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Obesogenic environment evidence review technical report

Trawsnewid **data** a **thystiolaeth** i **ddeallusrwydd** iechyd cyhoeddus



Transforming **data** and **evidence** into **public health intelligence**

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1 Background and purpose

The *Public Health (Wales) Act 2017* requires Welsh Government to publish a national strategy on preventing and reducing obesity. It has been proposed that the ANGELO Framework (Analysis Grid for Environments Linked to Obesity) should be used to scope the national strategy¹. This framework is rooted in an ecological model recognising environmental, biological and behavioural factors but focuses on how the environment influences obesity. The framework facilitates understanding of how environments may be obesogenic and is also a practical tool for prioritising interventions.

The basic framework considers environmental size (macro or micro) by type: physical (what is available); economic (what are the costs); political/legislative (what are the rules) and sociocultural (what are the attitudes and beliefs)². Within this framework those things which influence food intake and physical activity can be characterised as either obesogenic, contributing to weight gain, or conversely as leptogenic, contributing to weight loss.

A literature review on policy interventions to tackle the obesogenic environment using this framework, with specific regard to the adult population in Scotland, was published in 2011³. This review provided an overview of the literature on obesity prevention in adults across the ANGELO. The initial approach this review adopted was to look for research evidence on effective policy interventions or modifications to the built environment that promoted physical activity, reduced consumption of unhealthy diets or promoted consumption of healthier diets. The method was subsequently extended to include a much broader range of source types. To support the development of the Wales national strategy an evidence review broadly based on and updating this 2011 review was undertaken.

This research evidence review, an overview of evidence addressing the obesogenic environment, has been produced by the Public Health Wales (PHW) Observatory Evidence Service for the PHW Health Improvement Directorate. It forms part of the work being undertaken to support Welsh Government on an Obesity Prevention and Reduction Strategy.

¹ Egger G, Swinburn B. An 'ecological' approach to the obesity pandemic. *BMJ* 1997; 315:477–480.

² Swinburn B, Egger G, Raza F. Dissecting obesogenic environments: The development and application of a framework for identifying and prioritizing environmental interventions for obesity. *Prev Med* 1999; 29: 563-570.

³ Mooney J, Haw S, Frank J. *Policy interventions to tackle the obesogenic environment: Focusing on adults of working age in Scotland*. Edinburgh: Scottish Collaboration for Public Health; 2011.

2 Methods

This research evidence review followed systematic review methodology which was detailed in a protocol, available on request

A matrix was developed to capture the structure of chapters in the original review (Appendix I). This describes the high level definition/scope of the macro and micro environments influencing nutrition or physical activity interventions that were used across the four domains. The matrix also included the specific attributes, interventions and levers identified in the original review as potential influencers of the environment and identified potential areas for update.

This matrix was used to inform the development of search strategies for nutrition and physical activity using subject headings, keywords and free-text across a number of databases. Sources published in English since October 2010 and relevant to adults (19 to 64 years) were included. Full details of the search strategies used are included in a separate search technical document, available on request Initial searches included primary and secondary sources, however given that substantial numbers of relevant secondary sources were identified, a decision was made to focus on these. Citation tracking and reference lists of relevant systematic reviews were used to identify additional secondary sources.

Databases

MEDLINE	IDOX
EMBASE	ICONDA
CINAHL	Sociological Abstracts
Campbell Collaboration	Environmental Abstracts

Contact with subject experts

In addition, a number of subject experts were consulted for additional sources, however none were provided.

2.1 Review questions

Primary question

1. What does the literature say on how the physical, economic, political/legislative or sociocultural environment might influence physical activity and/or diet and contribute to obesity?

Secondary questions

2. What evidence is there on how population levels of obesity, physical activity or excessive caloric consumption are associated with the physical, economic, political/legislative or sociocultural environment?
3. What evidence is there on how modifying the physical, economic, political/legislative or sociocultural environment might contribute to the prevention of obesity or increase physical activity or decrease excessive calorie consumption in adults?
4. What ideas have been proposed as possible solutions to disrupt obesogenic environments but currently have been subject to limited or no evaluation?

2.2 Source identification, selection and data extraction

Comprehensive literature searching and screening by title was undertaken by the advanced information specialist. After searching, title and abstract screening, it was apparent that a substantial number of systematic reviews addressing relevant questions were available. Abstract screening was undertaken by both reviewers, any disagreements were resolved by discussion. Full text screening of all reviews (systematic and other reviews) was undertaken. Repeatability checks were undertaken by the co-reviewer, any disagreements were resolved by discussion. Reference lists of all reviews were screened to identify additional reviews that has not been identified in the original search. Reference lists of all additional reviews subsequently identified were screened until no additional reviews were found. All relevant systematic reviews identified through this process were subject to critical appraisal using a standardised checklist, repeatability checks were conducted by the co-reviewer. Systematic reviews produced to support National Institute of Health and Care Excellence (NICE) guidance, Cochrane Reviews and United States (US) Community Guide systematic reviews were not critically appraised. Systematic reviews that were found not to be well designed and conducted were excluded after critical appraisal, with agreement of both reviewers. Data was extracted into a standardised pro-forma by one reviewer and was checked by a second reviewer.

2.3 Evidence grading

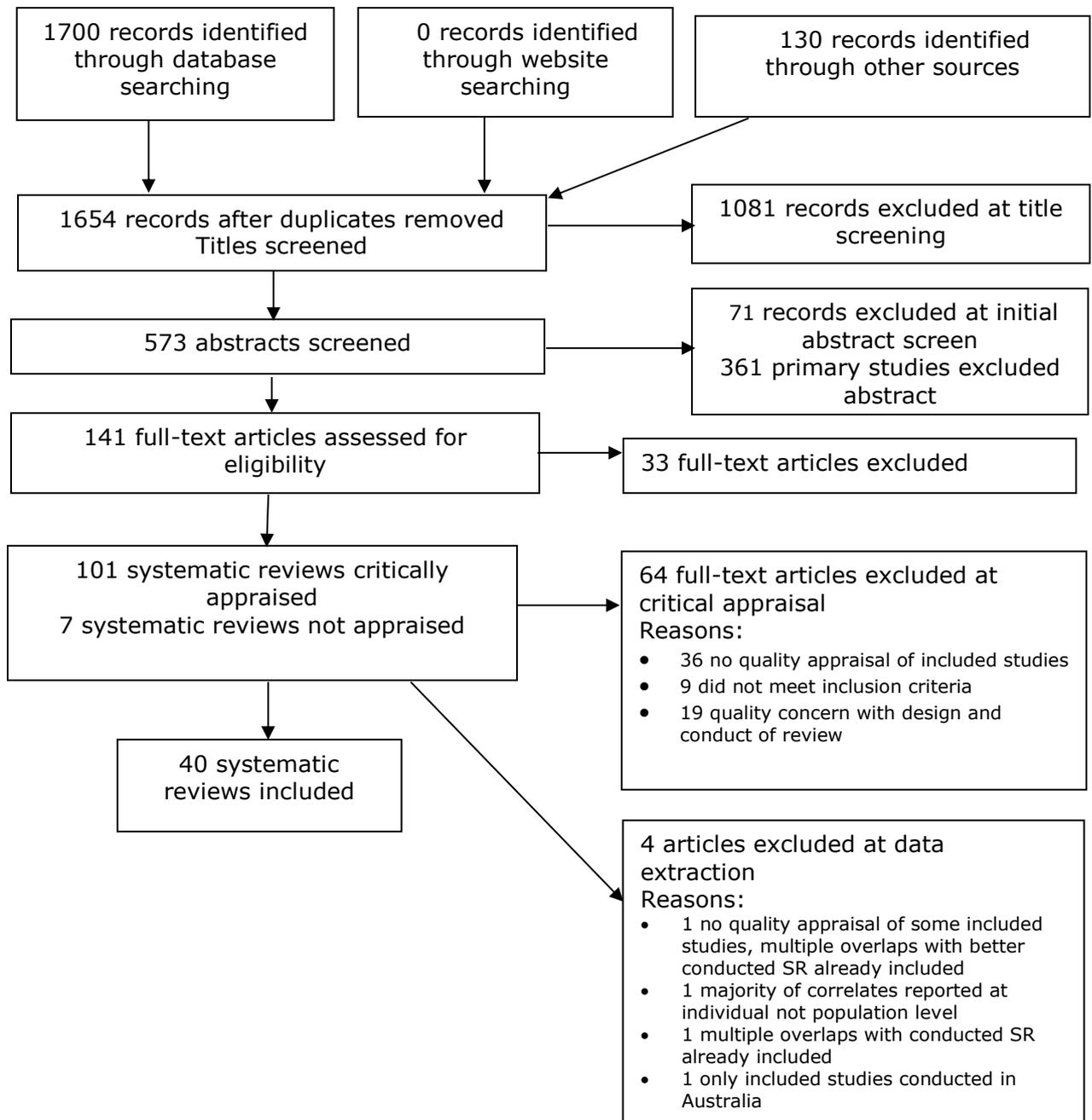
Evidence statements were produced and an evidence grading colour scheme has been applied to indicate the extent to which the potential effectiveness of the intervention is supported by the research evidence synthesised by the source (see Appendix II). In brief:

- Green indicates moderate or good evidence of effectiveness
- Yellow/amber indicates inconsistent/inconclusive evidence
- Red indicates evidence of ineffectiveness
- Grey indicates lack of evidence.

Effect sizes, as expressed by review authors, have been included in evidence statements, where available. In some instances the available evidence was limited to that where the study design was not considered sufficiently robust to evaluate the effectiveness of an intervention (usually uncontrolled before and after studies) or to test an hypothesis (usually cross sectional studies) the wording of the evidence grading has been modified to reflect this.

3 Results

Figure 1: Flow of information through the review process



3.1 Intervention summaries

Following data extraction, in discussion with the Health Improvement Division, the research identified was grouped into categories where potential intervention could be considered: these included price manipulation, labelling and nutrition information, food and portion size

availability, parks and urban green space and interventions influencing work environments and active travel.

Overviews of the findings for each category were produced to summarise the research evidence identified by this review. Within each overview:

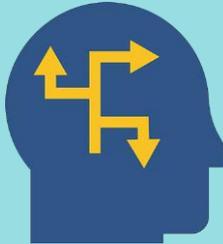
- *Directional thinking* reflects the wording of the evidence statements.
- *Other things to consider* covers other issues identified by review authors that are relevant to interpretation. This includes systematic review authors' comments that they have not included in their conclusions and relevant and/or additional findings not reflected in evidence statements
- *Limits to what we know* includes the limits to the evidence base that systematic review authors or Public Health Wales reviewers have identified.

3.1.1 Price manipulation through taxation

Environment size: Macro

Environment type: Economic / Political / Legislative

Directional thinking



There is some evidence that taxes reduce consumption of sugar sweetened beverages but it is not conclusive¹. Meta-analysis of three non-randomised intervention study arms and two cohort studies found each 10% increase in price reduced intake by 7% (95% confidence interval (CI) 3 to 10%).

[1 systematic review including poor to moderate quality studies]

Evidence that taxes reduce the consumption of unhealthy foods is lacking¹.

[1 systematic review including 1 poor to moderate quality study]

Other things to consider



- There is some evidence from modelling studies that taxes on carbonated drinks and saturated fats would be associated with beneficial dietary changes^{2, 3}.
- The research studies generally examine isolated effects and do not in general consider the nature of substitute purchases, overall diet or total caloric intake in response to price manipulation.

Limits to what we know



- Sales were taken as a reasonable approximation to consumption but may not be identical¹.
- Evidence on the relationship between taxation and diet mostly came from longitudinal observational studies where confounding by other social or environmental variables is possible¹.
- Interventions manipulating price have often also included other types of intervention which may have contributed to their impact¹.
- Modelling studies are simplifications of reality, the accuracy of their findings is limited by the quality of dietary, health and economic input parameters. Modelling is preliminary work; it follows theory and precedes testing. Targeted outcome evaluations of the effect of implemented policies is better evidence of effect than modelling studies
- Structural uncertainty and selection of parameter values in modelling studies were not assessed by review authors².
- Less than half of the included modelling studies in one review used a complete food demand system to try to account for substitute behaviour².
- Most studies in one systematic review failed to account for errors and variation/uncertainty in the modelling process and no studies attempted to validate the epidemiological model used to estimate impacts on consumption, health and disease².

References

1. Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. *PLoS One* 2017; 12(3): e0172277. [[Data extraction table](#)]
2. Eyles H et al. Food pricing strategies, population diets, and non-communicable disease: a systematic review of simulation studies. *PLoS Med* 2012; (12): e1001353. [[Data extraction table](#)]
3. Thow AM et al. A systematic review of the effectiveness of food taxes and subsidies to improve diets: understanding the recent evidence. *Nutr Rev* 2014; 72(9): 551-565. [[Data extraction table](#)]

3.1.2 Price manipulation with subsidies and discounts or price rises

Environment size: Micro

Environment type: Economic

Directional thinking



Offering price reductions on healthier food and drink options to increase purchase and consumption of the promoted products is supported by moderate quality evidence of its effectiveness¹.

[1 systematic review including 20 moderate to good quality studies]

The use of financial discounts to increase purchasing of fruit and vegetables is supported by moderate quality evidence of its effectiveness².

[1 systematic review including 4 moderate to good quality studies]

Subsidies to increase consumption of fruit and vegetables is supported by moderate quality evidence of its effectiveness³. Meta-analysis of 9 study arms 3 RCTS and 4 non-randomised interventional studies found 10% subsidies increased consumption of fruits and vegetables by 14% (95% CI 11 to 17%).

[1 systematic review including 7 moderate to good quality studies]

Subsidies to increase consumption of low fat products, whole grain pizza and dairy products is supported by moderate quality evidence of its effectiveness³. Meta-analysis of 5 RCT intervention arms and 5 non-randomised interventional studies found 10% subsidies increased intake by 16% (95% CI 10 to 23%).

[1 systematic review including 10 moderate to good quality studies]

There is some evidence that redeemable coupons or vouchers for healthy foods and beverages targeting participants in food assistance programmes [3 studies] consumption and those not participating in food assistance programs [2 studies] increases fruit and vegetable but it is not conclusive².

[1 systematic review including 5 poor to moderate quality studies]

There is some evidence that cash rebates increase purchase of healthy foods but it is not conclusive².

[1 systematic review including 5 poor to moderate quality studies]

There is some evidence that discounts the price of low calorie, reduced calorie or non-sugar sweetened beverages increases their purchasing but it is not conclusive².

[2 systematic reviews including 7 poor to moderate quality studies]

There is some evidence that increasing prices on energy dense/ high calorie for nutrient foods reduces their purchase in studies conducted in laboratory or virtual settings⁴.

[1 systematic review including 11 poor to moderate quality studies]

There is some evidence suggesting that price discounting is associated with increased sales of less healthy high sugar products⁵.

[1 systematic review including 2 studies of weak/inappropriate design to determine effectiveness of an intervention]

Evidence that removal of price incentives for large portions of soft drink to reduce their intake in overweight people is lacking⁵.

[1 systematic review including 1 study]

Other things to consider



- In the few studies where weight or obesity outcomes have been measured no impact has been observed despite seemingly beneficial changes to dietary quality¹.
- Modelling studies estimate that subsidies on fruits and vegetables may contribute to beneficial dietary changes^{6, 7}.
- The research studies generally examine isolated effects and do not in general consider the nature of substitute purchases, overall diet or total caloric intake in response to price manipulation².

Limits to what we know



- Most studies do not have significant follow up to assess long-term effectiveness of subsidies in influencing behaviour¹
- It is not possible to know if the effect of subsidies would persist if the incentive is withdrawn¹.
- Interventions manipulating price have often also included other types of intervention and it is difficult to isolate the independent effects of price changes¹.
- Modelling studies are simplifications of reality, the accuracy of their findings is limited by the quality of dietary, health and economic input parameters. Modelling is preliminary work; it follows theory and precedes testing. Targeted outcome evaluations of the effect of implemented policies is better evidence of effect than modelling studies
- Structural uncertainty and selection of parameter values in modelling studies were not assessed by review authors².
- Less than half of the included modelling studies in one review used a complete food demand system to try to account for substitute behaviour².
- Most studies in one systematic review failed to account for errors and variation/uncertainty in the modelling process and no studies attempted to validate the epidemiological model used to estimate impacts on consumption, health and disease².
- Studies on the effect of increased prices and price discounting on energy dense/less healthy foods was not conducted in real shopping environments^{5,6}.

References

1. An R et al. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. *Public Health Nutr* 2013; 16(7): 1215-1228. [[Data extraction table](#)]
2. Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. *Prev Chronic Dis* 2017; 14: E107. [[Data extraction table](#)]
3. Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. *PLoS One* 2017; 12(3): e0172277. [[Data extraction table](#)]
4. Ells LJ et al. *Sugar reduction: the evidence for action. Annexe 2: A mixed method review of behaviour changes resulting from experimental studies that examine the effect of fiscal measures targeted at high sugar food and non-alcoholic drink.* London: Public Health England; 2015. [[Data extraction table](#)]
5. Ells LJ et al. *Sugar reduction: the evidence for action. Annex 3: Review of behaviour changes resulting from marketing strategies.* London: Public Health England; 2015. [[Data extraction table](#)]
6. Eyles H et al. Food pricing strategies, population diets, and non-communicable disease: a systematic review of simulation studies. *PLoS Med* 2012; 9(12): e1001353. [[Data extraction table](#)]
7. Thow AM et al. A systematic review of the effectiveness of food taxes and subsidies to improve diets: understanding the recent evidence. *Nutr Rev* 2014; 72(9): 551-565. [[Data extraction table](#)]

3.1.3 Shelf labelling

Environment size: Micro

Environment type: Physical/ Sociocultural

Directional thinking



Interventions involving shelf labels using summary systems is supported by moderate quality evidence for effectiveness in increasing sales of healthy foods and decreasing sales of unhealthy foods¹.

[1 systematic review including 4 studies of moderate to good quality]

There is some evidence that multicomponent marketing interventions involving shelf labelling in supermarkets are effective in increasing purchases of healthier foods but it is not conclusive¹.

[1 systematic review including 17 studies of varying quality]

Other things to consider



- Few studies have investigated whether consumers overconsume products they perceive as healthy because of labelling².
- In half of the studies asking consumers whether they used nutritional labelling to inform purchase (shelf labelling or front of pack) fewer than 50% did reported doing so².

Limits to what we know



- Many interventions that have been examined in supermarkets are multicomponent therefore it is difficult to disentangle effects of the various components.
- The majority of included studies on supermarket-based interventions were conducted in the US so findings may not generalise to the Wales setting.
- Most supermarket interventions have focused on increasing the consumption of healthy foods; very few have targeted a reduction in the promotion or availability of unhealthy foods¹.
- Field experiments in collaboration with retailers mean that sample size, study duration, intervention scope and study design are not necessarily entirely in the researchers' control¹.

References

1. Cameron A et al. A systematic review of the effectiveness of supermarket-based interventions involving product, promotion, or place on the healthiness of consumer purchases. *Curr Nutr Rep* 2016; 5: 129. [[Data extraction table](#)]
2. Hersey JC et al. Effects of front-of-package and shelf nutrition labeling systems on consumers. *Nutr Rev* 2013; 71 (1): 1-14. [[Data extraction table](#)]

3.1.4 Front of pack labelling

Environment size: Micro

Environment type: Physical/
Sociocultural/ Political/Legislative

Directional thinking



The evidence to determine which type of front of pack labelling is effective in enabling consumers identify healthier products is inconsistent and it is not possible to draw a conclusion¹.
[1 systematic review including 19 studies]

Evidence about the effectiveness of front of pack labelling in influencing consumer purchasing in real shopping environments is lacking¹.
[1 systematic review including 1 study]

Evidence about the effectiveness of nutritional labelling for healthier purchasing from grocery stores is lacking².
[1 systematic review including 1 study]

Other things to consider



- The systematic review contributing information on front of pack labelling only searched for evidence to 2010¹; further primary studies conducted on front of pack labelling in laboratory settings may be available since this review was published. The Cochrane review on nutritional labelling included participants purchasing food or drink from any retail outlet and included studies to April 2017². The latter found one study examining pack labelling in grocery stores which had uninterpretable findings. Studies assessing nutritional summary scores on shelves or logos providing summary assessment of the healthiness of a product were ineligible for the Cochrane review. To be eligible for the Cochrane review the intervention label had to include type and amount of the nutrient.
- Few studies have investigated whether consumers overconsume products they perceive as healthy because of labelling¹.

Limits to what we know



- Studies on front of pack labelling schemes have been mostly conducted in artificial laboratory settings. Only one study was identified in a real shopping environment and this investigated the impact of traffic light labelling on ready to eat meals and sandwiches. This study showed no effect on sales of healthy foods¹.

References

1. Hersey JC et al. Effects of front-of-package and shelf nutrition labeling systems on consumers. *Nutr Rev* 2013; 71 (1): 1-14. [[Data extraction table](#)]
2. Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. *Cochrane Database Syst Rev* 2018; (2): CD009315. [[Data extraction table](#)]

3.1.5 Nutrition information in store

Environment size: Micro

Environment type: Physical/ Sociocultural

Directional thinking



The evidence that nutrition education and promotion of healthier food and drink in supermarkets or stores can increase purchase of those foods is inconsistent and it is not possible to draw a conclusion¹.

[1 systematic review including 15 studies]

The evidence that nutrition education and monetary incentives for customers and store owners in supermarkets or stores can increase availability of healthier foods is inconsistent and it is not possible to draw a conclusion¹.

[1 systematic review including 9 studies]

Evidence that nutrition education plus enhanced availability of healthy food through increased stocking is effective in increasing healthier purchases or consumption is lacking¹.

[1 systematic review including 1 study]

Other things to consider



- Review authors note that there is a need for study interventions to be more clearly defined in terms of their theoretical basis for changing behaviour and measurement of relevant outcomes and their mediating factors¹.

Limits to what we know



- Most studies had a high risk of selection bias¹.
- Included studies failed to note whether assessors were blinded to control and intervention participants¹.

References

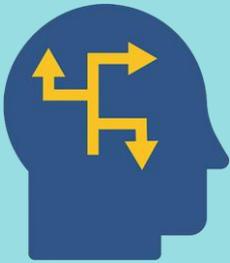
1. Liberato SC et al. Nutrition interventions at point-of-sale to encourage healthier food purchasing: a systematic review. *BMC Public Health* 2014; 14: 919. [[Data extraction table](#)]

3.1.6 Nutrition information during point of sale online

Environment size: Micro

Environment type: Physical/
Sociocultural

Directional thinking



Evidence that tailored nutrition advice, and opportunity to swap certain products for a healthier option at online point-of sale to increase sales of healthier foods is lacking¹.
[1 systematic review including 1 study]

Other things to consider



- The healthier option offered to consumers was a lower fat alternative¹

Limits to what we know



- The included study on online shopping had a high risk of selection bias however the overall quality rating for the study was moderate¹.
- The study was conducted over a period of 5 months¹.

References

1. Liberato SC et al. Nutrition interventions at point-of-sale to encourage healthier food purchasing: a systematic review. *BMC Public Health* 2014; 14: 919. [[Data extraction table](#)]

3.1.7 Opening grocery stores in underserved areas

Environment size: Micro

Environment type: Physical

Directional thinking



There is some evidence that opening new grocery stores/supermarkets in underserved areas is not effective in improving consumption of healthy foods but it is not conclusive¹.

[1 systematic review including 9 poor to moderate quality studies of 7 interventions]

Other things to consider



- Systematic review authors note that interventions that aim to address multifaceted dietary behaviour should also use multidimensional approaches to address them¹.

Limits to what we know



- Few studies evaluate new grocery store interventions¹.
- The studies that are available have been conducted over short timescales and do not allow assessment of effects over the longer term¹.

References

1. Abeykoon AMH, Engler-Stringer R, Muhajarine N. Health-related outcomes of new grocery store interventions: systematic review. *Public Health Nutr* 2017; 20(12): 2236-2248. [[Data extraction form](#)]

3.1.8 Menu labelling

Environment size: Micro

Environment
Political/Legislative

type:

Physical/

Directional thinking



There is some evidence that calorie content labelling of menus may contribute to reducing energy intake but the evidence is not conclusive¹. Meta-analysis of three randomised controlled trials conducted in real world settings demonstrated a reduction of 47kcal in energy purchased (MD -46.72 kcal, 95% CI -78.35 to -15.10, N=1877).

[1 systematic review including poor to moderate quality studies]

There is some evidence that calorie content labels incorporating additional contextual or interpretive information e.g. traffic light symbols may be more effective than those without such information but the evidence is not conclusive². Meta-analysis of calories selected across 10 comparisons was significant; -67 calories (95% CI -116.99 to -17.79; P=0.008). Meta-analysis of calories consumed across 16 comparisons was also significant; -81 calories (95% CI -138.99 to -22.36; P=0.007).

[1 systematic review including poor to moderate quality studies]

There is some evidence that calorie content labels without additional contextual or interpretive information are ineffective in reducing energy selected or consumed but it is not conclusive². Meta-analysis of calories selected across eight comparisons was not significant; -31 calories (95% CI -95.85 to 34.18; P=0.35). Meta-analysis of calories consumed across 8 comparisons was also not significant; -13 calories (95% CI -95.85 to 34.18; P=0.35)

[1 systematic review including poor to moderate quality studies]

There is some evidence that healthy food choice or traffic light labelling in cafeterias (workplace/canteens) is effective in influencing food choices but the evidence is not conclusive³

[1 systematic review including 16 poor to moderate quality studies]

The evidence for menu labelling in restaurants having desirable influences on food choices is inconsistent³.

[1 systematic review including 22 studies].

The evidence on whether making menu-labelling compulsory will encourage food outlets to reformulate or provide healthier options is inconsistent and it is not possible to draw a conclusion⁴.

[1 systematic review including 3 studies]

Other things to consider



- The evidence on labelling relates to immediate short-term choices and is not based on overall daily diet or long-term effects on weight over time². The possibility of compensatory behaviour, at different times of the day, influencing impact on weight is not addressed.
- In some labelling studies concurrent survey results suggested that taste was the main reason for food choices³.
- The percentage of customers noticing calorie information has varied in research studies. A lower percentage of customers report using calorie information than the percentage that report noticing it⁴.
- Better research is required to assess the impact of menu labels varying in content and format on purchasing and consumption^{1, 2}.

Limits to what we know



- Populations in key studies supporting menu labelling are frequently in university or health care settings; effects in general populations may be different^{1, 2, 3}.
- There was an absence of evidence assessing potential moderators of the effect of nutritional labelling including the ability to stratify results by socioeconomic status or health literacy^{1, 2}.
- Many quasi experimental studies identified did not adjust for the potential confounding that can arise when comparison groups are drawn from different populations².
- Randomization methods and blinding of analysis of calories selected or consumed were not reported².

References

1. Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. *Cochrane Database Syst Rev* 2018; (2): CD009315. [[Data extraction table](#)]
2. Sinclair SE, Cooper M, Mansfield ED. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. *J Acad Nutr Diet* 2014; 114(9): 1375-1388. [[Data extraction table](#)]
3. Fernandes AC et al. Influence of menu labeling on food choices in real-life settings: a systematic review. *Nutr Rev* 2016; 74(8): 534-548. [[Data extraction table](#)]
4. Sisnowski J, Street JM, Merlin T. Improving food environments and tackling obesity: A realist systematic review of the policy success of regulatory interventions targeting population nutrition. *PLoS One* 2017; 12(8): e0182581. [[Data extraction table](#)]

3.1.9 Interventions influencing portion size

Environment size: Micro

Environment type: Physical

Directional thinking



There is some evidence that exposure to larger portions, packages, units or associated tableware for food results in increased consumption¹. Meta-analysis of 86 independent comparisons showed a standard mean difference in unregulated consumption of 0.46 (95%CI 0.29 to 0.52). The size of this effect suggests that, if sustained reductions in exposure to larger-sized food portions, packages and tableware could be achieved across the whole diet, this could reduce average daily energy consumed from food by between 215 and 279 kcal in adults

[1 systematic review including poor to moderate quality studies]

There is some evidence that exposure to larger portions or tableware increased the quantities of food adults selected for subsequent consumption¹. Meta-analysis of 13 independent comparisons found a standard mean difference of 0.55 (95% CI 0.35 to 0.75). The size of this effect suggests that, if sustained reductions in exposure to larger-sized food portions and tableware could be achieved across the whole diet, this could reduce average daily energy selected for subsequent consumption from food by between 188 and 403 kcal

[1 systematic review including poor to moderate quality studies]

There is some evidence that exposure to shorter, wider glasses or bottles increased the quantities selected for subsequent consumption among adults¹. Meta-analysis of 3 independent comparisons found a standard mean difference of 2.31 (95% CI 1.79 to 2.83). The size of this effect suggests that, if sustained reductions in exposure to shorter, wider glasses and bottles could be achieved across the whole diet, this could reduce the quantity of non-alcoholic beverages selected for subsequent consumption by between 95g and 296g.

[1 systematic review including poor to moderate quality studies]

The evidence that offering smaller portions of food in workplace food environments decreases calorie intake is inconsistent and it is not possible to draw a conclusion².

[1 systematic review, 2 studies].

The evidence for the use of portion-controlled packaging to reduce intake by young adults in tertiary education settings is inconsistent and it is not possible to draw a conclusion³.

[1 systematic review, 2 studies]

Other things to consider



- The available research does not capture the influence of interventions on overall diet or changes in weight/ Body Mass Index (BMI) over time; outcomes focus on immediate choices and for the most part are unable to account for compensatory behaviours^{1, 2, and 3}.
- Systematic review authors have proposed potential intervention strategies to tackle the portion size effect. These include eliminating pricing practices whereby larger portion and package sizes offer value for money or are offered within price promotions and social marketing campaign to engender public acceptability for interventions to reduce the effects of exposure to large portions¹.
- Systematic review authors tentatively suggest that less healthy and energy dense food may be particularly affected by tighter portion control.¹ Systematic review authors highlight that portion size effects are still present for healthier low energy-dense foods suggesting that their consumption could potentially be differentially increased¹.
- Scaling up interventions on portion sizing will be challenging in the commercial and legal context of a complex food environment.¹
- Where smaller portion sizes have been offered in real world settings, this has often been alongside availability of larger portions. One study showed no effect on calorie intake and one study demonstrated downsizing of portions in some participants². The study demonstrating uptake of smaller portions assessed compensatory eating later in the day and found that those eating smaller portions by day ate more out of the workplace.²

Limits to what we know



- Portion sizes investigated in laboratory research studies were at the larger end of the size continuum. Absolute effect sizes may vary with a range of size differentials.¹
- Research on effects of portion size exposure have been conducted in highly controlled experimental conditions over short periods. Long term sustainability of the effects of prolonged/repeated exposure to smaller portion sizes under free-living conditions remain to be established.¹
- The research on portion sizes does not enable analysis of social differentiation of effects as no studies disaggregated effects by socioeconomic group.¹

References

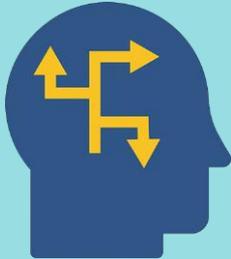
1. Hollands GJ et al. Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. *Cochrane Database Syst Rev* 2015; (9): CD011045. [[Data extraction table](#)]
2. Allan J et al. Environmental interventions for altering eating behaviours of employees in the workplace: a systematic review. *Obes Rev* 2017;18 (2): 214-226. [[Data extraction table](#)]
3. Roy R et al. Food environment interventions to improve the dietary behaviour of young adults in tertiary education settings: A systematic literature review *J Acad Nutr Diet* 2015; 115: 1647-1681. [[Data extraction table](#)]

3.1.10 Interventions in vending machines, pricing, stocking and nutritional information

Environment size: Micro

Environment type: Physical/ Economic/ Sociocultural/

Directional thinking



There is some evidence that reducing the price of healthier snack options in vending machines increases their purchase but the evidence is not conclusive¹.

[1 systematic review including 5 poor to moderate quality studies]

There is some evidence that increasing the availability of healthier snacks in vending machines increases their purchase but the evidence is not conclusive¹.

[1 systematic review including 6 poor to moderate quality studies]

The evidence that point of purchase nutrition information is effective in increasing purchases of healthier items from vending machines is inconsistent and it is not possible to draw a conclusion¹.

[1 systematic review including 8 studies]

Other things to consider



- Systematic review authors note that anecdotal evidence suggests that a barrier to change in vending machines stocking is the belief that healthier items will not sell well. However these authors conclude that if prices are competitive and healthier items are made available, vending machine customers will buy healthier snacks.¹

Limits to what we know



- Interventions involving vending machines included a lack of measured changes to diet or weight and the inability to determine if measured changes were due to the existing clients changing choices they would normally make or due to new customers¹.
- Many interventions were of short duration of interventions and included small sample sizes¹.

References

1. Grech A, Allman-Farinelli M. A systematic literature review of nutrition interventions in vending machines that encourage consumers to make healthier choices. *Obes Rev* 2015; 16 (12): 1030-1041. [[Data extraction table](#)]

3.1.11 Building new parks

Environment size: Micro

Environment type: Physical

Directional thinking



Evidence that introducing new parks increases park visits and physical activity, is lacking¹.
[1 systematic review, 2 studies]

Other things to consider



- People report that their use of parks is influenced by specific features and condition of a park, access to it, aesthetics, safety and whether it offers a social environment².
- People report that safety and security, environmental aesthetics, social relations, convenience and efficiency influence their walking experiences³.
- Poor perception of personal security appears to be a significant deterrent to using existing or new parks and trails however while interventions tend to result in improved perceptions of personal security, there is not always increased park or trail use and physical activity¹.
- Factors outside the scope of interventions such as incomplete construction at follow-up may contribute to mixed effects of park interventions on park visits and physical activity expenditure¹.

Limits to what we know



- One study on building new parks involved a control group, the other did not. The study involving a control group was of limited usefulness due to combination of intervention and control groups in the analysis¹.
- The studies on building new parks were conducted in the US¹.
- The qualitative research assessed influences on people's use of parks rather than factors having an effect on people being physically active in parks; the latter is what may influence levels of obesity. This research only captures data published prior to 2010 and the majority of studies were conducted in the US which may affect the generalisability of this evidence².

References

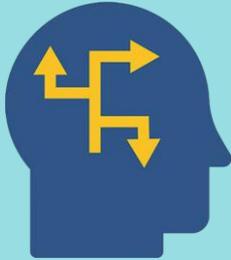
1. Bennie J et al. *Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence review 3: Park, neighbourhood and multicomponent interventions*. London: NICE; 2017. [[Data extraction table](#)]
2. McCormack GR et al. Characteristics of urban parks associated with park use and physical activity: a review of qualitative research. *Health & Place* 2017; 16 (4): 712-726. [[Data extraction table](#)]
3. Dadpour S et al. Understanding the influence of environment on adults' walking experiences: a meta-synthesis study. *Int J Environ Res Public Health* 2016; 13: 731. [[Data extraction table](#)]

3.1.12 Upgrading parks or urban green space

Environment size: Micro

Environment type: Physical

Directional thinking



The evidence on upgrading parks to increase physical activity is inconsistent and it is not possible to draw a conclusion¹.
[1 systematic review including 9 studies]

Evidence on the effects of development or improvement of green space on physical activity is inconsistent².
[1 systematic review including 9 studies]

Evidence that changing the microenvironment within parks (for example by changing or removing seating) increases physical activity is lacking¹.
[1 systematic review including 1 study]

Evidence about the effectiveness of multi-component interventions to improve green space increasing the proportion of individuals engaging in leisure walks, leisure cycling or sports weekly is lacking¹.
[1 systematic review including 1 study]

Other things to consider



- People report that their use of parks is influenced by specific features and condition of a park, access to it, aesthetics, safety and whether it offers a social environment³.
- People report that safety and security, environmental aesthetics, social relations, convenience and efficiency influence their walking experiences⁴.
- Poor perception of personal security appears to be a significant deterrent to using existing or new parks and trails however while interventions tend to result in improved perceptions of personal security, there is not always increased park or trail use and physical activity¹.
- The complexity and scale of the interventions in parks and neighbourhoods makes this an extremely challenging area of research¹. Studies assessing urban green space examine complex interventions with multiple interacting factors at the individual, community and population levels. A number of scientific and evaluative challenges arise for example, aligning research timetables with regeneration timelines, rapidly recruiting a baseline assessment prior to implementation of the intervention and measuring confounders and levels of exposure²

Limits to what we know



- Studies assessing the upgrading of parks included a variety of limitations. Some studies on parks involved inadequate control groups that would not allow reduction of confounding and sometimes giving rise to contamination, with users using both control and intervention parks because of geographic proximity. There were additional problems relating to length and timing of data collection periods, lack of blinding of assessors and small sample sizes¹.
- Only one study on upgrading parks was conducted in the UK^{1, 2}.
- The qualitative research assessing what influences people to use parks does not capture what influences people to be physically active in parks; the latter is what may influence levels of obesity. This research only captures data published prior to 2010 and the majority of studies were conducted in the US which may affect the generalisability of this evidence³.

References

1. Bennie J, et al. *Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence Review 3: Park, neighbourhood and multicomponent interventions*. London: NICE; 2017 [[Data extraction table](#)]
2. Hunter RF et al. The impact of interventions to promote physical activity in urban green space: a systematic review and recommendations for future research. *Soc Sci Med* 2015; 124: 246-256. [[Data extraction table](#)]
3. McCormack GR et al. Characteristics of urban parks associated with park use and physical activity: a review of qualitative research. *Health & Place* 2015; 16 (4): 712-726. [[Data extraction table](#)]
4. Dadpour S et al. Understanding the influence of environment on adults' walking experiences: a meta-synthesis study. *Int J Environ Res Public Health* 2016; 13: 731. [[Data extraction table](#)]

3.1.13 Promotion of parks and urban green space

Environment size: Micro

Environment type: Sociocultural/Physical

Directional thinking



Evidence about the effectiveness of training and resourcing of park managers to promote available green space to increase physical activity is lacking¹.

[1 systematic review including 1 study]

Evidence about the effectiveness of the development or improvement of urban greenspace in combination with promotion of its use, to increase physical activity is lacking¹.

[1 systematic review including 2 studies]

Other things to consider



- The single randomised controlled trial which investigated effects of training and resourcing park managers to promote physical activity within urban green space was assessed by systematic reviewers as being of low risk of bias and showed a significant increase in physical activity and number of park users over the follow up period of 24 months¹.
- Studies assessing urban green space examine complex interventions with multiple interacting factors at the individual, community and population levels. A number of scientific and evaluative challenges arise for example, aligning research timetables with regeneration timelines, rapidly recruiting a baseline assessment prior to implementation of the intervention and measuring confounders and levels of exposure¹.

Limits to what we know



- The studies which incorporated promotion of physical activity within green space were conducted in Australia [one study] and the US [two studies] which have very different climates to the UK.
- Only one of the studies investigating promotion of urban green space alongside development of, or improvement of facilities used a control group and systematic review authors noted that this study had an unclear risk of bias¹.

References

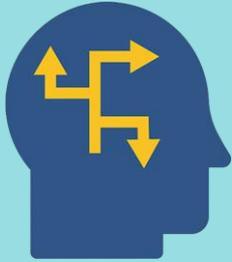
1. Hunter RF et al. The impact of interventions to promote physical activity in urban green space: a systematic review and recommendations for future research. *Soc Sci Med* 2015; 124: 246-256. [[Data extraction table](#)]

3.1.14 Community wide multi-component physical activity interventions

Environment size: Micro

Environment type: Physical/ Sociocultural

Directional thinking



There is some evidence suggesting that community-wide interventions are not effective in increasing physical activity but it is not conclusive¹.

[1 systematic review including 33 poor to moderate quality studies]

There is moderate to good quality evidence that community wide multi-component interventions are unlikely to be effective in improving physical activity¹.

[1 systematic review including 4 moderate to good quality studies]

Other things to consider



- Achieving penetration and under resourcing of projects has been suggested as possible reasons for a lack of effect of community wide interventions to increase physical activity¹. Gaining adequate funding to build, maintain and sustain promotion of facilities may not be feasible.
- Of the 33 studies, 20 included an individual counselling component and 23 a mass media component or other communication strategies alongside environmental changes, and cross sector collaboration¹.

Limits to what we know



- Short duration of studies and poor outcome measures to detect potential effects have been identified as reasons for failure by authors of the primary studies included in the review¹.

References

1. Baker-Philip RA et al. Community wide interventions for increasing physical activity. *Cochrane Database Syst Rev* 2015; (1): CD008366. [[Data extraction table](#)]

3.1.15 Interventions to promote stair use

Environment size: Micro

Environment type: Physical

Directional thinking



There is some evidence supporting the use of motivational signs in combination with directional signs to promote stair climbing in workplaces but it is not conclusive¹.
[1 systematic review including 14 poor to moderate quality studies].

There is some evidence supporting the use of motivational signs to promote stair climbing in public settings but it is not conclusive¹.
[1 systematic review including 34 poor to moderate quality studies]

Evidence about the effectiveness of stairwell enhancements is lacking¹.
[1 systematic review including 3 studies of heterogeneous enhancements]

Other things to consider



- Baseline rates of stair use and stair climbing varied greatly across the research studies available¹.
- Not all the available research study designs assessing stair-use interventions are clearly defined by systematic review authors; the majority are interrupted time series designs.
- About half the research on stair use interventions was conducted in the UK.

Limits to what we know



- Less than half the studies investigating stair use assessed effectiveness during a follow up period and only one study evaluated effectiveness six months later¹.
- Research studies assessing interventions to promote stair use are of limited duration¹.
- The currently available research studies do not determine the impact of stair interventions at the individual level¹.

References

1. Bellicha A et al. (2015) Stair-use interventions in worksites and public settings - a systematic review of effectiveness and external validity. *Prev Med* 2015; 70: 3-13. [[Data extraction table](#)]

3.1.16 Standing or treadmill workstations

Environment size: Micro

Environment type: Physical

Directional thinking



There is some evidence that standing workstations reduce sitting time but it is not conclusive¹.

[1 systematic review including 4 poor to moderate quality studies]

There is some evidence supporting the use of treadmill workstations to increase energy expenditure but it is not conclusive¹.

[1 systematic review including 7 poor to moderate quality studies]

Other things to consider



- It is not clear in the systematic review assessing workstations whether primary study authors assessed the potential compensatory physical activity outside of the workplace.

Limits to what we know



- Research assessing treadmill workstations has limited ability to assess maintenance of effects; the longest study was of 29 weeks duration¹.
- The studies assessing treadmill workstations were very small and may not adequately reflect the impact that might be observed in larger, more diverse populations.

