropometric and/or diet-related outcomes Store-based intervention with community health promotion in very remote communities, fiscal strategies and nutrition education and promotion programs show promise "Improvements reported in the store-based and community health promotion studies are likely related in part to their adoption of a strong ecological approach and moderate to

											biochemical/ haematological markers of nutrition and health outcomes	strong community engagement in discrete communities, reflecting the strong evidence for approaches to addressing poor dietary intake which are both multi-setting and multi-strategy" (p. 12) Strong Aboriginal and Torres Strait Islander community engagement is essential for effective nutrition intervention research and evaluation
42.	The effect of culinary interventions (cooking classes) on dietary intake and behavioral change: A systematic review and evidence map	Hasan, Bashar; Thompson, Warren, G.; Almasri, Jehad; Wang, Zhen; Lakis, Sumaya; Prokop, Larry J.; Hensrud, Donald D.; Frie, Kristen S.; Wirtz, Mary J.; Murad, Angela L.; Ewoldt, Jason S.; Murad, M. Hassan	2019	Systematic review	General (*Adult, Child)*	1990-2017	30	US, Israel, Australia, Britain, Japan, Ecuador, Denmark, Kenya, Canada	Cooking classes by chefs, dietitians, educators Cooking demonstration Additional components included gardening education, dietary education, physical activity recommendations, goal setting and grocery store tours	Cardiometabolic outcomes: glucose, haemoglobin A1c (HbA1c), insulin, homeostatic model assessment for insulin resistance (HOMA-IR), total cholesterol, triglycerides, low density lipoprotein cholesterol (LDL-C), systolic blood pressure (SBP), diastolic blood pressure	**No effect:** Culinary interventions were not associated with a significant change in body mass index (−0.07 kg/m2, 95% CI: −1.53, 1.40), systolic (−5.31 mmHg, 95% CI: −34.2, 23.58) or diastolic blood pressure (−3.1 mmHg, 95% CI: −23.82, 17.62) or LDL cholesterol (−8.09 mg/dL, 95% CI: −84.43, 68.25)	"Culinary interventions were not associated with a significant change in cardiometabolic risk factors, but were associated with improved attitudes, self-efficacy and a healthier dietary intake in adults and children" (p. 1)

										(DBP) and anthropometric measures (BMI, waist circumference and body fat percentage) Behavioural outcomes: attitude, self-efficacy and healthy dietary intake	**Indicative positive:** Culinary interventions were associated with improved attitudes, self-efficacy and healthy dietary intake in adults and children	
43.	Effectiveness of lifestyle interventions for preventing harmful weight gain among young adults from lower socioeconomic status and ethnically diverse backgrounds: A systematic review	Hayba, N; Partridge, SR; Nour, MM; Grech, A; Allman Farinelli, M	2018	Systematic review	Adolescent (*18–35 y/o*)	1980-2017	30	Australia, US, Canada, Britain, Sweden	*Physical activity interventions, including:* • Diet and exercise • Education • Behaviour change (e.g. goal-setting, self-regulation) • Peer/social support	*Primary outcomes:* • BMI and/or bodyweight *Secondary outcomes:* • Changes in lifestyle behaviours (i.e. diet and physical)	**Inconclusive**	**Inconclusive** Despite the promising results from these five lifestyle interventions using online and mobile components to effectively reach and prevent weight gain in this priority population, the evidence base of high-quality trials is limited
44.	School-based interventions to reduce sedentary behaviour in children: A systematic review	Hegarty, Lynda M; Mair, Jacqueline L; Kirby, Karen; Murtagh, Elaine; Murphy, Marie H	2016	Systematic review	Child	Until 2015	11 (*8 interventions*)	Britain, Australia, NZ, Belgium	*Environment-based interventions:* • Replacing standardised desks and chairs within the classroom with adjustable sit-to-stand desks to reduce sedentary time	Change in sitting time / sedentary time	**Positive:** Multi-component interventions that also include the use of standing desks may be an effective method for reducing children's sedentary time in a school-based intervention	Multi-component interventions that also include the use of standing desks may be an effective method for reducing children's sedentary time in a school-based intervention

									• Incorporating bean-bags, exercise balls and mat space into the classroom *Education-based interventions* *Multi-component interventions*			Longer-term trials are needed to determine the sustained effectiveness of such interventions on children's sedentary time
45.	The impact of interventions to promote healthier ready-to-eat meals (to eat in, to take away or to be delivered) sold by specific food outlets open to the general public: A systematic review	Hillier-Brown, FC; Summerbell, CD; Moore, HJ; Routen, A; Lake, AA; Adams, J; White, M; Araújo-Soares, V; Abraham, C; Adamson, AJ; Brown, TJ	2017	Systematic review	General	1993-2015	30 (*34 interventions*)	US, Britain, Australia	Nuffield intervention ladder: • *Restrict choice:* Trans fat law, changing pre-packed children's meal content, food outlet award schemes • *Guide choice:* Price increases for unhealthier choices, incentive (contingent reward), price decreases for healthier choices • *Enable choice*: Signposting (highlighting healthier/ unhealthier options), telemarketing (offering support for the provision of healthier options to businesses via telephone) • *Provide information:* Calorie labelling law,	*Consumer outcomes*, such as: • Dietary outcomes (e.g. energy intake) • Purchasing behaviour (e.g. sales data) • Attitudes towards healthier menu choice and preference *Food outlet outcomes*, such as: • Changes in retail practices, process outcomes and profit	**Inconclusive**	The quality of evidence was poor; impact of interventions appears to be negligible and inconsistent More 'intrusive' interventions (e.g. restrict choice and manipulate price) appear more effective than less intrusive interventions that simply include providing information and enabling choice (e.g. calorie labelling law) Public health policies and practices that simply involve

									voluntary nutrient labelling, personalised receipts			providing information are unlikely to be effective
46.	Interventions to increase physical activity in children 0–5 years old: A systematic review, meta-analysis and realist synthesis	Hnatiuk, JA; Brown, HE; Downing, KL; Hinkley, T; Salmon, J; Hesketh, KD	2019	Systematic review Meta-analysis	Child (*0–5.9 y/o*)	Until 2017	34	US, Britain, Australia, Belgium, Canada, NZ, Germany, The Netherlands, Switzerland, Chile	Interventions targeting increasing MVPA and LPA: • Education • Goal setting • Skill building • Role modelling • Monitoring • Modification of the physical environment • Tailoring • Received PA monitor (pedometer) • Incentives • Modification of policies	Changes in MVPA (minutes/day) Changes in LPA (minutes/day)	**Positive:** A small but statistically significant positive effect was found for interventions targeting increases in children's MVPA **Neutral:** No evidence of effect was observed for changing in children's LPA	*Suggestions by the authors:* 1. Interventions should be tailored to the target group of parents or care providers, in particular in the form of cultural considerations, community needs and the provision of ongoing support 2. In the context of the childcare setting, the delivery of structured physical activity sessions that can be easily incorporated into the daily 'routine' and are delivered through a hands-on approach may be most effective in increasing children's MVPA 3. Programs should focus on changing parent or provider practices to affect change in children's

												physical activity levels, and also on measuring changes in parent or provider behaviour, to help elucidate the impact of those behaviours on children's physical activity
47.	A systematic review of school-based interventions targeting physical activity and sedentary behaviour among older adolescents	Hynynen, S-T; van Stralen, MM; Sniehotta, FF; Araújo-Soares, V; Hardeman, W; Chinapaw, MJM; Vasankari, T; Hankonen, N	2016	Systematic review	Adolescent (*15–19 y/o)*	Inception until 2013	10 (*13 interventions*)	US, Brazil, Britain, Taiwan, Australia, India, The Netherlands	*Interventions included:* (1) Web-based intervention offering personalised feedback on readiness to change (2) Web-based intervention coupled with the use of accelerometers (3) Using pedometers to encourage walking (4) Intervention targeting the school environment and offering students PA opportunities (5) Health and exercise programs (6) Education — PE courses (7)Lifestyle behaviour changes (8) Multi-component	*Physical activity outcome measures:* • Objectively measured MVPA • Step count • Self reported physical activity *Sedentary behaviour outcome measures:* • Self-reported sedentary activity (e.g. TV viewing (hours/day)	**Inconclusive** *Unique to effective interventions were:* •Information about social and environmental consequences • Graded tasks • Self-monitoring of behaviour • Feedback on behaviour • Problem solving • Goal-setting (behaviour) • Action planning • Social support (unspecified)	**Inconclusive** The review suggested interventions targeting multiple health behaviours were less effective in promoting PA among older adolescents than ones focusing solely on PA or PA and SB There is limited evidence on how best to promote PA and reduce SB among older adolescents in school-based interventions in the long term