References

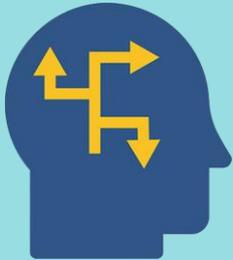
1. Torbeyns T et al. Active workstations to fight sedentary behaviour. *Sports Med* 2014; 44 (9): 1261-1273. [[Data extraction table](#)]

3.1.17 Subsidised public transport

Environment size: Micro

Environment type: Economic

Directional thinking



There is some evidence suggesting that provision of subsidised public transport passes is *associated with* increasing use of public transport but it is not conclusive¹.

[1 *systematic review including 3 studies, 2 of which are of weak/inappropriate design to determine effectiveness of an intervention*]

There is some evidence that provision of subsidised public transport passes is *associated with* increases in physical activity but it is not conclusive¹.

[1 *systematic review including 2 studies of inappropriate design to determine effectiveness of an intervention*]

Other things to consider



- Two of the studies examining the relationship between subsidised public transport passes and public transport use involved free public transport passes¹.

Limits to what we know



- Only one study examining subsidy of public transportation with passes utilised a design appropriate to determine intervention effectiveness and this study only had a follow up of 6 weeks¹.

References

1. Martin A et al. Financial incentives to promote active travel: an evidence review and economic framework. *Am J Prev Med* 2012; 43 (6): e45-e57. [[Data extraction table](#)]

3.1.18 Congestion charging

Environment size: Micro

Environment type: Economic

Directional thinking



There is some evidence that introduction of road pricing/congestion charging is *associated with* decreases in car use and increases in active travel but the evidence is not conclusive¹.

[1 systematic review including 4 studies of weak/inappropriate design to determine effectiveness of an intervention]

There is some evidence suggesting that the introduction of congestion charging is *associated with* increases in public transport use but it is not conclusive².

[1 systematic review including 5 studies of weak/inappropriate design to determine effectiveness of an intervention]

The evidence suggesting that there is *an association* between congestion charging and physical activity is inconsistent and it is not possible to draw a conclusion².

[1 systematic review including 3 studies, 2 of which were of weak/inappropriate design to determine effectiveness of an intervention].

Other things to consider



- There is a paucity of evidence that has been collected from real world implementation of congestion pricing schemes².
- The quality of the available evidence on congestion pricing schemes was considered to be low².
- Many potential studies investigating the impacts of congestion pricing schemes could not be included in the systematic review as they failed to collect data on physical activity or modal shift effects².
- The fact that there is still no clearly defined measure of physical activity and that data on active transport behaviours rarely comprehensively collected are significant barriers to a better understanding of potential population health impacts².

Limits to what we know



- Studies identified by systematic review authors investigating the effects of road pricing interventions are all of weak/inappropriate design to determine the effectiveness of an intervention¹.
- All studies related to congestion charging were likely susceptible to some form of bias through low quality data collection and reporting².

References

1. Martin A et al. Financial incentives to promote active travel: an evidence review and economic framework. *Am J Prev Med* 2012; 43 (6): e45-e57. [[Data extraction table](#)]
2. Brown V et al. Congestion pricing and active transport - evidence from five opportunities for natural experiment. *J Transp Health* 2015; 2 (4): 568-579. [[Data extraction table](#)]

3.1.19 Walking and cycling infrastructure

Environment size: Micro

Environment type: Physical

Directional thinking



There is some evidence that cycle demonstration towns and other interventions to encourage cycling increase active commuting¹.

[1 systematic review, including 3 poor to moderate quality studies]

There is some evidence supporting the use of on-street cycle lanes to increase cycling volume but it is not conclusive¹.

[1 systematic review including 4 poor to moderate quality studies]

The evidence that interventions to improve or build trails and paths to increase walking and cycling is inconsistent and it is not possible to draw a conclusion¹.

[1 systematic review including 9 studies]

Evidence about the effectiveness of street closures for increasing physical activity is lacking¹.

[1 systematic review including 1 study]

Evidence about the effectiveness of bicycle sharing schemes to increase cycling or overall physical activity is lacking².

[1 systematic review including 1 study]

Other things to consider



- Improvements to and walking and cycling infrastructure are more likely to impact people living close by¹.
- Investment in cycling infrastructure can be effective in some cities/towns but not in others. A study assessing the Cycling Cities and Towns initiative in England found differential effects across towns and authors of a primary study note that there is uncertainty about whether cycling would in general increase if comparable investments were made in other towns. Larger effects were found in towns placing greater emphasis on workplace cycling initiatives¹.
- While on street cycle lanes may significantly increase levels of cycling, the absolute increase, in terms of number of individuals, is likely to be very small¹.
- Changes to physical infrastructure did not always result in participants increasing their physical activity levels significantly more than control group. It is possible that this may have been the result of the groups not being different enough in terms of distance to observe an effect¹.
- Increases in physical activity levels may not be in those people who were previously inactive but rather the result of infrastructure changes funnelling existing cyclists and walkers to new paths/streets/trails¹.

Limits to what we know



- Insufficient follow up times may impact whether interventions were found to significantly increase physical activity levels; adequate time is required to allow behaviour change to take place¹.
- Several included studies did not provide enough information on the control group to determine whether it is sufficient to reduce confounding and others include control groups which are so close to intervention areas geographically that they are likely to have caused contamination¹.
- Some included studies did not consider possible influence of outside influences on outcomes¹.
- Some included studies are likely to have been affected by self-selection as participants applied for funding for particular projects or were involved in projects that were generated by area demand¹.
- Some included studies had behavioural elements which may have impacted the outcomes reported, but which could not be separated from environmental aspects¹.
- For some studies, evaluation methods were inconsistent¹.
- Self-reported data was widely used and may be subject to social desirability bias¹.

References

1. Bennie J et al. *Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence review 2: Ciclovia and street closures, trails and safe routes to schools*. London: NICE; 2017. [[Data extraction table](#)]
2. Mayne SL et al. Impact of policy and built environment changes on obesity-related outcomes: a systematic review of naturally occurring experiments. *Obes Rev* 2015;16 (5): 362-375. [[Data extraction table](#)]

4 Limitations

There are a number of limitations to the approach taken for this review, which are important to consider when interpreting its findings:

- This is not an extensive review of all of the evidence relevant to the obesogenic environment, only well designed and conducted secondary sources of evidence have been included. Any relevant primary sources published subsequent to search dates in the included reviews have not been considered in this current review.
- Some relevant topics may not have been included. This may be because there are no well-designed and conducted systematic reviews that assess the literature on a given area of interest. For example, the sociocultural environment in which people make food choices is one area where no systematic reviews were identified.
- The nature of the sources used mean that innovative technologies and novel approaches which have yet to be formally evaluated and published are less likely to have been included.
- The evidence grades assigned to different interventions are designed to give an indication of the strength and direction of the evidence as reviewed by the authors of this evidence review; the quality assessment of the primary research studies included within the reviews is that of the secondary source author.

5 Appendix I

Physical environment

Nutrition	What was included in 2011	Potential areas for update	What might have changed?
<p>Macro level: Features of physical surroundings affecting food purchasing essentially location and density of outlets.</p>	<p>Access to supermarkets – assumption that this provides access to widest choice and lower prices.</p> <p>Concentration of/access to fast food restaurants.</p>	<p>Does access/availability to healthy/unhealthy foods influence purchasing/consumption?</p> <p>Can policy/legislative interventions (e.g. planning law) be used to alter access/availability?</p>	<p>Growth of online shopping.</p> <p>Change in outlet type e.g. move away from superstore model which has increased numbers of outlets through convenience store model and 'low cost' supermarkets.</p>
<p>Micro level: Focused on organisational nutrition environment including home, work, educational settings and other defined environments such as restaurants and takeaway/fast food vendors – type of food and nutritional value rather than location and density.</p>	<p>Restaurants and fast food outlets – changes in proportion of meals taken outside the home.</p>	<p>Further changes in proportion of meals taken outside the home?</p> <p>Impact of efforts to provide 'healthy options' or nutritional information in any settings outside the home?</p>	<p>Availability of research differentiating between takeaway and full service restaurants. Provision of 'healthy options' and/or nutritional information. Rise of US style 'family restaurants'.</p>
	<p>Portion size and energy density – increase in these both in out-of-home settings and commercially prepared meals.</p> <p>Interaction between portion size and energy density.</p>	<p>Changes in portion sizes available in any setting?</p> <p>Impact of changes in portion size?</p>	<p>Responsibility deal</p>

Nutrition	What was included in 2011	Potential areas for update	What might have changed?
		Consumer awareness/ attitude changes/ impact?	
	<p>Educational settings and workplaces – notes that these settings have greater scope for providing healthier options than commercial premises.</p> <p>Again availability of healthy/unhealthy noted. Impact of price.</p> <p>Modifying recipes.</p> <p>Multi-component interventions diet and exercise (activity signs, number of stairs, stair facilitation, lunchtime nutrition, hotel nutrition signs and healthy eating prompts/posters).</p>	<p>Settings based interventions to promote healthy eating.</p> <p>Settings based multi-component diet and exercise interventions.</p>	<p>Might be UK studies.</p> <p>Choice Architecture type interventions.</p>

Physical activity	What was included in 2011	Potential areas for update	What might have changed?
<p>Macro level: The capacity of the built environment to encourage active living, transportation infrastructure.</p>	<p>Recreational physical activity – neighbourhood walkability, access to greenspace, parks and recreational facilities, urban sprawl - association with overweight and obesity. Preference for car oriented vs walkable neighbourhood.</p>	<p>Association between neighbourhood type and levels of physical activity or inactivity Preference for neighbourhood type – car vs physical activity oriented.</p> <p>Does pre-existing activity level influence choice of neighbourhood type? Self-selection issue.</p>	<p>Neighbourhoods specifically designed to encourage physical activity.</p> <p>Research conducted in UK</p>
	<p>Physical activity associated with active living – dominance of cars, availability of high street facilities within walking distance (pharmacies,</p>	<p>Relationship between environment characteristics and active</p>	<p>Relative cost of using cars.</p>

Physical activity	What was included in 2011	Potential areas for update	What might have changed?
	<p>opticians, dentists and banks associated with marginal decrease).</p> <p>Reducing private care dominance (disincentives).</p> <p>Transport infrastructure.</p> <p>Journeys by bike.</p> <p>Land zoning policies. Urban design.</p>	<p>travel, drivers of active travel.</p> <p>Perceptions of safety for cycle journeys.</p> <p>Is there more data on built environment measures promoting a shift away from car use?</p>	<p>Concerns about climate change.</p> <p>Concerns about air pollution.</p> <p>Increase in popularity of cycling, more designated cycle routes.</p>
Micro level: Design features within buildings	Point of decision prompts (stair use)		
	Building design features (stair skip)		

Economic environment

Nutrition	What was included in 2011	Potential areas for update	What might have changed?
Macro level: Nationally imposed fiscal measures, structural interventions.	<p>Sugar sweetened beverages (SSB):</p> <p>Education interventions in children</p> <p>Taxation of SSB and association with obesity/price elasticity</p> <p>Incentive schemes (discounts) to counter low costs of energy dense foods.</p>	<p>Any further data for adults and specifically for the UK?</p> <p>Any work on foods other than SSBs in relation to discounting? Aware of some on fruit and veg from Public Health Outcomes Framework (PHOF) work.</p>	<p>Government is attempting to implement soft drinks industry levy in 2018.</p> <p>Brexit could affect food prices.</p> <p>Trade agreements e.g. recent deregulation of restriction on imports of sugar and high fructose corn syrup (HFCS).</p>

Nutrition	What was included in 2011	Potential areas for update	What might have changed?
<p>Micro level: Local, institutional, site specific price incentives.</p>	<p>Vending machines: availability and price reductions on healthy snacks in workplaces and educational settings.</p> <p>Supermarkets: discounts on healthier foods.</p>	<p>Any UK studies available or general studies on influencing consumer purchasing towards more healthy options with discounts in micro environments?</p>	<p>Growth in online shopping.</p> <p>Hospital/schools policies on what is sold via vending machines.</p>

Physical activity	What was included in 2011	Potential areas for update	What might have changed?
<p>Macro level: Infrastructure to support safety and convenience of active travel.</p> <p>Provision of public transport and increasing costs of private car transport.</p>			
<p>Micro level: Financial incentive schemes.</p>	<p>Financial incentives- limited research identified and that which was found was in older adults and involved efforts to lose weight. Short term studies.</p>	<p>Further studies on incentives, in particular those reporting long term follow-up?</p>	<p>Public Health Wales focus on population health rather than targeted schemes. Sustainability of providing incentives in ongoing austerity?</p> <p>Overarching state subsidy of leisure facilities.</p> <p>Population level incentives internationally e.g. free swimming.</p>

Legislative environment

Nutrition	What was included in 2011	Potential areas for update	What might have changed?
<p>Macro level: Where legislative environment refers to government food and nutrition policies, regulations and laws, and food industry practices and standards.</p>	<p>Trade tariffs/restrictions to influence purchasing patterns: particularly fatty meats, trans fats.</p> <p>Food labelling regulations: providing information for consumers on the nutritional quality of foods: Traffic light system, qualitative research on consumer preferences for standardisation, consistent labelling and correct identification of healthier foods. Also some studies relating to effects of labelling on purchasing choices. Whether labelling leads to manufacturers reformulating products.</p> <p>Industrial and agricultural policy frameworks: agricultural subsidies supporting highly processed commodity derived products. Common Agricultural Policy (CAP) supporting dairy and beef farmers at the expense of fruit and vegetable producers. Reform of agribusiness trade agreements?</p>	<p>Is there any further evidence of impact on purchasing behaviour towards healthier products or that manufacturer's reformulate because of labelling?</p> <p>Is there any evidence combining labelling with pricing and social marketing?</p> <p>Any evidence relating to minimum nutritional standards?</p>	<p>Soft drinks industry levy.</p> <p>Brexit.</p> <p>Any changes at Food Standards Agency with labelling?</p> <p>Brexit- opportunity to change farming subsidy?</p>
<p>Micro level: Self-contained environments - focus on commercial food caterers and outlets as workplaces discussed in chapter 4 of Mooney (2011)⁴.</p>	<p>Commercial catering - expanded concept of food safety to incorporate obesogenicity as they are already significantly regulated by environmental health departments. Trans fat restriction in New York.</p>	<p>Any further examples of legislation leading to change in commercial catering industry?</p>	

⁴ Mooney J, Haw S, Frank J. *Policy interventions to tackle the obesogenic environment: Focusing on adults of working age in Scotland*. Edinburgh: Scottish Collaboration for Public Health; 2011.

Physical activity	What was included in 2011	Potential areas for update	What might have changed?
Macro level: Transport policies, urban planning.	Structural changes cycling demonstration towns. Discussed the World Health Organisation Health Economic Assessment Tool for cycling.		Active Travel (Wales) Act 2013.
Micro level: Interventions mediated through legislative means essentially facilitate behaviour change so are discussed in chapter 6.			

Sociocultural environment

Nutrition	What was included in 2011	Potential areas for update	What might have changed?
Macro level: Cultural & media messages.	Correlation between hours spent viewing television and poor diet, poor health and obesity (sedentary, associated with unhealthy eating and exposure to advertising). Advertising bans (children's programming)	Only one of the areas seems to have been covered, the recommendations extrapolates data from children.	Advertising evidence only relates to TV whereas now it is ubiquitous throughout other media channels. Impact of social media. Rise of celebrity culture.
Micro level: Food culture in Scotland	Refers to another review conducted by the Food Ethics Council exploring cultural associations of unhealthy food practices in the family or home environment. Appears to be a lack of data.	Any other data from Wales or UK on "shared practices and meanings relating to food." Would Choice Architecture fall in this	

Nutrition	What was included in 2011	Potential areas for update	What might have changed?
		category? Anything new regarding this?	

Physical activity	What was covered	Potential areas for update	What might have changed?
Macro level: Large scale media campaigns and public participation	<p>VERB™ campaign (US) aimed at children aged 9-13 years.</p> <p>Change4Life marketing campaign goes beyond physical activity and was aimed at young families initially but latterly tailored for at risk adults (45 to 65 years).</p> <p>Wheeling Walks (West Virginia) multimedia educational intervention.</p>	<p>Further evaluation of Change4Life?</p> <p>Any other evaluations of UK campaigns (around walking?)</p>	<p>Has Change4Life been subject to alteration because of austerity?</p> <p>Is there a planned evaluation of Brisk 10 Public Health England?</p>
	Public participation events and public self-perceptions of cycling ability.	<p>Any UK based studies?</p> <p>Park Run?</p>	
Micro level: Individual, household, workplace interventions	Primary care exercise referral.		Exclude exercise referral interventions- in Wales it is seen as a treatment intervention.
	Household targeted active travel: voluntary travel behaviour change, personalised travel planning.	Any traveller segmentation analysis conducted?	
	Workplace active travel 'culture' workplace travel plans, bicycle purchase schemes.	Further data from the UK?	

6 Appendix II Evidence grading scheme

Evidence grading scheme

Interventions

A (dark green): This intervention is supported by good quality evidence of its effectiveness	Systematic review, of mostly good quality studies, with meta-analysis or majority of studies favouring intervention effect
B (light green): This intervention is supported by moderate quality evidence of its effectiveness	Systematic review of moderate to good quality studies with majority, or meta-analysis favouring intervention effect
C (yellow): There is some evidence supporting the use of this intervention but it is not conclusive	Systematic review of moderate to poor quality studies with majority, or meta-analysis favouring intervention effect or systematic review where the number of studies favouring intervention effect is too small to allow firm conclusions to be drawn
D (orange): The evidence is inconsistent and it is not possible to draw a conclusion.	Systematic review of studies with inconsistent findings or systematic review including one study with mixed findings
E (pink): There is some evidence suggesting that this intervention is ineffective but it is not conclusive	Systematic review of moderate to poor quality studies with majority or meta-analysis favouring no effect intervention or where the number of studies favouring no effect is too small to allow firm conclusions to be drawn
F (red): There is moderate to good quality evidence that this intervention is unlikely to be effective	Systematic review of moderate to good quality studies with majority in favour of control/no effect of intervention
G (purple): There is high quality evidence of ineffectiveness or a specific recommendation that these interventions should not be introduced in the UK	There is high quality review level evidence from meta-analysis of good quality studies suggesting no effect of the intervention
H (grey): Evidence about the effectiveness of the intervention is lacking	Systematic review, or Public Health Wales reviewers conclude that no reliable evidence of effectiveness or ineffectiveness, is available either because there are no relevant studies of appropriate design or because a systematic review found one study of poor quality

Modification for associations

Used when the study design is not sufficiently robust to evaluate the effectiveness of an intervention or to test an hypothesis

C2 (yellow): There is some evidence suggesting that there is an association between the exposure of interest and the outcome but the evidence is not conclusive	Systematic review including only studies with weak and/or inappropriate designs or where the majority of studies have weak and/or inappropriate designs
D2 (orange): The evidence suggesting that there is an association between the exposure of interest and the outcome is inconsistent and it is not possible to draw a conclusion	Systematic review including only studies with weak and/or inappropriate designs or where the majority of studies have weak and/or inappropriate designs with inconsistent findings
H (grey): Evidence about the relationship between the exposure of interest and outcome is lacking	Systematic review that found one study of poor quality

7 Appendix III Data extraction tables

Source details	Results	Conclusions
<p>Abeykoon AMH, Engler-Stringer R, Muhajarine N. Health-related outcomes of new grocery store interventions: systematic review. <i>Public Health Nutr</i> 2017; 20(12): 2236-48.</p> <p>Intervention: Opening of a new grocery retail store/supermarket or a combination of new store and within store interventions</p> <p>Outcome: Physical or psychological health (self-report or physician diagnosed e.g. obesity), psychosocial factors, food security, dietary habits (fruit and vegetable purchase and consumption and other food related behaviour)</p> <p>Source type: Systematic review</p> <p>Searches conducted: 1995 to 24 August 2015</p> <p>Study population: Adults</p> <p>Included study types: Not specified</p> <p>Environment type/s: Food Physical Micro</p>	<p>Description of included studies: Eleven sources, seven interventions. Two interventions (six sources) took place in the UK and the remaining five (five sources) in the US.</p> <p>The two UK interventions were the opening of new food superstores, one in a low income, deprived area.</p> <p>The US interventions were:</p> <ul style="list-style-type: none"> • opening a new supermarket in a low income 'food desert' with a predominantly black population (two interventions) • one full service grocery store in a low socio-economic area where nearest equivalent store was more than one mile away from most residences • one new supermarket in a largely African-American or Hispanic/Latino low income neighbourhood with comparatively low grocery store area availability per person • one Healthy Food Financing Initiative-funded full service supermarket opened in an African-American, low income 'food desert'. <p>Quality of included studies: Nine of the included sources were quantitative and study quality of these was assessed using the Effective Public Health Practice (EPHPP) quality assessment instrument for quantitative studies. Six of the studies were considered weak, two strong and one moderate. Of the two studies not quality assessed, one was purely qualitative and one comprised a combination of qualitative and quantitative methodology.</p> <p>Synthesis: Narrative</p> <p>Findings:</p> <p>Consumption outcomes</p> <p>One study (difference in difference design with matched intervention and comparison groups, rated strong) reported a significant decline in self-reported fruit and vegetable (F&V) availability in both the intervention and comparison groups but salty snack availability in the intervention group was reported to be significantly reduced in the intervention group.</p> <p>A study in Pittsburgh (quasi-experimental, rated strong), US found that those who lived in the intervention neighbourhood consumed significantly less energy, added sugars and calories from solid fats, alcohol and added sugars (-3.11% of daily energy) compared with the comparison neighbourhood. However, there was a non-significant reduction in F&V and wholegrain consumption in both the intervention and control groups.</p> <p>The study in Scotland (controlled before and after, rated moderate) reported a statistically borderline increase of fruit consumption (0.03 portions/ d; 95% CI -0.25, 0.30) and a small (negative) impact on vegetable (-0.11 portions/d; 95% CI -0.44, 0.22) and F&V consumption (-0.10 portions/d; 95% CI -0.59, 0.40) in the intervention compared with comparison neighbourhoods. Separate analyses of 'switchers' (study participants who had a different primary grocery store at the study start and who said that the new store was their primary grocery store during the follow-up) compared with 'non-switchers' showed a slight increase (but not statistically significant) in all the above three consumption levels.</p>	<p>Intervention: Opening new grocery stores/supermarkets in underserved areas.</p> <p>Evidence statement [E]: There is some evidence that opening new grocery stores/supermarkets in underserved areas is not effective in improving consumption of healthy foods but it is not conclusive [9 studies, 7 interventions]</p> <p>Authors' conclusions: Approaches which address single aspects of healthy eating (such as improved access to retail food stores) do not seem to enhance diet and other selected health-related outcomes such as self-rated health, psychological health and BMI in an effective manner over short durations. These interventions might prove successful and result in intended effects in the longer term, yet we do not have enough evidence to say whether this is the case. Conversely, as complex and multifaceted dietary behaviours and resulting health-related outcomes are, interventions that aim to address these problems should also have multidimensional and multipronged approaches if any effect is to be seen. Presently the field of retail food environment interventions is developing and the complex linking pathways that connect these interventions to diet and health are yet to be elucidated. Further evidence is needed in the form of high-quality research to uncover these complex associations, as well as interventions in different communities and contexts with longer follow-up periods to inform policy decisions and recommendations.</p> <p>Limitations: Review authors noted the following. While the body of literature exploring the food environment is large, studies evaluating new grocery store interventions are very few. They limited their search to peer-reviewed literature published in English language after 1995 in selected but comprehensive electronic databases. Therefore, it is possible that relevant studies, for instance those published as non-peer reviewed reports or only in less comprehensive electronic databases, were missed. Further, included studies had used dissimilar methodologies which made comparisons challenging.</p> <p>Comment: Two of the seven interventions were conducted in the UK.</p>

Source details	Results	Conclusions
	<p>In Philadelphia, US a study (controlled pre and post, rated weak) reported in unadjusted intention-to-treat or adopters v. non-adopters analyses that there were no significant difference-in-differences in the F&V consumption.</p> <p>Another study (before and after, rated weak) in the US failed to detect any improvements in healthy eating behaviour. This found that the post intervention group was significantly more likely to either eat out in restaurants or purchase prepared (usually less healthy) meals from the new store, than during the pre-intervention period.</p> <p>No significant associations with food consumption behaviour were reported after the opening of a new grocery store in California (before and after study, rated weak).</p> <p>Studies looking at the opening of a new superstore in Leeds (three studies; two before and after, rated weak and one secondary analysis, rated weak) showed in the initial analysis a slight increase (but not significant) in F&V consumption from 2.88 to 2.92 portions/d. Respondents with poor (≤ 2 portions/d) and the worst (< 1 portion/d) pre-intervention diets improved by 0.44 and 0.83 portions/d during post-intervention, respectively. Further, analyses into switchers showed a significant 0.23 portions/d rise in F&V consumption. The data reanalysis reported a significant increase in F&V consumption in switchers; however, only in those who already consumed more during the pre-intervention. Residents living close to the store benefited the most. A non-significant increase from 2.56 to 2.81 portions/d in F&V consumption was found in respondents within a 750 m radius of the store using a straight-line distance approach while 0.7 portions/d increase (non-significant) was reported among those who lived in close proximity to the store and did not have a motor vehicle, using a road network measurement.</p> <p>BMI Two studies measured BMI; neither of them found significant difference-in-differences through intention-to-treat analyses or on-treatment analyses (one quasi experimental, rated strong; one controlled pre and post, rated weak).</p> <p>Perceptions of food access Two studies that assessed perceptions of food access found positive impacts. One intervention showed significantly greater difference-in-differences for a variety of components related to 'perceived access to healthy food,' among both the intervention v. comparison and regular users v. others in the intervention area. Another intervention revealed significantly greater perceptions of food access (1.47; adjusted) among the intervention v. comparison groups.</p> <p>Other outcomes One study reported increases in walking among those who switched to the new store, while the focus group discussions highlighted improvements in self-esteem among neighbourhood residents due to a new store in Leeds. The level of neighbourhood satisfaction was monitored for the Pittsburgh intervention and showed a significant improvement (11.10 %) in the intervention v. comparison groups.</p>	

Source details	Results	Conclusions
<p>Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. <i>PLoS One</i> 2017; 12(3): e0172277.</p> <p>Intervention: Change in food pricing</p> <p>Outcome: Dietary consumption (change in body weight or BMI was a secondary outcome)</p> <p>Source type: Systematic review</p> <p>Searches conducted: 1990 to June 2014, studies where price data was collected before 1990 were excluded</p> <p>Study population: Not specified</p> <p>Included study types: Interventional (randomised and non-randomised) and prospective cohort</p> <p>Environment type/s: Food Economic/policy/legislative Macro; tax Micro; subsidies</p>	<p>Description of included studies: Thirty studies were included; 23 interventional studies (7 randomised controlled trials (RCT); 16 non-randomised controlled trials) and seven prospective cohorts. Seven of these studies were conducted in children.</p> <p>The majority, 25 studies, were conducted in the US, two in the Netherlands with one each in New Zealand, France, and South Africa.</p> <p>Studies were conducted in different settings including four in supermarkets, two in farmers markets, eight in cafeterias, five in vending machines one in a restaurant and nine in the community and one at state level.</p> <p>Quality of included studies: A potential maximum score of 5 was attributed to a study based one point each for fulfilling criteria across elements of study design, assessment of exposure, assessment of outcome, control for confounding, and evidence of selection bias. Of the studies conducted in adults one of the included studies scored 5; nine studies scored 4; 19 scored 3 and one scored 2.</p> <p>Synthesis: Meta-analysis</p> <p>Findings: A 10% decrease in price (i.e. subsidy) increased consumption of healthy foods by 12% (95% CI 10 to 15%; n=22 studies/intervention arms) whereas a 10% increase price (i.e. tax) decreased consumption of unhealthy foods by 6% (95% CI 4 to 8%; n=15).</p> <p>Subsidies</p> <p>By food group 10% subsidies increased consumption of:</p> <p>Fruits and vegetables by 14% (95% CI 11 to 17%; n=9 I²=99.1%) (three RCTs, two scoring 3 and one scoring 2; 4 non randomised trials one scoring 4, remainder scoring 3).</p> <p>Low fat foods, by 16% (95% CI 10 to 23%; n=10, I²=98.4%) (three RCTs all scoring 3; 5 non randomised studies all quality scores 3).</p> <p>Three studies assessed the effects of subsidies on consumption of low fat milk (one non-randomised study scoring 3), low calorie beverages (one RCT scoring 3) and zero calorie beverages (one non-randomised study scoring 3). None of the three studies showed a significant effect in increasing consumption of such drinks. The study on low calorie beverages showed a significant reduction in consumption.</p> <p>Taxes</p> <p>Each 10% price increase reduced sugar sweetened beverage intake by 7% (95% CI 3 to 10%; n=4, I² 75.7%) (Two non-randomised studies, one scoring 5 and once scoring 3; two cohort studies, one scoring 4 and one scoring 5).</p> <p>Two of three studies assessing price increases on fast food consumption were conducted in children. Each 10% price increase reduced consumption by 3% (95% CI 1 to 10%) (all cohort studies scoring 4).</p> <p>One study assessed the effects of a tax on unhealthy foods. Consumption of unhealthy foods decreased significantly by 7% (95% CI -11 to -4%) for each 10% tax added to unhealthy products.</p> <p>Meta-regression identified direction of price change (tax vs. subsidy), number of intervention components, intervention duration, and study quality score as significant sources of heterogeneity (P heterogeneity<0.05 each).</p>	<p>Intervention: Subsidies on fruit and vegetables</p> <p>Evidence Statement [B]: Subsidies to increase consumption of fruit and vegetables is supported by moderate quality evidence of its effectiveness. Meta-analysis of 9 study arms 3 RCTs and 4 non randomised interventional studies found 10% subsidies increased consumption of fruits and vegetables by 14% (95% CI 11 to 17%).</p> <p>Intervention: Subsidies on low fat products, whole grain pizza and dairy products</p> <p>Evidence Statement [B]: Subsidies to increase consumption of low fat products, whole grain pizza and dairy products is supported by moderate quality evidence of its effectiveness. Meta-analysis of 5 RCT intervention arms and 5 non-randomised interventional studies found 10% subsidies increased intake by 16% (95% CI 10 to 23%).</p> <p>Intervention: Subsidies on low fat milk and low calorie beverages</p> <p>Evidence Statement [E]: There is some evidence that subsidies to increase consumption of low fat milk and low calorie beverages are ineffective but it is not conclusive [3 studies].</p> <p>Intervention [C]: Food taxes on sugar sweetened beverages (SSBs).</p> <p>Evidence Statement: There is some evidence that taxes reduce consumption of SSBs but it is not conclusive. Meta-analysis of 3 non-randomised intervention study arms and two cohort studies found each 10% increase in price reduced intake by 7% (95% CI 3 to 10%).</p> <p>Intervention: Food taxes on unhealthful foods</p> <p>Evidence statement [H]: Evidence that taxes reduce the consumption of unhealthful foods is lacking [1 study]</p> <p>Authors' conclusions: This systematic review and meta-analysis of interventional and prospective observational studies demonstrates that subsidizing healthful foods significantly increases their consumption; while taxation of unhealthy foods and beverages reduces their intake. Formal appraisal of the strength of evidence identified the highest class of evidence for effectiveness of subsidies to increase fruits and vegetables and other healthful foods; and</p>

Source details	Results	Conclusions
	<p>Visual inspection of funnel plots provided mixed evidence for publication bias. However, Beggs or Eggers test did not identify statistical evidence for publication bias, although numbers of studies in some of these analyses were limited.</p>	<p>moderately strong evidence for effects of taxes to reduce SSBs. These findings help to inform the design of fiscal policies, for example including tailored combinations of taxes and subsidies on specific food targets to improve diets and health in populations.</p> <p>Limitations: Review authors noted potential limitations should be considered. While sales records are more objective than self-reported intakes and are a reasonable proxy, consumption may not always be identical to sales. Evidence on the relationship between taxation and diet mostly came from longitudinal observational studies, in which the possibility of confounding by other social or environmental factors cannot be excluded. Many studies of subsidies included additional intervention components that might have contributed to their impact. Evaluation of price change and adiposity was based on few reports, informing the need for additional studies to evaluate this relationship. As with any meta-analysis, evaluation of heterogeneity and publication bias is partly dependent on the total number of studies, and statistical power may have been limited to detect subgroup effects.</p> <p>Comment: Study specific effects were standardised to a 10% price change assuming a linear dose-response relationship.</p> <p>There may be some issues with the appropriateness of some of the meta-analyses in this systematic review. Authors appear to have combined data from different study designs and in some cases have mixed child and adult population data. This may not be appropriate in particular for outcomes such as BMI. Such meta-analyses and others which only meta-analyse different arms of the same study, without additional data from other studies, have not been reproduced in this summary. Many of the meta-analyses exhibit high levels of heterogeneity between the combined studies. For consumption outcome I^2 was large for all price decrease for meta-analyses but none or moderate for price increase (taxation). We have not reproduced meta-analyses that we consider combine data from interventions that target different products. The study authors do discuss heterogeneity.</p> <p>Generalisation to the UK/Wales is probably not a major problem – there may be issues with socio-economic status. The majority of included studies are from the US with one each from South Africa, France, New Zealand and two from the Netherlands. One of the authors received funding from the food industry.</p> <p>The prospective studies and interventions identified by the systematic review did not generally estimate effects on potential substitute products/foods.</p>

Source details	Results	Conclusions
		<p>Overlap in included studies: Includes six studies also included in Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. <i>Prev Chronic Dis</i> 2017; 14: E107; 15 studies included in An R et al. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. <i>Public Health Nutr</i> 2013; 16(7): 1215-1228 and two studies included in Ells LJ et al. Sugar reduction: the evidence for action. Annexe 2: A mixed method review of behaviour changes resulting from experimental studies that examine the effect of fiscal measures targeted at high sugar food and non-alcoholic drink. London: Public Health England; 2015.</p>

Source details	Results	Conclusions
<p>Allan J et al. Environmental interventions for altering eating behaviours of employees in the workplace: a systematic review. <i>Obes Rev</i> 2017;18 (2): 214-226.</p> <p>Intervention: Environmental changes that involved altering the properties or placements of objects or stimuli within micro-environments in the workplace</p> <p>Outcome: Primary outcomes were self-reported or objective measures of purchase/consumption; secondary measures were objective or subjective measures of changes in weight related indices (BMI, weight, body fat percentage)</p> <p>Source type: Systematic review</p> <p>Searches conducted: To November 2014</p> <p>Study population: Employees in the workplace</p> <p>Included study types: All</p> <p>Environment type/s: Food Physical Micro</p>	<p>Description of included studies: Twenty two studies met the inclusion criteria.</p> <p>Of these studies one was a RCT, nine were cluster randomised trials, two matched intervention/control clusters on relevant characteristics, four used intervention/ control clusters without randomisation or matching, four used pre-post evaluations and two interrupted time series (ITS) studies.</p> <p>Thirteen studies were conducted in the US, two in Denmark, five in the Netherlands, one in Brazil and one in Japan.</p> <p>Typical outcome measures were self-reported fruit and vegetable consumption and sales data; physical outcomes such as weight and BMI were reported in only three trials.</p> <p>Quality of included studies: The Cochrane risk of bias tool and the RATIONALE tool were used to assess degree of possible bias in included studies. The Template for Intervention Description and Replication checklist (TIDieR) checklist was used to assess the quality of reporting of the implementation of the intervention. Authors do not report overall quality ratings for each study but provide risk of bias assessments for each study across 12 domains. Authors do note that many studies had a high or unknown risk of bias.</p> <p>Synthesis: Narrative</p> <p>Findings: The majority of interventions were comprised of multiple different elements (e.g. educational messages used in combination with point of purchase prompts or changes to the availability of healthy foods). The most commonly used strategies were labelling (either with calorie content or an indicator of relative 'healthiness'; used in 15 interventions), changes to the availability of healthy foods (used in 15 interventions) and point of purchase prompts (used in 13 interventions). Six studies included financial elements (reducing the cost of healthy options or providing them for free). Few interventions attempted to change the way in which foods were presented (one intervention), to alter the portion sizes available (two interventions), to unconsciously prime consumers to choose healthier products (three interventions) or to change the relative proximity of healthier foods (four interventions). None of the included interventions aimed to alter the ambience of the workplace food environment or to change the functional design of cafeterias, tableware or cutlery.</p> <p>Eating behaviour More than half of included studies (n=13) reported significant changes in primary measures of eating behaviour (increased fruit/veg consumption, increased sales of healthy options and reduction in calories purchased). Effect sizes could often not be calculated, and where they could they had small-medium effects. Of nine studies which included improving the availability of fruits and/ or vegetables alongside other environmental alterations eight increased sales or self-reported consumption of those products.</p> <p>Weight/BMI Three studies assessed changes in weight or BMI. Intervention components varied, all three studies altered availability, and two additionally involved labelling (one of which also included prompting) and the other involved prompting alongside availability. One study produced a small significant improvement in weight/body mass index but as no effects were observed on food intake it may have arisen through another pathway, chance or bias. The two other studies examining weight change found no difference in weight following the intervention; one of these studies found no difference in calorie intake whereas the other identified a significant reduction in the energy content of lunch purchases.</p> <p>Portion size Two studies investigated effects of offering smaller portions of food. One cluster randomised trial in manufacturing workers in the US was an environmental intervention stimulating healthy food choices and physical activity over a period of 12 months. Intervention components involved posters prompting healthy food choice, reduced portion sizes of entrees, half portions of entrees made available, full fat</p>	<p>Intervention: Workplace food environments increasing availability of fruit and vegetables but with a variety of other environmental components</p> <p>Evidence Statement [C]: There is some evidence that increasing the availability of fruit/ and or vegetables with other supporting environmental changes increases purchase or consumption of those products but it is not conclusive. [9 studies]</p> <p>Intervention: Workplace food environment alterations- multicomponent (including increasing availability of healthy foods, labelling and purchase prompting)</p> <p>Evidence statement [D]: The evidence that altering workplace food environments to influence weight/BMI is inconsistent and it is not possible to draw a conclusion [3 studies].</p> <p>Intervention: Offering smaller portions of food alongside larger portions of food in workplace food environments</p> <p>Evidence Statement [D]: The evidence that offering smaller portions of food in workplace food environments decreases calorie intake is inconsistent and it is not possible to draw a conclusion [2 studies].</p> <p>Authors' conclusions: In conclusion, while around half of the identified environmental 'choice architecture' interventions seemed to successfully change eating behaviour in the workplace; the design and reporting of studies was generally poor; effect sizes were small to medium, and there was no compelling evidence that this translated into changes in weight or BMI. 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. This systematic review reveals that the current evidence base does not enable clear recommendations to be made on the implementation of environmental interventions to change eating behaviour within the workplace setting.</p> <p>Comment: No repeatability checks were conducted during screening; uncertainties were considered by a second reviewer.</p> <p>The two studies related to offering smaller portions complement the work of Hollands et al (2015) on exposure to larger portions and are not considered by</p>

Source details	Results	Conclusions
	<p>cheese replaced with half-fat cheeses, at least 1 healthy entrée offered at any time, greater variety of fruit and vegetables offered, proportion of healthy to unhealthy snacks in vending machines increased, stickers on healthy items in vending machines, posters, tables tents and handouts in cafeteria and break room (containing facts, recipes and tips), a website with healthy eating information, binders made available with suggestions for healthy foods for catering meetings and healthy options available at nearby restaurants. In control worksites no information was provided. Energy and nutrient intake was calculated based on self-report in a food frequency questionnaire and BMI (height and weight were measured by study staff. Systematic review authors report no significant difference in calorie intake between intervention and control groups but that a p-value was not reported. Systematic review authors also report no significant difference in BMI between intervention and control groups, again the p-value was not reported.</p> <p>The other study, a cluster randomised trial, conducted over three months in worksite cafeterias in the Netherlands assessed the introduction of a smaller portion of a hot meal in addition to the existing portion with two pricing plans for the smaller portion, proportional pricing and value size pricing and compared this with a group where no smaller portions were available. A proportion of participants replaced a larger meal with a smaller meal. In this study proportional price reduction yielded no additional effect on meal size choice. This trial was the only study included in the systematic review to have measured compensatory behaviours. Systematic review authors found that in this study participants receiving a smaller meal in the worksite café were more likely to have a starter and a larger portion of the main meal when they later ate outside the workplace.</p>	<p>other systematic reviews. One of these studies is also the study which attempts to measure compensatory behaviour outside the workplace.</p> <p>Overlap in included studies: Overlaps with Grech A and Allman-Farinelli M. A systematic literature review of nutrition interventions in vending machines that encourage consumers to make healthier choices. <i>Obes Rev</i> 2015; 16 (12): 1030-1041 on two studies.</p> <p>Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. <i>PLoS One</i> 2017; 12(3): e0172277 and An R et al. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. <i>Public Health Nutr</i> 2013; 16(7): 1215-1228 on four studies.</p> <p>Overlaps with Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548 on three studies.</p> <p><i>Overlaps with Hersey JC et al.</i> Effects of front-of-package and shelf nutrition labeling systems on consumers. <i>Nutr Rev</i> 2013; 71(1): 1-14 on two studies.</p> <p>Overlaps with Sinclair SE et al. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388 on one study.</p>

Source details	Results	Conclusions
<p>An R et al. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. <i>Public Health Nutr</i> 2013; 16(7): 1215-1228.</p> <p>Intervention: Financial subsidies</p> <p>Outcome: Purchase and consumption of healthy foods</p> <p>Source type: Systematic review</p> <p>Searches conducted: Jan 1990 to May 2012</p> <p>Study population: From age 12 upwards</p> <p>Included study types: RCTs, cohort, before and after</p> <p>Environment type/s: Food Economic/policy/legislative Micro</p>	<p>Description of included studies: The systematic review included 24 papers, equating to 20 individual studies.</p> <p>Of these studies nine were RCTs, three were cohort studies and eight were uncontrolled before and after studies.</p> <p>Fourteen studies were conducted in the US and one each in New Zealand, France, Germany, Netherlands, South Africa and UK.</p> <p>Five studies had been conducted in supermarkets; one in both a supermarket and farmers market; three in universities; four in high schools; one in both a school and a worksite and one in each of the following settings: a farmers market, an organic food store a restaurant, a worksite, a hospital cafeteria and homes.</p> <p>Quality of included studies: Quality assessment criteria included the presence of a control group, intervention and follow up duration, assessment of outcomes, and handling of attrition and confounding in studies. Studies were scored 0 to 10, the mean score was 6. Review authors did not provide information on the quality score of individual studies. Almost all studies included an objective measure of food purchase or intake and were well documented, however very few recruited participants randomly with a response rate of 60% or more.</p> <p>Synthesis: Narrative</p> <p>Findings: Fourteen studies involved price discounts and six offered money off vouchers. Seven studies targeted fruit and vegetables, five targeted low fat foods and/or snacks, one targeted fruit juice, five targeted unspecified healthier foods/drinks and two targeted low calorie foods/drinks.</p> <p>All studies except one reported that the intervention significantly increased the purchase and consumption of the promoted products.</p>	<p>Intervention: Subsidies – price discounts or vouchers on healthy food and drinks</p> <p>Evidence statement [B]: Offering price reductions of healthier food and drink options to increase purchase and consumption of the promoted products is supported by moderate quality evidence of its effectiveness [20 studies].</p> <p>Authors' conclusions: Subsidising healthier foods tends to be effective in modifying dietary behaviour. Even so, existing evidence is compromised due to various study limitations – small and convenience sample of interventions obscures the generalisability of study results, absence of overall diet assessment questions the effectiveness in reducing total caloric intake, short intervention and follow-up duration does not allow assessment of long-term impact, and lack of cost effectiveness analysis precludes a comparison across competing policy scenarios. Future studies are warranted to address those limitations and examine the long-term effectiveness and cost-effectiveness of economic incentives at the population level.</p> <p>Limitations: Separating the effects of subsidies from those of other intervention elements (e.g. prompting, product sampling, increasing the number of healthier food choices) was often unfeasible due to the integrated study design. Review authors noted that most studies did not use a population representative sample. Intervention duration was limited and most studies did not follow up after the intervention. This means that long-term trends and effectiveness of subsidies has not been evaluated. It is not possible to know if the effect of the subsidies would persist if the incentive is withdrawn</p> <p>Comment: Majority of studies were from the US, only three conducted in Europe including one from the UK. There may be issues with generalisation to the UK/Wales setting. A single author undertook screening and quality appraisal – no consistency check.</p> <p>Overlap in included studies: Includes 10 studies included in Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. <i>Prev Chronic Dis</i> 2017; 14: E107.</p> <p>15 studies overlap with those included in Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. <i>PLoS One</i> 2017; 12(3): e0172277</p>

Source details	Results	Conclusions
<p>Baker-Philip RA et al. Community wide interventions for increasing physical activity. <i>Cochrane Database Syst Rev</i> 2015; (1): CD008366.</p> <p>Intervention: Community wide interventions to increase physical activity in the whole population comprising of at least two broad strategies from the following 6 options: 1. Social marketing through local mass media (e.g. television (TV), radio, newspapers). 2. Other communication strategies (e.g. posters, flyers, information booklets, websites, maps) to raise awareness of the project and provide specific information to individuals in the community. 3. Individual counselling by health professionals (both publicly and privately funded), such as the use of physical activity prescriptions. 4. Working with voluntary, government and non-government organisations, including sporting clubs, to encourage participation in walking, other activities and events. 5. Working within specific settings such as schools, workplaces, aged care centres, community centres, homeless shelters, and shopping malls. This may include settings that provide an opportunity to reach disadvantaged persons. 6. Environmental change strategies such as creation of walking trails and infrastructure with legislative, fiscal or policy requirements, and planning (having ecological validity) for the broader population.</p> <p>Outcome: Physical activity (both continuous and dichotomous outcomes)</p> <p>Source type: Systematic review</p> <p>Searches conducted: January 1995-January 2014</p> <p>Study population: Whole of community defined as persons of any age residing in a geographically defined community, such as urban, peri-urban, village, town, or city.</p> <p>Included study types: Cluster randomised controlled trials, randomised controlled trials, quasi-experimental designs which used a control population for comparison, interrupted time-series studies, and prospective controlled cohort studies</p>	<p>Description of included studies: Thirty three studies were included in the systematic review. Twenty five were in high income countries (11 in North America, three in Australia, one in Japan and 10 in Europe). Of the remaining studies one each was conducted in Iran, Pakistan and Vietnam and five in China</p> <p>The majority of studies were controlled before and after designs, there was one controlled ITS; one cluster cohort study and four cluster RCTs.</p> <p>Quality of included studies: All studies were assessed for risk of bias using GRADE. Nineteen studies were assessed as having high risk of bias, four low risk and for the remainder this was unclear</p> <p>Synthesis: Narrative</p> <p>Findings: Twenty nine interventions involved building partnerships with local government or non-governmental organisations. Of the 33 studies, 20 included an individual counselling component and 23 a mass media component or other communication strategies (26 studies). Only four interventions that were investigated by the included studies contained elements of all six of the components described in the inclusion criteria, two included only two components and the remainder included between three and five components.</p> <p>Generally the better designed studies showed no improvement in the primary outcome measure of physical activity at a population level. All four studies considered to be high quality reported no evidence of effect on community levels of physical activity.</p> <p>Ten studies (25 communities) (low quality evidence) and three studies (160 communities) (high quality evidence) reporting % physically active in the intervention compared to control typically showed no evidence of benefit</p> <p>Five studies (156 communities) (low quality) reporting impact on energy expenditure typically found no evidence of effect.</p> <p>One study (two communities) (moderate quality) reporting impact on average daily minutes of moderate to vigorous physical activity also found no evidence of effect.</p> <p>The studies assessed as being at low risk of bias were Kamada 2013; Phillips 2014; Solomon 2014 and Wilson 2014.</p> <p>Kamada 2013 was a cluster RCT conducted in Japan, promoting physical activity in middle-aged and elderly people. The intervention used social marketing, other communication strategies, joint working and working in specific settings. Outcomes were % of people engaged in regular physical activity including walking, daily flexibility activity and muscle strengthening. In three comparisons, controlled versus muscle strengthening versus aerobic activity versus combined, found no statistical increases in either arm of the intervention analysed (adjusted relative risk (RR) 1.00, 95% CI 0.99 to 1.00; RR 0.97 (confidence interval could not be calculated); RR 1.00 95% CI 0.94 to 1.10). The intervention did not increase physical activity in year one and did not increase walking time.</p> <p>Phillips 2014 reported on the <i>Well London</i> initiative which targeted deprived communities in London and aimed to improve wellbeing and healthy eating alongside efforts to increase physical activity; environmental aspects involved improving physical environments through development of community gardens and allotments and re-development of green-spaces and greenery. The study found no increase in the percentage of people meeting the target of 5 x 30 minutes per week (adjusted RR 1.03, 95% CI 0.96 to 1.22) and no evidence of an effect on increasing energy expenditure</p>	<p>Intervention: Community-wide multi-component interventions to increase physical activity at population level</p> <p>Evidence statement [E]: There is some evidence suggesting that community-wide interventions are not effective in increasing physical activity but it is not conclusive [33 studies].</p> <p>Intervention: Community wide multi-component interventions to increase physical activity at population level</p> <p>Evidence statement [F]: There is moderate to good quality evidence that community wide multi-component interventions are unlikely to be effective in improving physical activity [4 studies]</p> <p>Authors' conclusions: Although numerous studies of community wide interventions have been undertaken, there is a noticeable absence of studies reporting any benefits. The body of evidence in this review does not support the hypothesis that multi-component community wide interventions effectively increase population levels of physical activity. It could be postulated that, given the conflicting findings and the evidence from new high quality studies, that community wide interventions lack efficacy. We suggest caution in making such a broad conclusion as many of the authors of the included studies identified the reason for failure, as the program being unable to achieve penetration, being too short and poor measures were used to detect an effect, or the study was otherwise under-resourced. It is unclear whether effectiveness may be achieved if further resources or other improvements were made to these interventions. Historically, the tools used to measure physical activity were generally weak, inhibiting the ability to interpret the results and draw conclusions. However, with newer approaches such as accelerometry, the accurate measurement of physical activity appears possible. Policy makers and health professionals need to consider the options they advocate for and the programs they fund because this review has not found evidence of effectiveness at a population level. Community wide interventions to promote physical activity could in principle be effective, however in practice their effects may remain undetected unless the current research improves design, implementation and evaluation of these interventions. Neither of the four studies at low risk of bias provided evidence of an effect, however on their own they are inadequate to capture the breadth of the community wide approach, which is a global phenomenon. Based on the lack of robust studies</p>

Source details	Results	Conclusions
<p>Environment type/s: Physical activity Physical Sociocultural Micro</p>	<p>Solomon 2014 utilised community engagement to create activity friendly environments in the <i>Active Villages Devon</i> project. The study did not find an increase in the percentage meeting the UK recommendation of at least 150 minutes of moderate-intensity activity per week in bouts of 10 minutes or more, or at least 75 minutes of vigorous-intensity activity per week (RR 1.02, 95% CI 0.88 to 1.17). There was no evidence of an effect on increasing energy expenditure. Researchers found that very few residents participated in the intervention or were even aware of it.</p> <p>Wilson 2014, a cluster RCT in the US, was assessed by the review authors as being a high intensity intervention. This involved social marketing and other communication strategies, working with community organisations and environmental changes (walking paths). The study found an immediate programme level effect of more walking (greater number of walkers on the trail) but no effect on community levels of physical activity (individual level accelerometer estimates of moderate to vigorous physical activity) showed no significant differences. Estimate of effect for full intervention 0.69 (SE 0.39 95% CI -0.14 to 1.39).</p>	<p>achieving adequate penetration and duration, further exploration of combined community interventions may be merited if practical and likely to achieve penetration.</p> <p>Comment: The four included studies at least risk of bias, two of which were conducted in the UK, showed no meaningful improvements in physical activity amongst participants (evidence statement graded F).</p>

Source details	Results	Conclusions
<p>Bellicha A et al. Stair-use interventions in worksites and public settings - a systematic review of effectiveness and external validity. <i>Prev Med</i> 2015; 70: 3-13.</p> <p>Intervention: Point of decision prompts including motivation and/ or directional signs near stairs/lifts Stairwell enhancements (e.g. artwork or music) Promotion of stair use</p> <p>Outcome: Stair use (ascent and descent) or stair climbing (ascent)</p> <p>Source type: Systematic review</p> <p>Searches conducted: To June 2013</p> <p>Study population: Individuals in worksites and public settings</p> <p>Included study types: Any</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: The systematic review included 60 studies. Twenty five studies were conducted in worksites and 35 in public settings such as a train station or shopping mall.</p> <p>Included study designs are not well-defined by study authors. Of the 60 studies 41 were ITS designs and the remaining 19 were classified as other. All that is known about the design of these other studies is that they were not randomised controlled trials, controlled trials, cohort analytic, case control or cohort studies.</p> <p>The majority of studies from the United Kingdom and the US (28 in the UK, 18 in the US, three in Belgium, two in Australia, China, and Netherlands, and one in Denmark, Germany, Japan, South Africa and Spain).</p> <p>In studies conducted in worksites, stair use and stair climbing ranged during the baseline period from 11.1% to 69.0% and from 19.0% to 59.4%, respectively. In studies conducted in public settings, stair climbing ranged from 1.7% to 41.9% during the baseline period.</p> <p>Duration of the interventions ranged from 1 day to 16 weeks.</p> <p>Quality of included studies: The quality of included studies was evaluated using the EPHP Project Quality Assessment Tool for Quantitative Studies. Study quality was rated as strong, moderate and weak in 0, 22 and 38 studies, respectively. Less than half of reviewed studies (23 of 60 studies) included measurements during a follow-up period after the intervention. Only one study evaluated long-term effectiveness during follow-up (at least six months after the end of the intervention).</p> <p>Synthesis: Narrative, graphical and quantitative. Stair use or stair climbing was expressed as a percentage relative to the use of an escalator or an elevator and measured at baseline, intervention and follow-up where available. A harvest plot was used to visualize findings. The median absolute change and the median relative change in stair climbing were presented as the quantitative synthesis.</p> <p>Findings: The most widely used intervention across included studies was motivational prompts.</p> <p>Studies in workplaces</p> <p>All worksite interventions used motivational prompts, often in combination with directional signs and in a few studies in combination with stairwell enhancements or promotion of stair use.</p> <p>During the intervention period an increase in stair climbing was found in 64% of studies in worksites (14 studies, 16 arms, all rated weak). 10 study arms reported statistically significant increases in stair climbing. Studies using a combination of motivational and directional signs in worksites reported an increase in stair climbing more often than studies using motivational signs only.</p> <p>An increase in stair use was found in 73% of studies in worksites, and in the only study measuring stair use in public settings.</p> <p>Stairwell enhancements were used in four studies and involved artwork and music, interactive paintings or painting and replacement of doors. Three studies of weak quality using stairwell enhancements in addition to point of decision prompts in worksites found a significant increase in stair use or stair climbing. The nature of each enhancement intervention was different. Limited information is available about the fourth study examining stairwell enhancements in the systematic review.</p> <p>Studies in public settings</p>	<p>Intervention: Combined use of motivational and directional signs to promote stair climbing in workplaces</p> <p>Evidence statement [C]: There is some evidence supporting the use of motivational signs in combination with directional signs to promote stair climbing in workplaces but it is not conclusive [14 studies].</p> <p>Intervention: Motivational signs to promote stair climbing interventions in public settings</p> <p>Evidence statement [C]: There is some evidence supporting the use of motivational signs to promote stair climbing in public settings but it is not conclusive [34 studies]</p> <p>Intervention: Stairwell enhancement in addition to point of decision prompts in workplaces to increase stair use or stair climbing</p> <p>Evidence statement [H]: Evidence about the effectiveness of stairwell enhancements is lacking [3 studies of heterogeneous enhancements]</p> <p>Authors' conclusions: In conclusion, results of this review emphasize the importance of separating studies by intervention setting (i.e. worksites and public settings) in assessing the effectiveness of stair interventions. The data provide evidence that stair climbing is increased during the interventions in public settings. However, evidence of such effect is limited in worksites. They also suggest that some interventions may be recommended in each setting for greater effectiveness: in worksites, stair climbing is increased to a larger extent when directional signs supplement motivational signs; in public settings, increase in stair use appears maintained over time when interventions include two phases. Designing more effective interventions in worksites appears especially important from a public health perspective because worksites offer more opportunities to climb the stairs throughout the day than public settings and could allow a large number of people reaching the recommended level of physical activity by accumulating short bouts of physical activity. Stairwell enhancements seem promising in addition to point of decision prompts in this setting, and should be examined in future studies to better assess the evidence of their effectiveness. Information on external validity also needs to be better reported in future studies to help translate research results to practice.</p>

Source details	Results	Conclusions
	<p>During the intervention period an increase of 76% in stair climbing was found in studies in public settings.</p> <p>All but one study conducted in public settings used motivational prompts as the intervention; one study in a shopping mall used a stairwell enhancement.</p> <p>There were 34 studies (20 rated moderate, 14 rated weak) (40 arms) assessing the use of motivational settings to promote stair climbing in public settings, of these 24 studies reported statistically significant increases (11 rated weak, 13 rated moderate)</p> <p>In public settings, studies reporting an increase in stair climbing were, for about half of them, of moderate quality and for the other half of weak quality</p> <p>One study in public settings measured stair use and this reported an increase.</p> <p>Maintenance and follow up</p> <p>In 36 studies interventions were designed as a single phase whilst 24 studies involved two phases. Conducting a second intervention phase was found to allow maintaining over time a higher level of stair climbing compared to baseline, especially in public settings. The majority of studies conducting two intervention phases received a weak and a moderate quality rating in the worksites and public settings respectively.</p> <p>During follow-up (after the removal of interventions), stair climbing remained elevated compared to baseline in 75% of studies in worksites and 67% of studies in public settings. Few studies assessed effectiveness post intervention or in the long term.</p>	<p>Comment: The systematic review includes UK studies and there is no reason to believe that studies from other countries would not generalise. The Systematic review is unclear about included study types; 41 of the 60 studies are interrupted time series studies.</p> <p>Included studies are of limited duration and there is scant information on long-term effectiveness. However, such interventions are not likely to be expensive or incur ongoing costs. Authors themselves note that the impact of stairs interventions at the individual level remains challenging.</p>

Source details	Results	Conclusions
<p>Bennie J et al. <i>Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence review 3: Park, neighbourhood and multicomponent interventions</i>. London: NICE; 2017.</p> <p>Intervention: Park, neighbourhood and Multicomponent Interventions.</p> <p>Outcome: Physical activity</p> <p>Source type: Systematic review</p> <p>Searches conducted: 2006 to June 2016 (databases). Websites were searched in August 2016.</p> <p>Study population: General population</p> <p>Included study types: Comparative Studies and UK based qualitative studies.</p> <p>Cross-sectional surveys, correlation studies and modelling studies that were not economic modelling studies were excluded.</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: Twenty two studies were included in the review.</p> <p>Twelve studies reported on the effectiveness of interventions in parks: eight controlled before and after studies, two conducted in Australia, five conducted in the US and one from New Zealand; three uncontrolled before and after studies, all from the US and one mixed methods study from the UK with a qualitative and quantitative (before and after study) component.</p> <p>Five studies reported on the effectiveness of neighbourhood interventions in adults; two controlled before and after studies, one conducted in Australia, and one in the UK; one uncontrolled before and after study, conducted in Australia; and two qualitative studies, both conducted in the UK.</p> <p>Four studies reported on interventions which had multiple parts, and which have therefore been categorised as "multicomponent". Of these four, three were controlled before and after studies, one from the Netherlands one from the UK, and one from the US. The remaining study was an uncontrolled before and after study conducted in the UK.</p> <p>Quality of included studies: Each study was graded as to whether they had [++] <i>no risk of bias</i> (conclusions are very unlikely to alter), [+] <i>low risk of bias</i> (conclusions are unlikely to alter) or [-] <i>high risk of bias</i> (conclusions are likely to alter). GRADE which considers the risk of bias, consistency, directness, and precision of the studies reporting on a particular outcome was used to synthesise and present the outcomes from quantitative studies and these were presented as Evidence Statements. Qualitative evidence was disparate and sparse and summarised by presentation of their key themes.</p> <p>Overall, the quality of the studies was poor, none of the studies were rated [++] and only six studies were given a quality rating score of [+]. The remaining 16 studies were allocated [-]. No economic evaluations were identified, other than small sections on economic data within two studies.</p> <p>Synthesis: Narrative</p> <p>Findings: Five studies were concerned with neighbourhoods and reported outcomes in adults, 12 with parks (upgrading park facilities, the construction of new parks, or changing the micro-environment in the parks to encourage physical activity) and four with multicomponent interventions</p> <p>Parks Upgrading park facilities (n=9) Five (two Australian; three US) studies presented very low quality evidence showing that upgrading park facilities (including at least one of the following: lighting, facilities (seating or toilets), paths, greenery, gyms or landscape designs) has mixed effects on the number of people engaging in moderate to vigorous physical activity. Three of the five studies provided evidence that the intervention increased physical activity at follow up ranging between four months and two years, however when considering differences by gender one study presented evidence that there was a decline in girls engaging in Moderate to Vigorous Physical Activity (MVPA) at follow-up.</p> <p>One US study presented very low quality evidence showing that upgrading park facilities (including at least one of the following: lighting, facilities (seating or toilets), paths, greenery, gyms or landscape designs) increased the amount of energy expended by an average of 250% across all age groups (children, teens, adults and seniors) at three years follow up.</p> <p>Two studies (UK, Australian) presented very low quality evidence showing that upgrading park facilities had no effect on the proportion of individuals reporting that they meet the recommended 30 minutes and 60 minutes physical activity per day at 12 months follow up.</p> <p>Six (two Australian, four US) presented very low quality evidence showing that upgrading park facilities (including at least one of the following: lighting, facilities (seating or toilets), paths, greenery, gyms or</p>	<p>Intervention: Upgrading park facilities</p> <p>Evidence statement [D]: The evidence on upgrading parks to increase physical activity is inconsistent and it is not possible to draw a conclusion [9 studies]</p> <p>Intervention: Developing new parks</p> <p>Evidence statement [H]: Evidence that introducing new parks increases park visits and physical activity is lacking [2 studies]</p> <p>Intervention: Changes to the microenvironment in parks</p> <p>Evidence statement [H]: Evidence that changing the microenvironment within parks (for example by changing or removing seating) increases physical activity is lacking [1 study]</p> <p>Intervention: Moving to a liveable neighbourhood</p> <p>Evidence statement [D]: The evidence that moving to a neighbourhood that complies with liveable neighbourhood guidelines increases active travel or leisure walking is inconsistent and it is not possible to draw a conclusion [3 studies]</p> <p>Intervention: Increasing the safety and improving the appearance of streets (DIY streets)</p> <p>Evidence statement [H]: Evidence that interventions to improve the safety and appearance of streets increases levels of outdoor activity is lacking [1 study]</p> <p>Intervention: Multicomponent (Active Living by Design project) City-level bike and pedestrian coordinator positions supporting environmental changes)</p> <p>Evidence statement [H]: Evidence about the effectiveness of city-level bike and pedestrian coordinator positions supporting environmental changes to increase the proportion meeting recommended levels of moderate and vigorous physical activity is lacking [1 study]</p> <p>Intervention: Multicomponent Improvements to green space (redevelopment of parks, creation of public parks, natural playgrounds, community gardens, fishponds and public allotments)</p> <p>Evidence statement [H]: Evidence about the effectiveness of multi-component interventions to</p>

Source details	Results	Conclusions
	<p>landscape designs) had mixed effects on the number of individuals visiting and using the parks with four of the six studies providing evidence showing an increase in the number of visits at follow up ranging between four months and three years. Two of the studies had data by age group, and showed an increase for adults, children and seniors but not teenagers.</p> <p>Two studies (Australian, US) presented very low quality evidence showing that upgrading park facilities (including at least one of the following: lighting, facilities (seating or toilets), paths, greenery, gyms or landscape designs) had mixed effects on sedentary behaviour when individuals are visiting the park; one study shows a 5 fold increase in sedentary visitors, at one year follow up and another shows a decrease in individuals observed being sedentary (lying or sitting down) at 3-8 months follow up. Three US studies presented very low quality evidence showing that upgrading park facilities (including at least one of the following: lighting, facilities (seating or toilets), paths, greenery, gyms or landscape designs) improved perceptions of park safety, however this was not always linked to increases in park use or self-reported exercise at follow up ranging between one and three years.</p> <p>One New Zealand study presented low quality evidence showing that upgrading park facilities made no change to the mean total daily physical activities of individuals, even if they lived close to the park. The same study also presented low quality evidence showing that after upgrading park facilities, at 1 year follow-up, physical activity was associated with participant baseline age (the older the children the higher the mean total physical activity), school day (higher mean total physical activity on a school day), usual mode of travel to school (higher mean total physical activity if children usually walk to school), sex, and ethnicity.</p> <p>Attitudes to Parks (n=1) (non-grade evidence statement) One mixed methods study with a high risk of bias [-] based in the UK included qualitative interviews with 35 adults and 23 young people at baseline and 10 adults and no young people at follow up, investigated the general perception of green spaces, antisocial behaviour, park facilities and park safety.</p> <p>Parks in general were viewed as good for health and wellbeing, however participants found it difficult to have positive views on the intervention park – highlighting high levels of antisocial behaviour and feeling unsafe. At follow up most of the participants had not noticed the changes made in the park and antisocial behaviour remained a concern.</p> <p>New Parks (n=2) One US study with 432 participants presented very low quality evidence showing that introducing new pocket parks increased the proportion of adults reporting that they visit any park more than once per week (22.8 percentage point increase), engage in exercise in the park (4.8 percentage point increase) and engage in leisure time exercise (9.9 percentage point increase) at 2 year follow up.</p> <p>One US study with 4525 participants presented low quality evidence showing that constructing a new park on undeveloped green space increased average monthly visits by three times the original number of visits, energy expended in the park 3-fold and the proportion of individuals observed as engaging in either moderate or vigorous physical activity by a 40.8 percentage point increase at 2 year follow up.</p> <p>Cost effectiveness of park interventions (n=2) (non-grade evidence statement) Two studies with high risk of bias (both [-]) based in the US included small amounts of data on cost effectiveness of park locations, showing that larger and busier parks may be more cost effective than smaller or quieter ones.</p> <p>One study presented evidence that the average cost per Metabolic Equivalent Task (MET) in intervention parks which had been refurbished ranged from \$0.27/MET-hour at the larger renovated park to \$2.66/MET-hour for the smaller park. The second study reported cost per MET-hour of new pocket parks. Cost per MET-hour ranged from \$0.43 at the busiest park to \$2.63 at a quieter park. Both papers reported that previous benchmarks consider a physical activity intervention as cost-effective if the cost is less than \$0.50–\$1.00/MET-hour (US).</p>	<p>improve green space increasing the proportion of individuals engaging in leisure walks, leisure cycling or sports weekly is lacking [1 study]</p> <p>Intervention: Multicomponent (Smarter Choices, Smarter Places project) New bus services and shelters, ticketing improvements, improvements to paths and promotional activity)</p> <p>Evidence statement [H]: Evidence about the effectiveness of combined improvements to bus transport and infrastructure, paths and promotion in increasing adherence to moderate physical activity recommendations, is lacking [1 study]</p> <p>Authors' conclusions: The committee noted that the majority of studies included in the evidence reviews were considered poor quality. However, they also noted that the body of evidence as a whole indicated a consistent 'direction of travel' whereby sympathetic changes to the environment and/ or public transport provision increase physical activity. The committee noted that the complexity and scale of the interventions makes this an extremely challenging area of research.</p> <p>Consistent themes that emerged across the studies were:</p> <ul style="list-style-type: none"> • Park interventions show mixed effects on park visits and physical activity expenditure, possibly due to factors outside of the scope of interventions affecting outcomes (i.e. cancellation of events programmes and incomplete construction at follow-up). • Poor perception of safety (personal security) appears to be a significant deterrent to using existing or new parks and trails. While interventions tend to result in improved perceptions of safety (personal security), there is not always increased park or trail use and physical activity. • Neighbourhood interventions reported no significant effect on minutes of walking, moderate to vigorous physical activity, or frequency of outdoor activity. However, it may be that active travel by walking is associated with plentiful access to bus stops and railway stations, and a larger number of mixed destinations within walking distance. • Large scale programmes over multiple areas to increase physical activity through multiple interventions tend to show no significant effect. This may be obscuring variation by combining diverse interventions which, if analysed individually, may show more conclusive results.

Source details	Results	Conclusions
	<p>Changing micro-environment (n=1) One US study with 484 participants presented very low quality evidence showing that changing the micro-environment by moving park seating and picnic tables closer to the playground resulted in greater METS intensities. For adults, METS expended is significantly higher with no seating when compared with before seating was removed (mean difference 1030 0.20, 95% CI 0.11, 0.29), and also when compared with after seating was removed (mean difference 0.60, 95% CI 0.51, 0.69). For children, METS expended is significantly higher with no seating when compared with before seating was removed (mean difference 0.70, 95% CI 1033 0.54, 0.86), and also when compared with after seating was removed (mean difference 0.70, 1034 95% CI 0.53, 0.87). The odds of adults engaging in moderate and vigorous physical activity were at least 4.1 times higher and adults standing rather than sitting were at least 4.7 times greater (follow up unclear).</p> <p>Neighbourhoods Moving to a 'Livable Neighbourhood' (n=3) One Australian study with two publications and 1,047 participants presented very low quality evidence that moving to neighbourhoods complying with Livable Neighbourhood guidelines (which incorporate four design elements: 1) community design (mixed use planning, mixed lot sizes), 2) movement network (interconnected street networks, public transport access etc.), 3) public parklands (balance between small and large parks), 4) lot layouts (to maximise surveillance of streets / parks, increase density around activity hubs)) was not more effective than moving to conventional neighbourhoods for increasing active travel (walking) between baseline and 3-year follow-up (change over time in intervention and change over time in control not significantly different: p >0.05); and very low quality evidence was presented that the intervention did not cause a significant change in leisure walking at 3-year follow-up (change over time in intervention and change over time in control not significantly different: p >0.05).</p> <p>One of the publications reported low quality evidence that access to public transport stops, the presence of ≥8 types of destinations within the neighbourhoods (defined as within a 15 minute walk), and increased number and diversity of destinations (also called "land use mix") was associated with increased active travel by walking at 7-year follow-up.</p> <p>One study from the US with 95 participants (children aged 9 - 13) presented very low quality evidence that living in a Smart Growth neighbourhood did not increase the proportion of journeys to places of recreation made by walking or bicycling, or time spent in (MVPA) at 6-12 month follow-up.</p> <p>DIY Streets (n=1) One study from the UK with 96 participants over 65 years of age presented very low quality evidence that various interventions, including increasing safety and improving appearance of streets through planters, parking space provision and layout, and some restrictions to the width of the road in places (to control traffic), made no change to self-reported levels of outdoor activity in summer at 2-year follow-up, although participants felt that they were more active generally. The same study reported improved perceptions of street safety and ease of walking in the street, but lowered perceptions of garden and parking facilities at home at 2-year follow-up.</p> <p>Home Zone and cycle Walkway (n=2) (non-grade evidence statement) Two studies with low risk of bias (both +) from the UK collected qualitative data through focus groups on the perceptions of residents in a neighbourhood to which a Home Zone and an extension of an existing Cycle Walkway would be implemented.</p> <p>Prior to intervention implementation, personal safety was a concern of residents, who did not want the new walkway to be isolated. However, it was recognised that the Home Zone might improve road safety through reduced driving speeds. Anticipated opportunities for physical activity were not considered an important feature of the interventions.</p> <p>During and after implementation, residents saw their own physical activity as unchanged, but mentioned increased outdoor activity and playing by children. The walkway was primarily used to walk dogs and take children to nursery, a limitation being that the route did not connect to a station / city centre and so was less useful for active travel. Concerns about personal and road safety remained.</p>	<p>Limitations: The review authors noted that of the 22 studies in the review, 14 included control groups, and eight did not include a control to control for other influences on outcome measures. Of those that did include controls, several did not include enough information on the control group to determine whether it is was sufficient to reduce confounding. Others included controls which will cause contamination (i.e. control parks in the same neighbourhood as intervention parks, meaning that park users see the parks as alternatives to each other and the control does not truly measure a consistent state). Other limitations are: self-selection of intervention groups where interventions require applications for grants. Use of controls which were unlikely to effectively reduce confounding due to contamination or methodologically poor data collection. Several interventions had behavioural elements which may have impacted the outcomes reported, but which could not be separated from environmental aspects. Where sample sizes (of people or parks) are small, generalisability is limited. Short observation periods usually in a single season are unlikely to be representative of long term outcomes. Lack of blinding in assessors could lead to observer bias. Inability to control for other factors which will influence results means lower confidence in effect of interventions. Low response rate for surveys potentially leading to bias. Incomplete interventions at follow-up, or interventions at varying stages of completeness, meaning that results are not showing embedded behaviours. Varied interventions in varied settings being combined in analysis obscuring more detailed results of what is effective where. Selective reporting of outcome measures, and no provision of raw data means effect size and magnitude cannot be determined. Finally, there is a lack of reporting on the impact of interventions on those with mobility problems or disabilities.</p> <p>Comment: Authors note that of the 22 studies in this review, 10 were from the US, six were conducted in the UK, four in Australia, one from New Zealand and one from the Netherlands. The applicability of studies from other countries may be limited if population acceptability and use of parks, acceptable styles of neighbourhoods, and physical activities in open space are very different from those in the UK.</p>

Source details	Results	Conclusions
	<p>Multicomponent</p> <p>Active Living By Design project (n=1) One US study (at high risk of bias) with 484 participants presented very low quality evidence showing that a project which included the creation of city-level bike and pedestrian coordinator positions supporting implementation of environmental changes (crosswalks, park renovations etc.), and extension of a walking path connecting intervention town with a city, increases the odds and proportions of adults and high school students meeting the recommended moderate and vigorous physical activity at 3-5 years follow up.</p> <p>Improving Green Space (n=1) One study from the Netherlands (at low risk of bias) with 1018 participants presented low quality evidence showing that improving green spaces through the redevelopment of existing parks, creation of public parks, natural playgrounds, community gardens, fishponds and public allotments has no effect on the proportion of individuals engaging in leisure walks, leisure cycling trip or leisure sports at least once a week at 3.5 year follow up.</p> <p>Smarter Choices, Smarter Places (SCSP)(n=1) One UK study (at high risk of bias) with 9542 participants presented very low quality evidence showing that the Smarter Choices, Smarter Places (SCSP) programme which included introducing new bus services and shelters, ticketing improvements, promotional activity was associated with an increase the proportion of individuals meeting the moderate physical activity recommendation, however there was a reduction in the proportion of participants who were active at all at 3 year follow up. Those who were physically active were more likely to meet physical activity recommendations.</p> <p>Active England woodland projects (n=1) One UK study with 1467 participants presented very low quality evidence showing that the Active England woodland projects, including new play areas, visitor's centre, cycle tracks, walking trails, shower facilities, butterfly trail, climbing wall, promotional groups and events, on average increased the frequency of visits to the woodland from 1.74 (standard error 0.04) to 2.33 (standard error 0.04) (unit not given), and increased visitors by between 47% and 2,143%. However the percentage of all visitors that visited daily decreased at one to five year follow-up.</p> <p>The same study also presented very low quality evidence showing that the Active England woodland projects, including new play areas, visitor's centre, cycle tracks, walking trails, shower facilities, butterfly trail, climbing wall, promotional groups and events, was associated with a decrease in the proportion of visitors taking ≥ 5 days exercise/week (55.9% to 36.1% 1138 between baseline and follow-up ($p = <0.001$)) (follow up varied between 1 and 5 years).</p> <p>The same study presented very low quality evidence showing no change in the number of visitors with blue badges (actual numbers not given), however there was a decrease in proportion of visitors reporting having a long term illness (13.9% at baseline, 7.2% at follow- up; $p = <0.001$; actual numbers not reported). Black and Minority Ethnic (BME) individuals as a proportion of all visitors increased from 1.7% at baseline to 5.2% at follow up ($p = <0.001$).</p>	

Source details	Results	Conclusions
<p>Bennie J et al. <i>Physical activity and the environment update. Effectiveness and cost-Effectiveness: Evidence Review 1: Public transport</i>. London: NICE; 2017.</p> <p>Intervention: Public Transport</p> <p>Outcome: Physical activity</p> <p>Source type: Systematic review</p> <p>Searches conducted: 2006 to June 2016 (databases). Websites were searched in August 2016.</p> <p>Study population: General population</p> <p>Included study types: Comparative Studies and UK based qualitative studies.</p> <p>Cross-sectional surveys, correlation studies and modelling studies that were not economic modelling studies were excluded.</p> <p>Environment type/s: Physical activity Economic/physical Micro</p>	<p>Description of included studies: Eighteen studies were included in the review.</p> <p>Of these studies five were controlled before-after studies, 11 were uncontrolled before-after (some of which were nested within cohort studies or were more longitudinal in nature) and two were qualitative studies. Cost effectiveness data was sought but none was identified.</p> <p>Six of the 18 studies were from the US with seven from the UK, two from Sweden one each from Canada, Australia and Israel.</p> <p>Quality of included studies: Each study was graded as to whether they had <i>no risk of bias</i> [++] (conclusions are very unlikely to alter), <i>low risk of bias</i> [+] (conclusions are unlikely to alter) or <i>high risk of bias</i> [-] (conclusions are likely to alter). GRADE which considers the risk of bias, consistency, directness, and precision of the studies reporting on a particular outcome was used to synthesise and present the outcomes from quantitative studies and these were presented as Evidence Statements. Qualitative evidence was disparate and sparse and summarised by presentation of their key themes.</p> <p>Synthesis: Narrative</p> <p>Findings: Congestion charging was assessed in three studies, guided busway and improvement to bus services in five studies, light rail interventions in three studies, light rail intervention plus cycle lane and sidewalk improvements in three studies, work travel plans in two studies, integration of public transport fares in one study and a motorway extension in one study.</p> <p>Congestion charging One uncontrolled before and after Swedish study (low risk of bias, low quality evidence) with 303 participants found that that introducing congestion charging increased moderate and total physical activity, and reduced time spent being sedentary from baseline at 5 months follow up. Effect sizes were small $r=0.03$ for walking and $r=0.20$ for sitting Another Swedish cohort study (high risk of bias, very low quality evidence) with 1550 participants found that at two months after initiation of the charge 25% of car drivers crossing the toll cordon switched to public transport, whilst only 10% did so in the control group. Substantial public bus service enhancements had been made before the charge was introduced. Data from a study in London (controlled before and after, low risk of bias, very low quality evidence) indicated that bus passengers increased by 6-9%, cycling increased by 18%, and taxi use increased by 9%. The study did not indicate if these changes were statistically significant. In addition it reported that congestion charging may cause car drivers to switch transport method to public transport, or not to undertake the charged journey at all.</p> <p>Guided Busway One UK uncontrolled before and after study (high risk of bias, very low quality evidence) with 364 participants found the introduction of a guided busway decreased overall active travel, and had no effect on time spent on physical activity in everyday life at 6 to 18 months follow up. However, living close to the busway was associated with a greater likelihood of an increase in weekly cycle commuting time (relative risk ratio [RRR] 1.34, 95% CI 1.03, 1.76). The same study presented very low quality evidence that active commuting increased only for those who reported the lowest levels of active commuting at baseline (RRR = 1.76, 95% CI = 1.16, 2.67) at 6 to 18 months follow up. One UK uncontrolled before and after study (high risk of bias, very low quality evidence) with 470 participants presented very low quality evidence showing that introducing a guided busway predicted large increases in using active methods of travel in those living nearer (within 4km) to the busway compared to those living further away at 3 years follow up (relative risk ratio [RRR] 1.80, 95 % CI 1.27 to 2.55). The same study presented very low quality evidence that living in villages rather than</p>	<p>Exposure: Guided busway</p> <p>Evidence statement [D2]: Evidence suggesting an association between the development of a guided busway transport infrastructure and an increase in active commuting is inconsistent and it is not possible to draw a conclusion [2 studies]</p> <p>Intervention: Upgrading of bus routes</p> <p>Evidence statement [H]: Evidence about the effectiveness of upgrading bus routes in increasing public transport use is lacking [1 study]</p> <p>Intervention: Introduction of new light rail transit service</p> <p>Evidence statement [H]: Evidence on whether the introduction of a new light rail service increases walking or active travel is lacking [1 study]</p> <p>Intervention: Light rail interventions plus cycle lane and pavement improvements (complete street interventions)</p> <p>Evidence statement [H]: Evidence about the effectiveness of light rail interventions in combination with cycle lane and pavement improvements increasing physical activity is lacking [1 study]</p> <p>Intervention: Workplace Travel plan (express transit route to work and subsidised travel pass)</p> <p>Evidence statement [H]: Evidence about the effectiveness of work travel plans to increase active travel is lacking [1study]</p> <p>Intervention: Decreasing car parking availability and introducing parking charges as part of a workplace travel plan</p> <p>Evidence statement [H]: Evidence about the effectiveness of work travel plans to increase active travel is lacking [1study]</p> <p>Intervention: Integrated public transport fares</p> <p>Evidence statement [H]: Evidence about the effectiveness of integrated public transport fares increase public transport use is lacking [1 study]</p> <p>Authors' conclusions: The committee noted that the majority of studies included in the evidence reviews were considered poor quality. However, they also</p>

Source details	Results	Conclusions
	<p>urban areas predicted an increase in public transport use as a proportion of all commuting trips (RRR 2.53 (1.06, 6.05), pp<0.05) at 3 years follow up.</p> <p>Views and experiences of users of a guided busway (non-GRADE evidence statement) Two studies with no risk of bias [++] considered the views and experiences of users of the Cambridgeshire guided busway. One study used interviews and participant observation (participant numbers not provided – interviews conducted on 41 busway trips) and 1 study used interviews with 38 participants. These studies indicated that the busway’s proximity, accessibility and convenience affected people’s use of, and views on, the busway. The process of incorporating the busway into commuting patterns appeared to be influenced by whether the anticipated benefits of changing were achieved or not over time. Early experiences and the ease with which the busway could be integrated into existing daily routines were important to users. However, individuals’ use developed over time, with some increasing their use of the busway and walking to the stops as they realised how feasible it was. Both studies reported passengers’ concerns about the complexity of ticketing systems and multiple providers, which caused confusion, delays, and frustration amongst passengers, particularly new ones. Collective learning occurred as a result. Views differed between previous car and bus users; those who had previously travelled by car tended to describe the busway more positively, and talked about reduced stress of driving – a factor which might be common to all public transport. Existing bus users by contrast found the new system slower. Although participants were bus passengers, one study reported people’s frustration that the busway and parallel cycle path was not lit or sheltered, a safety concern for cyclists and pedestrians.</p> <p>Upgrading of bus routes One controlled before and after study conducted in Melbourne (high risk of bias) presented very low quality evidence showing upgrading bus routes increased public transport use by 4.6% for upgraded routes compared to 1.3% in those not upgraded routes at 1 year follow up.</p> <p>Light rail interventions New light rail transit service One US controlled before and after study (low risk of bias, low quality evidence) with 204 households presented very low quality evidence showing introducing a new light rail service had no effect on train and walking trips. Very low quality evidence from the same study showed no impact on the amount of time spent in moderate and vigorous physical activity, at 3-7 months follow up.</p> <p>New rail stop One US uncontrolled before after study (high risk of bias, very low quality evidence) reported in two publications with 51 participants presented very low quality evidence showing introducing a new rail stop increased public transport use (as measured by rail ridership: 50% to 69%, p = 0.001), but had no impact on the mean number of rail rides (mean difference 1.30 (95% CI-1.50, 4.10). Very low quality evidence from the same study showed no impact on the mean bouts of moderate physical activity per hour (bouts remained at 0.06 bouts/hr at baseline and 7-11 months follow up: mean difference 0.00 [95% CI -0.03, 0.03]). However, total number of bouts is significantly different between continuing riders (3.68, standard error 0.60), new riders (1.77, standard error 0.83) and non-riders (1.07, standard error 0.76).</p> <p>Complete Street Interventions One US uncontrolled before and after study (high risk of bias) (reported in three publications), with participants presented very low quality evidence showing introducing new stops along a light rail extension, a new bike lane and improved pedestrian sidewalks increased total time spent in physical activity, increased time spent in public transport related physical activity and made no change to non-public transport related physical activity. The intervention also increased moderate and vigorous physical activity and reduced sedentary time at 7-11 months follow up in ‘new riders’. Similar effects were not seen in other groups (continuing riders and former riders). Very low quality evidence from the same study showed residents living <800m away from the intervention were significantly more likely to make public transport trips at follow-up compared to</p>	<p>noted that the body of evidence as a whole indicated a consistent ‘direction of travel’ whereby sympathetic changes to the environment and/or public transport provision increase physical activity. The committee noted that the complexity and scale of the interventions makes this an extremely challenging area of research.</p> <p>Consistent themes that emerged across studies were:</p> <ul style="list-style-type: none"> • Improvements to public transport may increase opportunities for incidental physical activity, particularly among those who have previously travelled by car or who are less active at the outset. • Improvements to public transport are more likely to impact on people living close by. • Practical issues – such as increasing opportunities to access (e.g. ease of ticketing, bus frequency, sufficient bus stops or access points to walkways and cycle ways) may be important for the success of interventions. While changes to provision may be welcomed by those not currently using public transport, they may not always be welcomed by existing users. <p>Limitations: Review authors noted the following limitations. Overall the quality studies was poor, only 2 of the studies were graded [++], 3 studies graded [+] with the remaining 13 studies graded [-]. Several limitations are seen across many of the studies. Many of the studies were natural experiments. Follow up times may have been too short to detect long term changes in commuting decisions and physical activity behaviours and few used direct measures of physical activity. Many of the studies did not report whether they were adequately powered and the small sample sizes of some studies may suggest that they would not have had the power to detect changes in physical activity behaviours. While some studies do report findings for those who are the least active, none reported on the impact on those with mobility problems or disabilities. Some studies only surveyed those using public transport and therefore may be biased towards users.</p> <p>Comment: Authors note the applicability of studies from other countries may be limited if population acceptability and use of public transport, active modes of travel and car ownership are very different to those in the UK.</p> <p>No evidence statement has been made for congestion charging because the studies included in this systematic review are included in Brown V, (2015) which focuses on congestion charging.</p>