48.	Systematic review of dietary salt reduction policies: Evidence for an effectiveness hierarchy?	Hyseni, Lirijie; Elliot-Green, Alex; Lloyd-Williams, Ffion; Kypridemos, Chris; O'Flaherty, Martin; McGill, Rory; Orton, Lois; Bromley, Helen; Cappuccio, Francesco P; Capewell, Simon	2017	Systematic review	General	1975-2015	70	US, Australia, NZ, Britain, The Netherlands, Croatia, Finland, China, Portugal, Japan, Ghana, Spain, Taiwan, France, Vietnam, Mongolia, Syria, Tunisia, Palestine, Turkey, Brazil, Latin America, Argentina, Southeast Asia, Europe	*Dietary counselling:* Individual level: dietary advice on salt intake *Dietary counselling:* School-based and worksite interventions: health education aimed at altering diet *Dietary counselling:* Community level *Mass media campaign* *Nutrition labelling* *Reformulation* *Fiscal interventions:* Tax on salty snacks or on cheese and butter *Multi-component interventions*	gram of salt intake	**Positive:** Multi-component strategies involving both upstream and downstream interventions generally achieved the biggest reductions in salt consumption across an entire population, most notably 4g/day in Finland and Japan, 3g/day in Turkey and 1.3g/day recently in Britain **Positive:** Mandatory reformulation alone could achieve a reduction of approximately 1.45g/day (three separate studies), followed by voluntary reformulation (–0.8g/day), school interventions (–0.7g/day), short-term dietary advice (–0.6g/day) and nutrition labelling (–0.4g/day), but each with a wide range **Indicative positive:** Tax and community	"Comprehensive strategies involving multiple components (reformulation, food labelling and media campaigns) and 'upstream' population-wide policies such as mandatory reformulation generally appear to achieve larger reductions in population-wide salt consumption than 'downstream', individually focused interventions." (p. 2)

											based counselling could each typically reduce salt intake by 0.3g/day **Indicative positive :** Population benefits were derived from health education media campaigns (–0.1g/day) **Indicative positive:** Worksite interventions achieved an increase in intake (+0.5g/day) **Indicative positive:** Long-term dietary advice could achieve a –2g/day reduction under optimal research trial conditions; however, smaller reductions might be anticipated in unselected individuals	
49.	Interventions promoting active transport to school in children: A systematic review and meta-analysis	Jones, Rebecca A; Blackburn, Nicole E; Woods, Catherine; Byrne, Molly; van Nassau,	2019	Systematic review Meta-analysis	Child *(4–11 y/o)*	Inception till 2018	17 *(total)* 11 *(quantitative)*	US, Britain, Australia, Norway, Belgium, Denmark, Spain	Walking school buses Education and encouragement of active travel	Physical activity Physical fitness	Many successful interventions provided a walking school bus alongside other intervention components	"Active travel shows promise in increasing physical activity in primary school children…walking school

		Femke; Tully, Mark A							Both education and encouragement along with a one-day travel event Cycling training Street sensor activation Infrastructure changes Funding allocation (plan for structural changes/ infrastructure)		Education-based interventions found success in improving active travel behaviours *Continuous active travel outcomes:* Most studies had standard mean difference, favoured the intervention *Frequency of active travel outcome:* All studies favoured the intervention *Continuous physical fitness outcomes:* Overall standardised mean difference favoured the control group, effect was not significant	buses and educational strategies most effective for increasing relevant outcomes." No evidence found of increases in physical fitness (likely due to limited evidence) Effect size was not associated with the complexity of an intervention
50.	A systematic review, and meta-analysis, of the impact of health-related claims on dietary choices	Kaur, Asha; Scarborough, Peter; Rayner, Mike	2017	Systematic review Meta-analysis	General	Inception until 2015	31 (*Qualitative*) 17 (*Quantitative*)	Spain, Germany, The Netherlands, Denmark, Greece, Italy, Britain, Belgium, France, North America, Canada, Urguay,	1. Nutrition claims 2. Health claims 3. Both health and nutrition claims Most were choice experiments involving participants rating, on a Likert scale, their intention to purchase or	Likelihood of products being purchased Change in preference or consumption	**Positive:** Products carrying a health-related claim are 75% more likely to be chosen than an identical product without a health-related claim (OR 1.75, 95% CI 1.60–1.91).	"Health-related claims have a substantial effect on dietary choices. However, this finding is based on research mostly conducted in artificial settings. Findings from natural experiments have

								South America, Taiwan, Australia, NZ	consume products; and an experiment to measure how much participants consumed under different claim conditions		**Positive:** Effect is similar for nutrition claims (OR 1.74, 95% CI 1.29–2.35) and health claims (OR 1.73, 95% CI 1.57–1.91)	yielded smaller effects" (p. 1)
51.	Social media use for nutrition outcomes in young adults: A mixed-methods systematic review	Klassen, Karen M; Douglass, Caitlin H; Brennan, Linda; Truby, Helen; Lim, Megan SC	2018	Systematic review	Adult *(most studies included overweight/obese population)*	2000-2017	23	US, Australia, Britain, Brazil	Multi-component interventions with added digital (social media) component	Body composition Waist circumference Dietary intake (often fruit and/or vegetable intake)	The interventions containing a social media component **did not have a positive effect** on either outcome (BMI, weight) Fruit, vegetable and SSB intakes did not differ between intervention and control group	Limited evidence to attribute outcome improvements to use of social media because interventions were often multi-component "The majority of interventions … were not effective for improving outcomes such as weight, BMI, or dietary intake when compared with control groups" (p. 15)
52.	The effectiveness and promising strategies of obesity prevention and treatment programmes among adolescents from disadvantaged backgrounds: A systematic review	Kornet-van der Aa, DA; Altenburg, TM; van Randeraad-van der Zee, CH; Chinapaw, MJM	2017	Systematic review	Adolescent (*12–18 y/o*) *Low SES*	2000-2016	13	India, US, Australia, Sweden, Britain	Multiple interventions targeting obesity prevention and treatment	*Primary outcomes:* • Reduction in BMI *Secondary outcomes:* • Reduction in other adiposity measures	**Inconclusive**	No clear evidence for which strategies are particularly successful for adolescents from disadvantaged backgrounds The current evidence suggests involving adolescents in the

										• Increase in physical activity • Dietary behaviour • Reduction in screen time • Reduction in sedentary behaviour		development and delivering of interventions, the use of experiential activities and involvement of parents seem to be promising strategies
53.	Effectiveness of active school transport interventions: A systematic review and update	Larouche, Richard; Mammen, George; Rowe, David A; Faulkner, Guy	2018	Systematic review	Child Adolescent	2010-2016	27 papers from 30 interventions	US, Britain, Australia, Canada, Belgium, Denmark, NZ, Spain, China	Safe Routes to School School travel planning Walking school buses Cycle training Special events Multi-component interventions Curriculum-based interventions Drop-off spots Crossing guards	Prevalence of active school transport (AST) Number of weekly AST trips/ % of trip using AST/ weekly time spent engaging in AST Odds of cycling to school Number of students engaging in AST Steps and MVPA done	13/27 reported increase AST, 8 reported no changes, 1 reported a decrease in PA in intervention group ("can be viewed as a positive finding given that PA typically declines during the fall and winter") Remaining studies reported inconsistent or conflicting results • Safe Routes to School: trivial to medium effect • School travel planning: null to medium effect • Walking school buses: null to small effect • Cycle training: null to medium effect	Interventions may increase active school transport among children, but effects varied markedly between interventions Included studies suggested interventions with longer follow-up periods may achieve greater modal shifts "Interventions including both educational activities and infrastructure change resulted in greater increases in AST than interventions using only one of these strategies"