Source details	Results	Conclusions
	<p>baseline (baseline odds ratio when compared to follow-up 0.61 (95% CI 0.4 to 0.93), $p \leq 0.02$) and to take public transport trips than those living further away (odds ratio for 879 far group 0.60 (95% CI 0.37 to 0.97, $p \leq 0.04$).</p> <p>The same study presented very low quality evidence showing no difference in number of bike trips or time spent in light physical activity between baseline and follow-up for any group.</p> <p>Workplace Travel Plans</p> <p>One uncontrolled before and after Canadian study (high risk of bias) with 656 participants presented very low quality evidence that work-based travel plans introducing a new express transit route to work with subsidised travel pass increased public transport use by 3% at 1 year follow up. Participants were more likely to shift modes if they were female, had lower household income, had no driver's license or transit pass, and had no work parking permit.</p> <p>The same study provided very low quality evidence that introducing a new express transit route to work with subsidised travel pass resulted in a difference at follow-up in the self-reported time spent in total physical activity between groups. While those walking or cycling for their commute reported the highest PA at 140.3 mins PA (± 5.8 SE), those using public transport for their commute reported 79.2 mins (± 6.4 SE) at 1 year follow up which was higher than passive commuters (no mins PA). This trend was upheld even when recreational physical activity was combined with commuting minutes.</p> <p>One uncontrolled before and after UK study (high risk of bias) with 2,829 workers as participants presented low quality evidence that work-based travel plans increasing parking charges and decreasing parking spaces at the workplace increased walking and decreased car driving as a self-reported usual form of commute at 9-year follow-up. The intervention made no difference to cycling as a commute method.</p> <p>Integrated public transport fare</p> <p>One Israeli cohort study (high risk of bias) with 253,200 participants presented very low quality evidence showing that integrating public transport fares and simplifying paying systems increased public transport use. The number of passengers per day using public transport increased by 19% between baseline 2 (3 years pre intervention) and follow up (11 months post intervention). The average number of passenger trips increased by 9% between baseline 2 and follow up.</p>	<p>Overlap in included studies: Overlaps on three studies with Brown V et al. Congestion pricing and active transport - evidence from five opportunities for natural experiment. <i>J Transp Health</i> 2015;2 (4): 568-579.</p>

Source details	Results	Conclusions
<p>Bennie J et al. <i>Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence review 2: Ciclovia and street closures, trails and safe routes to schools</i>. London: NICE; 2017.</p> <p>Intervention: Street closures, trails and safe routes to school.</p> <p>Outcome: Physical activity</p> <p>Source type: Systematic review</p> <p>Searches conducted: 2006 to June 2016 (databases). Websites were searched in August 2016.</p> <p>Study population: General population</p> <p>Included study types: Comparative Studies and UK based qualitative studies.</p> <p>Cross-sectional surveys, correlation studies and modelling studies that were not economic modelling studies were excluded.</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: Thirty studies were included in the review.</p> <p>Of the 24 studies assessing interventions in adults or mixed populations, 10 were controlled before after studies, nine were uncontrolled before after studies, one was a cohort study, one an evaluation and three economic cost benefit analyses.</p> <p>Thirteen of the 24 studies were from the US with eight from the UK, and one each from Mexico and US, Norway, Australia.</p> <p>Quality of included studies: Each study was graded as to whether they had [++] <i>no risk of bias</i> (conclusions are very unlikely to alter), [+] <i>low risk of bias</i> (conclusions are unlikely to alter) or [-] <i>high risk of bias</i> (conclusions are likely to alter). GRADE which considers the risk of bias, consistency, directness, and precision of the studies reporting on a particular outcome was used to synthesise and present the outcomes from quantitative studies and these were presented as Evidence Statements. Qualitative evidence was disparate and sparse and summarised by presentation of their key themes.</p> <p>Synthesis: Narrative</p> <p>Findings: Five studies assessed safe routes to school. The findings of these are not reproduced here.</p> <p>Street Closures to motorised traffic (n=2) One repeated cross-sectional study (high risk of bias) from the US with 589 participants presented very low quality evidence showing implementing street closures may contribute to participants meeting the recommended 150 minutes of physical activity, as an average of 19.4% participants over three events met the recommendation. Between 34% and 55% of individuals attending the street closures events would have been sedentary if they had not attended the events.</p> <p>One cost benefit analysis (non-GRADE evidence) with high risk of bias [-] conducted in Mexico and US reported data suggesting that Ciclovia programmes are cost effective. According to the HEAT model, the benefit cost ratio (BCR) for the programme in Mexico was 1.02-1.23 (between \$1.02 and £1.23 in benefits for every \$1 in costs). For the programme in the US, the BCR was 2.32 (\$2.32 in benefits for every \$1 in costs). The difference in the medical cost for an active person and their inactive counterparts must be \$51.10 in Mexico and \$269.40 in the US to achieve a ratio over 1. As this was achieved in both instances, both programmes were beneficial.</p> <p>Cycle Infrastructure Improvement of cycle infrastructure for active commuting (n=1) One US uncontrolled study (high risk of bias) with 1853 participants presented very low quality evidence that improvement of cycle infrastructure (including installation of bike lanes, extension of an existing trail, new bike racks in public places and bike carriers on public buses) increased the total number of active commuters by 63% (of which 67% were walking and 30% were cycling) at 1 year follow up.</p> <p>Cycle Demonstration Towns (n=2) One UK study (low risk of bias) examining data from 6 towns with 1,266,337 participants presented very low quality evidence showing that introducing a variety of cycling interventions (included school travel planning; cycle facilities at schools, pedestrian bridges) increased the proportion of individuals self-reporting that they cycle regularly (≥ 30 minutes ≥ 12 times per month) by 0.9 percentage points, and increased observed cycling by 27% (absolute numbers not reported) between baseline and 1-3 years follow up. The same UK study presented very low quality evidence that introducing a variety of cycling interventions increased active travel (cycling to work) in intervention towns compared to the control groups at 10 year follow up.</p>	<p>Intervention: Street Closures</p> <p>Evidence statement [H]: Evidence about the effectiveness of street closures for increasing physical activity is lacking [1 study]</p> <p>Intervention: Improvements to cycle infrastructure/cycle demonstration towns</p> <p>Evidence statement [C]: There is some evidence that cycle demonstration towns and other interventions to encourage cycling increase active commuting [3 studies]</p> <p>Intervention: On-street cycle lanes</p> <p>Evidence statement [C]: There is some evidence supporting the use of on-street cycle lanes to increase cycling volume but it is not conclusive [4 studies]</p> <p>Intervention: Trails / paths for walking and cycling</p> <p>Evidence statement [D]: The evidence that interventions to improve or build trails and paths to increase walking and cycling is inconsistent and it is not possible to draw a conclusion [9 studies]</p> <p>Authors' conclusions: The committee noted that the majority of studies included in the evidence reviews were considered poor quality. However, they also noted that the body of evidence as a whole indicated a consistent 'direction of travel' whereby sympathetic changes to the environment and/ or public transport provision increase physical activity. The committee noted that the complexity and scale of the interventions makes this an extremely challenging area of research.</p> <p>Consistent themes that emerged across the studies were:</p> <ul style="list-style-type: none"> • Improvements to walking and cycling infrastructure are more likely to impact on the physical activity of people living close by. • While on street cycle lanes may significantly increase levels of cycling, the absolute increase, in terms of number of individuals, is likely to be very small. • Changes to physical infrastructure did not always result in participants increasing their physical activity levels significantly more than control groups, this may have been the result of the groups not being different enough in terms of distance to observe an effect.

Source details	Results	Conclusions
	<p>One UK study (high risk of bias) with more than 9000 participants presented very low quality evidence showing that introducing a variety of cycling interventions decreased the number of respondents describing themselves as inactive by 2.6 percentage points at 3 year follow up.</p> <p>The UK study at low risk of bias presented low quality evidence that introducing a variety of cycling interventions increased public transport use by 0.32%-points, decreased driving by 3% between baseline and follow up and increased walking by 1.71% at 10 years follow up. Cycling increased in all quintiles of deprivation although smaller improvements were seen amongst most deprived areas. Review evidence tables detail that for the study at low risk of bias, large effect size heterogeneity caused by some intervention towns displaying large changes whilst others showed only small non-significant changes.</p> <p>Cost benefit of Cycle Demonstration Towns (CDT) (non-GRADE evidence) (n=1) One study with a high risk of bias [-] based in the UK conducted a cost-benefit analysis which presented data suggesting that CDTs are likely to be cost saving. For every £1 spent on the CDT programme, between £2.60 and £3.50 of benefits are reported to be accrued due to reduced mortality, accidents and absenteeism, as well as decongestion and amenity impacts.</p> <p>On-Street Cycle Lanes (n=4) Four studies, two controlled and two uncontrolled before and after studies, (all high risk of bias) with 19,535 participants, one from Norway and three from US, presented low quality evidence showing that introducing on-street cycle lanes, separated from traffic by road markings only, increased the number of cyclists counted per day at 3 to 11 months follow up (increases of between 17 and 224.6%). Baseline numbers ranged from 9 to 91 cyclists observed per day, and at follow-up ranged from 10 to 257 cyclists observed per day. Two studies based in the US with 6,297 participants presented low quality evidence that implementing on-street cycle lanes increased the percentage of cyclists cycling with traffic rather than against it at 3 to 6 months follow up (between 2.8 and 8.5%-point increase, or between 3 and 11.6% increase). Three studies with 6,297 participants, two from the US and one from Norway, presented very low quality evidence that on-street cycle lanes had mixed effects on the percentage of cyclists riding on the pedestrian sidewalk. One study reported a decrease in the proportion of cyclists cycling on the pavements - 47% to 23% in one street and 22% to 5% in another street from baseline to follow up. The same study reported that cyclists stated they cycled less on the pavements in the intervention streets after counter-flow cycling was permitted, however pedestrians felt more insecure on these intervention streets. The two remaining studies reported no change in the proportions of cyclists cycling on the pavements (24.6% 1319 to 24.4%, p=0.90 and 93% to 93%; p= 0.8, respectively) at 3 to 11 months follow up.</p> <p>Trails and paths for walking and cycling (n=12)</p> <p>Extension of the existing greenway Two US studies (one uncontrolled at high risk of bias, one controlled at low risk of bias) with 343 participants presented very low quality evidence that extending a greenway made no difference to the mean number of days spent engaging in at least 30 minutes of walking, moderate and/or vigorous physical activity in residents living within 1 mile of the greenway (at 11 month to one year follow up).</p> <p>Improvement to routes (Infrastructural changes) (n=1) One uncontrolled UK study (high risk of bias) with 3541 participants presented very low quality evidence showing that improving trail routes increased the number of pedestrians walking along the route by 14.9% at 3-19 months follow up.</p> <p>Various on-street and off-street bicycle paths and bridge improvements (n=1) One controlled US study at high risk of bias presented very low quality evidence showing that introducing on-street and off street bicycle paths and bridge improvements increased the proportion of all journeys which were taken by bicycle in those living within 1.6km of the intervention in relation to other types of transport by between 0.21 and 0.47 percentage points (13.4 – 45.9% increase) between baseline and 10 year follow up.</p>	<ul style="list-style-type: none"> Increases in physical activity levels may not be in those people who were previously inactive but rather the result of infrastructure changes funnelling existing cyclists and walkers to new paths/streets/trails. Insufficient follow up times may impact on whether interventions were found to significantly increase physical activity levels; adequate time is required to allow behaviour change to take place. There is a need to be mindful of what else might be happening in an intervention area; one of the trail studies observed a sharp increase in physical activity levels at mid-intervention owing to a promotional campaign, after which levels tailed off. Although health economics data was of low quality, interventions in this review tend to be cost effective. <p>Limitations: The review authors noted the following limitations. Overall the quality of the studies was poor, none of the studies were graded [++] and only five of the studies assessing non-school related studies were graded [+]. The remaining studies were graded [-]. Many studies did not use a control group to control for other influences on outcome measures. Several do not include enough information on the control group to determine whether it is sufficient to reduce confounding (i.e. no information on distance from intervention site or similarity to intervention group). Four others use control groups which are unlikely to effectively reduce confounding, normally due to the intervention being so close to the control streets as to cause contamination, or due to intervention population / area being separated from the control with no buffer in between. For several types of intervention, self-selection occurred where participants were required to apply for funding for particular projects, or where projects are likely to be the result of demand in that area. Several interventions had behavioural elements which may have impacted the outcomes reported, but which could not be separated from environmental aspects. For several studies evaluation methods were inconsistent, particularly where data was collected by participant groups, and for other studies the methods used to count participants were potentially inaccurate. Self-reported data was widely used and may be subject to social desirability bias. Many studies were either unclear about the length of measurement periods and when they took place in relation to the intervention and baseline data collection, or had very short measurement periods. Where studies included multiple areas, results were often high level, obscuring differences in benefits across sites. Finally, there is a lack of reporting on the impact of interventions on those with mobility problems or disabilities.</p>

Source details	Results	Conclusions
	<p>Bicycle only road and off street bicycle facility (n=2) One controlled Australian study (high risk of bias) with 1396 participants presented very low quality evidence showing that introducing a bicycle boulevard and off street bicycle facility increased cycling along the route by 23% and 97% compared to 3% across the control areas at 4 month follow up. The same study also presented very low quality evidence showing that introducing a bicycle only road and off street bicycle facility increased the proportion of participants taking bicycle journeys, however, the mean minutes spent cycling (of trips lasting more than 10 minutes) decreased from 103.9 minutes (SD 73.0) to 65.9 minutes (SD 74.7) between baseline and 2-12 month follow up. One controlled US study (high risk of bias) with 154 participants presented very low quality evidence showing that introducing a bicycle only road and off street bicycle facility had no effect on the number of participants taking cycling and walking trips.</p> <p>A new greenway for cyclists (n=1) One uncontrolled US study at high risk of bias presented very low quality evidence showing that a new greenway for cyclists decreased the number of reported accidents involving cyclists by 28 crashes (from 78 crashes to 50) per year within 2.5km radius at one to two year follow up, this reduction was only meaningful up to 1km from the intervention.</p> <p>6 trails with new way-finding signage (n=1) One US study (low risk of bias) presented very low quality evidence showing that introducing way finding signage had no impact on the mean number of trail users at one to nine months follow up.</p> <p>Greenway/Path connecting residential and commercial areas (n=2) One controlled US study (low risk of bias) presented very low quality evidence showing that introducing a greenway connecting residential and commercial areas increased the number of individuals walking (p=0.001) and cycling (p=0.038) but had no effect on the number of children engaging in active transport to school at 14 month follow up. One uncontrolled US study (high risk of bias) presented very low quality evidence showing that introducing a greenway connecting residential and commercial areas increased the proportion of individuals observed engaging in moderate and/or vigorous physical activity by 4.3 percentage points and 2 percentage points (p<0.001) respectively. The same study presented very low quality evidence showing that the same intervention had no effect on the proportion of people reporting use of the trail for leisure and for transportation between baseline and 10 months follow up.</p> <p>Connect2 interventions including traffic free bridges and new riverside boardwalks (n=1) One UK cohort study (low risk of bias) reported in two publications with 3516 participants presented very low quality evidence showing that Connect2 interventions (including traffic free bridges and new riverside boardwalks) increased walking and cycling along the intervention routes. The study also presented very low quality evidence showing a decrease in moderate to vigorous physical activity at both 9 months and 21 months follow up. There was no association between the proximity of residents to the intervention route and time spent on either walking, cycling and moderate to vigorous physical activity at one year follow up, however individuals residing 1 km away from the intervention had an increase of between 9.2 min/wk and 15.3 min/week spent in walking and/or cycling at 2 years follow up.</p> <p>Connect2 interventions including traffic free bridges and new riverside boardwalks (non- GRADE evidence) (n=1) One uncontrolled mixed methods study with low risk of bias [+] based in the UK included qualitative interviews with 17 participants to explore the use and impact of Connect2 interventions (including traffic free bridges and new riverside boardwalks) in three sites (Cardiff, Kenilworth, and Southampton), prior to implementation. Expected primary use of the intervention, whether mainly commuting or mainly recreational, varied between sites, depending on whether affected routes led into a main town (mainly commuting), or across countryside (mainly recreational).</p>	<p>Comment: Authors note the applicability of studies from other countries may be limited if cultural differences affect population acceptability and use of public transport, active modes of travel and car ownership, as well as habits related to travel such as riding on pavements. Where these are different from in the UK, this will reduce applicability.</p> <p>Evidence grading has not included data from cost benefit studies.</p> <p>One of the included studies assessing the Cycling Cities and Towns initiative in England involved a control group. In that study, primary study authors note high heterogeneity and that the positive overall effect was driven by a few large towns. This suggests that effects may not be generalisable. Authors report, <i>Although there is evidence that cycling to work has increased overall among commuters living in the 18 interventions towns chosen thus far, there is uncertainty about whether cycling would in general increase if comparable investments were made in other towns.</i> Authors note evidence of larger effects in towns placing greater emphasis on workplace cycling initiatives adding that further process evaluations could investigate that association further.</p> <p>Overlap in included studies: Overlap with Stewart G et al What interventions increase commuter cycling? A systematic review. <i>BMJ Open</i> 2015; 5 (8): e007945 on three studies.</p>

Source details	Results	Conclusions
	<p>Where current trails were perceived as particularly unsafe or isolated, there was a higher perceived need for the improvements. In order for routes to be well used, participants reportedly perceived coherence of destinations and feeder routes to be important.</p> <p>Fitter for Walking programme (non -GRADE evidence) (n=1) One uncontrolled study with high risk of bias [-] based in five locations in the UK conducted a cost- benefit analysis which presented data suggesting that Fitter for Walking programmes may deliver benefits in excess of costs in some situations. The study reported benefit cost ratios (BCRs) for the project by individual location when using a) self-reported journey duration per week and b) self-reported journey distance per week at 14-20 month follow-up. HEAT, which takes into account only mortality benefits, was used.</p> <p>Results found that using journey duration produced BCRs below 1 (i.e. lower benefits than costs) for 2 of the five locations (-9.6:1; -0.4:1), and above 1 for three locations (2.2:1; 46:6; 3.7:1). When using journey distance, three of five locations had BCRs below 1 (-6.6:1; 0.9:1; -4.1:1) and 2 had BCRs above 1 (9.6:1; 34:1). BCRs appear to be strongly affected by initial project costs: the most expensive programme (London: £104,481) had BCRs below 1 for both measures, and the only location with BCRs above 1 for both measures had the lowest costs (Wolverhampton: £6,917).</p>	

Source details	Results	Conclusions
<p>Brown DR et al. Stand-alone mass media campaigns to increase physical activity: a Community Guide updated review. <i>Am J Prev Med</i> 2012; 43(5): 551-561.</p> <p>Intervention: Stand-alone mass media campaigns delivered to large and relatively undifferentiated audiences which are not part of broader multicomponent interventions</p> <p>Outcome: Increased awareness of physical activity message, increased knowledge about physical activity, increased intentions to be physically active, improved attitudes and beliefs related to physical activity, increased physical activity, increased or improved measures of physical activity /fitness</p> <p>Source type: Systematic review</p> <p>Searches conducted: 2001 to 2011</p> <p>Study population: Populations in high income countries</p> <p>Included study types: All</p> <p>Environment type/s: Physical activity Sociocultural Macro</p>	<p>Description of included studies: The systematic review included 16 studies, 12 of which assessed outcomes in an adult population. No information on the countries where the studies took place was provided,</p> <p>Included studies were three controlled trials, five cohort studies, five cross-sectional studies, and three single-group studies using before-after designs.</p> <p>Quality of included studies: Community guide methodology was used to assess research design suitability and quality of the execution of the research. Eight studies were rated as having greatest design suitability, including three with good and five with fair, ratings of execution quality. The remaining eight studies were rated as having least-suitable design, including one with good and seven with fair ratings of execution quality. Two studies included in an updated literature search are not rated for design suitability or quality of execution.</p> <p>Synthesis: Narrative</p> <p>Findings: Mass media campaigns were defined as stand-alone interventions that rely on mass media channels to deliver messages about physical activity to large and relatively undifferentiated audiences.</p> <p>The studies varied greatly in terms of their campaign intensity (although intensity was often not reported); duration; media dose (ranging from use of two channels to seven channels); and population reach of the various media campaigns.</p> <p>Physical activity outcomes were assessed using a variety of self-report measures with duration intervals ranging from 6 weeks to 4 years. Ten studies using comparable outcome measures documented a median absolute increase of 3.4 percentage points (interquartile interval: 2.4 to 4.2 percentage points), and a median relative increase of 6.7% (interquartile interval: 3.0% to 14.1%), in self-reported physical activity levels. The remaining six studies used alternative outcome measures: three evaluated changes in self-reported time spent in physical activity (median relative change, 4.4%; range of values, 3.1%–18.2%); two studies used a single outcome measure and found that participants reported being more active after the campaign than before it.</p> <p>One study found that a short term mass media weight-loss program that promoted increased physical activity was accompanied by a self-reported increase in physical activity levels.</p>	<p>Intervention: Stand-alone mass media interventions.</p> <p>Evidence statement [D]: The evidence is inconsistent and it is not possible to draw a conclusion about the impact of stand-alone mass media interventions, which do not include supporting multicomponent interventions, to undifferentiated audiences on physical activity outcome measures [16 studies].</p> <p>Authors' conclusions: This updated systematic review evaluated stand-alone mass media campaigns that varied in their intensity and duration, population targeted, control and comparison conditions, and reliance on varied and self-reported physical activity outcome measures. As a group, the studies found modest and inconsistent effects. Based on overall results of the current review, the effectiveness of stand-alone mass media campaigns to increase physical activity at the population level is unclear. Without stronger evidence for their effectiveness, such campaigns may be better used as part of a broader multicomponent community-wide intervention to increase awareness and knowledge about the benefits of physical activity and to change attitudes and norms—to create a broader social environment supporting population behaviour change.</p> <p>Comment: The use of mass media as a component of community interventions is covered in a separate systematic review (Baker-Philip RA, et al. Community wide interventions for increasing physical activity. <i>Cochrane Database Syst Rev</i> 2015, (1): CD008366.</p>

Source details	Results	Conclusions
<p>Brown V et al. Congestion pricing and active transport - evidence from five opportunities for natural experiment. <i>J Transp Health</i> 2015;2 (4): 568-579.</p> <p>Intervention: Congestion pricing scheme</p> <p>Outcome: Shift in behaviour from use of motor vehicle transport to walking, cycling or public transport; physical activity</p> <p>Source type: Systematic review</p> <p>Searches conducted: No search dates provided</p> <p>Study population: Populations in London, Singapore, Milan, Stockholm or Gothenburg</p> <p>Included study types: Quasi-experiments, uncontrolled before-after studies, analysis of survey data</p> <p>Environment type/s: Physical activity Economic Micro</p>	<p>Description of included studies: Twelve studies were included in the review.</p> <p>Four studies examined the London congestion pricing scheme, three examined the intervention type in Stockholm, one was conducted in Gothenburg and a further four were conducted in Singapore.</p> <p>Two studies were quasi experiments (one controlled before and after study and one boundary discontinuity design) whereas the remainder were uncontrolled before-after studies, estimates from available data or survey responses.</p> <p>Quality of included studies: The quality of the evidence included in this review was considered low with no study meeting all aspects of quality considered by the framework developed from MRC guidance on the evaluation of for natural experiments used to assess quality study. None of the included studies explicitly mentioned development of study protocols. Studies generally did not use multiple pre and post measures to estimate effect, nor collect information on multiple exposed and unexposed groups. Possible confounders were only mentioned or considered in seven of the included studies. All of the included studies were likely susceptible to some form of bias through low quality data collection and reporting. None of the studies attempted to control for such bias. Studies conducted in Sweden and London met a higher number of study quality criteria.</p> <p>Synthesis: Narrative</p> <p>Findings: The congestion pricing scheme in London uses cordon pricing utilising a fixed charge for weekday travel whereas schemes in Sweden use time-differentiated charges. In Singapore, a cordon pricing scheme uses differentiated charges by time, vehicle class and location. Findings from the Singapore studies are not summarised here as results are unlikely to be generalisable as Singapore also imposes car ownership quotas.</p> <p>London A study estimating the effect of the London congestion charge (11/15 study quality criteria met) comparing the travel behaviours of those living within the congestion pricing zone (who were eligible for a substantial discount on the charge) with those living near the congestion pricing zone border (who were not eligible for the discount), found that there was no difference in travel-related physical activity between the groups.</p> <p>A study (6/15 study quality criteria met) used flow data, trends in bus kilometre runs and estimates of elasticity to examine the factors behind the growth in bus patronage in Central London. By unpacking the factors behind the increase in bus patronage it was estimated that the congestion charge may have only contributed up to approximately 6% of the increase in observed bus patronage.</p> <p>In 2004, a study (8/15 study quality criteria met) estimated that the congestion charge had led to a reduction in traffic entering the zone of approximately 18%. Of the 18% reduction between 50 and 60% switched to public transport and 7% of the reduction switched to walking, cycling, motorcycle, taxi or car-share. Significant bus service improvements were also introduced around the same time as the congestion pricing scheme and there was a 37% increase in bus patronage within the first year of its introduction. Up to one half of these new bus travellers were attributed to the introduction of the charge, with the rest of the change attributed to network improvements.</p> <p>A 2008 analysis of the Western Extension Zone estimated that approximately 30% of those previously driving a car prior to the introduction of the charge had changed their travel behaviours, with the majority of these travellers also switching to public transport.</p> <p>Sweden A controlled before-after study (11/15 study quality criteria met) comparing differences in physical activity between residents of Stockholm, exposed to congestion pricing, and those unexposed to such costs in Gothenburg and Malmo yielded inconclusive results, with no significant difference in the magnitude of change in physical activity between residents of Stockholm and Goteborg or Malmo over the three year study period. Study participants living in the Stockholm region with access to a motor vehicle did however report more moderate physical activity (p=0.036), less time spent sitting (p=0.009) and an increase in overall weighted physical activity (p=0.015) compared to pre-implementation</p>	<p>Exposure: Congestion charging</p> <p>Evidence statement [C2]: There is some evidence suggesting that the introduction of congestion charging is associated with increases in public transport use but it is not conclusive [5 studies]</p> <p>Exposure: Congestion charging</p> <p>Evidence statement [D2]: The evidence suggesting that there is an association between congestion charging and physical activity is inconsistent and it is not possible to draw a conclusion [3 studies].</p> <p>Authors' conclusions: The overall evidence for a physical activity or modal shift effect is considered weak. The quality of the available evidence was also considered to be low. This is not to say that congestion pricing schemes may not have important secondary physical activity related health benefits. Instead, this review highlights the paucity of evidence that has been collected from real-world implementation of congestion pricing schemes. Given the growing recognition of the importance of distal mediators and determinants of health and the need for an 'all-of-government' approach more and better quality evidence of effectiveness of transport interventions for a broad range of outcomes, including health, is required. Significant barriers to the collection of such evidence exist</p> <p>Limitations: A number of studies were excluded due to their failure to report on modal shift to more active forms of transport or physical activity. The fact that there is still no clearly defined measure of physical activity and that data on active transport behaviours rarely comprehensively collected are significant barriers to a better understanding of potential population health impacts. The complexities introduced by the wide range of potential confounders of environmental interventions, coupled with a lack of evidence of potential substitution effects of an increase in active transport serve as further challenges.</p> <p>Comment: Included studies considered populations of London, Gothenburg, Singapore or Stockholm; no studies assessing effects in Milan were identified. Results of Singapore studies are likely to be less generalisable than those of from London or Sweden as Singapore also has car ownership quotas. It was surprising that authors only considered publications written in English given that authors sought grey literature and most schemes were located in countries where English is not the main language for communication.</p>

Source details	Results	Conclusions
	<p>An uncontrolled before and after study in Gothenburg (10/15 study quality criteria met) reported a 9% decrease in commuter car trips, 24% increase in commuter public transport trips but a 36% decrease in commuter cycling trips. The sample size in this study was described by its authors as small and unrepresentative</p> <p>The effects of the Stockholm congestion pricing trial on travel behaviours were explored in a study using data from a two-wave cross-sectional travel survey (10/15 study quality criteria met) undertaken before and after scheme implementation. The study found that whilst the majority of individuals did not change their travel behaviours as a result of the trial implementation, those who initially travelled by car and crossed the cordon had a 15% higher modal shift to public transport than those who did not drive across the cordon.</p> <p>An uncontrolled before and after study (8/15 study quality criteria met) aimed to estimate the effect of the Stockholm congestion pricing scheme on motor vehicle use and environmental behaviour. The authors found small increases in the number of people who walked and cycled post congestion charge (a 3% increase in those who walked and a 1% increase in those who cycled), although potential confounders were not discussed or controlled for and the study sample was quite small (n=291) for such a large population intervention.</p>	<p>The controlled before-after study from Sweden was underpowered to detect between group differences</p> <p>Authors note that there has been a limited opportunity for collecting evidence given the low numbers of cities worldwide that have implemented congestion pricing. However they add that many of the potential health benefits of transport policy are secondary endpoints means that many studies investigating the impacts of congestion pricing schemes fail to collect data on physical activity or modal shift effects.</p> <p>Overlap in included studies: Overlaps with Bennie J et al. <i>Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence review 1: Public transport.</i> London: NICE; 2017 on three studies.</p>

Source details	Results	Conclusions
<p>Bucher T et al. Nudging consumers towards healthier choices: a systematic review of positional influences on food choice. <i>B J Nutr</i> 2016; 115 (12): 2252-2263.</p> <p>Intervention: Positional changes of food placement (distance/proximity; order/accessibility)</p> <p>Outcome: Food choice including sales and consumption</p> <p>Source type: Systematic review</p> <p>Searches conducted: To February 2015</p> <p>Study population: No age restrictions; healthy, normal weight or overweight/obese individuals;</p> <p>Included study types: RCTs, experimental studies, pre-post studies, quasi-experiments and natural observations</p> <p>Environment type/s: Food Physical Micro</p>	<p>Description of included studies: Eighteen studies from 15 articles were included.</p> <p>Studies were described as:</p> <ul style="list-style-type: none"> • Five experimental – between subjects design • Three experiment (repeated measures possible) • One correlation analysis • Three between subjects experiment • One within subjects experiment • One naturalistic observation, experiment (repeated measures possible) • One longitudinal study pre-post design • 1 pre-post intervention • Two, two factor experimental design, between subjects <p>Ten studies were conducted in the US, four in the Netherlands, one in the UK, one in Switzerland. One paper did not report where the study was conducted.</p> <p>One study was conducted in children. Five studies were conducted in laboratories</p> <p>Quality of included studies: Studies were quality scored as per guidance in the Academy of Nutrition and Dietetics review evidence analysis manual⁵. Only one of the included studies received a positive quality rating. 14 were assessed as neutral and three as negative. To be rated positive studies had to meet at least 5/10 quality criteria; (four specific plus one other) neutral if they did not meet the 4/10 specific criteria and negative if they met only four or fewer of all the quality criteria.</p> <p>Synthesis: Narrative</p> <p>Findings: Foods involved in the studies included single healthy or unhealthy items (water, fruit and vegetable, cereal bars, chocolate candy or crackers) to more complex selections within canteen buffets with between eight and eleven products repositioned.</p> <p>Nine investigated the effect of distance/proximity changes on food choice, such as placing unhealthy foods further from the consumer. The other nine assessed whether changes in product order, such as, the food sequence on a buffet, could have a beneficial influence on food selection.</p> <p>Sixteen of the 18 studies concluded that positional changes had a positive (statistically significant) influence on food choice. The two studies that did not find an effect manipulated the product order of snacks on a computer screen as well as within a shelf at a checkout counter in a cafeteria (although there was a trend towards sales of healthy food being positively affected)</p>	<p>Intervention: Food position</p> <p>Evidence statement [C]: There is some evidence that changes in food position in out of home meal settings influences food choice but it is not conclusive [18 studies].</p> <p>Authors' conclusions: Although the evidence that food position influences food choice is consistent, it is difficult to quantify the magnitude of impact on food choice and intake and the effect size of these choice architecture interventions on actual food consumption and subsequent health outcomes. Use of harmonised terminology and indicators would allow comparability between experiments or interventions and assist in moving this field forward.</p> <p>Limitations: Review authors noted that literature investigating the effect of the assortment structure on buying behaviour within supermarkets was not identified they focused on out of home meal settings. Authors recognised factors affecting selection at the time of consumption and the time of purchase may differ. They further noted that there could be differences between nudges that aim to increase or decrease consumption, as well as between nudges that promote the choice of healthy foods v. nudges that discourage the consumption of unhealthy foods. Studies that strategically investigated the efficacy of the positional intervention depending on food type are missing from this review. Authors recommend that future studies address the issue of compensation (e.g. energy intake later in the day) and also whether personal factors influence effects and whether effects decay over time.</p> <p>Comment: May be issues of generalisation. Most of the included studies were conducted in university or hospital cafeterias. One study at a health conference. Five studies were conducted in laboratories. Search terms were not very comprehensive.</p> <p>Overlap in included studies: Overlaps with Wilson AL et al. Nudging healthier food and beverage choices through salience and priming. Evidence from a systematic review. <i>Food Quality and Preference</i> 2016; 51: 47-64 on five studies.</p>

⁵ Academy of Nutrition and Dietetics. *Evidence Analysis Manual: Steps in the Academy Evidence Analysis Process*. Chicago: Academy of Nutrition and Dietetics; 2012.

Source details	Results	Conclusions
<p>Cameron A et al. A systematic review of the effectiveness of supermarket-based interventions involving product, promotion, or place on the healthiness of consumer purchases. <i>Curr Nutr Rep</i> 2016; 5 (3): 129-138.</p> <p>Intervention: Supermarket – point of sale; product type, promotion, consumer education, product placement or a combination of these.</p> <p>Outcome: Store sales data, self-reported food purchase data, consumer food consumption and physical measures of body weight</p> <p>Source type: Systematic review</p> <p>Searches conducted: To November 2015</p> <p>Study population: Supermarket shoppers</p> <p>Included study types: Intervention studies – investigator led or natural experiments</p> <p>Environment type/s: Food Physical/sociocultural Micro</p>	<p>Description of included studies: The systematic review included 50 studies (49 articles).</p> <p>Study designs were 11 RCTs, 23 controlled trials, eight ITS and eight observational design.</p> <p>Twenty four studies included data from at least 400 participants or whole store data from at least three stores.</p> <p>Of the 50 studies, 37 were conducted in the US, four in the Netherlands, three in Australia, two in Canada, two in the UK, one in Japan and one in Norway.</p> <p>Interventions which involved price interventions were excluded unless independent effects of other intervention component could be identified.</p> <p>Quality of included studies: The quality of included studies was assessed using the Effective Public Health Practice Project (EPHPP) assessment tool for quantitative studies. 24 studies were rated as strong, 11 studies rated as moderate and 15 studies rated as weak. Note that tool was intended for use in studies with a control group and review authors included studies with no control group.</p> <p>Synthesis: Narrative</p> <p>Findings: Authors classified different components of interventions as relating to the “Four P’s of marketing”, product, promotion, place and price. In the context of healthy eating interventions, ‘product might include increasing the number of healthy options available; promotion can be with non-interactive (e.g. shelf-labels, signage, recipe cards) or interactive (taste testing, store tours, information sessions) interventions aimed at promoting healthier products or educating consumers with respect to nutrition: place may involve changing store layout or product positioning to promote healthier foods; while price can include discounts, taxes, vouchers or subsidies. Almost all studies involved promotion as an intervention target, with two studies incorporating product and six incorporating place. 30 studies tested multiple intervention promotion components (e.g. shelf tags, mass media, taste testing, flyers, posters or other signage and placement). Given the multicomponent nature of most interventions, it was not possible to evaluate the relative success of studies according to broad categorisation of product, promotion and place.</p> <p>Thirty five of the 50 studies reported a positive impact on the healthiness of consumer purchases.</p> <p>Most interventions focused on increasing the consumption of healthy foods; very few targeted a reduction in the promotion or availability of unhealthy foods. Only four studies included follow-up to ascertain the extent to which any intervention effects were maintained after the intervention ended. Body weight was not an outcome for any study. All studies reported intervention effects on purchases of food and the majority of studies (n=30) used store sales data as the primary outcome measure.</p> <p>Seventeen studies incorporated some form of shelf labelling, with 14 of these having a positive outcome. Of these, the shelf label component was either the only intervention or the primary focus of the intervention for more than half (n=9) of the studies. Four studies using nutrition summary scores as part of the shelf label, three in real world-settings (two of which were ITS design, both strong quality and one cohort analytic study of strong quality) and one in an online experimental supermarket (RCT, moderate quality) are among the only studies that could be said to have successfully increased sales of healthy foods and decreased sales of unhealthy foods.</p> <p>The interventions tested in the five studies considered to be the highest quality included (either RCTs or controlled trials):</p> <ul style="list-style-type: none"> • 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. • A multi-component healthy eating program including shelf labels, brochures, posters and a mass media campaign (estimated intervention effects ranging from 3.2 to 5.7 % for canned vegetables, dried beans and dried fruits). • A shelf label intervention identifying low-cholesterol and low-fat products, supported by information booklets (market share of tagged products increased in eight of 16 product categories (p < 0.05) with a 12 % average increase). 	<p>Intervention: Shelf labels identifying healthier options in supermarkets</p> <p>Evidence statement [B]: Interventions involving shelf labels using summary systems is supported by moderate quality evidence for effectiveness in increasing sales of healthy foods and decreasing sales of unhealthy foods. [4 studies]</p> <p>Intervention: Multicomponent marketing interventions involving shelf labelling in supermarkets</p> <p>Evidence statement [C]: There is some evidence that multicomponent marketing interventions involving shelf labelling in supermarkets are effective in increasing purchases of healthier foods but it is not conclusive [17 studies]</p> <p>Authors’ conclusions: Most high quality studies targeting the supermarket food environment reported improvements in the healthiness of consumer purchases in response to the intervention. Although it is difficult to identify specific intervention options that are likely to be most effective and sustainable in the setting, shelf labelling (particularly using nutrition summary scores) stands out as being particularly promising.</p> <p>Limitations: The review authors noted that many of the limitations of the included studies are a direct result of the limitations placed on researchers when conducting field experiments in collaboration with retailers. Sample size, study duration, intervention scope and even study design are not necessarily entirely in the researchers’ control.</p> <p>Comment: The majority of included studies were conducted in the US so findings, particularly in relation to specific types of food, may not generalise to the UK/Wales setting. Search terms were not very comprehensive.</p> <p>Most interventions focused on increasing the consumption of healthy foods; very few targeted a reduction in the promotion or availability of unhealthy foods. No studies</p>

Source details	Results	Conclusions
	<ul style="list-style-type: none"> • A complex RCT testing the effect of display space, newspaper advertising, display location quality and price on 16 types of fruits and vegetables (shelf space increased sales for all categories of products—hard fruit 44%, cooking vegetables 59%, salad vegetables 28 % and soft fruit 49 %). • 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). <p>Fourteen studies reported no or minimal effect of the intervention on the healthiness of consumer purchases. Eleven of these studies were controlled trials (four RCTs), and six of them involved numerous components and were part of large campaigns. No specific intervention type appeared to be more frequently represented among those that failed to change purchasing behaviour. Intervention types represented include nutrition-related flyers, demonstrations, videos, recipe cards, offering healthier product 'swaps' at point of purchase, posters and signage, shelf labels, placement (bananas only), podcasts, interactive video education, 'traffic- light' nutrition labelling (online) and a nutrition education 'bingo' game. The unsuccessful studies included three that could be considered a high-quality study design (controlled trial or RCT) with a large sample size and duration longer than 1 month.</p>	<p>included an outcome to assess change in weight of customers.</p> <p>Overlap in included studies: 13 studies with Liberato SC et al. Nutrition interventions at point-of-sale to encourage healthier food purchasing: a systematic review. <i>BMC Public Health</i> 2014; 14: 919 and three studies with Hersey JC, et al. Effects of front-of-package and shelf nutrition labeling systems on consumers. <i>Nutr Rev</i> 2013; 71(1): 1-14.</p>