											• Special events: null to small effect • Multi-component interventions: trivial to medium effect • Curriculum-based interventions: null to medium effect • Drop-off spots: large effect • Crossing guards: trivial effect	
54.	The impact of worksite interventions promoting healthier food and/or physical activity habits among employees working 'around the clock' hours: A systematic review.	Lassen, Anne Dahl; Fagt, Sisse; Lennernäs, Maria; Nyberg, Maria; Haapalar, Irja; Thorsen, Anne V; Mobjerg, Anna C M; Beck, Anne M	2018	Systematic review	Adult *(1 study included overweight/obese population)*	Inception until 2017	14 papers from 7 studies	East Asia, Europe, US, Australia	A broader lifestyle intervention approach Physical activity Physical strength Offering healthier food or meal options	Dietary habits Physical activity Physical strength Other important outcomes: general wellbeing (quality of life), sleep circadian rhythm, psychological stress, cognitive performance, blood measures, body composition, weight and BMI, influence on work performance, adverse effects	Improved dietary behaviour: increased F&V intake, decreased SSBs intake, increased water intake Improved physical activity Significant impact on physical strength No effect on lean body fat, small positive effect on body fat and waist circumference Significant difference in weight loss between intervention group and control	Small-to-moderate effects in various outcomes — dietary behaviour, PA — suggested that intervention at the community level can result in positive outcomes

											group, or less weight gain in intervention group	
55.	Text messaging interventions for improvement in physical activity and sedentary behavior in youth: Systematic review	Ludwig, Kim; Arthur, Rosie; Sculthorpe, Nicholas; Fountain, Hollie; Buchan, Duncan S	2018	Systematic review	Adolescent *(10–19 y/o)*	Inception until 2017	13 papers from 11 studies	US, Australia, Italy, Spain and Mexico, Hong Kong, Britain	Digital (text messaging) Intervention can be text messaging only or a combination of text messaging and other component(s), including mobile app, Fitbit tracker, online program, pedometer, group sessions, phone calls, online program or school program	Physical activity Sedentary behaviour	Some studies showed promising results for using SMS to improve PA and sedentary behaviour Of 10 interventions that assessed PA, 8 showed positive results in at least 1 PA outcome, 8 assessed sedentary behaviour and 5 showed improvements	"Findings … indicate that multi-component interventions incorporating SMS can be effective in improving PA and sedentary behaviour in adolescents" Unable to conclude which intervention elements positively impact the outcomes Unable to assess effect of SMS independently due to lack of appropriate control group
56.	Effectiveness of mobile health (mHealth) interventions for promoting healthy eating in adults: A systematic review	McCarroll, Rebecca; Eyles, Helen; Ni Mhurchu, Cliona	2017	Systematic review	Adult *(mostly female, mostly overweight/obese population)*	Inception until 2016	33 papers from 23 studies	US, Australia, Britain, Europe, South America, Korea	Digital (mHealth) Use of text messages (feedback about diet, nutrition intake, tailored diet goals, motivational text, or advice on PA, etc.), smartphone apps (monitor food intake, weight, PA, individual phone call from coach,	*Primary outcome:* • Healthy eating *Secondary outcome:* • Biochemical measures (e.g. blood pressure) and anthropometric measures	Healthy eating: Positive effect (5/18 trials) Anthropometric: Improved (5/13 trials) Biomedical measures: No effect Varied results reported on food and nutrient intake	Unable to make conclusion about positive effects of the intervention Small positive effects of mHealth interventions on healthy eating and weight loss

									etc.) or photograph (to record food and drink intake)		Weight loss reported	
57.	Classroom-based physical activity and sedentary behavior interventions in adolescents: A systematic review and meta-analysis	McMichan, Lauren; Gibson, Ann-Marie; Rowe, David A	2018	Systematic review Meta-analysis	Adolescent	Inception until 2017	9 *(total)* 5 *(quantitative)*	US, China, Britain, Iran	Educational intervention Peer mentoring Resource communication and planning intervention (communicating the vital role of PA and ways to overcome barriers to PA) Skills training	Physical activity Sedentary behaviour Psychological outcomes, such as self-efficacy, motivation and attitudes	**Neutral:** Small to no effects on PA and sedentary behaviour	The review suggested the classroom-based interventions had a non-significant effect on PA and a small, non-significant effect on sedentary behaviour
58.	Effectiveness of school food environment policies on children's dietary behaviors: A systematic review and meta-analysis	Micha, Renata; Karageorgou, Dimitra; Bakogianni, Ioanna; Trichia, Eirini; Whitsel, Laurie P; Story, Mary; Penalvo, Jose L; Mozaffarian, Dariush	2018	Systematic review Meta-analysis	Child	Inception until 2014 (and until 2017 in PubMed)	91 *(Total)* 21 *(Quantitative)*	US, Canada, Europe, NZ	*School food environment policies including:* • Direct provision of healthful foods/ beverages: Healthful food/beverage provision in classrooms, via increased availability in cafeterias, tuck shops or vending machines • Competitive food/ beverage standards: Strategies included product-specific restrictions, standards on nutrients, calories or portion sizes or both	*Primary outcome:* Dietary behaviour *Secondary outcome:* In-school meal nutrient content and intake, total caloric intake, adiposity (BMI), overweight/ obesity prevalence, and metabolic measures	*Direct provision policies:* 1. Those that largely target F&V: (i) Increased fruit consumption by 0.27 servings/d; (ii) Increased combined F&V consumption by 0.28 serving/d; (iii) Small impact on vegetable consumption; (iv) No effect on total calories 2. Those that target water: No effects *Competitive food/beverage standards:*	Food environment policies can improve targeted dietary behaviours Direct provision — fruit: Higher effects reported in free provision vs. reduced or full price. No effects identified after provision removal No changes in measures of adiposity Sodium reductions at school do not lead to meaningful compensation elsewhere

									• School meal standards: Polices on school meal (mainly lunch) standards (foods, nutrients/energy) generally targeted F&V, dietary fats and sodium		(i) Reduced SSB intake by 0.18 serving/d; (ii) Reduced unhealthy snacks by 0.17 serving/d; (iii) No effect on total calories *School meal standards:* (i) Increased fruit intake by 0.76 serving/d; (ii) Reduced total fat, saturated fat and sodium; (iii) No effect on total calories No significant decrease in adiposity Mixed results reported in studies assessing metabolic factors	School setting is important to improve overall dietary behaviour of children within and outside school "Findings suggest efficacy of a range of food environment policies" There is a need for "multiple programmatic and policy interventions, including within and outside schools, to improve children's diet" Changes in dietary benefits were evident, yet changes in adiposity metrics were not significant Dietary behaviours were likely unsustained when policies were not in place
59.	The effectiveness of lunchbox interventions in improving the foods and beverages	Nathan, Nicole; Janssen, Lisa; Sutherland, Ra-	2019	Systematic review	Child	1995-2017	13 papers from 10 studies	Mexico, Britain, US, Israel, Australia	Improve the quality of foods in lunchboxes, e.g. by guidelines	Dietary behaviour Weights/ mean	*Fruit and vegetables:* 1. Significant increase in vegetable provision but not fruit	"There is some evidence that lunchbox interventions are effective in improving

	packed and consumed by children at centre-based care or school: A systematic review and meta-analysis	chel; Hodder, Rebecca Kate; Evans, Charlotte EL; Booth, Debbie; Yoong, Sze Lin; Reilly, Kathryn; Finch, Meghan; Wolfenden, Luke		Meta-analysis						servings/ prevalence of food items of interest packed	(quantitative) 2. Increase in fruit and vegetable provision (quasi trials) 3. Increased number of servings of vegetables but not fruit (quasi trials) *Discretionary foods:* 1. Reduced weight of discretionary foods packed 2. No changes *SSBs:* 1. Reduced SSB provision 2. No changes *'Healthy' lunchboxes:* 1. Higher % of students with healthy lunchboxes 2. No changes	the packing of vegetables in children's lunchboxes" Modest effect on vegetable provision Inconclusive effect on other food provision across studies Intervention should "engage parents through active intervention strategies and report the reach of the strategies" Potential to increase success of intervention through improving food environment, e.g. increase availability of healthy foods, reducing marketing of discretionary foods and SSBs
60.	A systematic review of the health and well-being impacts of school gardening: Synthesis of quantitative and qualitative evidence	Ohly, Heather; Gentry, Sarah; Wigglesworth, R; Bethel, A; Lovel, R; Garside, R	2016	Systematic review	School children, school staff, family and commu-	Not specified	40	OECD countries: Britain, Portugal, US, Australia	School gardening programs only Or in combination with other elements such as cooking and/or nutrition education	Physical or mental health or wellbeing 1. Fruit and vegetable intake 2. Nutrient intake 3. Food preferences	**Indicative positive:** 2/13 studies reported statistically significant increase in F&V intakes 4/6 studies report statistically significant	Evidence for changes in fruit and vegetable intake was limited "Limited quantitative evidence that school gardens can have health and wellbeing

					nity members (all ages)					4. Knowledge and attitudes towards food 5. Physical health and PA	changes in nutrient intake 8/13 studies reported an increase preference for F&V 7/10 studies reported positive effects on children's knowledge and attitudes towards food in intervention group	benefits for students" (p. 34) "The qualitative evidence suggests that participants in school gardening programs (including children and adults) may experience and perceive a range of health and wellbeing impacts." (p. 35)
61.	Can targeted policies reduce obesity and improve obesity-related behaviours in socioeconomically disadvantaged populations? A systematic review	Olstad, DL; Ancilotto, R; Teychenne, M; Minaker, LM; Taber, DR; Raine, KD; Nykiforuk, CIJ; Ball, K	2017	Systematic review	General	2004-2015	20 papers from 18 studies	US, The Netherlands, NZ, Britain	*Organisational policies:* Combination of educational measures with environmental change and targeted dietary and PA behaviours *Government policies:* 1) Information/ education provision 2) Fruit and vegetable subsidies 3) Changes to the built environment	*Dietary behaviour:* • F&V intake • Fat intake • Water consumption • Discretionary foods consumption • SSBs • Total daily energy intake *Anthropometric measures*: • BMI • Waist and hip circumference *Physical activity*: • Total daily PA	*Organisational policies:* 50% of organisational policies reported positive change in anthropometric measures; school-based policy interventions were effective in reducing obesity inn the population; 1 school-based organisational policy intervention had no positive outcome *Government policies:* (1) Information/ education had no impact on parental PA level;	Organisational policy interventions had less success in changing anthropometric measures compared with dietary and PA outcomes Multi-component interventions are likely to enhance efficacy Government policies were less successful in changing physical activity compared with dietary behaviours Government policies (1) and (2) were more

										• Number of PE classes	interventions aimed at disadvantaged children and adults showed modest effects (2) F&V subsides had strong positive impacts on children's F&V intake, little effect on BMI. Interventions funding many types of foods (SNAP) contributed to weight gain and risk of obesity in women. Targeted F&V subsidy programs (WIC) improved women and children's dietary behaviours (3) New supermarkets in disadvantaged areas showed no impact on dietary behaviours (in both children and adults) or adults' BMI	effective among disadvantaged children than among disadvantaged adults (3)The new supermarket intervention "yielded nearly uniformly null findings in children and adults" Government policies implemented in community settings did not positively influence any outcomes among adults Interventions targeting disadvantaged groups had mixed results, little effects on anthropometric outcomes and moderate effects on behavioural outcomes Common elements of successful policy-containing interventions were making foods and beverages that met nutritional standards available, additional PA opportunities, school self-

												assessment, teacher, child and parental nutritional and PA education
62.	Systematic review of the impact of nutrition claims related to fat, sugar and energy content on food choices and energy intake	Oostenbach, Laura H.; Slits, Esther; Robinson, Ella; Sacks, Gary	In press	Systematic review	General	2003-2018	11	US, Australia, European countries, Germany, Britain, The Netherlands	Nutrition claims related to fat, fat and sugar, fat and energy content on food products	Food choices Energy intake	**Indicative negative:** Nutrition claims can make the appropriate portion size appear to be larger and lead to an underestimation of the energy content of food products	"There is evidence that ... [nutrition claims] may also lead consumers to increase food consumption and overall energy intake. This may run counter to efforts to address overweight and obesity" (p. 2)
63.	The effectiveness of school-based physical activity interventions for adolescent girls: A systematic review and meta-analysis	Owen, Michael B; Curry, Whitney B; Kerner, Charlotte; Newson, Lisa; Fairclough, Stuart J	2017	Systematic review Meta-analysis	Adolescent	2004-2016	20 *(total)* 17 *(quantitative)*	Poland, Australia, Britain, Belgium, US, Cyprus, Iran	*Physical activity multicomponent interventions:* • School environment adaptions • Modified PE lessons • Extracurricular PA sessions • Educational sessions • Counselling sessions • Provision of further opportunities to be physically active *Single-component interventions*:	Physical activity	**Indicative positive:** Significant small positive effect for school-based PA interventions for adolescent girls	Changing PA behaviours in adolescent girls through school-based interventions is challenging

									• Modified PE lessons • After-school dance interventions • Modified playground intervention • Lunchtime PA sessions and after-school PA clubs			
64.	Obesity prevention: A systematic review of setting-based interventions from Nordic countries and The Netherlands	Panter, Jacqueline; Tanggaard Andersen, Pernille; Aro, Arja R; Samara, Anastasia	2018	Systematic review	General	Inception until 2016	33	The Netherlands, Denmark, Finland, Iceland, Norway, Sweden	Community, school or worksite setting w/ at least 1 environmental component. Combination of: *1. Individual* • Individual counselling • Cholesterol screening • Walking test • Health and/or nutrition screening • Professional monitoring of body composition • 'In-balance box' e.g. calorie guide, exercise diary • Computer tailored advice *2. Environmental* • Policy • Supporting material • Organised activities	BMI	*Community-based*: 1. Positive BMI change 2. Negative BMI change 3. No effect *Worksite-based:* No effect *School-based*: 1. No effect (15/23) 2. Positive BMI change 3. Negative BMI change 4. Positive for control group only 5. No data available	Inconclusive results for effects on BMI. "The review was unable to demonstrate associations with BMI outcomes among these settings" Whole-of-community interventions: 50% of the interventions showed no change Worksite-based interventions: no change School-based interventions: most showed no effect

									(free) • Infrastructure • Worksite: encouragement of PA for staff employed • Capacity building in the community, e.g. school food service • Food stores and restaurants, e.g. discount campaigns for foods, food labelling • School: health education • Awareness campaign • Canteen: healthy choice • Food provision, e.g. free healthy meal(s) • Curriculum, e.g. lessons on diet, PA • Teachers, e.g. training for PE teachers to increase active involvement • Parents, e.g. pamphlets on healthy lifestyle • Recommendations and training regarding the interventions applied			

									• School-wide, e.g. implemented strategies from various schools			
65.	Systematic review of randomised controlled trials of interventions that aim to reduce the risk, either directly or indirectly, of overweight and obesity in infancy and early childhood	Redsell, Sarah A; Edmonds, Barrie; Swift, Judy Anne; Siriwardena, Aloysius Niroshan; Weng, Stephen; Nathan, Dilip; Glazebrook, Cris	2016	Systematic review	Child *(0–2 y/o)*	1990-2013	35 papers from 27 studies/trials		1. Nutrition and/or responsive feeding intervention targeted at parents of infants 2. Breastfeeding promotion and lactation support for mothers 3. Parenting and family lifestyles 4. Maternal health 5. Manipulating formula milk composition	*Primary outcomes* (from birth to 7y/o): 1. BMI 2. Weight 3. Weight gain velocity 4. Weight-for-length 5. Weight-for-age *Secondary outcomes* (from birth to 7 y/o): 1. Breastfeeding uptake and duration 2. Timing of introduction of solid food 3. Diet intake and quality 4. Responsive feeding practices 5. PA	*1. Nutrition and/or responsive feeding interventions:* (a) PO: weight decreased, weight increased, lower BMI for age, no significant effects in anthropometric measures, greater growth, lower weight gain rate (b) SO: sedentary behaviour reduced, improved breastfeeding duration, increased F&V intake, less healthy dietary behaviours, increased PA (tummy time), reduced TV watching time, reduced sweet snack intake, reduced juice intake *2. Breastfeeding interventions* Significant improvements in outcomes including uptake, duration and breastfeeding	Any antenatal breastfeeding education can increase uptake of breastfeeding and duration No breastfeeding trials reported "positive effects on infant weight in the first 2 years of life" "Intervention specifically designed to build maternal self-efficacy around infant feeding … may lead to more sustainable changes" "Interventions that aim to improve parental feeding practices, including infant diet and parental responsiveness to infant cues, showed most promise in relation to behaviour change but not weight"

											3. Parenting interventions (a) PO: no effects on weight (b) SO: fewer unhealthful foods consumed *4. Maternal health* (a) PO: no significant effects in reducing weight, higher birthweight, weight-for-length, and BMI, no effects on weight *5. Formula milk* (a) higher protein milk led to greater weight gain velocity, lower protein milk associated with lower mean weight-for-age, weigh-for-length and BMI, "infants fed with hydrolysed protein formula were satiated with less formula that those fed cow's milk"	
66.	Efficacy of population-wide diabetes and obesity prevention programs: An overview of system-	Roberts, Samantha; Pilard, Louis; Chen, Junqiao; Hirst, Jennifer; Rutter, Harry;	2019	Overview of systematic reviews	General	Inception until 2017 *n=11 (before 2010)*	53 (*total*) 22 *(Quantitative)*	Global	Reducing energy consumption through: 1. *Economic measures*: (i) Taxation of sugar-sweetened beverages; (ii) Increased price of	Increase in selection/ purchase/ consumption of healthier options	*Economic measures:* (1) SSB tax — reduction of purchase with increased price; small effects on BMI with	Increased price of SSBs and fast food, decreased price of fruit and vegetables, food labelling and

	atic reviews on proximal, intermediate, and distal outcomes and a meta-analysis of impact on BMI	Greenhalgh, Trisha		Meta-analysis		*n=26 (since 2014)*			fast food; (iii) Fruit and vegetable prices 2. *Policy measures*: (i) Food labelling in grocery and convenience stores; (ii) Menu labelling in restaurants and other food service establishments 3. *Combination of economic, policy, and physical measures*: Changing the layout or food provided or promoted in food stores — "grocery store interventions" Increasing energy expenditure through: 1. *Sociocultural measures*: Mass media campaigns encouraging physical activity 2. *Physical measures*: (i) Park and playground renovations; (ii) Point of decision prompts to encourage stair usage 3. *Combination of economic and physical measures*: Encouraging active travel (walking or cycling rather than using motorised transport)	Decrease total calorie consumption Reduction in BMI Reduction in prevalence of overweight / obesity	increased price; insufficient evidence of impact on probability of obesity / overweight (2) Fast food tax — reduction of purchase with increased price; insufficient evidence of impact on BMI; insufficient evidence of impact on probability of obesity / overweight (3) Fruit and vegetable subsidy — reduction of purchase with increased price; insufficient evidence of impact on BMI; insufficient evidence of impact on probability of obesity / overweight *Policy measures:* (1) Menu labelling — impact on calories ordered only in some contexts / labelling formats / study types; insufficient evidence in real-world settings impacting on the total calories consumed	grocery store interventions were associated with positive effects on diet Park and playground renovations and point-of-choice prompts to increase stair use were associated with positive effects on physical activity Increased price of SSBs, menu labelling, grocery store interventions, and multicomponent interventions were associated with small reductions in BMI Insufficient evidence of impact of any interventions on the prevalence of overweight, obesity, or type 2 diabetes mellitus "Multiple small changes — in menu labelling, food and