Source details	Results	Conclusions
<p>Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315.</p> <p>Intervention: Labelling products with information on nutrients or energy</p> <p>Outcome: Objective measurements of purchasing or consumption of foods or non-alcoholic drinks</p> <p>Source type: Systematic review</p> <p>Searches conducted: To April 2017</p> <p>Study population: Adults and children</p> <p>Included study types: Randomised or quasi-randomised controlled trials (RCTs or QRCTs), controlled before–after studies or ITS studies</p> <p>Environment type/s: Food Physical/legislative Micro</p>	<p>Description of included studies: The systematic review included 28 studies. Of these 17 were RCTs, five were quasi-randomised controlled trials (Q-RCTs) and six were ITS studies.</p> <p>The majority, 21 studies, were conducted in the US with a further four studies in Canada, two in the UK and one in the Netherlands.</p> <p>Fourteen studies recruited university students or staff, six recruited university students or staff as well as members of the general population, six recruited from general population groups, one recruited from a high income population and one recruited in more socially deprived areas.</p> <p>Twenty six studies included adult participants, one included adolescents and adults and one study targeted families of young children.</p> <p>Most studies assessed the impact of labelling on menu or menu boards, or on or adjacent to a range of foods and drinks (n=20) and eight provided participants with only one labelled food or drink option and measured the amount consumed.</p> <p>Eleven studies assessed in the impact of nutritional labelling on purchasing food or drink options in real –world settings and 17 assessed the impact of nutritional labels on consumption in laboratory studies or settings.</p> <p>Quality of included studies: All studies were assessed for risk of bias across 10 domains. The quality of the available evidence was designated using GRADE. This uses the following categories: <i>High quality:</i> Further research is very unlikely to change our confidence in the estimate of effect. <i>Moderate quality:</i> Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. <i>Low quality:</i> Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. <i>Very low quality:</i> We are very uncertain about the estimate. The overall quality of evidence incorporated into this review ranged between moderate and very low.</p> <p>Synthesis: Meta-analysis and narrative</p> <p>Findings: To be included labelling interventions needed to provide information on the type and amount of nutrients, (although technically not a nutrient energy (e.g. calories) were included). Labels also needed to be visible on purchase by being placed on product packaging or containers, on shelves alongside the product, on the exterior of vending machines, on the counter from which food was being served or on a restaurant menu.</p> <p>Purchasing food or drinks in real-world settings Purchases from vending machines (one cluster-RCT), grocery stores (one ITS), or restaurants, cafeterias or coffee shops (three RCTs, one QRCT and five ITS). Findings on vending machines and grocery stores were not interpretable, and were rated as very low quality.</p> <p>A meta-analysis of the three RCTs, all of which assessed energy labelling on menus in restaurants, demonstrated a statistically significant reduction of 47 kcal in energy purchased (mean difference (MD) –46.72 kcal, 95% CI –78.35, –15.10, N = 1877). Assuming an average meal of 600 kcal, energy labelling on menus would reduce</p>	<p>Intervention: Nutritional labelling comprising energy information for products sold in restaurants</p> <p>Evidence statement [C]: There is some evidence supporting the use of labelled menus to reduce energy purchase but it is not conclusive. Meta-analysis of three randomised controlled trials demonstrated a reduction of 47kcal in energy purchased (MD -46.72 kcal, 95% CI -78.35 to -15.10, N=1877). On an average meal of 600kcal this would equate to a reduction of 7.8% (95% CI 2.5% to 13.1%).</p> <p>Intervention: Nutritional labelling for products sold from vending machines</p> <p>Evidence statement [H]: Evidence about the effectiveness of nutritional labelling for healthier purchasing from vending machines is lacking [1 study]</p> <p>Intervention: Nutritional labelling for products sold from grocery stores</p> <p>Evidence statement [H]: Evidence about the effectiveness of nutritional labelling for healthier purchasing from grocery stores is lacking [1 study]</p> <p>Authors’ conclusions: Findings from a small body of low-quality evidence suggest that nutritional labelling comprising energy information on menus may reduce energy purchased in restaurants. The evidence assessing the impact on consumption of energy information on menus or on a range of food options in laboratory settings suggests a similar effect to that observed for purchasing, although the evidence is less definite and also of low quality.</p> <p>Accordingly, and in the absence of observed harms, we tentatively suggest that nutritional labelling on menus in restaurants could be used as part of a wider set of measures to tackle obesity. Additional high-quality research in real-world settings is needed to enable more certain conclusions.</p> <p>Further high-quality research is also needed to address the dearth of evidence from grocery stores and vending machines and to assess potential moderators of the intervention effect, including socioeconomic status.</p> <p>Limitations: The extent to which the results of this review are applicable beyond North American university settings or laboratory settings is uncertain.</p> <p>Comment: Of the three studies included in the meta-analysis two were based in university-based restaurants or dining centres and in the workplace of a large healthcare company. One of the studies contributed 66% of the data and this study was assessed by systematic review authors as being at very high risk of bias.</p>

Source details	Results	Conclusions
	<p>energy purchased per meal by 7.8% (95% CI 2.5% to 13.1%). Authors considered two of the three RCTs to be at unclear risk of bias and one as being at very high risk of bias. The quality of the evidence for these three studies was rated as low, so our confidence in the effect estimate is limited and may change with further studies.</p> <p>Of the remaining six studies, only two (both ITS studies involving energy labels on menus or menu boards in a coffee shop or cafeteria) were at low risk of bias, and their results support the meta-analysis. The results of the other four studies which were conducted in a restaurant, cafeterias (two studies) or a coffee shop, were not clearly reported and were at high risk of bias.</p> <p>Consumption of food or drinks in laboratory settings Of these, eight (all RCTs) assessed the effect of labels on menus or placed on a range of food options. A meta-analysis of these studies did not conclusively demonstrate a reduction in energy consumed during a meal (MD -50 calories, 95% CI -104.41, 3.88, N = 1705). We rated the quality of the evidence as low, so our confidence in the effect estimate is limited and may change with further studies.</p> <p>Six laboratory studies (four RCTs and two Q-RCTs) assessed the impact of labelling a single food or drink option (such as chocolate, pasta or soft drinks) on energy consumed during a snack or meal. A meta-analysis of these studies did not demonstrate a statistically significant difference in energy consumed (standard mean difference (SMD) 0.05 calories, 95% CI -0.17 to 0.27, N = 732). However, the confidence intervals were wide, suggesting uncertainty in the true effect size. We rated the quality of the evidence as low, so our confidence in the effect estimate is limited and may change with further studies.</p>	<p>All three studies included in the meta-analysis included an intervention arm that assessed energy information with traffic light format interventions versus an arm only providing energy information versus no labelling. For the purposes of the meta-analysis both intervention arms were combined; information on the most effective type of labelling is not available from this systematic review. Authors note in their implications for practice section that further high quality studies are needed to assess the impact of nutritional labels varying in content and format on purchasing and consumption.</p> <p>Overlap in included studies: Overlaps with Overlap with Sinclair SE et al. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388 on 6 experimental studies and one quasi-experimental study.</p> <p>5 studies overlap with Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548.</p> <p>Of the three systematic reviews focussed on reflecting the evidence about menu labelling Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315 has the tightest inclusion criteria regarding study design, followed by Sinclair SE et al. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388. Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548 had the least stringent inclusion criteria with regard to study design.</p> <p>Search dates are most recent for Crockett, followed by Fernandes followed by Sinclair.</p>

Source details	Results	Conclusions
<p>Dadpour S et al. Understanding the influence of environment on adults' walking experiences: a meta-synthesis study. <i>Int J Environ Res Public Health</i> 2016; 13: 731.</p> <p>Influencing factor: Physical and Social environment</p> <p>Outcome: Walking</p> <p>Source type: Systematic review</p> <p>Searches conducted: 1990 to November 2015</p> <p>Study population: Adults</p> <p>Included study types: Qualitative studies</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: Ten studies were included in the systematic review. Of these three were conducted in Australia, six were conducted in Europe and one in North America.</p> <p>Two studies were conducted in low income areas, one study included participants who were women from social minorities whilst other studies included both men and women.</p> <p>Five of the 10 studies used focus groups, three studies used individual interviews and two studies used individual interviews and diaries to gather data for analysis.</p> <p>Quality of included studies: The quality of included studies is not discussed however two papers were excluded on the basis of the quality assessment.</p> <p>Synthesis: Meta-synthesis of qualitative studies</p> <p>Findings: Six studies were nonspecific on the type of walking, two studies had a focus on dog walking, one study focussed on recreational walking whilst one considered walking for transportation.</p> <p>Four broad themes were identified in the analysis, namely, safety and security, environmental aesthetics, social relations, and convenience and efficiency.</p> <p>For each of the main themes, sub-themes were identified.</p> <p><i>Safety and security</i> sub-themes Sense of insecurity and sense of inadequate safety.</p> <p><i>Environmental aesthetics</i> sub-themes Built environment aesthetics and natural elements.</p> <p><i>Social relations</i> sub-themes Being with others and public perception</p> <p><i>Convenience and efficiency</i> sub-themes Time of walking, walking spaces appropriateness, inefficient public transportation services, sounds in the environment, facilities and natural conditions.</p>	<p>Influencing factors:</p> <p>Themes that influence walking, identified in qualitative data, include <i>safety and security, environmental aesthetics, social relations</i> and <i>convenience and efficiency</i>.</p> <p>Evidence statement: It is not appropriate to grade this evidence as it is a reflection of qualitative data.</p> <p>Authors' conclusions: Environmental factors influencing the walking experience were "safety and security", "environmental aesthetics", "social relations", and "convenience and efficiency". Some factors enhanced or hindered the impact of other factors on walking. Convenience and efficiency enhanced the impact of social relations on walking in some aspects. Environmental aesthetics and social relations could hinder the influence of convenience and efficiency on walking experience. Conditions like income level could influence the impact of the environment on walking.</p> <p>The results of this study suggest some strategies to enhance the walking experience. These included proper maintenance and adequately wide walking places such as sidewalks, increasing the population density and providing mixed land use to shorten walking distances. Combining natural elements and green spaces in the walking environment, providing sufficient variety, details, and legibility in the design of buildings and public spaces, managing and protecting view corridors from walking spaces to picturesque places are additional suggestions. The proper lighting of walking places and providing sufficient crosswalks on streets should be a priority for pedestrians. As the population density increases, traffic and insufficient walking spaces should be considered.</p> <p>It is recommended to carry out quantitative studies to examine the effect of the new environmental factors obtained from qualitative studies on walking.</p> <p>Comment: Six out of ten studies were conducted in Europe. It was unclear in the reporting of this systematic review how many people undertook screening for eligible articles.</p>

Source details	Results	Conclusions
<p>Ells LJ et al. <i>Sugar reduction: the evidence for action. Annexe 2: A mixed method review of behaviour changes resulting from experimental studies that examine the effect of fiscal measures targeted at high sugar food and non-alcoholic drink</i>. London: Public Health England; 2015.</p> <p>Intervention: Fiscal measures targeting high sugar food and non-alcoholic drink</p> <p>Outcome: Consumption patterns, purchasing patterns, dietary intake, excess weight, weight gain, dental health, diabetes, cardiovascular disease risk, attitudes, energy</p> <p>Source type: Systematic review</p> <p>Searches conducted: 2010 - October 2014</p> <p>Study population: Adults and children in OECD countries</p> <p>Included study types: Experimental, quasi experimental and observational studies.</p> <p>Qualitative studies from the literature were excluded however qualitative data from stakeholders was collected.</p> <p>Environment type/s: Food Policy/legislative Macro</p>	<p>Description of included studies: Eleven studies were included in the review, 10 of which were in adult populations, with only one in children.</p> <p>Seven studies were conducted in the US, three in the Netherlands and one in France.</p> <p>Eight studies were largely experimental in either a laboratory (n=4) virtual setting (n=4) with two controlled field experiments in supermarkets and one in a cafeteria. The vast majority of included studies reported outcomes related to sales/purchases. No studies were found examining the effects of pricing on consumption or longer-term health outcomes.</p> <p>The majority of studies were small scale (n<200).</p> <p>Findings from the literature review were combined with emerging themes from 15 stakeholder interviews (with an additional two individuals providing written evidence).</p> <p>Quality of included studies: The quality of included studies were assessed using Johanna Briggs appraisal tools. Many of the studies lacked details about blinding, allocation concealment and withdrawals so they failed to gain higher scores on the quality assessment. Authors graded five studies as being of moderate quality, five studies as high quality and one as being of poor quality.</p> <p>Synthesis: Narrative</p> <p>Findings: Several studies examined the effect of other factors such as calorie labelling or nutrition education alongside increased prices though most reported outcomes from 'tax only conditions'. Three studies assessed the effect of subsidising 'healthy' or low calorie for nutrient foods.</p> <p>Laboratory/virtual experiments</p> <ul style="list-style-type: none"> • Seven out of eight studies (four descriptive laboratory, one high quality randomised controlled trial (RCT) virtual, one moderate quality controlled virtual, one moderate quality controlled laboratory) demonstrated that an increase in the price of sugar sweetened drinks (SSDs) or groups of unhealthy energy dense (ED)/high calorie for nutrient (HCFN) foods resulted in a decrease in purchases. The remaining high quality randomised controlled trial (RCT) showed no effect • Two studies provided outcomes specifically related to high sugar products or sugar consumption, and both showed a reduction in consumption of high sugar products or unhealthy foods as a result of a fiscal strategy • One study examined the different impacts of a fiscal strategy (which included subsidies on healthy foods as well as a tax on high sugar food and drink) in low and medium income groups, and while this strategy improved the energy density and nutritional quality of foods purchased overall in both income groups, it was reported that the low income group derived fewer financial (from subsidies) and nutritional benefits compared to the medium income group <p>Supermarket/cafeteria/restaurant experiments:</p> <ul style="list-style-type: none"> • All studies were undertaken in adult US populations. One randomised controlled field study and one descriptive study were conducted in supermarkets. One controlled field study took place in a cafeteria • All studies reported reductions in sugar purchasing as a result of the fiscal strategy • one high quality controlled field experiment study reported a short-term reduction (one month) in SSDs purchases but this reduction was not sustained at three or six months • A high quality descriptive field study reported that a 30% tax on unhealthy food increased the probability of purchasing 'healthy' food by 11% compared with the baseline • A poor-moderate quality controlled field study showed a 35% tax on regular soft drinks (no tax on diet drinks or water) in a hospital cafeteria resulted in a reduction in sales of regular soft drinks by 26% (increasing to 36% during a combined phase of education and tax) and 	<p>Intervention: Increased prices on energy dense/high calorie for nutrient foods</p> <p>Evidence Statement [C]: There is some evidence that increasing prices on energy dense/ high calorie for nutrient foods reduces their purchase in studies conducted in laboratory or virtual settings [11 studies].</p> <p>Authors' conclusions: Evidence from both stakeholders and current research studies suggest that increasing prices of high sugar foods and non-alcoholic drinks, potentially through taxation, is likely to reduce purchases of these products in the short term. All the empirical data assessed in the included studies reviewed demonstrated that consumers are responsive to changes in food and drink prices and those that did not report an effect had implemented a relatively low tax compared with other studies. These findings complement the evidence from modelling studies, which indicate that taxation would lead to a reduction in purchases proportionate to the level of tax applied, suggesting a tax of 10% to 20% would be necessary to have a significant impact on purchases, consumption, and ultimately population health. Moreover, the available evidence on sales data from countries that have implemented a tax on sugar products also aligns with these findings to suggest that purchases have reduced since the tax was implemented. The current evidence base appears to converge and suggests that a fiscal strategy is likely to reduce purchases of high sugar products at least in the short term. However, the overall lack of peer-reviewed experimental evidence has resulted in very little insight into effects that have been highlighted in the broader literature. These include the difference in short and long term effects, the extent and nature of a regressive (and progressive) effect and an understanding of compensatory behaviours and their impact on individual and population level dietary intake and nutritional quality overall. Any new tax should be accompanied by a robust evaluation which examines the long term effects of any price increases, specifically assessing compensatory behaviours and whether price increases would exacerbate health inequalities within certain population subgroups.</p> <p>Comment: Screening potential studies for inclusion was conducted by a single reviewer rather than in duplicate. A number of the experimental studies took place in laboratory settings. The extent to which behavior in such settings reflects what would actually happen in a real setting is unknown.</p>

Source details	Results	Conclusions
	<p>an increase in sales of diet soft drinks by 20%. A 'control' site with no increase in price showed no change in soft drink sales during the same time period.</p> <p>Summary of stakeholder interviews The key emerging themes focused on countries with a fiscal strategy and then more general themes around impact, evaluations, regressive and progressive nature, and response to the fiscal strategy from industry, public, and political representatives. However, the interviews revealed very little unpublished intelligence.</p> <p>Summary of combined findings When triangulated, evidence from the literature and stakeholder interviews provided convergent and complementary themes to suggest:</p> <ul style="list-style-type: none"> • increased prices on unhealthy food and drink results in a decrease in purchasing and sales • sales data from five countries indicate that existing taxes reduce purchases, although there were no official published evaluations • taxation may be regressive, having a higher impact on those from lower income groups, but this is believed to be progressive if this strategy reduces sugar consumption <p>Inter-method discrepancies were found when themes from the interviews covered areas which were either not identified in the literature review or fell outside the scope of the review. These themes, which were only identified in the stakeholder interviews, addressed the lack of evaluations from countries with a tax on high sugar products, responses from industry, political representatives, and the public, and taxation leading to a reduction in consumption.</p>	<p>No evidence statement has been written for evidence arising from experiments in supermarket, cafeteria or restaurants. The evidence presented here would lead to an evidence grading of inconsistent. Evidence in relation to taxes on sugar sweetened beverages has been graded on the basis of the findings of Afshin A et al. The prospective impact of food pricing on improving dietary consumption: A systematic review and meta-analysis. <i>PLoS One</i> 2017; 12(3): e0172277 which included more data.</p> <p>The majority of studies (7/11) were from the US which may impact generalisability of the evidence to the UK.</p> <p>Overlap in included studies: Overlaps with Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. <i>PLoS One</i> 2017; 12(3): e0172277 on two studies and Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. <i>Prev Chronic Dis</i> 2017; 14: E107 on one study.</p>

Source details	Results	Conclusions
<p>Ells LJ et al. <i>Sugar reduction: the evidence for action. Annex 3: Review of behaviour changes resulting from marketing strategies</i>. London: Public Health England; 2015.</p> <p>Exposure: Marketing strategies that target high sugar food and non-alcoholic drink</p> <p>Outcomes: Consumption patterns, purchasing patterns, dietary intake, excess weight, weight gain, dental health, diabetes, cardiovascular disease risk, attitudes, energy.</p> <p>Source type: Systematic review</p> <p>Searches conducted: 2010-October 2014</p> <p>Study population: Adults and children in OECD countries</p> <p>Included study types: Experimental, quasi experimental and observational studies.</p> <p>Qualitative studies from the literature were excluded however qualitative data from stakeholders was collected.</p> <p>Interventions examining the impact of labelling were outside of the scope of this review.</p> <p>Environment type/s: Food Economic/policy/legislative Micro</p>	<p>Description of included studies: A total of 45 primary research publications were identified and included in the literature review. The majority of the evidence focused on children (29 studies) with adults being the focus of 14 publications and two publications including adults and children.</p> <p>Studies were conducted across 10 different countries: 16 studies in the US, eight in the Netherlands, five in England, four in Australia, four in Belgium, two in Mexico, two in Portugal, one across several European countries, one in Austria, one in South Korea and one in Canada.</p> <p>Include studies comprised a mix of 31 experimental/controlled and 14 descriptive observational studies. Despite searching for studies with health and attitudinal outcomes the majority of studies focused on the impact in terms of preference, purchase and consumption.</p> <p>Findings from the literature review were integrated with emerging themes from 20 stakeholder interviews (one interviewee provided a written response).</p> <p>Quality of included studies: The quality of included studies were assessed using Johanna Briggs appraisal tools. The majority of studies were short term, small scale studies of generally low to moderate quality, with many of the experimental studies lacking clear details on blinding, allocation concealment, randomisation and withdrawals.</p> <p>Synthesis: Narrative</p> <p>Findings: The impact of marketing strategies was examined under the 4P's framework (Product, Place, Promotion and Price). Five studies were concerned with exposure to promotion, three studies examined the impact of price, six studies examined the impact of product characteristics of size, one study assessed product branding and one study examined end of aisle displays (place) in adults.</p> <p>Promotion</p> <ul style="list-style-type: none"> The evidence base on the impact of screen advertising was highly heterogeneous in study design, with a reliance on relatively small, variable quality experimental or observational studies. However, the findings from five relatively small experimental studies suggest that screen advertising has the potential to influence intake of high sugar products, or unhealthy foods to varying degrees in adults, with some evidence to suggest this impact may vary by population subgroup (e.g. individual psychology, gender and BMI). Findings from the studies examining the impact of screen advertising in children were mixed, with two studies in parents and children demonstrating an association between advertising and self-reported consumption of high sugar foods, and two studies (one from the UK) demonstrating an association between high sugar product consumption and TV advertising, while the remaining four studies were inconclusive. Eight studies examining the role of advergames (advertising incorporated into computer games), demonstrated an impact increasing consumption of, or preference for unhealthy or high sugar foods, under experimental conditions. One observational and one experimental study provided evidence to illustrate the role of traditional print marketing approaches in promoting high sugar product choices in children. The observational study demonstrated that alongside print/transport/school marketing, exposure to TV and digital marketing also influenced self-reported food choices. Sponsorship was identified as an emerging marketing strategy however, only one small, relatively low quality Portuguese study examined the influence of event sponsorship on children's purchase intention for a high sugar drink. <p>Price</p> <ul style="list-style-type: none"> Two observational studies, rated high quality, one US longitudinal study (n=82) and one cross-sectional study from England, demonstrated that price discounting can have a significant impact on increasing sales of less healthy, high sugar products. 	<p>Exposure: Price discounting on less healthy high sugar products</p> <p>Evidence Statement [C2]: There is some evidence suggesting that price discounting is associated with increased sales of less healthy high sugar products [2 studies]</p> <p>Intervention: Removing price incentives for large portions of food and soft drinks at fast food outlets.</p> <p>Evidence Statement [H]: Evidence that removal of price incentives for large portions of soft drink to reduce their intake in overweight people is lacking [1 study]</p> <p>Exposure: Product placement using end of aisle displays of carbonated drinks</p> <p>Evidence statement [H]: Evidence about the effectiveness of end of aisle displays in increasing sales of carbonated drinks is lacking [1 study].</p> <p>Author's conclusions: Findings from this review, support evidence from previous systematic reviews to suggest that marketing is effective in influencing the purchase and consumption of high sugar foods. Unsurprisingly much of the research evidence focuses on children, given they lack an adult's understanding of advertising intent, and are therefore considered more vulnerable to the impact of marketing. While current evidence suggests that advertising, advergames, discounting, use of character branding, product size and supermarket product placement can influence high sugar product selection or consumption, much of the research evidence is reliant on small scale, low to moderate quality experimental/controlled studies from outside of the UK. Although TV remains a dominant marketing channel, there are also several emerging and new marketing strategies such as sponsorship, integrated, digital and online marketing that require further research.</p> <p>Comment: A number of the experimental studies took place in laboratory settings. The extent to which behaviour in such settings reflects what would actually happen in a real setting is unknown. Screening potential studies for inclusion was conducted by a single reviewer rather than in duplicate.</p> <p>No evidence statement has been written for promotion though screen advertising as Mills SD et al. Systematic literature review of the effects of food and drink advertising on food and drink-related behaviour, attitudes and beliefs in adult populations. <i>Obes Rev</i></p>

Source details	Results	Conclusions
	<ul style="list-style-type: none"> One moderate quality field experiment from the Netherlands examined the impact of removing price incentives for large portion food and soft drink items within a fast food scenario. While the proportional pricing had no significant impact on self-reported soft drink selection within the general population, it was effective in reducing the size of soft drink selection in the overweight participants. <p>Product</p> <ul style="list-style-type: none"> Evidence from five experimental studies demonstrated that use of character branding/spokes characters may increase preference for, or intake of high sugar foods in young children aged 2 to 7 years. Five studies examined the impact of branding, suggesting an influence on high sugar food/drink preference. Although the evidence was difficult to summarise collectively because of heterogeneity of study designs, there was some evidence (although inconsistent) to suggest that branding may be more influential in children with a higher body weight. Evidence from the six heterogeneous studies examining the impact of product size, suggests that reducing the size of high sugar food and drink products may help to reduce sugar consumption in both adults and children. <p>Place:</p> <ul style="list-style-type: none"> One high quality observational study in England provided good evidence to suggest that end of aisle displays (after controlling for the effect of price, promotion and number of display location) can significantly increase purchases of carbonated soft drinks by just over 50%. <p>Themes identified from the interviews</p> <p>Academics and international stakeholders generally believed that marketing influences consumer choices and can increase consumption, however, they argued it was difficult to systematically measure impact due to the wide range and reach of marketing strategies. NGOs also believed marketing strategies impact on consumption and influence choice, however, they tended to talk in terms of advocacy, in helping reduce children's exposure to unhealthy food advertising for example, as opposed to focusing too heavily on developing an evidence base. Industry stakeholders argued that marketing was primarily aimed at sales growth or growing market share, and that particular strategies will certainly increase purchases as well as potentially increasing consumption.</p> <p>When combined, evidence from the literature and stakeholder interviews provided convergent themes to suggest:</p> <ul style="list-style-type: none"> Marketing strategies (price, product, place, promotion) are likely to impact on purchases and consumption, with the evidence predominantly focused on children. Pricing strategies such as discounting can increase purchases of high sugar food. Product placements such as end of aisle displays can promote high sugar purchases. 	<p>2013; 14 (4): 303-314 is a focussed systematic review on this topic. The two more recent studies published and identified in this review would not change the evidence grading for food advertising.</p> <p>No evidence statement has been written for product size as all the studies in this review have been included, excluded or are awaiting assessment by the Cochrane review Hollands (2015).</p> <p>Overlap in included studies: Three of the studies in this review overlap with Mills SD et al. Systematic literature review of the effects of food and drink advertising on food and drink-related behaviour, attitudes and beliefs in adult populations. <i>Obes Rev</i> 2013; 14 (4): 303-314.</p> <p>Overlap with Hollands GJ et al. Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. <i>Cochrane Database Syst Rev</i> 2015; (9): CD011045 on the five studies relating to product size.</p>

Source details	Results	Conclusions
<p>Eyles H et al. Food pricing strategies, population diets, and non-communicable disease: a systematic review of simulation studies. <i>PLoS Med</i> 2012; 9(12): e1001353.</p> <p>Intervention: Food pricing strategies</p> <p>Outcome: Food purchasing and consumption, health status (risk factors e.g. BP), non-communicable disease</p> <p>Source type: Systematic review</p> <p>Searches conducted: January 1990 to October 2011</p> <p>Study population: OECD countries</p> <p>Included study types: Simulation modelling studies</p> <p>Environment type/s: Food Economic/policy/legislative Macro; taxes Micro; subsidies And tax/subsidy combinations</p>	<p>Description of included studies: Thirty two studies were included in the systematic review.</p> <p>Thirty studies assessed the impact of food pricing on diet outcomes; 17 assessed food taxes, six subsidies and seven combinations of taxes and subsidies.</p> <p>Nineteen studies assessed the impact of food pricing on health and disease outcomes; 15 assessed taxes; three subsidies and four combinations of subsidies and taxes</p> <p>Quality of included studies: Assessment of the quality of the studies were based on the types of price elasticities calculated, how they were developed and assessment of input data to the model components but did not including assessment of the assumptions made in linkages between model components. No included studies met the authors' definition of high quality. Seven studies were considered to be of moderately high quality; 25 studies were considered to be of low quality.</p> <p>Synthesis: Where three or more studies examined the same pricing strategy and outcomes results were pooled and a mean own-price elasticity (own-PE) estimated. A meta-analysis was not undertaken because of heterogeneity between models.</p> <p>Findings:</p> <p>Impact on food and nutrient consumption A 10% increase in price on carbonated soft drinks could decrease consumption by 9.3% (range, 0.6 to 24.3%), and the resulting modelled reduction in energy consumption was 0.2% (range, 0.1%, 0.4%).</p> <p>The modelled reduction in saturated fat resulting from a saturated fat tax was 0.2% (range, 0.1% to 0.4%) of total energy for a 10% increase in price.</p> <p>A 10% decrease in the prices of fruits and vegetables could increase consumption by 3.5% (range, 2.1 to 7.7%).</p> <p>Plotting the estimated impact on consumption resulting from food taxes and subsidies of various magnitudes produces a linear trend, suggesting that, to a point, overall the larger the magnitude of the tax or subsidy, the larger the impact on consumption (in the desired direction).</p> <p>Impact on health and disease and difference by socio-economic group Variability of food taxes and subsidies and types of consumption, health, and disease outcomes assessed prevented any pooled analyses.</p> <p>Higher quality studies estimated that dairy/saturated fat taxes may increase mortality from cardiovascular disease (CVD) and coronary heart disease (CHD) (n = 1), and less healthy/junk food taxes may increase overall mortality (n = 1) and mortality from stroke and CVD (n = 2). There was also some evidence that pricing strategies may result in unintended compensatory buying through cross-price elasticities; two moderately high quality studies estimated a potential increase in consumption of sodium in response to a saturated fat tax, and a potential increase in mortality from CVD in response to a tax on less healthy foods.</p> <p>Of 14 studies assessing absolute impacts for lower socio-economic groups, 11 estimated that effects on food and nutrient consumption, and health and disease, would be pro-health. Relative impacts may also be greater for lower income groups, and thus food taxes and subsidies have the potential to be pro-equity.</p>	<p>Intervention: Taxes on carbonated drinks and saturated fats; subsidies on fruit and vegetables</p> <p>Evidence statement: There is some evidence from modelling studies that taxes on carbonated drinks and saturated fats and subsidies on fruits and vegetables would be associated with beneficial dietary changes</p> <p>Authors' conclusions: Based on modelling studies, taxes on carbonated drinks and saturated fats and subsidies on fruits and vegetables would be associated with beneficial dietary changes, with the potential for improved health. High-quality evidence is lacking, particularly with regard to the unintended effects of compensatory purchasing and the potential impacts on health equity, long-term health, and non-communicable disease mortality. Moreover, cost-effectiveness and pragmatic issues associated with the implementation of food pricing strategies must also be addressed. Robust evaluations built into the implementation of food pricing policies would help answer some of these questions and engender confidence that such strategies will provide positive effectiveness on population diets and reduce the global burden of non-communicable diseases.</p> <p>Limitations: Review authors noted that they did not attempt to undertake a thorough assessment of the structural uncertainty of the models, including the selection of relative risk functions. They also state that it was not possible to compare the potential effects of specific food pricing strategies by population or country of interest. Less than half of included studies used a complete food demand system examining own-price elasticities and cross-price elasticities. Most studies identified by the systematic review failed to account for errors and variation/uncertainty in the modelling process. No studies included in the review attempted to validate the epidemiological model used to estimate impacts on consumption, health and disease.</p> <p>Comment: RCTs and observational studies were specifically excluded. Because this systematic review relies on modelling studies the evidence has not been graded. No repeatability check was conducted for inclusion.</p> <p>Authors have noted the importance of further research on cross-price elasticities to assess potential substitute foods Where substitute foods are as, or more, unhealthy than the taxed food diet is not improved and may even be worse.</p> <p>Overlap in included studies: Overlaps with Thow AM et al. A systematic review of the effectiveness of food taxes and subsidies to improve diets: understanding the recent evidence. <i>Nutr Rev</i> 2014; 72(9): 551-565 on six studies.</p>

Source details	Results	Conclusions
<p>Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548.</p> <p>Intervention: Quantitative or qualitative menu labelling visibly displayed at points of selection in real life settings, restaurants or cafeterias</p> <p>Outcome: Absolute number (calories and/or nutrients) or proportion (%) of sales, purchases, choice of targeted items, food items/food groups or different portion sizes purchased or selected on site</p> <p>Source type: Systematic review</p> <p>Searches conducted: To June 2015</p> <p>Study population: Adults, university students or general consumers</p> <p>Included study types: Experiments (randomized trial), quasi-experiments (controlled trial or pre-post experiments with or without control groups), observational pre-post studies that were natural experiments with or without controls, or cross-sectional studies with exposed and non-exposed groups</p> <p>Environment type/s: Food Physical/legislative Micro</p>	<p>Description of included studies: This systematic review includes 38 studies.</p> <p>Of these, two were RCTs, four were non-randomised controlled trials, 19 were other types of quasi experiments (ITS, controlled before after, cohort analytic), 10 were uncontrolled before after studies and three were cross sectional studies.</p> <p>Of the 38 studies, 32 were conducted in the US, two in the UK, and one each in Sweden, Switzerland, Denmark and the Netherlands.</p> <p>Ten studies were conducted in fast food restaurants and 12 in sit-down restaurants. Of the cafeteria studies six were conducted in universities, five in hospitals and five in workplaces.</p> <p>Outcomes were classified into three categories according to whether the influence of menu labelling on food choices was considered desirable: overall desirable effect, partial desirable effect or no desirable influence.</p> <p>Quality of included studies: The (EPHPP) tool for quantitative studies used to assess quality. Studies were assigned a quality rating of strong, moderate or weak. Out of the 38 studies, 18 were assessed as moderate in quality, 11 as weak, and nine as strong. Most studies did not clarify whether the samples adequately represented the target population. In uncontrolled before after studies rated weak for selection bias it was not possible to determine if the participants before and after were the same or if the authors controlled for identified confounders. Studies usually did not mention whether the participants were blinded to the research question, but data collection instruments were valid and reliable. Most studies analysed receipts before and after the intervention without evaluating the same people.</p> <p>Synthesis: Narrative</p> <p>Findings: In this systematic review, menu labelling designated all calorie information, nutritional information, contextual information, food information and traffic light labelling. Findings from studies in restaurants and cafeterias were analysed separately because of differences in food service characteristics and in menu labelling formats. Restaurants included fast food and sit-down restaurants in commercial settings whereas cafeterias were in workplaces and universities (institutional settings). Most studies in cafeterias displayed information designed specifically for the patrons of each location. Additionally, each category of studies was classified according to type of food service (fast food vs sit down) and location (university, hospital or other type of workplace cafeteria).</p> <p>Overall when results were stratified 59% of studies in restaurants and 75% of studies in cafeterias showed partial or overall effects. Authors cite the Cochrane Handbook for Systematic Reviews of Interventions in influencing their recommendations: when 34% to 66% of studies favour intervention, evidence shows mixed effects.</p> <p>Restaurants Fast food restaurants (n=10): Only one study of weak quality found an overall positive effect. Four studies (three strong quality, one weak) found partial effects. Five studies (one strong quality, three moderate, one weak) examining calorie labelling on calorie content of food selections and found no effect. Sit-down restaurants (n=12): One study assigned moderate quality showed overall positive effect of calorie labelling in a fine dining restaurant. However this study had no control group. Four of seven studies conducted in sit down restaurants found partial effects of healthy food symbols. Of the seven studies, six were considered to be of moderate quality except for one considered weak. Three studies combining calorie information alongside qualitative information from symbols traffic light labelling or numeric nutrient information showed partial effects but two of these three studies were assessed as being of weak quality with one being moderate. The only strong study in a sit-down restaurant did not find any effect of a reduced-fat message on total energy or fat content of dishes ordered. Three other studies in sit down restaurants (one weak quality, two moderate quality) did not find any effect of menu-labelling strategies on food choices. In general, studies of higher quality in restaurants seemed to be associated with partial or negative results, and those of lower quality were associated with positive results.</p>	<p>Intervention: Menu labelling in restaurants (commercial settings)</p> <p>Evidence statement [D]: The evidence for menu labelling in restaurants having desirable influences on food choices is inconsistent [22 studies].</p> <p>Intervention: Healthy food choice or traffic light labelling in cafeterias (institutional settings, workplace/canteens)</p> <p>Evidence statement [C]: There is some evidence supporting healthy food choice or traffic light labelling showing desirable influences on food choices [16 studies].</p> <p>Authors' conclusions: The overall results suggest that menu labelling has mixed effects, although it is more effective in cafeterias than in restaurants, especially fast-food restaurants. The use of calorie information as the focus of menu-labelling strategies is questionable, as it seems not to lead to healthier choices. Qualitative information, such as – but not limited to – the types used in the studies included in this review (healthy-food symbols and traffic-light labelling), may prove more effective in promoting healthy eating. Further research could test the most effective menu-labelling formats identified in this study by using controlled randomized trials or other designs that include control groups and analyse real-life selection or consumption data before and after menu-labelling interventions.</p> <p>Comment: Populations in studies in cafeterias included subjects from universities and hospitals whereas general populations were studied in restaurants. There are likely to be differences in educational levels between these populations and higher education may be correlated with healthier choices.</p> <p>Authors note in their discussion that survey results at locations of some studies suggested that taste was the main reason for choices. The authors also postulate that restaurants are places for pleasure and enjoyment, where people go to celebrate, which may explain why calorie labelling may not be as effective in these locations.</p> <p>Of the three systematic reviews focussed on reflecting the evidence about menu labelling</p>

Source details	Results	Conclusions
	<p>Cafeterias</p> <p>University cafeterias (n=6): Two studies (one strong quality, one moderate quality) showed overall desirable effects of displaying numeric information about calories and various nutrients. Three studies (one moderate quality, two weak) reported partially positive results with calorie plus healthy message/ symbol or fat content labelling. One study of moderate quality found no effect of numeric information about calories, calories from fat, or cholesterol on decreasing intake of the targeted outcome.</p> <p>Hospital cafeterias (n=5): Two studies (one strong, one moderate) showed positive overall results of qualitative menu-labelling strategies (keyhole symbol and traffic-light labelling). Two studies (one moderate, one weak) found partial effects of numeric calorie labelling. One moderate quality study found no effect of a "healthy picks" label plus numeric calorie labelling and nutrient information on sales of targeted foods.</p> <p>Workplace cafeterias (n=5): One study of strong quality showed overall positive effects of healthy food symbols on the sales of targeted food items. Two other studies (one moderate quality, one weak) evaluating qualitative menu labelling had partial desirable effects. Two studies (one strong quality, one weak) found no effect of healthy food symbols. Although one strong quality study in cafeterias assessing healthy food symbols did not find a positive effect, other studies of higher quality in cafeterias found more positive effects of menu labelling on choices than those of lower quality, while those of weak quality were mostly identified as having partially effective results.</p>	<p>Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315. Crockett (2018) has the tightest inclusion criteria regarding study design, followed by Sinclair SE et al. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388. Those for Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548 were the least stringent.</p> <p>Search dates are most recent for Crockett, followed by Fernandes followed by Sinclair.</p> <p>Overlap of included studies: Five studies with Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018, (2): CD009315 and eight studies with Sinclair SE et al. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388.</p>

Source details	Results	Conclusions
<p>Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. <i>Prev Chronic Dis</i> 2017; 14: E107.</p> <p>Intervention: Pricing incentives and disincentives (discounts, coupons and vouchers in food assistance programmes; cash rebates, taxes. Alone or combined with promotion of healthy foods. Excluded studies of vending-machines and online sales and government programmes for schools</p> <p>Outcome: Stocking and sales of healthy and unhealthy foods. Purchasing and consumption.</p> <p>Source type: Systematic review</p> <p>Searches conducted: January 2006 to December 2016</p> <p>Study population: High and middle income countries</p> <p>Included study types: Real word experimental studies (RCTs, quasi-experimental studies and natural experiments)</p> <p>Environment type/s: Food Economic/policy/legislative Macro; tax Micro; incentives</p>	<p>Description of included studies: Thirty studies from 65 papers included. Twenty four experimental design (included RCTs and quasi-experiments), three natural experiment, three mixed method.</p> <p>Seventeen studies were conducted in US, one in Canada, two in Australia, two in New Zealand, one in the UK, one in South Africa, one in Denmark, one in Belgium, two in South America and two in France.</p> <p>Eighteen studies targeted low income, disadvantaged populations. Twelve targeted specific populations (worksite, sports gym, school, swimming pool, hospital).</p> <p>Settings included grocery stores and supermarkets (n=7); all retailers in a setting (e.g. city neighbourhood) (n=6); farmers markets (n=5); work and school cafeterias (n=5); food delivery services (n=2); takeout restaurants (n=1) and corner stores (n=1).</p> <p>Quality of included studies: Some included studies had no control or comparison condition. Studies were scored on the presence or absence of 10 dichotomous criteria resulting in a quality score ranging for 0 to 10 for each study. Mean score was 6.9. Review authors reported common study limitations as short intervention duration, possible biases because of self-reporting, use of non-validated assessment tools and lack of power and external validity of findings, no assessment of food substitutions or the effects of pricing interventions on food purchasing and diets</p> <p>Synthesis: Narrative</p> <p>Findings: Twenty seven studies looked at interventions promoting healthy food, most commonly fruit and vegetables (n=20) and low sugar beverages (n=10). Only six studies discouraged unhealthy foods such as sugar sweetened beverages (SSBs) generally by raising the prices.</p> <ul style="list-style-type: none"> • Nine studies assessed financial discounts on healthier food and beverages • Four studies assessed redeemable coupons/vouchers for healthy food and beverage items targeting recipients of food assistance programmes • Six studies assessed redeemable coupons or vouchers for healthy food and beverages targeting consumers not participating in food assistance programmes • Five studies assessed cash rebate on healthier foods and beverages • Six studies assessed disincentives for unhealthy food and beverage, with and without incentives for healthy food and beverage purchase <p>Studies of financial discounts on healthy foods and beverages (n=9) One study reported a 450% increase in sales of promoted foods (healthy prepared carry out foods and reduced or no sugar beverages) (quasi experimental, quality score 9/10). One study reported a 40-60% increase in stocking score in all intervention groups but reported no consumer outcomes (fruit and vegetables, low sugar beverages, nutrient dense foods, low fat snacks and whole grain products) (RCT quality score 8/10). One study reported a 30% increase in sales of healthy items during the discounted period in a sub sample (quasi experimental quality score 6/10). One study reported an increase in sales of water, sports drinks and fruit juice (quasi experimental quality score 5/10). One reported a 63% increase in availability of fruit and vegetables, and a 60% increase in purchase of fruit and vegetables and a 13.4% increase in purchase of non- SSBs (group randomised RCT, quality score 7/10). One study reported a 35% increase in purchase of fruit and vegetables and a 15% increase in purchase of non SSBs, this impact was not maintained at 6 months and there was no impact on the purchasing of water or low calorie drinks (RCT, quality score 10/10). One study reported a 10% increase in purchase of healthy items (fruit and vegetables, low calorie soft drinks and water) (RCT, quality score 8/10).</p>	<p>Intervention: Financial discounts on healthy food and beverages</p> <p>Evidence statement [B]: The use of financial discounts to increase purchasing of fruit and vegetables is supported by moderate quality evidence of its effectiveness [4 studies].</p> <p>Evidence statement [C]: There is some evidence that discounts the price of low calorie, reduced calorie or non-sugar sweetened beverages increases their purchasing but it is not conclusive [5 studies].</p> <p>Intervention: Redeemable coupons or vouchers for healthy foods and beverages targeting participants in food assistance programmes</p> <p>Evidence statement [C]: There is some evidence that redeemable coupons or vouchers for healthy foods and beverages targeting participants in food assistance programmes increases fruit and vegetable consumption but it is not conclusive [3 studies]</p> <p>Intervention: Redeemable coupons or vouchers for healthy foods and beverages targeting those not participating in food assistance programmes</p> <p>Evidence statement [C]: There is some evidence that redeemable coupons or vouchers increase fruit and vegetable consumption in those not participating in food assistance programmes but it is not conclusive [2 studies]</p> <p>Evidence statement [E]: There is some evidence that redeemable coupons or vouchers for healthy foods and beverages targeting participants not in in food assistance programmes has no impact on weight outcomes but it is not conclusive [3 studies]</p> <p>Intervention: Cash rebates</p> <p>Evidence statement [C]: There is some evidence that cash rebates increase purchase of healthy foods but it is not conclusive [5 studies]</p> <p>Evidence statement [E]: There is some evidence that using cash rebates to encourage purchasing and consumption of healthy foods has no impact on obesity but it is not conclusive [2 studies].</p> <p>Authors' conclusions: Pricing interventions generally increased stocking, sales, purchasing and consumption of promoted foods and beverages. Additional studies are needed to differentiate the potential impact of selected pricing</p>