									Increasing energy expenditure and decreasing energy consumption: 1. *Combination of physical, policy, sociocultural, and economic measures*: Multi-component community-based interventions		(2) Food labelling — increased selection of healthy options; insufficient evidence on the total calories consumed *Physical and economic measures:* (1) Food stores — increased selection of healthy options; some evidence of weight loss in studies including discounts on healthy food *Sociocultural measures:* (1) Mass media campaigns — insufficient evidence on the total physical activity *Physical measures:* (1) Park and playground renovations — increases in park use following intervention; insufficient evidence on the total physical activity (2) Point of decision prompts — increase in stair use following	drink prices, and grocery stores — may combine and reinforce one another (or, in some cases, work against each other) to generate both immediate and longer term impacts (some of which will be measured and some not)" (p. 959)

											intervention *Economic and physical measures:* (1) Active travel — overall, insufficient evidence. Tailored interventions aimed at households likely to change behaviour most promising; insufficient evidence on the total physical activity; insufficient evidence on reduction in BMI; insufficient evidence on the prevalence of obesity / overweight *Sociocultural, policy, economic, and physical measures:* (1) Multi-component community-based interventions — positive effect on BMI; insufficient evidence on the total physical activity or total calories consumed; insufficient evidence on the prevalence of obesity / overweight	

67.	Can smartphone apps increase physical activity? Systematic review and meta-analysis	Romeo, Amelia; Edney, Sarah; Plotnikoff, Ronald; Curtis, Rachel; Ryan, Jillian; Sanders, Ilea; Crozier, Alyson; Maher, Carol	2019	Systematic review Meta-analysis	Adult	2007-2018	9 *(total)* 7 *(quantitative)*		Digital (smartphone apps) with step counts, PA tracking and feedback on progress	Physical activity	Increased PA but effects were small, non-significant	Modest evidence supporting the effectiveness of smartphone apps to increase physical activity Apps have been most effective in the short term (up to 3 months). Engagement declines over time "Results from the sensitivity analysis suggest that it may be more effective to intervene in PA alone rather than in combination with other health behaviours"
68.	A systematic review of digital interventions for improving the diet and physical activity behaviors of adolescents	Rose, Taylor; Barker, Mary; Jacob, Chandni Maria; Morrison, Leanne; Lawrence, Wendy; Strömmer, Sofia; Vogel, Christina; Woods-Townsend, Kathryn; Farrell, David; Inskip, Hazel; Baird, Janis	2017	Systematic review	Adolescent *(Specific at-risk population)*	Inception until 2015	27	Not specified	Digital including smartphone apps, websites, text messaging, social media, email and PDA (personal digital assistant) use	Dietary behaviour Physical behaviour	*Website interventions* 1. Significant improvements in diet or PA 2. Inconclusive results 3. No effect on calories from fat or F&V servings per 1000 calories *Text message interventions*	It is possible to effect significant health behaviour change in adolescents through digital interventions that incorporate education, goal setting, self-monitoring and parental involvement Most interventions that included a parental element

											1. Did not show significant effect but intervention with nutrition lessons showed increase in F&V consumption 2. No significant effect on PA *Games and apps* 1. Intervention arm had lower attendance and time spent doing PA compared with control arm 2. Increased fruit consumption *Email delivered intervention* 1. No significant effect on dietary or PA behaviours at follow-up *Social media intervention* 1. Significant increase in self-reported PA 2. No significant results for monitored PA *Multi-component in-*	showed significant improvement The review did not find any significant results for app interventions Most text messages and emailing interventions were ineffective at changing behaviours Changes are not sustained in the medium or long term

											tervention with a digital element 1. Increased step count 2. No change in diet or PA 3. Lower SSB consumption	
69.	The influence of menu labelling on food choices among children and adolescents: A systematic review of the literature	Sacco, Jocelyn; Lillico, Heather G; Chen, Emily; Hobin, Erin	2017	Systematic review	Child Adolescent	Inception until 2015	11	Did not specify	Menu labelling (in artificial and real-world settings)	Food choices	*Artificial settings:* Suggested menu labelling may improve food choices *Real-world settings:* 1. Potential to improve food choices 2. No significant effect on food choices	Limited evidence supporting the impact of menu labelling on lowering the energy content of restaurant and cafeteria food choices made for or by children or adolescents Findings from real-world studies (compared with hypothetical studies) suggested menu labelling was likely to be effective in cafeteria settings Unclear if contextual or interpretive menu labelling formats are more effective as compared with numeric calorie information alone

												The traffic light rating system was more likely to be noted by participants compared with calories alone
70.	The impact of menu energy labelling across socioeconomic groups: A systematic review	Sarink, Danja; Peeters, Anna; Freak-Poli, Rosanne; Beauchamp, Alison; Woods, Julie; Ball, Kylie; Backholer, Kathryn	2016	Systematic review	General	Until 2015	18 (4 papers based on one study in New York — all included but referred to as one study; another two papers were based on one SEP, hence, referred to as one study)		Menu labelling	Awareness Purchase outcomes	Based on the 6 studies that evaluated awareness of exposure to menu energy labelling, it appears that both high and low SEP groups notice energy labelling when introduced; however, studies comparing awareness between high and low SEP groups suggest that awareness is likely to be greater for individuals with a higher SEP Two qualitative studies found those with a lower SEP may have difficulty understanding menu energy labels Two studies reported either a significant decline in fast food	The current evidence describing the impact of menu energy labelling within or across SEP is limited in quantity and quality It is difficult to know whether the absence of effectiveness reported in low SEP populations represents a true lack of effectiveness or is a result of a more general lack of policy effectiveness or the limited quality of the reviewed studies

											calories purchased from consumers in high (but not low) SEP neighbourhoods or a significantly greater decline in calories purchased among consumers visiting stores in higher SEP neighbourhoods post policy implementation	
71.	Increasing fruit and vegetable intake among children and youth through gardening-based interventions: A systematic review	Savoie-Roskos, Mateja R; Wengreen, Heidi; Durward, Carrie	2017	Systematic review	Child Adolescent (*2–15y/o*)	2005-2015	14	US, Britain, Australia, Canada	Gardening interventions: gardening-related programming through outside gardens, micro farms, container gardens, or other alternative gardening methods that allowed children to receive hands-on experience with planting, growing and harvesting F&V	F&V intake	**Indicative positive:** 10 out of 14 studies reported statistically significant increases in fruit or vegetable consumption among participants after implementation of a gardening intervention	"Although the evidence is mixed and fraught with limitations, most studies suggest a small but positive influence of gardening interventions on children's F/V intake." (p. 240)
72.	Social marketing including financial incentive programs at worksite cafeterias for preventing obesity: A systematic review	Sawada, Kimi; Wada, Koji; Shahrook, Sadequa; Ota, Erika; Takemi, Yukari; Mori, Rintaro	2019	Systematic review	Adult	2010-2016	3	The Netherlands, US	Social marketing with financial discount on general foods, low energy dense foods or financial reward on achieving dietary goal	Weight Cholesterol level Fruit intake	**No effect:** No significant effect on weight change; no significant effect on total cholesterol levels and fruit intake; no significant results of energy intake/ sales	No clear evidence if the intervention had an effect on weight Incentive-focused intervention incorporating healthy menus at discounted prices in workplace cafeterias was associated