Source details	Results	Conclusions
	<p>One study reported a 57% increase in fruit purchasing in women and a tripling in men (quasi experimental quality score 2/10).</p> <p>One RCT study reported a health outcome (quality score 9/10). This found no difference in weight outcomes over the 2 years of the study however only the availability of healthy snacks was modified, the 15% proposed price reduction on calorie-smart foods was not implemented.</p> <p>Studies of redeemable coupons or vouchers for healthy foods and beverages targeting participants in food assistance programmes (n=4)</p> <p>No studies reported weight outcomes.</p> <p>One study reported a 24% increase in people consuming 5 or more servings of fruit and vegetables a day (uncontrolled before and after, quality score 6/10).</p> <p>One study reported a 140% to 640% increase in fruit and vegetable intake score (quasi experimental, quality score 7/10) and 1 a 30% increase in this score (quasi experimental quality score 7/10).</p> <p>One study reported no consumer or food availability outcomes.</p> <p>Studies of redeemable coupons or vouchers for healthy foods and beverages targeting consumer not participating in food assistance programs (n=6)</p> <p>One study reported a 33% increase in fruit and vegetable consumption but no significant impact on BMI (RCT quality score 6/10).</p> <p>One reported a 20% increase in fruit and vegetable intake but no significant impact on BMI (non-randomised controlled trial, quality score 7/10).</p> <p>One study looked at spending on fruit and vegetables and reported no effect (RCT quality score 7/10).</p> <p>One study reported an increase in sales of low fat foods 33.6% at 2 years but no impact on consumer food choices (RCT quality score 10/10).</p> <p>One study reported a 59% increase in fruit juice consumption (RCT, quality score 8/10).</p> <p>One study found an 8% decrease in the total calories consumed and a 6% decrease in total fat in food purchases and a non-significant decrease in weight (RCT quality score 9/10).</p> <p>Studies of cash rebates (n=5)</p> <p>One study reported no impact on food purchasing (RCT, quality score 10/10)</p> <p>One study reported 9.3% increase in healthy food to total food expenditures, a 63% increase in consumption of fruit and veg and 195% increase in consumption of whole grain foods and a 68% decrease in consumption of unhealthy foods (high sugar, high salt, fried, processed meats and fast foods). This study reported no impact on obesity (non-randomised trial, quality score 7/10)</p> <p>One study reported 40% increase in fruit and veg intake and a 10% decrease in intake of refined grain (RCT, quality score 9/10)</p> <p>One study reported a 10% increase in protein intake, 28% in calcium and 60% increase in daily vegetable intake but no significant impact on BMI (RCT, quality score 6/10)</p> <p>One study reported a 25 to 30% increase in purchasing of fruit and vegetables. This effect was not sustained when the incentive was reduced (RCT, quality score 7/10)</p> <p>Studies of taxes on unhealthy foods (n=3)</p> <p>One study looking at taxes on SSBs reported that this led to a 9% increase in retail price, a 21% increase in consumption of SSBs and a 63% increased consumption of water (controlled, non-randomised before and after quality score 6/10). A second study on SSB tax reported a 12% decrease in purchase of SSBs (uncontrolled before and after quality score 5/10).</p> <p>One study looked at the impact of the Danish saturated fat tax. This reported a 5% decrease in sales of ground beef and cream but a 4% increase in saturated fat intake and a 1% increase in salt intake (uncontrolled before and after quality score 5/10).</p>	<p>strategies over others. Further research that uses robust designs and assessments are needed in real community settings to simultaneously test subsidies of healthy foods and beverages and the effects of increased costs of unhealthy foods and beverages.</p> <p>Limitations: The review authors noted that many studies reviewed had limitations, including lack of formative research, process evaluation, or psychosocial and health assessments of the intervention's impact; short intervention duration; or no assessment of food substitutions or the effects of pricing interventions on food purchasing and diets.</p> <p>Comment: The method used for assessment of the quality of the included studies is not well reported. Little consideration was given to the quality of the included studies in formulating conclusions. No conflict of interest statement was provided. Funded by charitable foundation supported by Johnson and Johnson. Majority of included studies were conducted in the US; may be some issues with generalisation to UK/Wales setting.</p> <p>No evidence statements have been written for studies examining redeemable coupons or vouchers for healthy food and beverages targeting consumers not participating in food assistance programmes because most of these studies also involved some form of counselling alongside the intervention. No evidence statement has been written for taxes on sugar sweetened beverages as Afshin et al (2017) has more detailed information on categories of foods.</p> <p>Overlap of included studies: One study overlaps with Ells LJ et al. <i>Sugar reduction: the evidence for action. Annex 3: Review of behaviour changes resulting from marketing strategies</i>. London: Public Health England; 2015; 10 studies with An R et al. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. <i>Public Health Nutr</i> 2013; 16(7): 1215-1228 and six studies overlap with Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. <i>PLoS One</i> 2017; 12(3): e0172277.</p>

Source details	Results	Conclusions
<p>Grech A, Allman-Farinelli M. A systematic literature review of nutrition interventions in vending machines that encourage consumers to make healthier choices. <i>Obes Rev</i> 2015; 16 (12): 1030-1041.</p> <p>Intervention: Nutrition interventions to promote dietary change in vending machines</p> <p>Outcome: Dietary behaviours change – sales data, dietary intake, BMI</p> <p>Source type: Systematic review</p> <p>Searches conducted: Not given</p> <p>Study population: Any population having access to vending machines</p> <p>Included study types: Controlled intervention studies</p> <p>Environment type/s: Food Physical/socioeconomic Micro</p>	<p>Description of included studies: Twelve studies were included; three RCTs, three cluster RCTs, five pre-post test design and one quasi-experimental controlled trial.</p> <p>Ten studies were conducted in the US, one in the Netherlands and one in New Zealand.</p> <p>Five studies were conducted in universities, four in worksites, two in schools and one in a hospital.</p> <p>Quality of included studies: Studies were assessed for risk of bias using the Evidence analysis Manual developed by the Academy of Nutrition and Dietetics. Authors excluded any studies considered to be at high risk of bias. Seven of the included studies were rated as being at moderate risk of bias and five low risk.</p> <p>Synthesis: Narrative</p> <p>Findings: Some interventions were multi-component.</p> <p>Point of purchase nutrition promotion of healthier snacks (n=8) These studies used interpretive nutrition labels either in isolation or in conjunction with other promotional materials to promote healthier choices. Five studies reported significant increases in the purchase of healthier items, with increases ranging from 1 to 5%. These five studies included two RCTs (low risk of bias) and three pre-test post-test trials (moderate risk of bias). The other three studies reported non-significant results (all RCTs one low risk of bias, two moderate risk of bias)</p> <p>Increasing availability of healthier snacks (n=6) Interventions that increased the availability of healthier snacks used different criteria to define these including low-fat and low-calorie while others specified nutrient cut points for several different nutrients.</p> <p>Five interventions that increased the proportion of healthy snacks increased sales of healthier items while maintaining sales volume and/or profits (two RCTs, low risk of bias, three pre-test post-test studies, moderate risk of bias). One pre-test post-test study reported a moderate decrease in sales.</p> <p>Price interventions (n=5) All studies were successful in changing the purchases of adults and children (four pre-test post-test, moderate quality, one quasi experimental study, moderate quality). A dose response was evident with the largest price reductions increasing sales volume of healthy items the most. All of the interventions produced a significant positive change in the purchase of the discounted items when the incentive was greater than 10% in both adults and children.</p> <p>Behavioural programmes (n=1) A pre-test post-test study (moderate quality) that altered price and availability of healthier items was part of a larger multi-component intervention used behavioural techniques such as healthy eating and physical activity challenges that may have enhanced the sales of healthier items. Although sales of healthier items changed considerably, no difference in frequency of vending machine use or diet between experimental and control or groups was found.</p>	<p>Intervention: Point of sale nutrition information at vending machines</p> <p>Evidence statement [D]: The evidence that point of purchase nutrition information is effective in increasing purchases of healthier items from vending machines is inconsistent and it is not possible to draw a conclusion [8 studies]</p> <p>Intervention: Healthier choices in vending machines</p> <p>Evidence statement [C]: There is some evidence that increasing the availability of healthier snacks in vending machines increases their purchase but the evidence is not conclusive [6 studies].</p> <p>Intervention: Price reductions on healthier items in vending machines</p> <p>Evidence statement [C]: There is some evidence that reducing the price of healthier snack options in vending machines increases their purchase but the evidence is not conclusive [5 studies]</p> <p>Authors' conclusions: This review offers evidence that pricing and availability strategies are effective at improving the nutritional quality foods and beverages purchased from vending machines. Vending machines have traditionally only sold unhealthier snacks and beverages and anecdotal evidence suggests that a barrier to change is the belief that healthier items will not sell well. The findings of this review provide evidence to the contrary. If prices are competitive and healthier items are made available to them, vending machine customers will buy healthier snacks. Given the limitations of the available studies, future research is needed to confirm these results, with particular attention paid to how the interventions alter consumer's diet and objective outcomes such as BMI and weight gain.</p> <p>Limitations: Review authors noted that limitations common to all interventions included a lack of measured changes to diet or weight and the inability to determine if measured changes were due to the existing clients changing choices they would normally make or due to new customers. Other limitations included short duration of interventions in four studies, limited availability of healthy products in two studies and small sample sizes in four studies.</p> <p>Comment: Search terms were limited. It is not clear whether consistency checks were conducted for screening. Inclusion criteria stated that studies must include unexposed control group but before and after studies which may not have included an unexposed control group have been included. Point of purchase nutrition interventions were heterogeneous.</p> <p>Study characteristics were not included for all included studies and there appears to be some inconsistency between tables and text in the reporting of study design and rate quality.</p>

Source details	Results	Conclusions
<p>Hersey JC, et al. Effects of front-of-package and shelf nutrition labeling systems on consumers. <i>Nutr Rev</i> 2013; 71(1): 1-14.</p> <p>Intervention: Nutritional labels-different features</p> <p>Outcome: Attention capture, understanding label information, use of labels, labels prompting healthier purchases and consumption choices.</p> <p>Source type: Systematic review</p> <p>Searches conducted: Jan 1990-Sept 2010</p> <p>Study population: No restriction</p> <p>Included study types: Any</p> <p>Environment type/s: Food Physical/sociocultural/legislative Micro</p>	<p>Description of included studies: The systematic review included 38 studies.</p> <p>Twenty studies included an experimental or cross-over design with randomised assignment. The remainder were cross-sectional or involved in-store observations.</p> <p>Ten of the studies were conducted in the US, eight in the UK and four in the Netherlands with several other studies conducted across a number of countries. All studies were conducted in high income countries.</p> <p>Studies that only measured consumers' preferences for different labelling systems were excluded.</p> <p>Quality of included studies: Studies were scored 0-10 on the basis of 10 criteria however authors do not report what the criteria were based on or whether they developed them for the purpose of the review. Only nine of the studies included a random sample, 13 studies were not subjected to a peer-review process, and eight of the studies were conducted by the same organisation that developed the front of pack or shelf nutrition labelling system.</p> <p>Synthesis: Narrative</p> <p>Findings: Front of package and shelf nutrition labelling are extensions to the nutrition labelling which is typically located in an information panel located on the back or side of food packaging. Authors note two general types of front of pack (FOP) or shelf-labelling systems are in use, summary and nutrient specific systems.</p> <p><i>Summary systems:</i> FOP symbols display a few key nutrients; examples of these include the percentage guideline daily amounts (%GDA) and the traffic light schemes (TL). % GDA schemes display nutrients per portion and include the amount in grams and as a percentage of each person's GDA for each nutrient. TL labelling schemes are colour coded and more interpretive than GDA schemes. They usually display a ranking (e.g. high, medium or low) of total fat, saturated fat sugar, salt and sometimes energy. Levels are given colour codes of red, amber green respectively. In some instances a combination of the TL and %GDA is used.</p> <p><i>Nutrient specific systems:</i> use an algorithm to provide an overall nutritional score. Examples include the Choices Programme logo, which displays a tick mark on a food package if it meets specified nutrition criteria or the Keyhole symbol which is displayed on <i>healthier</i> products in Sweden, Denmark and Norway. Other summary systems are graded for example the Guiding Stars system, which displays a ranking of zero to three stars, or provide a score, such as the NuVal system, which displays a food's nutritional score on a scale from 1 to 100 (both from the US).</p> <p>A number of outcomes were addressed by studies grouped as outlined below according to health communication theory. The conceptual framework used proposes that attention processing, and perception can lead to understanding that might direct the consumers' decision making process and prompt the consumer to make healthier food purchases and, thus, healthier consumption choices.</p> <p>Understanding (n=19) <i>FOP label versus a no-label condition (n=8)</i> Three of seven studies reviewed found that consumers could more easily identify the healthier of two products using all FOP labels studied compared with the no-label condition. One study found that FOP labels increased ability to identify healthier products across a range of product categories when compared to no labels. The other four studies found mixed results, depending</p>	<p>Intervention: Front of pack labelling</p> <p>Evidence statement [D]: The evidence to determine which type of front of pack labelling is effective in enabling consumers identify healthier products is inconsistent and it is not possible to draw a conclusion [19 studies]</p> <p>Intervention: Front of pack labelling</p> <p>Evidence statement [H]: Evidence about the effectiveness of front of pack labelling in influencing consumer purchasing in real shopping environments is lacking. [1 study]</p> <p>Intervention: Nutritional labelling- shelf and front of pack</p> <p>Evidence Statement: There is some evidence from surveys suggesting use of front of pack labels varies and that they are less likely to be used by those who are less nutrition conscious, those of lower socio-economic status, those with higher BMI and those who have children living in their households (2 studies). Health-conscious consumers and consumers who have family members on special diets are more likely to purchase foods indicated as "healthy" by FOP and shelf-labelling systems than price-focused consumers (3 studies).</p> <p>Authors' conclusions: In summary, this review found that consumers more easily identify healthier foods using nutrient-specific schemes compared with summary systems. More importantly, particular features of FOP labels, such as text and symbolic colour to indicate nutrient levels, allow consumers to more easily select healthier products. On the contrary, studies have found that consumers have more difficulty comprehending FOP labels that display only numeric information such as %GDA and/or grams. For the largest public health impact, education efforts should target consumers with low socioeconomic status and high body mass indices rather than consumers who are nutrition focused. There is merit in using summary symbols such as a symbol recommended by the Institute of Medicine committee because studies have found that summary icons attract consumers' attention, and multiple-level summary icons may influence consumers to purchase healthier products. However, this review found relatively few studies that compared consumers' understanding using nutrient-specific systems, such as TL schemes, with multiple-level summary systems. More research is also needed to assess the influence of nutrient-specific labels on consumers' purchases. Additionally, more research should be conducted to examine the factors that surround the implementation of FOP and shelf-labelling systems – for example, how nutrition claims interact with consumers' understanding of FOP labelling schemes. More studies of US consumers in actual shopping situations are needed to characterize more accurately how FOP labelling systems affect consumer purchase decisions and dietary intakes.</p>

Source details	Results	Conclusions
	<p>on the particular FOP label that was compared with the no-label condition, the specific type of test that was conducted, or the specific product categories compared.</p> <p><i>Summary versus nutrient-specific systems (n=10)</i> Six of ten studies found that consumers can more easily assess levels of nutrients or healthfulness of a single product or identify the healthier product among two products using nutrient specific systems compared with summary systems. Among the other four studies that compared consumers' understanding of nutrient-specific versus summary systems, three studies found that consumers could more easily rate the healthiness of foods using summary systems compared with nutrient-specific systems, and the remaining study did not find a difference in consumers' understanding when rating the healthiness of foods with summary versus nutrient-specific labels.</p> <p><i>Symbolic colour versus no symbolic colour (n=15)</i> Eight studies found that FOP labels with symbolic colour (e.g., TL colour codes) compared with labels without symbolic colour more easily allow consumers to determine which of two products is healthier, to more accurately rate the healthfulness of an individual product, or to have more realistic attitudes about a product's healthfulness. Among the remaining seven studies with mixed results, five studies found no significant differences when viewing a label with colour versus a label without colour, and two studies found different results depending on the specific test that was conducted with consumers or whether the label used symbolic colour.</p> <p><i>Text versus no text (n=14)</i> Eight studies found that consumers can more easily compare products in terms of their healthiness or can rate the healthiness of an individual product when an FOP label has text versus no text. Of the other six studies, four studies did not find any significant differences and two studies found mixed results.</p> <p><i>Text and colour versus no text or no colour (n=12)</i> Seven studies found that consumers can more accurately interpret nutrient levels of an individual food, compare or rate products in terms of their healthiness, or be led to have more realistic attitudes/opinions about the healthiness of a product when they use nutrient-specific labels with both TLs and text compared with nutrient-specific labels that do not display these features but instead display only numeric information that included %GDA and/or grams. Among the other five studies, two studies found mixed results, depending on the experimental task; in the other three studies, two studies found no significant differences or minimal differences and one showed inverse findings.</p> <p>Purchase behaviour (n=6) Four of six empirical studies suggest that consumers were influenced to purchase products indicated as "healthy" by shelf-labelling systems, and among the three studies that analysed consumers' purchase behaviour after the introduction of multiple-level summary icon shelf tags in supermarkets, all studies found that consumers were influenced to purchase healthier products as a result of these icons. In contrast, one study found no effect of shelf nutrition labelling systems on sales of healthy foods. Another study assessing the introduction of FOP traffic light labels in a major UK food retailers' store found no effect on the sales of healthy foods. This study analysed only two product categories, ready-to-eat meals and sandwiches.</p> <p>Reported use, observed use & likely purchase (n=13) Five studies found that over 50% of study participants reported they use or are likely to use FOP and shelf nutrition labelling systems (labels with different features studied) at least some of the time and are likely to allow these labels to influence their purchases. 5 studies found reported use of FOP labels to be lower than 50%. Two of the 13 studies examined willingness to pay more for certain labels or label features. Eight of the thirteen studies examined potential associations between consumers demographic and/or other characteristics, such as whether they were health or weight conscious and their frequency of label use. Of these studies one found that awareness of a Health check logo was associated with use and attitude toward healthy purchases. The other seven studies found that some groups of consumers are less likely to use FOP labels than other groups. Groups less likely to use FOP labels include less nutrition-conscious individuals, those of low socioeconomic status, those with higher body mass indices, and those who have children</p>	<p>Limitations: This review identified considerable variability in outcome measures across the studies. In addition, many of the studies reported only statistically significant differences between groups rather than reporting means and variances; therefore, comparing findings across studies to easily identify the magnitude of effects was difficult. Another limitation was the range of studies that have been conducted in different settings. Although there is a growing body of evidence about consumer response to FOP labels in experimental situations (e.g., in-store intercept studies or Web-based panels), this review identified relatively few studies that assessed consumer use of FOP labels in a shopping environment. Existing studies provide limited information about the effects of other contextual information, such as nutritional claims on the front of packages or the interrelationship between the Nutrition Facts Panel and FOP symbols. Few studies have provided evidence on the likelihood or existence of substitution effects, that is, whether and how much consumers may overconsume products displaying healthy symbols (e.g., green lights or high scores) because they perceive them as healthy. Finally, little is known about the effects of broader social marketing, in-store promotions, and consumer education to encourage the understanding and use of FOP labels.</p> <p>Comment: Search terms and strategy somewhat limited. Quality assessment of included studies could have been stronger - the criteria used did not cover usual elements considered to assess study conduct.</p> <p>No evidence statement has been written for the four studies examining attention as they relate to laboratory environments rather than real shopping environments where people would use labels to make a purchase.</p> <p>No evidence statement has been written for shelf labelling from this systematic review as many more recent studies have been included on this topic in Cameron A et al. A systematic review of the effectiveness of supermarket-based interventions involving product, promotion, or place on the healthiness of consumer purchases. <i>Curr Nutr Rep</i> 2016; 5 (3): 129-138 because of the later search date.</p> <p>Overlap in included studies: Cameron A et al. A systematic review of the effectiveness of supermarket-based interventions involving product, promotion, or place on the healthiness of consumer purchases. <i>Curr Nutr Rep</i> 2016; 5 (3): 129-138 on three studies.</p>

Source details	Results	Conclusions
	<p>living in their households. Health-conscious consumers and consumers who have family members on special diets are more likely to purchase foods indicated as “healthy” by FOP and shelf-labelling systems than price-focused consumers.</p> <p>Likely consumption, reported consumption and observed consumption (n=5) Only one study that was reviewed analysed consumers’ actual dietary intake; this involved a single-level summary icon and found no significant differences in participants’ actual consumption of a chocolate mousse cake between logo and non-logo conditions. Another simulated shopping study examined subjects’ food and drink selections, representing what they intended to consume the following day and found no difference among five FOP label schemes. Of three other studies two reported that FOP and shelf labelling systems can have a positive impact on consumers’ reported diets and one found no significant difference.</p> <p>Attention & processing (n=4) One study found that labels that are large and positioned in a consistent location on a food package more quickly capture attention. Two of three studies that examined processing time found that it was faster for summary labels versus nutrient specific labels. One study found that consumers can more quickly process FOP labels with colour compared with labels without colour and FOP labels with text compared with labels without text. A second study found mixed results on whether labels with colour and text are easier to interpret than labels without colour and text.</p>	

Source details	Results	Conclusions
<p>Hillier-Brown FC 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. <i>Obes Rev</i> 2017; 18 (2): 227-246.</p> <p>Intervention: Any intervention that aimed to change the practices of food outlets in order to promote healthier menu offerings</p> <p>Outcome: Consumer (e.g. dietary energy intake, purchasing behaviour and attitudes towards healthier menu choice and preferences) or food outlet outcomes (changes in retail practices, process outcomes and profit)</p> <p>Source type: Systematic review</p> <p>Searches conducted: Jan 1993 to Oct 2015</p> <p>Study population: Consumer of ready to eat meals (community, school, health/ social care and workplace settings excluded as were take-away ready to eat meals from supermarkets)</p> <p>Included study types: Any design</p> <p>Environment type/s: Food Physical Micro</p>	<p>Description of included studies: Thirty four interventions were captured in 30 included studies in this systematic review. Of these 30 studies, seven were repeat cross-sectional studies, 12 were cross-sectional studies, five were cohort studies, two studies were before-after studies and four studies were controlled trials.</p> <p>Of the 30, 27 included studies were conducted in the US, two studies were based in Australia and one was based in the UK.</p> <p>Twenty two studies reported outcomes for adults, three reported outcomes for parents and their children and one study reported child outcomes only. Four further studies assessed food outlets rather than individuals as units of observation.</p> <p>Quality of included studies: The quality of included studies was assessed using an adapted version of the (EPHPP) Quality Assessment Tool for Quantitative Studies. Only four studies were assigned a global quality rating of 'strong', 10 were rated as 'moderate' and 16 were rated 'weak'</p> <p>Synthesis: Narrative review</p> <p>Findings: Included food outlets were those that, as their main business, sold ready to eat meals and were openly accessible to the general public. Any type of intervention that aimed to change the practices of food outlets in order to promote healthier menu offerings was included. Eleven intervention categories were identified by the review authors using the Nuffield Intervention Ladder definitions.</p> <p>Studies with customer level outcomes</p> <p>Nuffield ladder definition - restrict choice</p> <p>Trans-fat law (n=1) One repeat cross-sectional study (moderate quality) assessed implementation of the trans-fat law in New York restricting food establishments from using storing or serving food that includes trans-fats. The law was associated with a significant reduction in trans-fat content per purchase along with a small but significant increase in saturated fat content per purchase. The effect of the law was inconsistent and varied between fast food chain types.</p> <p>Changing pre-packed children's meal content (n=1) A repeat cross-sectional study (weak quality) assessed changing pre-packed content of children's meals (decrease in portion size of fries and addition of apple slices). A small decrease in total energy purchased was found; compensatory effects in terms of additional foods outside the pre-packed meal components were not assessed.</p> <p>Food outlet award schemes (n=2) Two cohort studies (weak quality) assessed food outlet award schemes. One of these studies identified that the intervention influenced availability of reduced-sized portions and 'healthier' children's meals. The other study noted increased adherence to 'healthy criteria' but noted that only a few changes were needed for outlets to achieve the award.</p> <p>Nuffield ladder definition - guide choice</p> <p>Disincentives (n=1) One controlled trial (strong quality, two arms) found no intervention effect when only a price increase was applied, but when combined with signposting of the unhealthy options, there was a decrease in unhealthy main dishes ordered.</p> <p>Incentives (n=3) One brief cohort study (moderate quality) investigated offering customers who intended to order a full-sized sandwich a half-sized sandwich plus lottery option (entry to a \$10, \$50 or \$100 lottery) for the same price of the full-sized option. The proportion of customers who changed their menu choice from a full-sized to a half-sized sandwich varied by the size of the lottery prize from 5% (\$10 lottery) to 8% (\$50 lottery) to 22% (\$100 lottery).</p>	<p>Authors' conclusions: Most interventions identified focused on providing information aimed at adults in US fast food chains and collected only customer-level outcomes; some of these interventions included a function of enabling choice. Overall, most studies were of low or moderate quality. More 'intrusive' interventions that restricted or guided choice generally showed a positive impact on food-outlet-level and customer-level outcomes. However, interventions that simply provided information or enabled choice had a negligible impact. Qualitative findings were reported for many studies, particularly around acceptability and process, and these provide useful learning to inform the development of interventions. Interventions involving incentives and more 'intrusive' interventions (functions further up the Nuffield ladder, e.g. restrict choice and 'incentives') generally showed consistent positive effects on catering practices and the energy value of foods purchased by customers.</p> <p>Limitations: The evidence arises mainly from studies conducted in adults in specific fast food chains in the US which may limit generalisability. No information was found on food consumption by either meal or total daily intake. The quality of evidence was generally poor with few high-quality designs which limits the strength of the results. Overall, the impact of interventions appears negligible and inconsistent.</p> <p>Comment: No evidence statements have been made for this review because of the wide range of heterogeneous studies included and overlap with topics in other included reviews</p>

Source details	Results	Conclusions
	<p>A controlled trial (weak quality, 2 arms) assessed a price decrease for healthier options and price decreases of healthier options alongside health promotion techniques to highlight the healthier options to customers. Both arms found positive effects on the purchase of healthier food items.</p> <p>Nuffield ladder definition - enable choice</p> <p>Eight studies investigated the effects of nine interventions that involved signposting. In three studies, signposting was implemented alone, in two studies signposting was incorporated with menu changes and four studies were of health promotion or social marketing campaigns that included signposting</p> <p>Signposting alone (n= 3) One controlled trial (strong quality) found that, overall, adding a symbol to menus that identified 'unhealthy' main dishes resulted in a decrease in the number of these ordered however, this effect was driven predominately by women. A repeat cross-sectional study (weak quality) showed that 'healthy' signposting led to no significant overall change in sales of all 'healthy' items. Another repeat cross-sectional study (weak quality) found no effect of healthy signposting on the purchase of healthy main meals when added to an existing award intervention.</p> <p>Signposting with menu changes (n=2) A controlled trial (strong quality) found that an intervention promoting new healthier choices was effective in increasing sales of healthy food items. However, a repeat cross-sectional study (weak quality) found that an intervention of table signage promoting new alternative healthier options had no effect on the purchase of healthy choices.</p> <p>Signposting with health promotion or social marketing campaigns (n=3) Three studies investigated the effects of interventions that primarily aimed to increase customer awareness of healthy options in the participating food outlets. One study using a repeat cross-sectional design with control groups (moderate quality) found a significant, small effect on the purchase of healthy menu items compared with controls. In this study holders of campaign discount coupons were 17% more likely to purchase healthy menu items. A weak-quality repeat cross-sectional study investigated an intervention delivered in community food outlets that also included 'persuasion' intervention functions (advertisements and articles in local newspaper and newsletters, and promotional material). A trend towards a slight increase in the percentage of healthy items sold was observed, but this did not reach significance. A weak-quality controlled trial found that displaying in-store posters listing healthier options led to increases in sales of the healthier options.</p> <p>Nuffield ladder definition - provide information</p> <p>Calorie labelling law (n=10) Studies assessed calorie labelling laws across US states and localities.</p> <p>One repeat cross-sectional study with control (rated strong for quality) showed a statistically significant decrease in average energy purchased following menu calorie labelling in one large coffee chain (Starbucks) compared to control. One repeat cross-sectional study (weak quality) described an increase in the number of customers who reported seeing and acting on the calorie information following introduction of mandatory menu labelling. The remaining studies (one weak, five moderate and one strong quality) reported no association between introduction of mandatory menu calorie labelling and average energy purchased. One controlled study (moderate quality) investigated the effects of providing customers with calorie recommendation information before and after the New York City calorie labelling law was implemented. The study found that calorie recommendations did not significantly affect food purchases.</p> <p>Voluntary calorie labelling (n=1) A moderate-quality repeat cross-sectional study found that voluntary nutrient (calories, fat, sodium and carbohydrates) labelling in non-chain food outlets resulted in significant decreases in energy, fat and sodium content of customer purchases, with no change in carbohydrate content. The study also found that 71% of customers surveyed reported noticing the nutrition information, with 20% (of all customers) stating that this resulted in choosing a lower-energy main meal and 17% reported ordering a lower-fat main meal.</p>	

Source details	Results	Conclusions
	<p>Personalized receipts (n=1) One study (repeat cross-sectional; weak quality) assessed a receipt-based intervention. The receipts consisted of three components: information, motivation and recommendations. The personalised receipts were associated with an increase in healthier item substitutions that were encouraged by the messages, such as substituting ham for sausage in a breakfast sandwich or substituting frozen yogurt for ice cream. However, there was no significant change in total energy or total fat per transaction.</p> <p>Studies with food-level outcomes</p> <p>Nuffield ladder definition - restrict choice</p> <p>Award schemes (n=2) The criteria in each award scheme covered a range of intervention features, and both included restricted choice (e.g. recipe reformulation and default healthy drinks with children's meals). Both studies followed cohort study designs (weak quality) and observed increases in healthier catering practices and healthy options available. However, authors of one study reported that only a small number of changes were needed for outlets to achieve the award.</p> <p>Nuffield ladder definition - enable choice</p> <p>Signposting (n=1) One weak-quality study investigated the effects of a social campaign that included the intervention team working with food outlets to encourage them to add, and signpost, healthier options to their menus. The majority of food outlets changed practices by either simply distributing health education materials (94% of 16 food outlets) or introducing or promoting healthier side options (81%), whilst half began promoting healthier main meal options.</p> <p>Signposting with health promotion or social marketing campaigns (n=1) A culturally tailored social marketing campaign, conducted in Mexican-American food outlets, which included the provision of guidelines and training to food outlet owners, incentives (for outlet staff and customers) and newspaper advertising, increased the number of healthier food options provided in the majority of the participating outlets (cohort study; weak quality). In this study, all materials were given to food outlet owners in English and Spanish and were image oriented or comprised simple checklists.</p> <p>Telemarketing of healthy food choices (n=1) Two Australian studies related to one telemarketing health promotion intervention that included an element of healthy food provision, with one paper focusing on outcomes for hotels, clubs and nightclubs and the other on outcomes for restaurants and cafes. Both studies used a repeat cross-sectional study design, with the same cohort of premises evaluated at both time points, and were rated weak for quality. One found no significant change in the percentage of restaurants and cafes undertaking nutrition-related health promotion practices between 1997 and 2000, in either the cross sectional or cohort samples. However, the other study found the prevalence of healthy food choices increased significantly in hotels, clubs and nightclubs, in both cross sectional and cohort samples.</p> <p>Nuffield ladder definition - provide information</p> <p>Calorie labelling law (n=1) Two studies investigated the effects of the King County, US, calorie labelling law on food-outlet-level outcomes. In one cohort study (weak quality), there was a significant decrease in the energy content of main meals available in fast food chain food outlets following the introduction of calorie labelling. One strong-quality controlled study found no association between the introduction of mandatory menu calorie labelling and the 'healthfulness' of menus.</p>	

Source details	Results	Conclusions
<p>Hollands GJ et al. Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. <i>Cochrane Database Syst Rev</i> 2015; (9): CD011045.</p> <p>Intervention: Exposure to different sizes or sets of physical dimensions of a portion, package, individual unit or item of tableware</p> <p>Outcome: Unregulated selection (with or without a purchase) or consumption of food, alcohol or tobacco.</p> <p>Source type: Systematic review</p> <p>Searches conducted: To January 2015 (Only studies identified up to Nov 2012 have been fully incorporated to date, authors consider further eligible studies have minimal potential to change the conclusions.)</p> <p>Study population: Adults and children</p> <p>Included study types: Randomised controlled trials with between-subjects (parallel group) or within-subjects (cross-over) designs, conducted in laboratory or field settings.</p> <p>Environment type/s: Food Physical Micro</p>	<p>Description of included studies: The review includes 72 studies, published between 1978 and July 2013. A further 11 studies are currently accepted into the review but are awaiting full integration.</p> <p>More studies investigated effects among adults (76% (58/72)) than children. All studies were conducted in high-income countries. 58 studies were conducted in the US, five in Canada, three in Belgium, two in the Netherlands, two in the UK and one study each from Australia and South Korea.</p> <p>Thirty eight studies were within subject (crossover) randomised controlled trials and 34 were a between-subjects (parallel group) randomised controlled trials.</p> <p>The majority of included studies were conducted in laboratory settings (n=50) while the others (n=22) were conducted in field settings – predominantly restaurants or school or workplace cafeterias.</p> <p>Consumption outcomes were reported in 59 studies, selection outcomes were reported in seven studies whilst consumption and selection outcomes were reported in six other studies. Outcomes were measured objectively rather than by participant self-report in almost all included studies (n=70) and were typically measured over a period of one day or less.</p> <p>Quality of included studies: All studies were assessed for risk of bias. Seven studies from the 65 that measured consumption were classified as at overall high risk of bias with the remaining 58 studies classified as at overall unclear risk of bias for this outcome. Nine of the 13 studies that measured selection (without purchase) as at overall unclear risk of bias with respect to this outcome with four at high risk of bias. The quality of the available evidence was designated using GRADE. This uses the following categories: <i>High quality:</i> Further research is very unlikely to change our confidence in the estimate of effect. <i>Moderate quality:</i> Further research is likely to have an important impact on our confidence in the estimate of effect and may change the estimate. <i>Low quality:</i> Further research is very likely to have an important impact on our confidence in the estimate of effect and is likely to change the estimate. <i>Very low quality:</i> We are very uncertain about the estimate. The overall quality of evidence incorporated into this review ranged between moderate and very low.</p> <p>Synthesis: Meta-analysis</p> <p>Findings: Included studies considered either the effects of exposure to difference sizes (volume, shape, height, width or depth) of food portions, its package or individual unit size or an item of tableware used to consume it. Portion referred to the overall amount (volume, weight or both) of a product presented for selection. Package referred to the different ways of packaging a specific portion, including that used for service, consumption or storage (for example boxes, bags, cans or bottles). Individual unit referred to the unit of a product presented within a given portion (for example individual sweets or biscuits). Tableware included crockery, cutlery or glassware used for serving and consuming food and drink.</p>	<p>Outcome: Consumption of food by adults when exposed to larger portions, packages, units or associated tableware</p> <p>Evidence statement [C]: There is some evidence that exposure to larger portions, packages, units or associated tableware for food results in increased consumption. Meta-analysis of 86 independent comparisons showed a standard mean difference in unregulated consumption of 0.46 (95%CI 0.29 to 0.52). The size of this effect suggests that, if sustained reductions in exposure to larger-sized food portions, packages and tableware could be achieved across the whole diet, this could reduce average daily energy consumed from food by between 215 and 279 kcal in adults.</p> <p>Intervention: Selection of food by adults when exposed to larger portions or tableware.</p> <p>Evidence Statement [C]: There is some evidence that exposure to larger portions or tableware increased the quantities of food adults selected for subsequent consumption. Meta-analysis of 13 independent comparisons found a standard mean difference of 0.55 (95% CI 0.35 to 0.75). The size of this effect suggests that, if sustained reductions in exposure to larger-sized food portions and tableware could be achieved across the whole diet, this could reduce average daily energy selected for subsequent consumption from food by between 188 and 403 kcal.</p> <p>Intervention: Consumption of non-alcoholic drinks by adults when exposed to shorter, wider (versus taller, narrower) glasses or bottles.</p> <p>Evidence Statement [C]: There is some evidence that exposure to shorter, wider glasses or bottles increased the quantities selected for subsequent consumption among adults. Meta-analysis of 3 independent comparisons found a standard mean difference of 2.31 (95% CI 1.79 to 2.83). The size of this effect suggests that, if sustained reductions in exposure to shorter, wider glasses and bottles could be achieved across the whole diet, this could reduce the quantity of non-alcoholic beverages selected for subsequent consumption by between 95g and 296g.</p> <p>Authors' conclusions: This review found that people consistently consume more food and drink when offered larger-sized portions, packages or tableware than when offered smaller-sized versions. This suggests that policies and practices that successfully reduce the size, availability and appeal of larger-sized portions, packages, individual units and tableware can contribute to meaningful reductions in the quantities of food (including non-alcoholic beverages) people select and consume in the immediate and short term. Actions to halt, reverse or mitigate the effects of recent trends towards larger portions may therefore be justified on public health grounds.</p> <p>Limitations: The portion sizes investigated in included food studies were typically at the larger end of the absolute size continuum, therefore the evidence in this review confers confidence that reducing the sizes of portions and packages that are large in absolute terms can achieve effects of the magnitude estimated. However, the evidence in this review neither convincingly supports, nor undermines, claims that making sizes smaller than have become typical or standard can be expected to have similarly meaningful impacts on food selection or consumption.</p>

Source details	Results	Conclusions
	<p>Ninety-six per cent of included studies (69/72) manipulated food products and 4% (3/72) manipulated cigarettes. No included studies manipulated alcohol products. Only finding related to food products have been reproduced here.</p> <p>Forty-nine per cent (35/72) manipulated portion size, 14% (10/72) package size and 21% (15/72) tableware size or shape.</p> <p>A meta-analysis of 86 independent comparisons from 58 studies (6603 participants) found a small to moderate effect of portion, package, individual unit or tableware size on consumption of food (SMD 0.38, 95% CI 0.29 to 0.46), providing <i>moderate quality</i> evidence that exposure to larger sizes increased quantities of food consumed among children (SMD 0.21, 95% CI 0.10 to 0.31) and adults (SMD 0.46, 95% CI 0.40 to 0.52). The size of this effect suggests that, if sustained reductions in exposure to larger-sized food portions, packages and tableware could be achieved across the whole diet, this could reduce average daily energy consumed from food by between 144 and 228 kcal (8.5% to 13.5% from a baseline of 1689 kcal) among UK children and adults.</p> <p>One included study (50 participants) estimated a large effect on consumption of exposure to differently shaped tableware (SMD 1.17, 95%CI 0.57 to 1.78), rated as <i>very low quality</i> evidence that exposure to shorter, wider bottles (versus taller, narrower bottles) increased quantities of water consumed by young adult participants.</p> <p>A meta-analysis of 13 independent comparisons from 10 studies (1164 participants) found a small to moderate effect of portion or tableware size on selection of food (SMD 0.42, 95% CI 0.24 to 0.59), rated as <i>moderate quality</i> evidence that exposure to larger sizes increased the quantities of food people selected for subsequent consumption. This effect was present among adults (SMD 0.55, 95% CI 0.35 to 0.75) but not children (SMD 0.14, 95% CI -0.06 to 0.34).</p> <p>In addition, a meta-analysis of three independent comparisons from three studies (232 participants) found a very large effect of exposure to differently shaped tableware on selection of non-alcoholic beverages (SMD 1.47, 95%CI 0.52 to 2.43), rated as <i>low quality</i> evidence that exposure to shorter, wider (versus taller, narrower) glasses or bottles increased the quantities selected for subsequent consumption among adults (SMD 2.31, 95% CI 1.79 to 2.83) and children (SMD 1.03, 95% CI 0.41 to 1.65).</p>	<p>Findings were derived from studies that typically investigated exposures that were one-off, or if repeated at all, were repeated over relatively short time periods, often under highly controlled experimental conditions. The longer term sustainability of the effects of prolonged or repeated exposures, and effects under free-living conditions, therefore remain to be established. This underscores that the long-term effectiveness of interventions introduced with the aim of reducing people's exposure to larger portion, package and tableware sizes is currently unknown (worldwide) and will be subject to all the challenges and complexities of achieving effective and sustained implementation at scale. The potential for compensatory consumption of other foods is not elucidated by this review.</p> <p>No assessment of social differentiation in effects relevant to health equity in terms of material or social deprivation was possible as no studies disaggregated effects by socioeconomic group.</p> <p>Comment: Further discussion of potential 'real world' intervention strategies is available in the implications for practice section of the full publication. This review does not cover research assessing the impact of such strategies.</p> <p>Potential interventions strategies these authors suggest include:</p> <ul style="list-style-type: none"> • Targeting the economic environment to eliminate pricing practices whereby larger portion and package sizes offer value for money and restricting price promotions on larger-sized packages. • Social marketing campaigns to raise awareness and engender public acceptability of the public health case for interventions to reduce or moderate the effects of exposure to larger-sized portions. <p>They also note that:</p> <ul style="list-style-type: none"> • Less healthy and energy dense foods may be particularly effected by tighter portion control. • A portion size effect is still present when people are exposed to larger sizes of healthier low energy-dense foods, suggesting that interventions that successfully increase people's exposure to larger portions of these foods may be effective to increase their consumption. • Scaling up interventions on portion sizing would involve introduction into a complex food environment and further challenges would arise from the commercial and legal contexts in which products are sold.