											data between intervention and control group	with an increased intake of fruit
73.	Efficacy of interventions that use apps to improve diet, physical activity and sedentary behaviour: A systematic review	Schoeppe, Stephanie; Alley, Stephanie; Van Lippevelde, Wendy; Bray, Nicola A; Williams, Susan L; Duncan, Mitch J; Vandelanotte, Corneel	2016	Systematic review	General	2006-2016	27	Australia, US, NZ, The Netherlands, Canada, Switzerland, Ireland, Italy, Israel	Digital (health and fitness apps) Intervention can be use of fitness apps or use of fitness apps in combination with other components, such as physical education, parental education, counselling sessions, printed materials, motivational emails, websites and pedometer use	Dietary behaviour Physical activity behaviour Sedentary behaviour Related health outcomes, e.g. weight, blood pressure, quality of life, cholesterol	*Website interventions* 1. Significant improvements in diet or PA 2. Inconclusive results 3. No effect on calories from fat or F&V servings per 1000 calories *Text message interventions* 1. Did not show significant effect	Modest evidence for the efficacy of app interventions to improve diet, physical activity and sedentary behaviours for NCD (non-communicable disease) prevention "Interventions using apps to improve diet, physical activity and sedentary behaviour for prevention show promise for effective behaviour change in children and adults" "Multi-component interventions that combine apps with other intervention strategies appear to be more effective than stand-alone app interventions"
74.	Physical activity equivalent labelling vs. calorie labelling: A systematic review and meta-analysis	Seyedhamzeh, Shirin; Bagheri, Minoo; Keshtkar,	2018	Systematic review Meta-analysis	Adult	2000-2016	8 *(total)* 8 *(quantitative)*	US, Britain, Canada	Food labelling (physical activity labelling and calorie labelling)	Calories ordered	Small reduction in calories ordered in physical activity labelling in minutes vs.	Physical activity calorie equivalent labelling in minutes does not significantly reduce calories ordered

		Abbas Ali; Qorbani, Mostafa; Viera, Anthony J									calories only group No difference in calories ordered in physical activity labelling in miles vs. calories only group	compared with calorie-only labelling
75.	A meta-analysis of food labelling effects on consumer diet behaviors and industry practices	Shangguan, Siyi; Afshin, Ashkan; Shulkin, Masha; Ma, Wenjie; Marsden, Daniel; Smith, Jessica; Saheb-Kashaf, Michael; Shi, Peilin; Micha, Renata; Imamura, Fumiaki; Mozaffarian, Dariush	2019	Meta-analysis	General	1990-2014	60	US, Canada, Europe, Australia, Asia	*Labelling interventions:* 1. Content quantity 2. Nutrition or health-related claims 3. Logos 4. Grading systems 5. Physical activity equivalents Label placements can be on the packages, menus, and other point-of-purchase locations (on shelf, vending machines, posters) In 14 studies, food labelling was combined with other components such as education, mass media campaigns, economic incentives, or direct regulation (restrictions, bans, requirements of the contents	Diet behaviours (e.g. energy intake, vegetable consumption, total fat intake) Industry responses (e.g. changes in product contents in terms of sodium, artificial trans fat)	**Positive:** Food labelling decreased consumer intakes of energy by 6.6% (95% CI= −8.8%, −4.4%, n=31), total fat by 10.6% (95% CI= −17.7%, −3.5%, n=13), and other unhealthy dietary options by 13.0% (95% CI= −25.7%, −0.2%, n=16), while increasing vegetable consumption by 13.5% (95% CI=2.4%, 24.6%, n=5) **Positive:** Evaluating industry responses, labelling decreased product contents of sodium by 8.9% (95% CI= −17.3%, −0.6%, n=4) and artificial trans fat by 64.3%	"… Food labelling reduces consumer dietary intake of selected nutrients and influences industry practices to reduce product contents of sodium and artificial trans fat" (p. 300)

									or availabilities of certain nutrients or food/beverage items)		(95% CI= −91.1%, −37.5%, n=3)	
76.	Environmental interventions to promote healthier eating and physical activity behaviours in institutions: A systematic review	Shaw, Anneliese M; Wootton, Stephen A; Fallowfield, Joanne L; Allsopp, Adrian J; Parsons, Emma L	2019	Systematic review	Adult (*18–45 y/o*)	Inception until 2017	11 papers from 9 studies	US, Denmark, Finland, Norway	Multi-component Environmental changes only Making healthy changes to food content and/or option Introducing health promotion information and/or education Labelling food item Introducing cooking classes for canteen staff Improving fitness facilities Offering individual exercise guidance Offering individual health check-ups	Dietary behaviour Physical activity Anthropometric outcomes: metabolic factors Physical fitness Nutrition knowledge	Food intake and/or food selection quality: • 7/8: significant positive results • 1/8: negative effects on some measures, including fruit intake Physical activity: No significant effect Body composition indices: No significant effect Physical fitness: Significant positive effect Nutrition knowledge: Significant positive effect 2/3 labelling interventions: Significant positive effect on food intake and/or food selection quality	The evidence base appears to be in favour of implementing environmental interventions in institutions to improve the dietary behaviours of adults No evidence was identified that the interventions included in the review resulted in significant positive changes in body measurement and/or body composition indices

											Better presentation of food options intervention resulted in positive effect on food intake	
77.	Obesity prevention and obesogenic behavior interventions in childcare: A systematic review	Sisson, Susan B; Krampe, Megan; Anundson, Katherine; Castle, Sherri	2016	Systematic review	Child *(3–5 y/o)*	2014-2016	97 papers from 71 studies	US, Australia, Britain, Scotland, Israel, Germany, Belgium, France, Switzerland, Turkey, Chile, China	Intervention included 1–3 components, including: PA, e.g. PA education, PA games, movement skills development activities Diet, e.g. healthy diet education/ training, healthy foods provision, teacher-led through games and books on nutrition topics, etc. TV viewing, e.g. education on reducing TV viewing time/ media use, encouragement, monthly newsletter to parents	Outcome measure of obesity, e.g. BMI, waist circumference, skin folds Physical activity Diet Screen time	Obesity: reduced measure of obesity in at least 50% of the studies Physical activity: "73% elicited a desired change in PA outcomes" Dietary behaviours: "87% elicited a desired change in at least one nutrition outcome" Screen time: most presented a favourable effect on screen time	"Most interventions produced the targeted changes in obesity and obesity-associated behaviours" Regarding measure of obesity outcome: "those focusing on children at greater risk may demonstrate higher efficacy" "intervention focusing on the childcare centre environment and that includes structured physical activity during the day, parental engagement, staff training and wellness, and technical support and training seems to facilitate positive changes" "intervention that fo-

												cused on the child-care centre environment and included technical support and training seemed to facilitate positive changes"
78.	Impact of sugar-sweetened beverage taxes on purchases and dietary intake: Systematic review and meta-analysis	Teng, Andrea M; Jones, Amanda C; Mizdrak, Anja; Signal, Louise; Genç, Murat; Wilson, Nick	2019	Systematic review Meta-analysis	General	Inception until 2018	15 studies, 17 outcomes	Chile, US, Spain, France, Finland, Hungary, Mexico	SSB tax	SSB purchase and consumption (sales, purchase, intake)	**Positive:** The equivalent of a 10% SSB tax was associated with an average decline in beverage purchases and dietary intake of 10.0% (95% CI: −5.0% to −14.7%, n = 17 studies, 6 jurisdictions) with considerable heterogeneity between results (I2 = 97%) **Indicative positive:** The equivalent of a 10% SSB tax was also associated with a non-significant 1.9% increase in total untaxed beverage consumption (e.g. water) (95% CI: −2.1% to 6.1%, n = 6 studies, 4 jurisdictions)	Based on real-world evaluations, SSB taxes introduced in jurisdictions around the world appear to have been effective in reducing SSB purchases and dietary intake
79.	Physical activity interventions in faith-	Tristão Parra, Maíra; Porfírio,	2018	Systematic review	Adult	Inception until 2016	18	US, NZ, Australia	Organised PA such as PA classes, strength	1. Physical activity 2. Physical fitness	*Physical activity:* 1. Significant changes	Increased PA can positively influence

	based organizations: A systematic review	Gustavo J.M; Arredondo, Elva M; Atallah, Álvaro N							training, aerobic sessions Contest (e.g. walking) Social support Some included nutrition classes or motivation calls Based on various models and theories: health promotion model, social cognitive theory, social ecology	3. Measures of health (BMI, weight, blood pressure, % body fat)	favouring the intervention (5 out of 18) 2. No significant impact *Physical fitness:* 1. Favoured changes in cardiorespiratory fitness 2. Longer walked distance among participants 3. Better performance in walk test 4. No changes in upper body strength *Measures of health:* 1. Did not result in weight loss 2. Reduced weight, BMI, body fat, waist circumference, hip circumference 3. No changes in blood pressure and blood lipids 4. Increased waist circumference, blood pressure, weight	health and fitness measures, very low quality evidence Interventions were likely to promote weight, BMI, body fat, waist and hip circumference reduction. Yet effects were small and unlikely to lead to significant health benefits Interventions did not have impacts on blood lipids or blood pressure Faith-based organisations are **promising** settings in which to encourage PA, and tackling health inequalities
80.	Effectiveness of policies and programs to combat adult obesity: A systematic review	Tseng, Eva; Zhang, Allen; Shogbesan, Oluwaseun; Gudzune, Kimberly A; Wilson,	2018	Systematic review	Adult	2000-2018	17	US, Australia, Britain, China	*Physical activity/physical and built environment:* Building of light rail extension, housing choice voucher, subsidy	Weight BMI	**Inconclusive:** Physical activity and built environment and food and beverage:	No evidence that policies promoting PA and dietary behaviours had beneficial effects on

		Renee F; Kharrazi, Hadi; Cheskin, Lawrence J; Bass, Eric B; Bennett, Wendy L							for home appliances purchase, categories of compulsory PA in schools, new light rail transit system, free bus passes to older adults *Food and beverage environment:* Opening of supermarket, SNAP program, fast food ban *Messaging environment:* Calories menu labelling in chain restaurants *Multiple environments:* Community and workplace programs for healthy eating, reducing health inequalities program		low strength of evidence regarding impact on BMI/weight **Inconclusive:** Messaging and multiple environment: insufficient strength of evidence regarding impact on BMI/weight	weight/BMI "Results for diet and physical activity outcomes were not consistent"
81.	Physical activity-related policy and environmental strategies to prevent obesity in rural communities: A systematic review of the literature, 2002–2013	Umstattd Meyer, M Renée; Perry, Cynthia K; Sumrall, Jasmin C; Patterson, Megan S; Walsh, Shana M; Clendennen, Stephanie C; Hooker, Steven P; Evenson, Kelly R; Goins, Karin V; Heinrich, Katie M; O'Hara Tompkins,	2016	Systematic review	General	2002-2013	30 articles from 26 distinct studies	Canada, US	Policies Environmental strategies COCOMO (Common Community Measures for Obesity Prevention) Strategy (by strategy number) *Encourage physical activity or limit sedentary activity among children and youth*	Change in psychosocial belief/ support (e.g. PA self-efficacy, readiness to engage in PA, importance of PA, awareness of opportunity for PA) Change in behaviour Change in health	*Psychosocial*: 1. Increased awareness of the importance/ necessity of PA/ PA-related activities 2. Increased PA self-efficacy 3. Improved readiness/ social support to engage in PA activities	"The main findings of both reviews include the importance of making schools the focal point of nutrition- and PA-related interventions and building on existing community resources" "Improvement of public transportation

		Nancy; Eyler, Amy A; Jones, Sydney; Tabak, Rachel; Valko, Cheryl							12. Require physical education in schools 13. Increase the amount of physical activity in physical education programs in schools 14. Increase opportunities for extracurricular physical activity 15. Reduce screen time in public service venues *Create safe communities that support physical activity* 16. Improve access to outdoor recreational facilities 17. Enhance infrastructure supporting bicycling 18. Enhance infrastructure supporting walking 19. Support locating schools within easy walking distance of residential areas 20. Improve access to public transportation 21. Zone for mixed-use development 22. Enhance personal safety in areas where people are or could be physically active	status (anthropometric measures, prevalence of overweight / obesity)	4. No change in belief 5. NR *Behaviour:* 1. Increased participants in PA 2. No significant different between groups and significant higher self-reported PA identified in intervention group 3. Increased PA staff members 4. Increase in PA time spent 5. No change in PA level 6. NR *Health status:* 1. Decreased weight/ BMI 2. Improvements in chronic illness 3. No change 4. Increased overweight / obesity prevalence 5. Decreased overweight / obesity prevalence 6. NR	or geographic availability of supermarkets, may not be applicable to rural communities" Most PA-related strategies were applicable to rural areas

									23. Enhance traffic safety in areas where people are or could be physically active Non-COCOMO Strategy 1. Adopt worksite policies or practices 2. Increase PA opportunities at school outside of PE 3. Increase amount of and access to PA equipment or improve existing equipment resources 4. Promote PA resources 5. Reduce sedentary time in school or preschool setting 6. Provide access to public buildings after hours 7. Adopt PA-supportive curriculum in school district Interventions can be COCOMO strategy only, non COCOMO strategy only or mixed strategies			

82.	Effectiveness of school-based physical activity and nutrition interventions with direct parental involvement on children's BMI and energy balance-related behaviors: A systematic review	Verjans-Janssen, Sacha RB; van de Kolk, Ilona; Van Kann, Dave HH; Kremers, Stef PJ; Gerards, Sanne MP L	2018	Systematic review	Child	Inception until 2018	25	US, Greece, Norway, China, Italy, Australia, Germany	Physical activity Nutrition behaviour	BMI Physical activity Sedentary behaviour Nutrition behaviour	*BMI/ BMI z-score:* 1. Favourable results (mainly small effect) 2. Effective in reducing BMI, but not BMI z-score 3. Negative results *Physical activity:* 1. Increased at least 1 PA outcome measure 2. Ineffective on PA but had positive trend *Sedentary behaviour:* 1. Reduced sedentary behaviour *Nutrition behaviour:* 1. Favourable results (5/12) 2. Small to moderate effect on SSB, F&V, added sugar, and red meat consumption 3. Mixed results 4. Ineffective (5/12)	"The majority of the studies reporting results regarding BMI and BMI z-score found favourable, though mainly small, effects. In addition, almost all studies that measured effects on physical activity behaviour, or sedentary behaviour showed favourable results. The effects on nutrition behaviour were inconclusive" The review demonstrated the potential of school-based interventions with direct parental involvement to improve BMI, BMI z and physical activity, and decrease sedentary behaviour
83.	Efficacy of school-based interventions aimed at decreasing sugar-sweetened beverage consump-	Vézina-Im, Lydi-Anne; Beaulieu, Dominique; Bélanger-Gravel, Ariane; Boucher, Danielle; Sirois, Caroline; Dugas,	2017	Systematic review	Adolescent (*12–17 y/o*)	No restriction (until 2016)	36	US, Canada, Australia, Belgium, Brazil, China, India, Korea, The Netherlands	*Legislative/ environmental:* • Impact of nutrition policies on SSB • Reducing the availability of SSBs	Dietary behaviour (*reduction in SSB consumption)*	**Positive:** More than 70% of all interventions, regardless of whether they targeted individuals, their environment or both, were effective	School-based interventions showed promising results in reducing SSB consumption among adolescents

	tion among adolescents: A systematic review	Marylène; Provencher, Véronique							*Educational/behavioural:* • Healthy eating & physical activity intervention • Intervention aimed at promoting sleep		in decreasing SSB consumption **Positive:** Legislative/ environmental studies had the highest success rate (90.0%) **Positive:** Educational/ behavioural interventions only and interventions that combined educational/ behavioural and legislative/ environmental approaches were almost equally effective in reducing SSB consumption, with success rates of 65.0% and 66.7%, respectively	
84.	Environmental interventions to reduce the consumption of sugar-sweetened beverages and their effects on health (review)	von Philipsborn, P; Stratil, JM; Burns, J; Busert, LK; Pfadenhauer, LM; Polus, S; Holzapfel, C; Hauner, H; Rehfuess, E	2019	Systematic review	General	Inception until 2018	58	General	*Labelling interventions:* 1. Traffic-light labelling 2. Nutritional rating score shelf-labels 3. Menu-board calorie labelling 4. Emoticon labelling *Nutrition standards in public institutions:* 1. Reduced availability of SSBs in schools	*Primary outcomes:* (1) Direct and indirect measures of SSB intake (2) Diet-related anthropometric measures and health outcomes (e.g. BMI, BMI z-scores, waist circumference, waist-to-hip ratio)	*Labelling interventions:* 1. Traffic-light labelling — moderate certainty evidence 2. Nutritional rating score shelf-labels — low-certainty evidence 3. Menu-board calorie labelling — inconclusive	Successful interventions include the following: 1. Labels that are easy to understand, such as traffic-light labels, and labels that rate the healthfulness of beverages with stars or numbers 2. Limits to the availability of SSBs in