Source details	Results	Conclusions
<p>Hunter RF et al. The impact of interventions to promote physical activity in urban green space: a systematic review and recommendations for future research. <i>Soc Sci Med</i> 2015; 124: 246-256.</p> <p>Intervention: Promotion/ encouragement of the use urban green space (UGS) or development of new or improved UGS or combinations thereof.</p> <p>Outcome: Objective and subjective measures of physical activity</p> <p>Source type: Systematic review</p> <p>Searches conducted: To July 2014</p> <p>Study population: All</p> <p>Included study types: Experimental or Quasi experimental Included studies required a control group</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: The systematic review included 12 studies of which eight were controlled pre-post design, one difference in difference design, one randomised controlled trial, one post-test only comparison and one pre and post population based survey.</p> <p>Of the 12 studies, nine were conducted in the US with the other three studies being conducted in Australia.</p> <p>Seven studies were set in inner city areas where the majority of the population were of low socioeconomic position and from ethnic minority groups.</p> <p>Quality of included studies: The quality of studies was assessed using the Cochrane risk of bias tool. Only one study had a low risk of bias, five studies had a high risk of bias and six had an unclear risk of bias</p> <p>Synthesis: Narrative</p> <p>Findings:</p> <p>Development or improvement of urban green space Nine studies investigated the influence of an urban green space intervention that involved physical change to the built environment. Interventions were heterogeneous and included renovations, improvements, design of an urban greenway trail, greening of vacant lots, and installation of family fitness zones. Of the nine studies investigating physical changes to urban spaces without promotion four showed a positive outcome with increases in physical activity and park usage. Of these one study has a high risk of bias and three were assigned as having an unclear risk of bias. Five studies showed no significant impact on park use and physical activity. Of these five studies three were assigned by authors as being at high risk of bias.</p> <p>Promotion of urban green space through training of park managers The single randomised controlled trial investigating the impact of physical activity promotion in urban green space, without built environment changes, was assigned by authors as having a low risk of bias and showed a significant increase in physical activity and number of park users over the follow up period of 24 months. The intervention involved providing Park Directors with five training sessions from a marketing consultant regarding outreach, customer service, promotion events, improving park image and building the customer base. Each park received \$4000 to spend on signage, promotional incentives and outreach activities.</p> <p>Development or improvement in combination with promotion of urban green space Two studies investigated interventions that included a combination of both physical change to the built environment (construction of a trail, renovation to playfields) and physical activity promotional aspect. The study investigating usage of a newly constructed trail was assigned by authors as having a high risk of bias and used a pre-post population based survey design. Usage of the trail was moderated by proximity and was used more by cyclists than pedestrians. The other study where significant renovations to playfields mainly for soccer and baseball in two public parks, using a controlled pre-post design was assigned by authors as having an unclear risk of bias and showed significantly increased visitation and overall physical activity compared to the control park.</p>	<p>Intervention: Development or improvement of urban green space</p> <p>Evidence statement [D]: Evidence on the effects of development or improvement of green space on physical activity is inconsistent [9 studies].</p> <p>Intervention: Training park managers to promote available green space and providing a budget to do so</p> <p>Evidence statement [H]: Evidence about the effectiveness of training and resourcing of park managers to promote available green space to increase physical activity is lacking. [1 study]</p> <p>Intervention: Development or improvement of urban green space in combination with promotion</p> <p>Evidence statement [H]: Evidence about the effectiveness of the development or improvement of urban greenspace in combination with promotion of its use, to increase physical activity is lacking [2 studies].</p> <p>Authors' conclusions: There was some evidence to support the use of built environment only interventions for encouraging use and increasing physical activity in urban green space. However, more promising evidence existed for the use of physical activity programs combined with a physical change to the built environment. These findings highlight that multifaceted urban green space intervention strategies are likely to have a more significant impact on levels of PA than changes to the built environment in isolation. However, these results should be interpreted with caution given the relative dearth of intervention-based research in this area and further work is urgently required. Results from this review show promising evidence to support the use of physical activity programs and physical changes to the built environment for increasing urban green space use and physical activity.</p> <p>Limitations: Only one study reviewed mentioned details of a sample size calculation to inform their study population. Studies used a varying number of observation times per day and number of days making it more difficult to accurately compare groups. There was also a range of follow-up assessment timings across the included studies and it was unclear whether these were adequate. Identifying adequate control parks was challenging. Studies assessing urban green space examine complex interventions with multiple interacting factors at the individual, community and population levels. A number of scientific and evaluative challenges arise for example, aligning research timetables with regeneration timelines, rapidly recruiting a baseline assessment prior to implementation of the intervention and measuring confounders and levels of exposure</p> <p>Comment: There may be socio-cultural or local differences when considering this evidence in the Wales context</p> <p>Overlap in included studies: Four studies in this review overlap with Bennie J et al. <i>Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence review 3: Park, neighbourhood and multicomponent interventions.</i> London: NICE; 2017.</p>

Source details	Results	Conclusions
<p>Liberato SC et al. Nutrition interventions at point-of-sale to encourage healthier food purchasing: a systematic review. <i>BMC Public Health</i> 2014; 14: 919.</p> <p>Intervention: Point of sale interventions; availability/affordability healthier foods, incentives (coupons/vouchers), nutrition education/promotion and combinations of these in stores supermarkets or vending machines</p> <p>Outcome: Purchase and/or consumption (primary outcomes)</p> <p>Source type: Systematic review</p> <p>Searches conducted: To May 2014</p> <p>Study population: General population (stores, supermarkets, vending machines)</p> <p>Included study types: RCTs, controlled before and after (CBA), ITS</p> <p>Environment type/s: Food Physical/sociocultural Micro</p>	<p>Description of included studies: Thirty two studies were included in the systematic review; 15 RCTs; 15 CBA; one quasi-experiment with repeated measures and one prospective cohort.</p> <p>Twenty three studies were conducted in US, three in New Zealand, one in Canada, one in South Africa, three in the Netherlands and one in Australia. 30 studies were conducted in urban settings, two in rural settings.</p> <p>Twenty seven were conducted in stores and supermarkets, four in vending machines in schools or worksites and one in an online supermarket.</p> <p>Quality of included studies: The EPHPP quality assessment tool for quantitative studies was used. Studies having an overall low risk of bias were assigned strong quality whilst those having a high risk of bias were rated weak quality. Twelve studies were assessed as being of strong quality, nine assessed as being of moderate quality and 11 as being of weak quality. Most of the studies had high risk of selection bias, low risk due to the allocation process, low risk of confounders, no mention of blinding of assessors to control and intervention participants and of participants' awareness of research question, valid data collection methods for primary outcomes, and low attrition bias.</p> <p>Synthesis: Narrative</p> <p>Findings: A wide range of types of interventions were identified, the authors categorised these into six groups. Interventions were defined as short-term if they lasted for 6 months or less.</p> <p>Nutrition education and promotion in supermarkets/stores These included posters, signs, flyers, nutrition education sessions, store-tours, taste-testing and cooking demonstrations. 15 studies were included (seven assessed as strong quality, three of moderate quality and five of weak quality). Three studies targeted low fat milk, two targeted fruits and vegetables and 10 targeted multiple food groups.</p> <p>One RCT of strong quality and two controlled before-after studies of weak quality looked at short term non-interactive interventions impact on point of sale data – all showed no significant effect.</p> <p>Two controlled before-after studies (one strong, one weak) and one strong quasi experimental study applied long term non-interactive nutrition education interventions – one reported a positive programme effect and two found no effect.</p> <p>Five RCTs (two strong, one moderate, two weak) and four controlled before-after studies (two strong, one moderate, one weak) applied short term interactive nutrition education activities no studies applied long term interactive interventions – four reported no effect, four some effect and one mixed effect.</p> <p>Nutrition education plus enhanced availability of healthy food through increased stocking One controlled before-after study assessed as being of strong quality aimed to increase the stock of healthy food options from multiple food groups in low income communities reported no effect on healthier food intake.</p>	<p>Intervention: Nutrition education and promotion in supermarkets/stores</p> <p>Evidence Statement [D]: The evidence that nutrition education and promotion of healthier food and drink in supermarkets or stores can increase purchase of those foods is inconsistent and it is not possible to draw a conclusion. [15 studies]</p> <p>Intervention: Nutrition education plus enhanced availability of healthy food in low income communities through increased stocking</p> <p>Evidence Statement [H]: Evidence that nutrition education plus enhanced availability of healthy food through increased stocking is effective in increasing healthier purchases or consumption is lacking. [1 study]</p> <p>Intervention: Nutrition education plus monetary incentives for customers and store owners</p> <p>Evidence Statement [D]: The evidence that nutrition education and monetary incentives for customers and store owners in supermarkets or stores can increased availability of healthier foods is inconsistent and it is not possible to draw a conclusion [9 studies]</p> <p>Intervention: Nutrition intervention during online shopping</p> <p>Evidence Statement [H]: Evidence that tailored nutrition advice, and opportunity to swap certain products for a healthier option at online point-of sale to increase sales of healthier foods is lacking [1 study]</p> <p>Authors' conclusions: This study highlights the many different dimensions of interventions that have been examined in the endeavour to influence customer food choice. Although numerous studies at point-of-sale have been undertaken, there is a wide range of different types of interventions and different mechanisms by which various interventions are expected to work.</p> <p>The evidence from this review indicates that monetary incentives offered to customers for a short-term seem promising in increasing purchase of healthier food options when the intervention is applied by itself in stores or supermarkets.</p> <p>There were insufficient studies to draw clear conclusions on the effectiveness in increasing purchase and/or intake of healthier food options when any of the interventions described in this review were applied.</p> <p>There were insufficient studies that examined mediating factors that might affect primary outcomes of relevant interventions to make an assessment of their impact in increasing purchase and/or intake of healthier food options.</p> <p>This review suggests that there is a gap in good quality studies addressing several types of relevant point-of-sale interventions to increase purchase and/or intake of healthier food options. Due to the importance of the relationship between population health and dietary improvement there is a need for better designed studies on the effectiveness of the different types of point-of-sale interventions to encourage healthier eating and to improve health outcomes. There is also a need for studies examining the mediating factors that might affect the primary outcomes of these interventions. There is also a need for study interventions to be more clearly defined in terms of their theoretical basis for changing behaviour and measurement of relevant outcomes.</p>

Source details	Results	Conclusions
	<p>Monetary incentives alone Four studies (three of strong quality, one moderate) these looked at short term use of price discounts, store coupons/vouchers and cash rebates for healthy food purchases. All studies reported positive effects.</p> <p>Nutrition education plus monetary incentives for customers alone or customers and store owners Nine studies were included in this category.</p> <p>Six studies were aimed at customers (three weak, two moderate and one strong). One reported a long-term intervention involving interactive and non-interactive activities and the other five applied a short term intervention. Four of these reported a positive effect, one mixed effects and one no effect.</p> <p>Two controlled before-after studies (both weak) and one RCT of moderate quality were aimed at store owners and customers. Two of the studies reported on the primary outcomes; one reported increased stocking and sales of targeted products the other increased availability of vegetables but not fruit. The other study showed no change in most mediator factors between intervention and control stores.</p> <p>Nutrition intervention through vending machines Four studies (two strong, one moderate and one weak) with six sub categories.</p> <p>Two studies applied short term, non-interactive nutrition education interventions effects were mixed and did not appear to persist beyond the intervention in one study.</p> <p>Two studies applied short term non-interactive interventions which included enhanced availability of healthier food options. One showed no effect the other found higher sales of healthier food options in the intervention groups.</p> <p>Two studies applied short term non-interactive interventions which included enhanced availability of healthier food options plus nutrition education. One showed no effect the other found higher sales of healthier food options in the intervention groups.</p> <p>One study of short term non-interactive interventions with monetary incentive alone. Higher sales of healthier food options were observed with higher price reductions of 25% and 50% but no difference was observed with a 10% price reduction.</p> <p>One study of short term non-interactive intervention including monetary incentive plus nutrition education Price reduction was associated with an increase in healthier food option sales volume but nutrition education was unrelated to the change in healthier food option sales volume.</p> <p>Nutrition intervention through during online shopping One RCT of moderate quality examined a short term interactive intervention. The study targeted low fat products during a 5-month period and provided tailored nutrition advice and opportunity to swap certain products for a healthier option at point-of sale). Higher sales of healthier food options were observed in the intervention group compared to the control group.</p>	<p>Limitations: The review authors identified the following limitations A limitation of this review is the potential for publication bias. Other studies may exist that would meet this review's criteria but have not been submitted or accepted for publication and therefore were not identified in this review. The likelihood of this is difficult to judge. Another limitation is the inclusion of studies reported in three languages only. Other studies published in other languages were not considered for inclusion in this review. Overcoming, detecting and correcting for publication bias is problematic. Funnel plots allow review authors to make a visual assessment of whether small study effects may be present in a meta-analysis. Due to the range of outcome measures and data collection methodologies it was not possible to undertake a meta-analysis or funnel plots. This limits the ability to adequately consider overall effect.</p> <p>Comment: Most studies conducted in high income countries, likely to generalise to UK/Wales setting.</p> <p>For the studies relating to interventions in both customers and store owners it is not possible to ascertain whether both components contribute to the effects seen or to disentangle the contribution of each element.</p> <p>Overlap in included studies: No evidence statement has been written for nutritional interventions with monetary incentives in customers alone. Of the six studies considering such interventions four studies have been considered by other reviews. An R et al. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. <i>Public Health Nutr</i> 2013; 16(7): 1215-1228 includes three, Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. <i>Prev Chronic Dis</i> 2017; 14: E107 includes two and Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. <i>PLoS One</i> 2017; 12(3): e0172277 includes one.</p> <p>This has also not been used to grade the evidence on monetary incentives alone as more detail is available from the other systematic reviews included in PHW's evidence review. The four studies considered by the authors under the heading monetary incentives alone have been considered alongside further studies in other reviews examining pricing specifically. These reviews are Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. <i>Prev Chronic Dis</i> 2017; 14: E107, An R et al. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. <i>Public Health Nutr</i> 2013; 16(7): 1215-1228 and Afshin A et al. The prospective impact of food pricing on improving dietary consumption: a systematic review and meta-analysis. <i>PLoS One</i> 2017; 12(3): e0172277.</p> <p>Similarly, the four studies considered under nutrition intervention through vending machines are all included in a systematic review focussed on vending machine interventions (Grech A, Allman-Farinelli M. A systematic literature review of nutrition interventions in vending machines that encourage consumers to make healthier choices. <i>Obes Rev</i> 2015; 16 (12): 1030-1041) therefore the evidence relating to such interventions has not been graded here. One of the vending machine studies included in this review was also considered by Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315.</p>

Source details	Results	Conclusions
<p>Mackenbach JD et al. Obesogenic environments: a systematic review of the association between the physical environment and adult weight status, the SPOTLIGHT project. <i>BMC Public Health</i> 2014; 14: 233.</p> <p>Exposure: Built environment characteristics at neighbourhood, province or national level across five domains: Physical activity environment Food environment Transport opportunities Urban form characteristics Other</p> <p>Outcome: Adult weight status (BMI, overweight or obesity)</p> <p>Source type: Systematic review</p> <p>Searches conducted: Jan 1995-May 2013</p> <p>Study population: Adults in high income countries</p> <p>Included study types: Cross-sectional and longitudinal studies</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: The systematic review included 92 studies. Eight studies are reported by systematic review authors as using longitudinal data with follow up time ranging from 4 to 25 years. The remainder used cross-sectional data in their analysis.</p> <p>A large majority of studies, were conducted in North America with 66 in the US and eight in Canada, 12 were conducted in Europe with six in the UK and six were conducted in Australasia. 45 studies were published from 2010 onwards.</p> <p>Seventy five studies used exclusively objective measures of the physical environment, while 17 studies used perceived measures to link physical environmental characteristics to weight status. Of these 17 studies, nine studies examined both the objective and the perceived environment but most of these studies did not assess the same factors objectively as subjectively.</p> <p>Quality of included studies: Quality of the included studies was assessed using an adapted version of the EPHPP tool for quantitative studies. Overall, for 29 articles the methodological quality was rated as strong, for 54 articles as moderate and for eight as weak. One study was not given an overall quality score. Authors examined whether the quality of primary studies were associated with the likelihood of reporting associations that were in line with the authors hypotheses and found none. Authors also state the field would be advanced by putting more emphasis on the difference between causation and correlation noting that longitudinal and natural experiments can allow for temporal associations. Of the longitudinal studies discussed in the findings four were of strong methodological quality, three moderate and one weak.</p> <p>Synthesis: Narrative</p> <p>Findings: Heterogeneity across studies was great and included variation in the metrics used, the number of features studied and the different contexts of the studies. Fifty three studies investigated the association between an environmental factor that was presumed to affect obesity through physical activity (such as parks or sports facilities), 36 studies assessed the association of the food related environment (such as the density of fast-food restaurants) and six studies assessed the transport-related environment (such as proximity to public transport amenities). Thirty one studies assessed urban form characteristics such as street connectivity, urban sprawl and land use mix, and 20 studies investigated other types of environmental factors such as graffiti or crime. Fifteen studies assessed associations between both food related and physical activity related environments and obesity.</p> <p>There was no consistent pattern of associations between physical environmental factors and weight status. Two environmental measures, urban sprawl and land use mix, were relatively consistently and statistically significantly associated with overweight status or BMI although only in North America.</p> <p>Of the 92 included studies, 36 presented results that broadly corresponded with the hypothesis in the study (i.e. the results were according to what was expected). Thirteen studies reported that they did not find statistically significant results and five studies reported unexpected results, i.e. opposite to the hypothesised direction. Another 38 studies reported on a mixture of expected, unexpected and/or non-significant results. No consistent differences were identified between studies that used objective measures versus perceptions of the environment.</p>	<p>Exposure: Physical environment</p> <p>Evidence statement [D2]: The evidence on which physical environmental factors are associated with adult weight status is inconsistent and it is not possible to draw a conclusion [92 studies]</p> <p>Authors' conclusions: This systematic review provides an updated overview of the studies examining associations between the physical environment and weight status. We add to the existing literature by stratifying articles by continent and mode of measurement. The fact that this extensive review showed minimal evidence for an association between characteristics of the built environment and weight status indicates that we still do not fully understand the complex relations involved. Although land use mix and urban sprawl were more consistently associated with overweight or obesity than other physical environmental factors, the evidence remains weak and the nature of associations between the physical environment and weight status needs further study.</p> <p>Comment: It is difficult to ascertain whether data from the longitudinal studies are generalisable to the UK as they are mostly conducted in North America with one study from Australia. Only 6 included studies were from the UK and all were of a cross-sectional design. There are significant differences in scale/ distances in the physical environment and climate and there may be also be cultural issues impacting on food environments.</p> <p>The longitudinal studies included in this review looked at specific aspects of the physical environment. Two studies (one strong quality, one moderate) looked at food environment/proximity to food establishments. Two longitudinal studies (one moderate quality, one weak quality) assessed urban sprawl and a further three strong longitudinal studies assessed the relationship between BMI and walkability. The other longitudinal study of moderate quality looked at stores, facilities and crime as correlates of adult weight.</p>

Source details	Results	Conclusions
<p>Martin A et al. Financial incentives to promote active travel: an evidence review and economic framework. <i>Am J Prev Med</i> 2012; 43 (6): e45-e57.</p> <p>Intervention: Financial incentives relating to any mode of travel</p> <p>Outcome: Active travel, physical activity, obesity</p> <p>Source type: Evidence review</p> <p>Searches conducted: 1997 to May 2011-Jan 2012</p> <p>Study population: All</p> <p>Included study types: Any</p> <p>Environment type/s: Physical activity Economic Micro</p>	<p>Description of included studies: Twenty studies were included in the evidence review. The review included three RCTs, two longitudinal studies, nine uncontrolled before and after studies, four cross sectional studies, one stated preferences study, and one qualitative study.</p> <p>Six studies were conducted in the UK, six conducted in the US, two in Sweden, one across a number of European countries, and one each in Germany, Denmark, Australia, the Netherlands and Norway.</p> <p>Quality of included studies: Authors assessed the quality of included studies using the Cambridge Quality Checklists in which quality score was based on the ability to determine causal effects based on study design. Of the 20 included studies three scored highly on the checklists and two scored moderately well. The other studies received a checklist score of zero. Authors define scores of zero as referring to study designs on which causal inferences cannot be drawn. Scores of 1-4 were designs from which some causal inferences might be drawn and scores 5-7 study designs most likely to support robust causal inferences.</p> <p>Synthesis: Narrative</p> <p>Findings:</p> <p>Positive financial incentives</p> <p>Walking and cycling (n=5)</p> <p>Three studies looked at the impact of providing free bicycles.</p> <p>An RCT (quality score (QS) 7) conducted in Sweden for middle-aged women with abdominal obesity compared a moderate-intensity program including free bicycles with a control group involving a low-intensity program (excluding free bicycles). After a follow up of 18 months significant increases were observed in women cycling more than 2km per day.</p> <p>An uncontrolled before and after (UBA) study in Denmark (QS 0) reported an increase in bike trips from 9% to 28%. A second UBA (QS 0) also reported an increase in bike trips.</p> <p>An RCT (QS 7) conducted in the US in older adults (n=51) compared an intervention involving payments contingent on exercise levels (number of aerobic minutes per day each week) with a comparator group receiving a fixed payment irrespective of exercise levels. At 1 month follow-up significant differences in exercise levels were observed.</p> <p>The final study was a stated preference study which suggested that payment for cycling more often might increase the number of bike trips taken.</p> <p>Public transportation (n=4)</p> <p>An RCT (QS 7) conducted in Germany in people who recently moved to Stuttgart assessed the effects of subsidised public transport passes. Researchers found the intervention group receiving free public transport passes showed significant increases in the proportion of people using public transport and reductions in car use after a follow-up of 6 weeks.</p> <p>An observational study (QS 0) in the US offered subsidized public transport passes to workers. This found that those who received subsidised passes showed significant increases in physical activity levels in comparison with employees from workplaces that did not offer subsidised passes.</p>	<p>Exposure: Subsidised public transport passes</p> <p>Evidence statement [C2]: There is some evidence suggesting that that provision of subsidised public transport passes is associated with increasing use of public transport but it is not conclusive [3 studies]</p> <p>Exposure: Subsidised public transport passes</p> <p>Evidence statement [C2]: There is some evidence that provision of subsidised public transport passes is associated with increases in physical activity but it is not conclusive [2 studies]</p> <p>Exposure: Road pricing/congestion charging</p> <p>Evidence statement [C2]: There is some evidence that introduction of road pricing/congestion charging is associated with decreases in car use and increases in active travel but the evidence is not conclusive [4 studies]</p> <p>Exposure: Fuel pricing</p> <p>Evidence statement [C2]: There is some evidence suggesting that there is an association between increasing fuel prices and increases in physical activity but it is not conclusive [2 studies].</p> <p>Authors' conclusions: The review identified only a limited amount of evidence on financial incentives for active travel. Although the identified studies provide useful insights into specific interventions for particular populations, a more general understanding about how people might be expected to respond has yet to emerge. Recent empirical evidence, complemented by a simple economic rational-choice framework, suggests that financial incentives for active travel may represent an underused but potentially promising method for encouraging healthier behaviours. However, higher-quality studies, particularly at the macro-environmental level, are required if policymakers are to use evidence of effectiveness to make confident decisions about allocating scarce resources to such schemes.</p> <p>Comment: The limited available evidence is heterogeneous in terms of populations targeted and types of incentive used.</p> <p>Overlap in included studies: One study overlaps those included in Stewart G et al What interventions increase commuter cycling? A systematic review. <i>BMJ Open</i> 2015; 5 (8): e007945.</p>

Source details	Results	Conclusions
	<p>The English Longitudinal Study of Ageing (QS 4) investigated effects of subsidised public transport passes in older people. Eligibility for the free bus pass was associated with a 51% increase in the odds of using public transport, whereas public transport use in old age was associated with 21% lower odds of being obese, even after adjustment for previous weight status. Follow-up of the study was for 24 months.</p> <p>An observational study in the UK (QS 0) found that giving subsidised public transport passes to young people was associated with increases in the number of journeys made and as a consequence increases in physical activity were reported.</p> <p>Negative financial incentives</p> <p>Road pricing (n=4)</p> <p>An uncontrolled before and after study (QS 0) in Durham found that introducing road pricing was associated with a 10% increase in pedestrian activity.</p> <p>In London an uncontrolled before and after study (QS 0) found that the introduction of road pricing was associated with a 30% increase in distances cycled.</p> <p>Introduction of a \$2 congestion charge in Sweden was associated with a 25% reduction in the number of car journeys (uncontrolled before and after QS 0).</p> <p>In Norway and uncontrolled before and after study (QS 0) found that removal of road pricing was associated with increases in car journeys and decreases in public transport use and active travel.</p> <p>Other negative financial incentives (n=3)</p> <p>In an uncontrolled before and after study (QS 0) in the Netherlands car drivers were given financial incentives (\$3 to \$7) to switch to alternative travel modes – 14% who received the incentive did so.</p> <p>In California (uncontrolled before and after QS 0) those commuting by car were paid for not using a car park. This was associated with a 39% increase in active commuting.</p> <p>At Manchester airport (uncontrolled before and after QS 0) the introduction of car park charging as part of a work-place travel plan was associated with a threefold increase in cycling.</p> <p>Fuel pricing (n=4)</p> <p>Cross sectional data (QS 0) from 24 European countries showed a significant inverse relationship between fuel prices and obesity levels and prevalence. A repeated cross sectional study (QS 0) in the US also found the same relationship.</p> <p>Another cross sectional analysis in the US (QS 0) found a significant relationship between fuel prices and self-reported cycling</p> <p>A longitudinal study conducted (QS 3) in four cities in the US in young adults (aged 18-30 years at baseline) found a significant relationship between car fuel prices and physical activity over 15 years. Roughly there were 17 minutes of additional walking each week after a \$0.25 per gallon increase.</p>	

Source details	Results	Conclusions
<p>Mayne SL et al. Impact of policy and built environment changes on obesity-related outcomes: a systematic review of naturally occurring experiments. <i>Obes Rev</i> 2015; 16 (5): 362-375.</p> <p>Intervention: Natural event due to a new policy (defined as municipal or federal government regulations and laws including school district policies) or change to the built environment</p> <p>Outcome: BMI, weight, diet and physical activity</p> <p>Source type: Systematic review</p> <p>Searches conducted: January 2005 to January 2014</p> <p>Study population: Any</p> <p>Included study types: Natural or Quasi experiments</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: Thirty seven studies were included in the systematic review. Twelve studies were conducted in children. This is a broad review considering heterogeneous interventions: supplemental nutrition assistance programs, greenspace or changes to outdoor exercise equipment, active transportation interventions, health education policies, nutrition labelling, restaurant food environments and supermarket introduction to a food desert. Of the 37 studies included in this review only four studies have been described here in more detail. Of the 25 studies conducted in adults, 20 have been considered by more focussed systematic reviews of specific interventions included elsewhere in this evidence review. One of the five studies conducted in adults, which has not been considered by other reviews, was specific to wireless payment systems for food voucher programmes at farmers' markets in the US. The results of this study have not been reproduced here as its relevance is limited.</p> <p>Quality of included studies: Quality assessment focussed on study design and does not appear to have considered study conduct. Studies employing the strongest design were rated (+++), studies employing intermediate designs (++), and studies using weaker designs (+).</p> <p>Synthesis: Narrative</p> <p>Findings:</p> <p>Opening supermarkets in underserved areas Two studies in the systematic review considered opening supermarkets in 'food deserts'. One within person longitudinal with comparison group study (+++), conducted in Scotland, assessed the effects of opening a supermarket in a food desert on fruit and vegetable consumption. Survey data collected 10 months post intervention reported no change on fruit and vegetable consumption associated with the supermarket (n=412 households). The other repeat cross-sectional, with comparison group study (++) examined opening a supermarket in a disadvantaged neighbourhood of Michigan, US. Systematic review authors report the study found no impact of the intervention on mean daily servings of fruit and vegetables 10 months post intervention.</p> <p>Bicycle sharing initiatives Two studies in this review considered bicycle sharing initiatives. One repeat cross-sectional study with comparison group (++) assessed cycling ≥ 10 minutes in the past week by survey (self-report) 5 months post intervention in those exposed to a bicycle share scheme in Montreal, Canada. Systematic review authors report the study found greater odds of cycling among those exposed to the program. One repeat cross-sectional, case only study (+) assessed the effects of public transport strikes on mean bicycle trips per day and mean trip duration from a bicycle share scheme in London. Systematic review authors report the study found an increase in daily bicycle trips following public transport strikes.</p>	<p>Intervention: Bicycle sharing schemes</p> <p>Evidence Statement [H]: Evidence about the effectiveness of bicycle sharing schemes to increase cycling or overall physical activity is lacking [1 study].</p> <p>Authors' conclusions: In conclusion, current research suggests some policy and built environmental interventions, especially active transportation infrastructure improvements, bans or restriction on unhealthy foods, and altering purchase/payment rules for low-income food vouchers, can increase certain types of physical activity and improve diet. It is not clear, however, whether these changes result in reduced obesity, and more research is needed on the effect of built environment changes like park improvements, trails, and active transportation infrastructure on total physical activity, beyond the process outcomes commonly measured. Natural experiments provide certain advantages over traditional observational research, including the ability to focus on policy-relevant changes and real-world efficacy. However, challenges related to lack of control, timing and funding often necessitate the use of weaker study designs which limits the strength of evidence from such studies.</p> <p>Limitations: Some natural experiments have weak designs that offer little improvement over traditional observational studies. Few studies employed probability sampling and a number of studies did not even adjust for confounders in regression models.</p> <p>Comment: It is not clear whether there was a repeatability check conducted on the quality assessment of studies.</p> <p>There is considerable overlap between this systematic review and other systematic reviews that have been data extracted. Rather than document each overlap we have focussed on data for studies not captured elsewhere and have provided an evidence grading only for the study on bicycle sharing.</p>

Source details	Results	Conclusions
<p>McCormack GR et al. Characteristics of urban parks associated with park use and physical activity: a review of qualitative research. <i>Health & Place</i> 2017; 16 (4): 712-726.</p> <p>Exposure: Characteristics of urban parks</p> <p>Outcome: Park use and physical activity</p> <p>Source type: Systematic review</p> <p>Searches conducted: To February 2009</p> <p>Study population: Any</p> <p>Included study types: Qualitative research</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: Twenty one studies were included in the systematic review. Eleven studies were undertaken in the US, six in Australia, and one each in Scotland, Canada, South Africa and Spain.</p> <p>Target populations and subsequent sample characteristics were heterogeneous among the studies. Three studies included a sample of park users only while another included only dog-owners. Seven studies included data collection from children and adolescents, four collected data from caregivers and six studies sampled women or girls. Several studies sampled from specific ethnic groups. Socioeconomic status levels of participants varied across studies. Sample sizes ranged from 11 to 132 with two studies not reporting precise information about the number of participants.</p> <p>Studies relied mainly on semi-structured interviews; 11 studies used focus groups to collect data, four used individual interviews, six used multiple methods to collect data, five of which included <i>in situ</i> observations. 10 studies used grounded theory or thematic coding as part of their data analysis, one referred to open, axial and selective coding approaches, one referred to constant comparison methods and three referred to inductive content analysis. The other included studies did not describe their procedures of data analysis.</p> <p>Quality of included studies: Authors note that the possibility of selective presentation of data within included articles resulting from the authors' perspectives or points-of-view cannot be ruled out. All included studies collected data at one time-point and most used a single method for data collection.</p> <p>Synthesis: Narrative</p> <p>Findings: Park attributes were classified using the following categories: Features, condition, access, aesthetics, and safety.</p> <p>Features Variety in facilities to support active and passive structured or unstructured recreational activities across a range of age groups were identified as important. Park amenities such as barbeques, seating, water fountains, picnic tables and bathrooms were also identified as important. Dog litter bins and bags and dog-specific agility equipment was identified as important by a sample of dog-owners.</p> <p>Condition Maintained playing surfaces and cleanliness, including presence of dog faeces, were identified as important in influencing park use.</p> <p>Accessibility Having more local parks within walking distance was positively associated with park use, while the necessity of driving to reach a park often deterred use. Other factors such as personal safety concerns may over-ride proximity.</p> <p>Aesthetics Graffiti and vandalism discouraged park use. The presence of wildlife in parks was considered both positive and negative. Positive attributes of parks also included the presence of trees and bushes, gardens, grass, flowers, natural settings, and water features. Air quality and the presence of distinctive smells in parks contributed to park aesthetics. The presence of nature sounds and the quietness of parks made them attractive to some individuals.</p> <p>Safety Most personal safety concerns mentioned in studies were associated with the presence of undesirable users of parks. Specific park attributes identified as influencing safety from crime included the presence of lighting, presence of law-enforcement, increased security and surveillance, presence of homeless and drug users/dealers, and the presence of secluded paths and areas. Park attributes related to safety from injury included the presence of glass, syringes, rocks, debris, heavy traffic, and other users of paths</p>	<p>Influencing factors Themes that influence park use include features and condition, access, aesthetics, safety and whether it offered people a social environment.</p> <p>Evidence statement: It is not appropriate to grade this evidence as it is a reflection of qualitative data. However, authors note the rigour of studies included in the review limits the strength of the review findings.</p> <p>Authors' conclusions: Our synthesis aligns with previous quantitative research showing that attributes including safety, aesthetics, amenities, maintenance, and proximity are important for encouraging park use. Furthermore, our synthesis of qualitative research suggests that perceptions of the social environment entwine inextricably with perceptions of the physical environment. If so, physical attributes of parks as well as perceptions of these attributes (formed in relation to broader social contexts) may influence physical activity patterns.</p> <p>Comment: The majority of studies were conducted in the US, with only one from the UK which may affect generalisability of this evidence. Screening of records and repeatability checks were poorly reported. Most of the outcomes related to park use rather than physical activity in parks.</p>

Source details	Results	Conclusions
	<p>(e.g. cyclists). The separation of dogs from other park users by fences enclosing off-leash areas as well as dog-specific signage were considered important for encouraging park use among dog owners.</p> <p>Social environments Social and physical environments appear to inform one another in ways that influence park use and park-based physical activity. One study identified organized festivals and celebrations in a local park as bringing together people from divergent backgrounds. Other studies recognised that it gave individuals opportunities to socialise. Social clubs and neighbourhood associations were linked positively to park use and physical activity.</p>	

Source details	Results	Conclusions
<p>Mills SD et al. Systematic literature review of the effects of food and drink advertising on food and drink-related behaviour, attitudes and beliefs in adult populations. <i>Obes Rev</i> 2013; 14 (4): 303-314.</p> <p>Intervention: Advertising of food and non-alcoholic drinks delivered by television, print media, radio, outdoor billboards, internet or other new media techniques</p> <p>Outcome: Food related behaviours, attitudes and beliefs.</p> <p>Source type: Systematic review</p> <p>Searches conducted: Dates not specified; included studies ranged in publication dates from 1980 to 2012</p> <p>Study population: Adults (16+ years)</p> <p>Included study types: Interventional experimental studies (RCTs and non-randomised studies)</p> <p>Environment type/s: Food Sociocultural Macro</p>	<p>Description of included studies: Nine studies were included in the systematic review all of which were RCTs.</p> <p>Five studies used university students as participants and one used university staff members.</p> <p>All studies were conducted in developed countries (France, the Netherlands and US)</p> <p>Quality of included studies: The quality of included studies was assessed using the EPHPP Quality Assessment Tool for Quantitative Studies. None of the studies were rated strong, six studies were rated moderate and three studies were rated as weak. Most studies were subject to selection bias so might not be generalizable to the population from which they were selected.</p> <p>Synthesis: Narrative</p> <p>Findings: Seven studies looked at the effects of food advertising by showing television programmes or films, interspersed with food or beverage advertisements. In four of these studies controls were non-food advertisements, one used being alone in a quiet room, another used water advertisements and one used no advertisements. Of these seven, six examined individual food consumption during exposure to advertising and the other used a taste test after exposure.</p> <p>One study investigated the effects of exposure to negative media information regarding beef-related diseases, positive food advertising for beef, both media exposures or no information. This study investigated participants' willingness to pay.</p> <p>The remaining study used split-panel experiments in American households, with participants receiving either television advertisements for a specific food brand, or public service announcements. This study measured sales volume changes for the specific food brands.</p> <p>Studies looking at exposure to advertising during TV viewing:</p> <ul style="list-style-type: none"> • Two of the studies (one moderate quality, one weak) demonstrated that advertisements increased food consumption. One of these studies, looking at cookie consumption, found the greatest effect was in obese participants. • Two further studies (moderate quality) found no impact on food intake. • Two further studies (one moderate, one weak) were inconclusive, one of these finding different effects for males and females. • The study (weak quality) which included a taste test was also inconclusive. <p>The study (weak quality) investigating willingness to pay was inconclusive.</p> <p>The study looking the impact of advertising specific food brands (moderate quality) found that food advertisements increased purchases for slightly over half of the advertisements.</p>	<p>Intervention: Televised food and non-alcoholic drinks advertising</p> <p>Evidence statement [D]: The evidence that televised advertising increases associated food or non-alcoholic drinks consumption in adults is inconsistent and it is not possible to draw a conclusion [7 studies]</p> <p>Intervention: Televised food advertising</p> <p>Evidence Statement [H]: Evidence that food advertising increases purchasing of the advertised products is lacking. [1 study]</p> <p>Authors' conclusions: Overall, the results did not show conclusively whether or not food advertising affects food-related behaviour, attitudes or beliefs in adults, but suggest that the impact varies inconsistently within subgroups, including gender, weight, and existing food psychology. Concern regarding the effects of televised 'unhealthy' food advertising on children's food preferences and behaviour has resulted in recent advertising restrictions, but no comparable regulations currently exist for adults. The results of this review suggest that the potential effects of food advertising on adults cannot be ignored and merit further research</p> <p>Limitations: With the exception of one study, all were conducted on a small scale. Research was generally carried out in populations of young adults and a large proportion of studies relied on self-referral of participants. Participants were aware of involvement in a research project and studies conducted in an experimental environment which may limit generalisability to snack food consumption in the home environment.</p> <p>Comment: Unclear whether repeatability checks on quality assessment were conducted. Many studies involved university staff or students so it is unclear whether results would be generalisable to adult populations. Of the nine trials, eight were conducted in lab settings rather than real-world settings. Most investigated outcomes do not consider impact on purchasing nor longer term impact on purchasing or consumption.</p> <p>Review authors noted that a substantial body of evidence on how food promotion affects the food preferences and behaviour of children but noted that the impact of food advertising on adults is less clear. They reported that they were not aware of any reviews of the effects of food promotion, including food advertising, specifically on adults.</p>

Source details	Results	Conclusions
<p>Nago ES et al. Association of out-of-home eating with anthropometric changes: a systematic review of prospective studies. <i>Crit Rev Food Sci Nutr</i> 2014; 54 (9): 1103-1116.</p> <p>Exposure: Out of home eating</p> <p>Outcome: Risk of becoming overweight or obese and increases in body weight, BMI, BMI z-score, and waist circumference</p> <p>Source type: Systematic review</p> <p>Searches conducted: To March 2011</p> <p>Study population: Free living humans – healthy at baseline</p> <p>Included study types: Prospective not further specified - cross sectional and qualitative studies specifically excluded</p> <p>Environment type/s: Food Physical Micro</p>	<p>Description of included studies: Fifteen studies were included in the systematic review. Of these, 12 were ITS, two were controlled trials and one a cohort study.</p> <p>Ten had been conducted in the US, one analysed data from 10 European countries and one each was conducted in the UK, Australia, Spain, and Canada.</p> <p>One study was conducted solely in children, one included children and the remainder included participants over 16 at study commencement.</p> <p>Quality of included studies: In assessing methodological quality authors note they considered risk of bias in sample selection (representativeness and participation rate), the design (controlled trial or not), data collection methods (validity and reliability, the appropriateness of statistical tests, and whether they accounted for potential confounders). Most studies were subject to some selection bias, analysing the risks of bias did not allow differentiation among them. Sample size and follow up duration were used as criteria to identify the seven studies the review authors considered to be the best.</p> <p>Synthesis: Narrative</p> <p>Findings: Any definitions of out-of-home eating were considered, using place or preparation or consumption of foods and studies using a single source of out of home foods for example fast foods or school foods.</p> <p>Risk of overweight and obesity Two studies, both ITS: one found that eating out once or more each week was associated with an increased risk of becoming overweight or obese compared with not eating out; the second study looked at frequency of meals eaten out of home by type and found a higher risk of obesity associated with breakfast and dinner frequency but a lower risk with lunch frequency.</p> <p>Change in body weight Seven studies (one controlled trial, six ITS) reported data on weight change. Follow ups varied from 12 weeks to 15 years. All except 1 study reported a significant association between eating out of home and weight gain. Two studies found that eating at fast food outlets positively predicted weight change and one that weight gain associated with frequent fast food use was higher than for restaurant use.</p> <p>Change in BMI Five studies looked at BMI change (one controlled trial, one cohort, three ITS) in adults. Of the two best papers (both ITS), one showed no association between eating out in the broad sense and BMI change. In the other, eating takeaway foods frequently was positively associated with BMI change in women. Three papers (one cohort, one controlled trial, one ITS) looked at fast foods specifically but results were conflicting. Two studies, one of short duration, found no difference in BMI with increasing fast-food use whereas the other (ITS) showed an association over a period of 3 years.</p> <p>Change in waist circumference Three papers looked at this (one cohort, two ITS) and there was no clear trend between fast food use and waist circumference.</p>	<p>Exposure: Out-of-home fast-food and restaurant food</p> <p>Evidence statement [C2]: There is some evidence that eating fast foods and restaurant foods is associated with increased risk of weight gain, overweight and obesity but it is not conclusive [11 studies]</p> <p>Authors' conclusions: Evidence on the association of out-of-home eating and anthropometric changes is mostly based on fast-foods and to a lesser extent on restaurant foods. There is not enough research on other out-of-home foods such as street foods, canteen, and school foods. Eating out-of-home frequently, in the broad sense, is positively associated with the risk of becoming overweight or obese and weight change. With regard to specific out-of-home sources, the review shows that eating at fast-food outlets is associated with a greater increase in body weight and waist circumference over time than eating at restaurants. Furthermore, takeaway foods were shown to positively predict BMI change in women.</p> <p>Comment: There is little detail on search terms/search strategy used. Authors do not report use of a specific tool to assess the quality of the included studies. Not all included studies were in adults. Review authors did not discuss any limitations of their review.</p>