									2. Improved access to drinking water in schools 3. Small prizes for the selection of healthier beverages in school cafeterias 4. Improved placement of healthier beverages in school cafeterias 5. Fruit provision in schools *Economic tools:* 1. Price increases in SSBs 2. Financial incentives to purchase low-calorie beverages implemented through supermarket loyalty cards 3. Price discounts on low-calorie beverages in community stores 4. Taxation of SSBs — not included in this review *Whole food supply interventions:* 1. Voluntary food and beverage industry initiatives to improve the nutritional quality of the whole food supply	(3) Any reported adverse outcomes or unintended consequences (e.g. compensatory behaviour, reduced fluid intake and dehydration) *Secondary outcomes:* (1) Measures of financial and economic viability (e.g. costs, cost-effectiveness, return on investment) (2) Diet-related psychosocial variables (e.g. perceived dietary self-efficacy, general self-efficacy) (3) Target group perceptions of the intervention (e.g. satisfaction with the intervention) (4) Consumption of beverages other than SSBs (e.g. the amount of beverages other than SSBs consumed or purchased)	*Nutrition standards in public institutions:* 1. Reduced availability of SSBs in schools — low-certainty evidence 2. Improved access to drinking water in schools — very low-certainty evidence *Economic tools:* 1. Price increases in SSBs — moderate-certainty evidence 2. Price discounts on low-calorie beverages in community stores — inconclusive 3. Taxation of SSBs — not included in this review *Whole food supply interventions:* 1. Voluntary food and beverage industry initiatives to improve the nutritional quality of the whole food supply — inconclusive	schools (e.g. replacing SSBs with water in school cafeterias) 3. Price increases on SSBs in restaurants, stores and leisure centres 4. Children's menus in chain restaurants that include healthier beverages as their standard beverage 5. Promotion of healthier beverages in supermarkets 6. Government food benefits (e.g. food stamps) that cannot be used to buy SSBs 7. Community campaigns focused on SSBs 8. Measures that improve the availability of low-calorie beverages at home, e.g. through home deliveries of bottled water and diet beverages 9. Improved availability of drinking water and diet beverages at home could help people lose weight 10. Small prizes for

									Retail and food service interventions: 1. Healthier default beverages in children's menus in restaurants 2. In-store promotion of low-calorie beverages in supermarkets 3. Healthier vending machines in workplaces and schools 4. Urban planning restrictions on new fast-food outlets 5. Restrictions to the number of stores selling SSBs in remote communities *Action across sectors:* 1. Trade and investment liberalisation in low- and middle-income countries 2. Government food benefit programs with incentives for buying fruit and vegetables and restrictions on the purchase of SSBs 3. Government food benefit programs without incentives for buying fruit and vegetables		*Retail and food service interventions:* 1. Healthier default beverages in children's menus in restaurants — low-certainty evidence 2. In-store promotion of low-calorie beverages in supermarkets — moderate certainty evidence 3. Healthier vending machines in workplaces and schools — inconclusive 4. Urban planning restrictions on new fast-food outlets — very low certainty evidence 5. Restrictions to the number of stores selling SSBs in remote communities — very low certainty evidence *Action across sectors:* 1. Trade and investment liberalisation in low- and middle-income countries — inconclusive 2. Government food	children who chose plain milk in their school cafeteria, as well as emoticon labels, might help children drink less sugar-sweetened milk

									and restrictions on the purchase of SSBs 4. Multi-component community campaigns focused on SSBs *Home-based interventions:* 1. Improved access to low-calorie beverages in the home environment 2. Provision of active video-gaming equipment to teenagers		benefit programs with incentives for buying fruit and vegetables and restrictions on the purchase of SSBs — moderate certainty evidence 3. Government food benefit programs without incentives for buying fruit and vegetables and restrictions on the purchase of SSBs — inconclusive 4. Multi-component community campaigns focused on SSBs — moderate certainty evidence *Home-based interventions:* 1. Improved access to low-calorie beverages in the home environment — moderate certainty evidence *Sugar-sweetened milk interventions:* Emoticon-labelling and small prizes for the selection of	

											healthier beverages in elementary school cafeterias — low to moderate certainty evidence	
85.	Strength of obesity prevention interventions in early care and education settings: A systematic review	Ward, Dianne S; Welker, Emily; Choate, Ashley; Henderson, Kathryn E; Lott, Megan; Tovar, Alison; Wilson, Amanda; Sallis, James F	2017	Systematic review	Child *(0–6 y/o)*	2010-2015	47 papers from 43 studies	US, Australia, Germany, Switzerland, Chile, Belgium, England, Colombia, Spain, Turkey	Lessons on physical activity, healthy diet, variety of foods/food groups Increase PA time Provision of healthy snack Innovation of playground/outdoor area With/without parent engagement	Dietary behaviour Physical activity Screen time Anthropometrics	*Dietary behaviour:* 1. Increased healthful foods intake 2. Decreased unhealthful foods intake 3. No significant results *Physical activity (PA):* 1. Decreased sedentary time 2. Increased PA 3. No significant results *Screen time:* 1. Decrease in time spent at computer and TV 2. No significant results *Anthropometrics:* 1. Decreased zBMI, BMI 2. Decreased % obese 3. Decreased body fat, waist circumference	"The review provided tentative evidence that multi-component, multi-level early care and education interventions with parental engagement are most likely to be effective with anthropometric outcomes" Single-behaviour interventions were more likely to result in better anthropometric outcomes No findings suggested that more comprehensive interventions lead to better behavioural outcomes Good implementation of intervention was likely to produce higher effect size "Interventions

											4. No significant results	strength was positively correlated with reporting of positive anthropometric outcomes for physical activity ..." (p. S37)
86.	Interventions to promote healthy eating choices when dining out: A systematic review of reviews	Wright, Breanna; Bragge, Peter	2018	Systematic review of reviews	Adult	2010-2015	10	Not specified	*Three behavioural interventions:* 1. Social models/norms 2. Manipulation of size 3. Provision of health information	Measure of food consumption / purchase	**Positive:** Use of social models/ social norms **Inconclusive:** Manipulation of portion/ dishware/ cutlery size **Negative** (single intervention) **Positive** (with contextual or interpretive materials) • Provision of health information	Policies or interventions that aim to improve healthy choices or consumption when dining out would benefit from harnessing social norms and positive positioning of social identity Provision of health information should always be accompanied by an interpretative guide, such as traffic lights Manipulation of plate/ portion/ cutlery size may be effective but effect size is small
87.	The effect of interventions targeting screen time reduction: A systematic review and meta-analysis	Wu, Lei; Sun, Samio; He, Yao; Jiang, Bin	2016	Systematic review Meta-analysis	Child Adolescent Adult	1999-2015	14 *(2238 participants)*	Canada, US, NZ, Turkey	Randomised controlled trials (RCTs) Health promotion curriculum	BMI reduction Screen time reduction	The pooled analysis suggested that interventions targeting screen time reduction	Interventions for screen time reduction might be effective in reducing screen time

									Monitor TV viewing and computer use reduction Counselling		had a significant effect on BMI reduction and on screen time reduction	and preventing excess weight
88.	A systematic review of behavioural interventions promoting healthy eating among older people	Zhou, Xiao; Pérez-Cueto, Federico JA; dos Santos, Quenia; Monteleone, Erminio; Giboreau, Agnès; Appleton, Katherine M; Bjørner, Thomas; Bredie, Wender L P; Hartwell, Heather	2018	Systematic review	Adult *(older people)*	2011-2016	16	Spain, Sweden, Japan, Britain, Germany, Iran, US	Dietary educational interventions Meal service interventions Multi-component	F&V intake Food variety Health conditions	*Dietary educational interventions:* 1. Consumption of foods such as F&V, potatoes, eggs, meat: **positive**; dairy product consumption: **no effect** 2. Self-rated health: **no effect** 3. Energy intake: **no effect** *Meal service interventions:* 1. Weight increase (favoured): **positive** 2. Energy intake increase (favoured): **positive** 3. F&V intake increase: **positive** *Multi-component (all included interventions were under the same project, PREDIMED)* 1. Diabetes incidence decreased: **positive**	Dietary education is likely to improve older people's healthy eating behaviour Meal service intervention has successfully improved F&V intake, nutrition status and health condition Multi-component interventions "presented a positive effect on reducing risk of chronic disease" "Effective dietary education, meal service and multi-component dietary interventions increased older people's F&V intake, eating variety and improved their physical conditions and nutrition status"

											2. Lower risk of depression: **positive**	Diet changes from the intervention may possibly result in improve heathy eating and quality of life
89.	Mandatory calorie disclosure: A comprehensive analysis of its effect on consumers and retailers	Zlatevska, Natalina; Neumann, Nico; Dubelaar, Chris	2018	Meta-analysis	General		186 *(calorie disclosure on calories selected)* 41 *(calorie disclosure on calories offered by retailers)*	US	Calorie disclosure	Consumers' and retailers' behaviours	**Positive:** Calorie disclosure for healthy meals also results in a significantly smaller effect (reduction of 2 calories per meal), everything else being equal **Positive:** The study found retailers also respond to mandatory disclosure of calorie information, by reducing on average 15 calories per menu item	A significant and unequivocal calorie disclosure effect for menu labels; disclosure results in both fewer calories selected (−27 calories) and fewer calories offered by retailers (−15 calories)

AST = active school travel interventions; BMI = body mass index; BP = blood pressure; CCM = chronic care model; COCOMO = Common Community Measures for Obesity Prevention; F&V = fruit and vegetables; Kg = kilogram; LPA = light physical activity; MET = metabolic equivalent; Mmol L-1 = millimol per litre; MVPA = moderate to vigorous physical activity; PA = physical activity; PE = physical education; SB = sedentary behaviour; SES = socioeconomic status; SSB = sugar sweetened beverage; VO2 = maximal oxygen uptake