Source details	Results	Conclusions
<p>Roy R et al. Food environment interventions to improve the dietary behaviour of young adults in tertiary education settings: A systematic literature review. <i>J Acad Nutr Diet</i> 2015; 115: 1647-1681.</p> <p>Intervention: Increasing the availability of healthy food choices and portion control; providing information on, and the promotion of, healthy food choices using in-store signage; reducing the price of healthy foods and increasing the price of unhealthy items; and changing the placement of healthy foods within food outlets to make these more prominent.</p> <p>Outcome: Dietary behaviours. Primary outcomes: changes to healthier food choices, reductions in unhealthy food choices, nutrition knowledge, and/or food/drink sales. Secondary outcomes: food preferences; food-related psychology; motivations, barriers, beliefs, and attitudes toward food and lower body mass index; reduced weight.</p> <p>Source type: Systematic review</p> <p>Searches conducted: 1998 to December 2014</p> <p>Study population: Young adults attending university/college</p> <p>Included study types: RCTs, pre- and post-intervention studies, quasi experimental studies, cross-sectional studies, and other non-experimental studies in real world settings.</p> <p>Environment type/s: Food Physical Micro</p>	<p>Description of included studies: The systematic review included 15 studies.</p> <p>In terms of study design the included studies comprised of two RCTs, a randomised 2-period crossover study, two pre-post intervention studies, six nonrandomised quasi experimental studies and four cross-sectional studies.</p> <p>Eleven studies were conducted in the US, one in the UK, two in Belgium and one in Italy.</p> <p>Nearly all interventions exclusively targeted nutrition/ dietary habits as outcome measures. Some included non-health-related targets such as customer satisfaction and intent to purchase, awareness, food production, food waste, and food insecurity. One study included weight changes as a health-related target.</p> <p>Quality of included studies: The quality of included studies was assessed using the assessment tool for primary studies from the Evidence Analysis Manual created by the Academy of Nutrition and Dietetics. This assessment tool has 10 components that consider the clarity of the study question, comparability of groups, selection bias, measurement bias, blinding, confounders, statistical analysis, withdrawals, validity of conclusions, and sponsorship bias and rates studies as positive, negative, or neutral. Positive or high-quality studies must be free from bias, include comparable controls, and have the intervention clearly stated, whereas confounders should be described and be free from measurement bias with valid reliable study design, outcome measures, and statistical analysis. If the answers to validity criteria indicate that the study has some risk of bias, the report is designated neutral or medium quality. In the case that a study fails on most (i.e. six or more of the domains) of these essential validity criteria, the study is designated negative or poor quality.</p> <p>Authors report that according to their assessment five studies were of high quality (low risk of bias), seven assessed as medium quality (medium risk of bias) and three studies being of poor quality (high risk of bias).</p> <p>Synthesis: Narrative</p> <p>Findings:</p> <p>Signage and labels (n=10) These studies provided information on healthy foods using signage and labelling at the point of purchase (POP) and were studies in 10 university venues, including cafeterias, vending machines and college dining halls.</p> <p>Four studies tested change in dietary behaviour after exposure to POP macronutrient labels; all studies reported statistically significant effects (one cross sectional, rated medium quality; one ITS rated medium; one non randomised controlled study rated medium and one ITS rated high).</p> <p>Three studies aimed to increase sales of healthy foods by using advertisements and/or promotional materials; two of these reported statistically significant positive effects (both cross sectional studies rated medium quality. The other study reported a positive, non-significant effect (quasi experimental rated poor quality).</p> <p>Two studies used interpretive nutrition labelling or messages (star system and pyramid figures) to show the energy and nutrition content of each meal. The study assessing the star system found no effect (uncontrolled before and after rated high quality; the study assessing the pyramid figures reported a statistically significant effect (cross sectional design rated poor quality).</p> <p>One study (an RCT rated high quality) used energy labels and motivational posters on vending machines and reported a statistically significant lower growth rate of sales of SSBs.</p>	<p>Intervention: Food environment interventions to improve the dietary behaviour of young adults in tertiary education settings.</p> <p>Evidence statement [C]: There is some evidence supporting these interventions but it is not conclusive [15 studies].</p> <p>Intervention: Signage and nutrition labelling at point of purchase in tertiary education settings</p> <p>Evidence statement [C]: There is some evidence supporting the use of signage and labelling to improve food choices by young adults in tertiary education settings [10 studies].</p> <p>Intervention: Portion control in tertiary education settings</p> <p>Evidence statement [D]: The evidence for the use of portion-controlled packaging to reduce intake by young adults in tertiary education settings is inconsistent and it is not possible to draw a conclusion [2 studies].</p> <p>Authors' conclusions: A range of single-intervention strategies has been tested to improve food environments in the university and college settings. Interventions such as food labelling, promotional materials, increasing the availability of healthy products, and providing price incentives to increase purchases of healthy foods were identified as being potentially useful. Increasing the availability of healthy foods and decreasing portion size of unhealthy foods improved dietary intake. Price incentives to increase purchases of healthy foods and increased availability of healthy foods combined with nutrition information were identified as having a positive effect on nutrition-related outcomes.</p> <p>Additional research comparing the effectiveness of individual and in-combination approaches is needed. Much of this research has methodologic limitations, rendering it difficult to draw conclusions across studies. Therefore, there is a need for more cluster-RCTs and assessment of the influence of food-environment changes on overall diet quality, body weight, and other health-related outcomes.</p> <p>Comment: Majority of studies were from the US; there may be differences in tertiary education settings that are relevant. Authors noted some of the included studies used 24 hour recall or food logs and one might be subject to social desirability of self-report.</p>

Source details	Results	Conclusions
	<p>Availability of healthy food through changing catering practices and portion sizes (n=3) One study (RCT rated high quality) used portion controlled packaging to reduce total snack intake, results were inconsistent. A crossover design was used over and there was no significant difference between the groups in the second stage.</p> <p>A study which reduced the portion size of french fries in an all you can eat dining hall using individual paper bags (quasi experimental, rated medium quality) reported a significant decrease in consumption per diner.</p> <p>An RCT (rated high quality) found that provision of free fruits and vegetables in a university canteen resulted in participants eating significantly more fruits and more vegetables and having a better dietary profile.</p> <p>Nutrition promotion or information combined with incentives to increase purchases or greater accessibility of healthy foods (n=2)</p> <p>One study (uncontrolled before and after, rated medium quality) combining a 20% subsidy for healthy foods with distribution of education materials led to an increase in the consumption of healthy foods and a decline in the consumption of less-healthy foods with effects sustained when prices returned to their original levels.</p> <p>A study combining increased accessibility of fruit on campus with a social marketing campaign (uncontrolled before and after rated poor quality) showed a significant increase in fruit intake.</p>	<p>The data does not allow understanding of influence on overall diet and any potential compensatory behaviour.</p> <p>Overlap in included studies: Two studies included in Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315. Two studies in Hollands GJ et al. Portion, package or tableware size for changing selection and consumption of food, alcohol and tobacco. <i>Cochrane Database Syst Rev</i> 2015; (9): CD011045. Three studies included in Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548 and two with Liberato SC et al. Nutrition interventions at point-of-sale to encourage healthier food purchasing: a systematic review. <i>BMC Public Health</i> 2014; 14: 919.</p> <p>Two studies included within this systematic review had been excluded by other systematic reviews because of their study design.</p>

Source details	Results	Conclusions
<p>Sinclair SE et al. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388.</p> <p>Intervention: Informative, contextual or interpretive menu-based nutritional information</p> <p>Outcome: Caloric consumption, selection</p> <p>Source type: Systematic review</p> <p>Searches conducted: Jan 1990- March 2013</p> <p>Study population: Populations from countries with similar nutritional labelling environment to Canada (e.g. US, UK, AUS, New Zealand)</p> <p>Included study types: Experimental and quasi-experimental studies</p> <p>Environment type/s: Food Physical/legislative Micro</p>	<p>Description of included studies: The systematic review included 17 studies; 10 experimental studies and seven quasi-experimental studies.</p> <p>Seven of the experimental studies identified took place in laboratories, two were conducted in a University restaurant and one in a fast food restaurant.</p> <p>The quasi-experimental studies identified included a form of control and five took place in fast-food restaurants and two in worksite cafeterias.</p> <p>Quality of included studies: The Scottish Intercollegiate Guidelines Network (SIGN) checklists were used to assess controlled trials and a modified version of the SIGN checklist for cohort studies was used to assess the quality of the quasi-experimental studies. Authors assigned studies as being of higher quality and lower quality. Three of the 10 experimental studies were designated as higher quality as were three of the seven quasi experimental studies.</p> <p>Synthesis: Meta-analysis and narrative</p> <p>Findings: <i>Informative</i> menu labelling described approaches that provided nutrient content amounts only, such as the number of calories in a menu item. <i>Contextual</i> referred to approaches that provided additional information, such as the recommended daily calories for an average adult to help put the number of calories into context for consumers. <i>Interpretive</i> described approaches that offered additional interpretation of the menu item. These included exercise equivalency labels that provided the number of minutes exercise needed to burn the calories contained in the food item or traffic light labels, where green, amber or red symbols were used to represent increasing calorie amounts</p> <p>Experimental Studies Study authors meta-analysed intervention study arms which tested all label conditions versus no label conditions and separately meta-analysed subsets of calorie content labels alone and calorie content labels that provided additional contextual or interpretative information.</p> <p>Any labelling condition significantly decreased calories selected (seven studies, 18 comparisons) -42.54 calories (95% CI -81.90 to -3.19) and calories consumed (five studies, 22 comparisons) -41.22 calories (95% CI -78.98 to -3.46) versus no label group. In these meta-analyses for calories selected outcomes from artificial laboratory studies have been combined with real-world studies whereas those for calories consumed only included studies from laboratory or artificial settings.</p> <p>In studies that tested calorie content labels without additional contextual or interpretive information, the pooled mean difference for calories selected (six studies, eight comparisons) was not significant, 31 fewer calories (95% CI -95.85 to 34.18; P=0.35). Similarly, calories consumed (four studies, eight comparisons) was non-significantly attenuated to 13 fewer calories (95% CI -62.29 to 36.82; P=0.61).</p> <p>Conversely, when conditions that provided additional contextual or interpretive information were examined, the pooled mean difference in calories selected (five studies, 10 comparisons) was significant, 67 fewer calories (95% CI -116.99 to -17.79; P=0.008). Contextual or interpretive</p>	<p>Intervention: Menu labelling- all formats combined</p> <p>Evidence Statement [C]: There is some evidence that menu labelling is effective in reducing energy selected or consumed but it is not conclusive. Meta-analysis of calories selected across 18 comparisons was significant; -42.4 calories (95% CI -81.90 to -3.19). Meta-analysis of calories consumed across 16 comparisons was also significant; 41.22 calories (95% CI -78.98 to -3.46).</p> <p>Intervention: Menu labelling with calories alone</p> <p>Evidence statement [E]: There is some evidence that calorie content labels without additional contextual or interpretive information are ineffective in reducing energy selected or consumed but it is not conclusive. Meta-analysis of calories selected across eight comparisons was not significant; -31 calories (95% CI -95.85 to 34.18; P=0.35). Meta-analysis of calories consumed across 8 comparisons was also not significant; -13 calories (95% CI -95.85 to 34.18; P=0.35)</p> <p>Intervention: Calorie content labels incorporating additional contextual or interpretive information</p> <p>Evidence statement [C]: There is some evidence that calorie content labels incorporating additional contextual or interpretive information are effective in reducing energy selected or consumed but it is not conclusive. Meta-analysis of calories selected across 10 comparisons was significant; -67 calories (95% CI -116.99 to -17.79; P=0.008). Meta-analysis of calories consumed across 16 comparisons was also significant; -81 calories (95% CI -138.99 to -22.36; P=0.007).</p> <p>Authors' conclusions: Despite mixed findings on the efficacy of labelling foods in restaurants and foodservices, public health and consumer advocacy groups, within both Canada and the US, continue to advocate for the availability of nutrition information for foods sold in these settings. The findings of our meta-analysis support menu labelling approaches that include contextual or interpretive nutrition information along with calories to help consumers select and consume fewer calories when eating in restaurants and other foodservice establishments. The labelling of menus with calories alone does not have a significant influence on consumers' selection or consumption of calories. The best approach for menu-based nutrition information, particularly for those consumers who may be limited in their food and health literacy skills, merits further exploration.</p> <p>Limitations: The majority of the studies had methodologic weaknesses. Several of the studies had small sample sizes with questionable power to detect statistical differences. All of the studies measured the immediate effect rather than the longer-term effects of menu labelling. The quasi-experimental designs were susceptible to confounding bias because the comparison groups were from different source populations. More than half of the quasi-experimental studies did not adjust for potential confounding variables in the analysis. None of the experimental studies reported concealing allocation or the method of randomization used to allocate participants to treatment groups. Furthermore, whereas blinding of the participants was not feasible, blinding of the individuals performing the</p>

Source details	Results	Conclusions
	<p>interventions also resulted in a pooled mean difference in calories consumed (four studies, 16 comparisons) of 81 fewer calories (95% CI -138.99 to -22.36; P=0.007).</p> <p>A much greater proportion of the input data was from higher quality studies in the calorie labelling alone meta-analysis than was available for the labelling with additional contextual or interpretive meta-analysis.</p> <p>Authors also meta-analysed separately the three studies occurring in natural settings. Combination of these three studies reported that calories selected in menu label group were reduced by 53 (-92 to -13 calories, P= 0.009). None of these studies were assessed as being of higher quality.</p> <p>Combining data from the three studies rated as higher quality, all conducted in laboratory or artificial settings, showed a reduction of 63 calories selected, (-167 to 39 calories, P=0.22) and 45 fewer calories consumed (-129 to 39 calories, P=0.29), both results not being statistically significant.</p> <p>Quasi-experimental studies In the five studies conducted in fast-food restaurants, menu labels consisted of calorie content only (no contextual or interpretative components). In the three studies of higher quality one showed a statistically reduction in calories purchased (14.4 calories per transaction), one had a small sample that may not have been sufficient to detect small changes in the amount of calories purchased and the other with a large sample found only small between group differences which were not statistically significant.</p> <p>Neither of the two worksite cafeteria studies were identified as being of higher quality. Both reported more frequent selection of targeted items where menu labels were provided however statistical significance of between-group difference was not reported.</p>	<p>analysis of calories selected or consumed should have been feasible but was not reported.</p> <p>Comment: Changes in BMI, weight or overall daily calories from menu labelling interventions are not outlined. The majority, 70% of experimental studies contributing to results were conducted in laboratory or artificial settings often in University settings. The meta-analyses of calorie content labelling without additional contextual or interpretative information had a much larger proportion of data from higher quality studies than did the meta-analyses of interventions with additional contextual information. In some analyses natural and artificial setting environments were mixed.</p> <p>Overlap of included studies: Six experimental studies and one quasi-experimental study overlapped with those included in Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315. Eight studies overlapped with Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548.</p> <p>Of the three systematic reviews focussed on reflecting the evidence about menu labelling Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315 has the tightest inclusion criteria for study design, followed by Sinclair SE et al. The influence of menu labelling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388. The inclusion criteria for Fernandes A et al. Influence of menu labelling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548 were the least stringent. Search dates were most recent for Crockett, followed by Fernandes followed by Sinclair.</p>

Source details	Results	Conclusions
<p>Sisnowski J, Street JM, Merlin T. Improving food environments and tackling obesity: A realist systematic review of the policy success of regulatory interventions targeting population nutrition. <i>PLoS One</i> 2017; 12(8): e0182581.</p> <p>Intervention: Statutory regulation of the food environment targeting consumption of energy dense food and beverages</p> <p>Outcome: BMI, weight, or calorie intake and indicators measuring parameters on presumed causal pathway to changed consumption patterns including measures of the degree of programme implementation and non-behavioural consumer responses such as awareness and knowledge (intermediate outcomes along the causal pathway to policy success).</p> <p>Source type: Systematic review</p> <p>Searches conducted: Jan 2004- Oct 2015</p> <p>Study population: Adults</p> <p>Included study types: Any including some measure of comparison</p> <p>Environment type/s: Food Policy/legislative Macro</p>	<p>Description of included studies: The systematic review included 36 studies from peer-reviewed articles and grey literature reports. The review classified included studies and noted six repeat cross sectional studies with control group, four cross sectional studies with comparison group, 11 repeat cross sectional studies, five cross sectional studies, one case control study and one cohort study, and five descriptive studies with three remaining unclassified.</p> <p>Twenty nine of the studies assessed interventions implemented in the US, three in Denmark, two in Australia, one in France, and one in Hungary.</p> <p>Quality of included studies: The quality of included studies was assessed using tools developed by the National Heart, Lung and Blood Institute for before- after, cohort and cross-sectional studies. The majority, 17 studies, were judged to be of medium quality, with one being high quality, seven being of good quality, three being of fair quality, five being of poor quality and two unrated.</p> <p>Synthesis: Narrative</p> <p>Findings:</p> <p>Menu labelling (n=19) Nine studies investigated changes in consumer knowledge using self-reported noticing of calorie labels and seven studies used self-reported usage of calorie labels. Percentage of customers noticing calorie labels varied across intervention sites as did the much lower percentage of people acting on calorie information. There were few consistent trends to determine which sub-populations were using the labelling in their decision making.</p> <p>Three medium quality studies examined reformulation by chain restaurants following new menu labelling regulations. One recorded an estimated 5% drop in main meal calories at 18 months after enactment of the rule. A case-control study showed that availability of healthier food options increased by 8% at regulated chains but remained constant at control chains however no difference was observed in average caloric content was found. Another study found few changes to the food environment other than compliance with the regulation.</p> <p>One repeat cross-sectional study with control group rated as high quality found no change in frequency of visits to fast food restaurants after introduction of statutory menu labelling.</p> <p>One poor quality repeat cross sectional study examined policy diffusion across other Australian States once one state enacted mandatory menu labelling and reported that nutrition information available in stores rose significantly nationwide.</p> <p>Twelve studies examined changes in calories purchased following a regulatory intervention involving menu labelling. 10 studies measuring average caloric intake, based on verified purchases or self-reported consumption suggested that menu labelling using calorie per item does not impact on consumer purchasing behaviour. Two studies reported a differential post-implementation drop in average calories ordered.</p> <p>Improvement of food infrastructure (n=5) Four studies assessed the impact of New York city's Green Carts program which made available up to 1000 permits for mobile vendors of fresh produce in specified disadvantaged neighbourhoods. Two of these studies were descriptive, one was a cross sectional study with a comparison group and one was a cross sectional study. No</p>	<p>Intervention: Menu labelling in chain restaurants</p> <p>Evidence statement [C]: There is some evidence that a proportion of customers report noticing calorie information after introduction of menu labelling but it is not conclusive [9 studies].</p> <p>Evidence Statement [C]: There is some evidence that fewer customers report using calorie information than report noticing the calorie information but it is not conclusive [7 studies].</p> <p>Evidence Statement [D]: The evidence supporting the hypothesis that menu labelling encourages reformulation in to lower caloric values of food options in chain restaurants is inconsistent and it is not possible to draw a conclusion [3 studies].</p> <p>Evidence statement [H]: Evidence about the effects of menu labelling on frequency of visits to fast food restaurants is lacking [1 study].</p> <p>Intervention: Mandatory menu labelling</p> <p>Evidence statement [H]: Evidence about diffusion of mandatory menu labelling to other geographic areas is lacking [1 study].</p> <p>Intervention: Improving food infrastructure - Green carts for disadvantaged areas</p> <p>Evidence Statement [H]: Evidence about the impact of green carts on intake of fresh produce is lacking [4 observational studies].</p> <p>Intervention: Improving food infrastructure - Banning new free-standing fast food chain outlets</p> <p>Evidence Statement [H]: Evidence about the impact of banning new free-standing fast food outlets is lacking [1 study].</p> <p>Intervention: Procurement standards for public institutions</p> <p>Evidence Statement [H]: Evidence about the impact of procurement standards for public institutions is lacking [1 study]</p> <p>Authors' conclusions: To conclude, our review underlines that the immediate expectations associated with the examined types of regulatory interventions need tempering. At this point in time, the policy examples discussed above primarily deliver proof of feasibility: the fact that they survived the policy-making process and have been mostly successful in reaching immediate program goals should enhance the political palatability of such approaches even if, at the time of examination, there has been little demonstrated impact on risk factors and health outcomes. Policy-makers should therefore not dismiss such recent policy experiments as failures, but pursue the example of these</p>

Source details	Results	Conclusions
	<p>statistically significant increase in fruit and vegetable consumption was reported. Vendors tended to cluster along public transport, commercial and other hubs by passing the most disadvantaged neighbourhoods. Take up was around 50% for the permits however only 166 active carts could be located.</p> <p>South Los Angeles introduced a ban on new free standing fast food chain outlets. This intervention showed limited effectiveness in a fair quality cross-sectional study with comparison group; four and a half years after implementation only 10 % of food outlets operating at the time of study had opened under the new rule. This indicates the limited reach of a law applying only to new businesses in a fairly stable food environment.</p> <p>Procurement standards for public institutions (n=1) The Healthy Beverage Executive Order enacted by the city of Boston has been evaluated in a fair quality repeat cross-sectional study with comparison group. Two years post implementation, unhealthy beverage availability and average caloric content per beverage declined compared to pre-implementation compared to control sites owned by the city and State of Massachusetts and not covered by the order.</p> <p>Subsidies for healthy foods (n=5) All five studies involved subsidies involving the US Supplemental Nutrition Assistance Program (SNAP) and were cross-sectional or descriptive in design (two studies rated as good quality, two as medium quality). The studies showed increases in sales at farmers' markets and green carts however health survey data in New York City where some of the interventions took place showed no differential increase in self-reported fruit and vegetable intake after introduction of the program compared to control neighbourhoods.</p> <p>Taxation of unhealthy foods and beverages (n=5) All five studies (repeat cross sectional studies, three assessed as good quality, two assessed as medium quality) investigated European measures. A French beverage tax of 0.076 Euros per litre was passed through fully to retail prices for soda and partially for other taxed beverages six months post implementation. Three studies quantified the effects of the now abolished Danish tax on saturated fat content. All studies concluded there was an effect on consumption as measured by proxy sales and purchasing data. Initial decreases of 10-15% in purchases of butter, butter blends, margarine and oils in the first nine months in one study were partially attributed to hoarding prior to entry. Sales changes in another study suggested a decrease of 4-6% in the intake of saturated fat from minced beef and cream. Another study examined sales data for 12 taxed foodstuffs over the 15 months of the taxes existence and reported a decrease across product categories of 0.9% but an increase by 1.3% pre-implementation and post abolition of the tax. A broad based, junk food tax in Hungary was estimated to have reduced purchases of processed foods, which were mostly taxed, by 3.4% at 16 months post-implementation whilst purchased quantities of unprocessed foods increased by a statistically insignificant 1.1%.</p> <p>Nutritional labelling of products (n=1) One study assessed whether product samples matched the exact nutritional information on a label by testing 350 product samples and found that only 7% did so.</p>	<p>jurisdictions as necessary building blocks for more stringent and comprehensive nutrition policy and obesity prevention regimes.</p> <p>Comment: Authors do discuss issues around study design but do not seem to refer to the quality of the included studies in the discussion and conclusions.</p> <p>No evidence statement has been written for the change in calories purchased after a regulatory menu labelling intervention. Many of the studies included by this author have been excluded by Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315 because of their study design.</p> <p>No evidence grading has been provided on subsidies for healthy foods as all were specific to the US Supplemental Nutrition Assistance Program and all studies were cross sectional or descriptive in design. Evidence gradings are available for subsidies on healthy foods from other systematic reviews.</p> <p>Authors excluded studies which introduced sugar sweetened beverage taxes enacted solely as means to raise revenue due to lack of public health policy intent. No evidence grading has been written for taxation of healthy foods and beverages from this review as all studies appear to be repeat cross-sectional studies.</p> <p>No evidence grading has been provided for the single study assessing nutritional labelling of products as it assesses accuracy. The authors of this systematic review however do through this study raise the question of what an acceptable margin of error is for consumer information on labelling.</p> <p>Overlap in included studies: This systematic review overlaps with a number of others on menu labelling. One study overlaps with Crockett RA et al. Nutritional labelling for healthier food or non-alcoholic drink purchasing and consumption. <i>Cochrane Database Syst Rev</i> 2018; (2): CD009315. Five studies overlap with Sinclair SE et al. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388. Eight studies overlap with Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548. Ten studies overlap with Hillier-Brown FC 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. <i>Obes Rev</i> 2017; 18 (2): 227-246.</p>

Source details	Results	Conclusions
<p>Stewart G et al What interventions increase commuter cycling? A systematic review. <i>BMJ Open</i> 2015; 5 (8): e007945.</p> <p>Interventions: Individual/Group interventions Environmental interventions including: Whole city approaches Changes in walking and cycle infrastructure Ride to work day</p> <p>Outcome: Changes in commuter cycling; frequency of cycling, change in workforce commuting mode, change in commuting population transport mode, use of infrastructure by defined populations, and population modal shift</p> <p>Source type: Systematic review</p> <p>Searches conducted: October and November 2014</p> <p>Study population: Adults 18+</p> <p>Included study types: Studies including comparison groups and/or pre-intervention and post-intervention data</p> <p>Environment type/s: Physical activity Sociocultural Micro</p>	<p>Description of included studies: Twelve studies were included, two of which were individual level intervention so the findings from these have not been included. All studies relating to environmental interventions were before-after studies, two of which appear to have involved a control group.</p> <p>Four were conducted in England, one in Scotland, one in Ireland, two in Australia and one in the US, one in New Zealand.</p> <p>Quality of included studies: Authors applied the quality checklist from NICE’s public health guidance manual to give a quality rating of ++ (study designed to minimise risk), + (potential sources of bias not addressed in the study or not clear from the way the study was reported) or – (study with significant sources of bias).</p> <p>Synthesis: Narrative</p> <p>Findings:</p> <p>Workplace travel interventions (n=3) An uncontrolled before and after study (UBA rated -) in Bristol reported a non-significant rise in cycle commuting following implementation of a workplace travel plan. In Australia (before and after, rated -) 17% of those who registered for a ride to work event and provided baseline data indicated that they had not cycled to work before the event. At 5 months post intervention, 27% of first timers were still cycling to work (defined as at least once a week) compared with 67% of those who had been cycling to work before the event. In New Zealand (UBA rated -) 40 organisations were recruited to the ‘Bike Now’ programme; 27 of these (675 workers) remained in the plan at one year; 112/675 (16.6%) indicated they were cycling less, 347 (51.4%) about the same and 216 (32%) more</p> <p>Cycle training (n=2) A study in Sydney (UBA, rated -) found no difference in either frequency or duration of cycling at 2 months following a cycling proficiency training programme although a significant difference was found for those who did not cycle before the programme. In London (UBA rated -) questionnaire at 3 months post intervention found that the mean number of days cycled to work in the past week had increased from 0.66 to 1.33. However, this study reported a large loss to follow up – 104 responses from 471 participants.</p> <p>Cycling Towns and Cities (n=1) The systematic review refers to the Cycling Cities and Towns (CCT) initiative in England as a capital revenue (promotional activities, cycle training) and investment (e.g. cycle lanes, cycle parking) scheme but does not give detail on actual changes implemented as a result of increased funding. The controlled before-after study (rated +) assessing this initiative involved three types of control groups, matched towns, towns that were unsuccessful in receiving CCT funding and a non-London national comparison group. The study showed a 0.69% increase in cycling to work in intervention towns, compared to matched towns between 2001 and 2011. Larger effects were seen against the two other control groups.</p> <p>Whole city approaches (n=1) A whole city intervention was implemented in Dublin (UBA, rated -) involving financial incentives (tax free loans to purchase cycles), infrastructure change and promotional events and shared bike schemes. Census data indicated that cycle modal share increased from 4% to 5% in 2011 but it is unclear to what extent the 2008 financial crisis in Ireland affected the results.</p> <p>Infrastructure (n=3) Traffic free infrastructure involving a main project and feeder routes in three UK cities/town were evaluated for effects on residents living within 5km of the respective projects (UBA, rated +). 3516/22500 individuals responded to survey packs and 53% and 43% provided data and 1- and 2- year follow up respectively (excluding those that had moved house). Respondents were asked if they had cycled on the infrastructure for six journey purposes including commuter cycling. At 2-year follow-up 18% of people who knew about the project reported transport cycling compared to 7% of the full study.</p> <p>A before-after study (rated -) of opening a bridge in Glasgow showed an increase in the number of cyclists entering the city centre from the South with almost no changes in cyclists crossing other bridges. Results for this study may have been confounded by concurrent roadworks which were not controlled for.</p>	<p>Exposure: Workplace travel interventions</p> <p>Evidence statement [D2]: The evidence suggesting that workplace interventions are associated with increased commuter cycling is inconsistent and it is not possible to draw a conclusion [3 studies]</p> <p>Exposure: Cycle training</p> <p>Evidence statement [D2]: The evidence suggesting that cycle training is associated with increases in commuter cycling is inconsistent and it is not possible to draw a conclusion [2studies]</p> <p>Authors’ conclusions: Despite its potential to increase health, there is little robust evidence of effective interventions to increase commuter cycling even at a subpopulation level. Many studies lack appropriate controls, their external validity to the wider population remains unclear, and they have high rates of loss to follow-up—all indicating a high risk of bias. Wider environmental interventions that make cycling conducive appear to reach out to hard to define but larger populations. This could mean that environmental interventions, despite their small positive effects, have greater public health significance than individual-based or group-based measures because those interventions encourage a larger number of people to integrate physical activity into their everyday lives. More research is needed to establish how prevalence of commuter cycling can be increased.</p> <p>Comment: See the data extraction form on Bennie J et al. <i>Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence review 2: Ciclovía and street closures, trails and safe routes to schools.</i> London: NICE; 2017.</p> <p>.</p> <p>Overlap of included studies: Three studies with Bennie J et al. <i>Physical activity and the environment update. Effectiveness and cost-effectiveness. Evidence review 2: Ciclovía and street</i></p>

Source details	Results	Conclusions
	<p>Another before–after study (rated -) conducted Minneapolis and the University of Minnesota assessed the effects on cycle commuting once cycle facilities had been implemented or improved and compared outcomes to suburban populations. At the University cycle commuter modal share increased from 2.8% to 3.3% (n=4855) and in Minneapolis it increased from 0.788 to 0.841 (n=21,111). Authors reported that in the suburbs cycle commute share fell from 0.335% to 0.279% (n=9016). External influences including “The Lance Armstrong effect” may have been present at the time.</p>	<p><i>closures, trails and safe routes to schools.</i> London: NICE; 2017.</p>

Source details	Results	Conclusions
<p>Thow AM et al. A systematic review of the effectiveness of food taxes and subsidies to improve diets: understanding the recent evidence. <i>Nutr Rev</i> 2014; 72(9): 551-565.</p> <p>Intervention: Food taxes and subsidies</p> <p>Outcome: Consumption of healthy foods</p> <p>Source type: Systematic review</p> <p>Searches conducted: January 2009 to March 2012</p> <p>Study population: Not specified</p> <p>Included study types: Not specified a priori</p> <p>Environment type/s: Food Economic/policy/legislative Macro; taxes Micro; subsidies</p>	<p>Description of included studies: Forty three papers, including 38 studies. Study designs included two RCTs, 29 modelling studies and seven survey based studies.</p> <p>Quality of included studies: The review authors did not provide specific comment on the conduct of the individual studies that they included.</p> <p>Only two RCTs included data on observed behaviour in relation to price changes, but these were location specific so could not account for substitution outside of the study location.</p> <p>Of the modelling studies the review authors considered the most robust were the 14 studies that considered substitution.</p> <p>The seven survey based studies enabled consideration of substitution however, they rely on data about hypothetical purchasing decisions and the extent to which these reflect real world decisions is unclear.</p> <p>Synthesis: Narrative</p> <p>Findings: Included studies looked at SSB taxes, fat and calories based taxes, nutrient profiling based taxes and healthy food subsidies.</p> <p>Studies of subsidies on healthy food Subsidies ranged from 1.8% to 50%, all reported increased consumption of targeted foods. Their effect on total calorie intake was inconsistent. Some studies found that subsidies would reduce calorie intake by a small amount whereas others suggested that this might increase.</p> <p>Studies of taxes on sugar sweetened beverages Sixteen studies modelled the effect on consumption of taxes on SSBs ranging from 5% to 30%. All showed a reduction in consumption ranging from 5% to 48%, suggesting that response was proportional to the taxes applied.</p> <p>Four studies modelled substitution and three of these studies showed an overall reduction in calorie consumption from all beverages. Three studies of existing state-based soft drink taxes in the US showed little difference in consumption between states with small taxes (around 5%) and states without taxes.</p> <p>Studies of taxes on individual nutrients Six studies assessed taxes on fat, sugar, and salt. Taxes ranged from 5–40% and reduced consumption of the targeted nutrient by 0–8%. However, only one study considered the effect on other intake of nutrients: this study suggested that a focus on a single nutrient may increase intakes of other unhealthy nutrients.</p> <p>Studies of taxes based on nutrient profiling Taxes on foods deemed “unhealthy” on the basis of nutrient profiling ranged from 10 to 50%, and all but one study found reductions in purchase and consumption of target foods that ranged from 6.5% (total calories) to 30% (target food purchase)</p>	<p>Intervention: Tax or subsidy targeted to influence the price of a specific food product or nutrient.</p> <p>Evidence statement: There is some evidence from modelling studies that fiscal measures, particularly soft drink taxes and healthy food subsidies, might be effective in promoting desired dietary changes.</p> <p>Authors’ conclusions: This review suggests that fiscal measures, particularly soft drink taxes and healthy food subsidies, can be effective in promoting desired dietary changes. While prospective observational studies provide valuable information about consumer behaviour in response to price, robust modelling studies also provide important insights into the potential for taxes and subsidies to affect consumption by utilising data about all food consumption and by furnishing opportunities to assess actual taxes and subsidies. Experimental survey-based studies can also provide valuable data about consumer choice and detailed consumption data in controlled settings.</p> <p>To extend the current evidence base, more intervention studies as well as studies of implementation of actual (implemented) taxes and subsidies will be needed to give a better understanding of the effect of fiscal interventions on consumer behaviour, including potential differential effects. Future research could also consider the effect of taxation in conjunction with other interventions (as part of a multi-sectoral strategy to improve diets and health), the effect of brand variation (i.e., consumers substituting with cheaper brands or varieties of a product in response to a tax), and industry responses to taxation.</p> <p>Limitations: The review authors noted that the wide variety of targets of taxation that have been proposed and modelled add uncertainty to the conclusions that can be drawn regarding public health and policy measures. This study is also limited by its focus on assessments of fiscal policy interventions, which means that other, possibly relevant studies that focused only on price would have been excluded.</p> <p>Comment: No evidence grading has been provided because the majority of included studies were modelling studies. As such, the majority will not have reported objective measures of observed behaviour. The inclusion and quality assessment processes appear to have been conducted by a single author, therefore no consistency check would have been conducted.</p> <p>Two of the 38 studies were from UK, some from elsewhere in Europe, many from US. Given the limitations of modelling studies (lack of data on observed behaviour) generalisation might not be an issue.</p> <p>Overlap of included studies: Only includes one RCT that was included in Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. <i>Prev Chronic Dis</i> 2017; 14: E107. Although search dates for this review were limited there were six studies in the Gittelsohn et al (2017) review that would seem to meet the inclusion criteria for this review but no list of excluded studies so it is not possible to tell if these were identified and excluded. Includes one RCT also included in An R et al. Effectiveness of subsidies in promoting healthy food purchases and consumption: a review of field experiments. <i>Public Health Nutr</i> 2013; 16(7): 1215-1228. Overlaps with Eyles H et al. Food pricing strategies, population diets, and non-communicable disease: a systematic review of simulation studies. <i>PLoS Med</i> 2012; 9(12): e1001353 on six studies.</p>

Source details	Results	Conclusions
<p>Torbeyns T et al. Active workstations to fight sedentary behaviour. <i>Sports Med</i> 2014; 44 (9): 1261-1273.</p> <p>Intervention: Standing and Active Workstations</p> <p>Outcome: Health, energy expenditure, cognition, quality of life, computer task performance, productivity, absenteeism, independent living, cognitive decline and academic achievement</p> <p>Source type: Systematic review</p> <p>Searches conducted: To February 2014</p> <p>Study population: Any</p> <p>Included study types: Randomised controlled trials, non-randomized controlled trials and non-randomised non-controlled studies.</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: Thirty two studies were included in the systematic review, 27 of which were conducted in adults.</p> <p>Eleven studies investigated the effects of standing workstations whereas 16 studies assessed walking and cycling workstations, stepping devices, elliptical machines and pedal exercise machines.</p> <p>Quality of included studies: The quality of included studies was assessed using a tool created from a combination of questions used in the SIGN methodology checklist and the EPHPP quality assessment tool for quantitative studies.</p> <p>Synthesis: Narrative</p> <p>Findings: Some studies assessed more than one type of device. Some of the included studies only reported work related outcomes (for example attention, typing speed).</p> <p>Standing workstations There were 16 studies, 11 of which had been conducted in adults. Of these 11 studies, seven reported relevant outcomes.</p> <p>Of four non-randomised studies (described as longitudinal design), three reported significant reductions in sitting time (one self-report) (two rated moderate, one rated weak) and the other study (rated weak) found no effect.</p> <p>Two studies (one described as crossover design, rated moderate and one RCT rated strong) reported significant increases in energy expenditure. One further study (rated moderate, design unclear) found no effect on energy expenditure.</p> <p>Treadmill workstations There were 15 studies looking at the impact of treadmill workstations, of these 10 reported relevant outcomes. Seven studies; four RCTs (one rated moderate, three rated strong) one longitudinal crossover study (rated moderate), two non-longitudinal (rated moderate) reported a significant increase in energy expenditure. One RCT (rated strong) reported a significant increase in metabolic rate. One longitudinal study (rated weak) reported significant reductions in waist and hip circumference. One longitudinal study (rated weak) reported a significant reduction in sitting time and significant weight loss.</p> <p>Other types of workstations One weak longitudinal study looked at the impact of using a pedal exercise machine and found this reduced self-reported sedentary time. A crossover study, rated moderate, looked at use of a stepping device and found this increased energy expenditure. An RCT, rated strong, looking at the impact of an elliptical machine workstation found a slight increase in physical activity and increased energy expenditure.</p>	<p>Intervention: Standing workstations</p> <p>Evidence statement [C]: There is some evidence that standing workstations reduce sitting time but it is not conclusive [4 studies]</p> <p>Intervention: Treadmill workstations</p> <p>Evidence statement [C]: There is some evidence supporting the use of treadmill workstations to increase energy expenditure but it is not conclusive [7 studies]</p> <p>Authors' conclusions: The implementation of active workstations might contribute to improving people's health and physical activity levels. The effect of the use of these active workstations on cognition and applied work tasks, such as computer task performance, needs further investigation before conclusions can be drawn.</p> <p>Comment: Repeatability checks for inclusion were not conducted. Quantitative results were not presented for studies finding no effect and there was some lack of detail about the relevant outcomes. It is not clear from the data presented in this review whether primary study authors assessed potential compensatory changes in physical activity outside of the workplace. There is limited data on maintenance of the effect.</p> <p>Most studies had few participants and were of short duration.</p> <p>The evidence statement relating to energy expenditure and treadmill workstations is based on seven studies. The evidence grading has been downgraded from B to C to reflect the number of participants in these studies and their short duration. Four of the seven studies were described by the authors as non-longitudinal. This could mean that measurements were taken during one episode of directed use and would then not account for whether an individual chooses to use the active feature of the workstation available to them.</p>

Source details	Results	Conclusions
<p>Wanner M et al. Active transport, physical activity, and body weight in adults: a systematic review. <i>Am J Prev Med</i> 2012; 42(5): 493-502.</p> <p>Exposure: Active transport</p> <p>Outcome: Physical activity or body weight</p> <p>Source type: Systematic review</p> <p>Searches conducted: To October 2010</p> <p>Study population: Adults</p> <p>Included study types: Observational studies reporting a quantitative association but excluding ecological studies</p> <p>Environment type/s: Physical activity Physical Micro</p>	<p>Description of included studies: Thirty six studies were included in the systematic review. All studies were cross-sectional except one longitudinal study conducted in France and Northern Ireland.</p> <p>Of the 15 studies reporting on active transport and physical activity five were conducted in Europe, seven in North America, Canada, Australia and New Zealand and three from other countries.</p> <p>Of the 30 studies reporting on active transport and body weight 15 were conducted in Europe, 11 in North America, Canada, Australia and New Zealand and four from other countries.</p> <p>Quality of included studies: Quality assessment was based on the <i>Strengthening the Reporting of Observational Studies in Epidemiology</i> (STROBE) statement. Studies generally received low quality scores mainly due to crude measures of active transport and physical activity. All active transport measures were self-report. Only two of 15 studies reporting physical activity used an objective method. 14 of 30 studies reporting weight used an objective assessment. Authors report no clear pattern regarding the quality scores of articles and reported associations.</p> <p>Synthesis: Narrative</p> <p>Findings: Six studies reported associations between active transport and general physical activity, 21 studies reported associations between active transport and body weight and nine studies reported both associations. All assessments of active transport were based on self-reports.</p> <p>Active transport and physical activity Five of 15 studies reported exclusively or mostly significant associations showing more active transport associated with more general physical activity, nine studies reported some significant associations in the same direction and some non-significant associations. One study did not report any significant association between active transport and physical activity. The two studies using objective measures of physical activity reported some significant associations and some non-significant associations in the expected direction.</p> <p>Active transport and body weight Twenty five of the 30 studies observed an inverse association between active transport and body weight and in 13 of these studies were mostly or exclusively significant. Two studies reported some significant associations in the expected direction, but also some significant associations in the other direction. Three studies did not report any significant associations between active transport and body weight. All studies reporting no significant associations had used self-report measures.</p> <p>Not all studies adjusted for the possible confounding effect or other physical activity, however studies which did control for other forms of physical activity were not more likely to report a lack of association.</p> <p>The only longitudinal study reported exclusively significant associations in the expected direction for both for cross-sectional (baseline) and longitudinal analyses and attained a quality score of 6/10. Baseline ages in this longitudinal study conducted in men ranged from 50-59 and follow-up was for 5 years. 2039/8865 men contributed data to the analysis of change in BMI with walking or cycling to work.</p>	<p>Exposure: Active transport</p> <p>Evidence statement [D2]: The evidence that self-reported active transport is associated with significantly increased levels of physical activity is inconsistent and it is not possible to draw a conclusion [15 studies]</p> <p>Exposure: Active transport</p> <p>Evidence statement [D2]: The evidence that active transport is associated with a reduced risk of being overweight or obese is inconsistent and it is not possible to draw a conclusion [30 studies]</p> <p>Authors' conclusions: According to evidence from cross-sectional studies, active transport is associated with higher general physical activity levels and lower body weight in adults. Considering the diverse other positive health effects of active transport, this kind of physical activity behaviour has potential to contribute significantly to public health improvements at the population level, especially because it is amenable to most people, given that safe environments for active transport are becoming more available, as recommended by WHO and other international bodies. However, the quality of the included studies limits final conclusions, and more longitudinal studies using more detailed and ideally objective measures of active transport, physical activity and body weight are needed to explore the causal nature of the associations further.</p> <p>Comment: All but one of the studies were cross-sectional in design. The available research mainly captures associations between active transport and physical activity or adult body weight at a single point in time. Cross sectional studies are descriptive, not analytical. They can be used to see what proportion of a population has been exposed to a potential risk (or protective factor) of interest but cannot be used to estimate the relationship between cause and effect.</p> <p>Quality assessment of included studies was limited.</p>

Source details	Results	Conclusions
<p>Wilson AL et al. Nudging healthier food and beverage choices through salience and priming. Evidence from a systematic review. <i>Food Quality and Preference</i> 2016; 51: 47-64.</p> <p>Intervention: Nudging/choice architecture</p> <p>Outcome: Food and beverage choices</p> <p>Source type: Systematic review</p> <p>Searches conducted: To April 2014</p> <p>Study population: Adults</p> <p>Included study types: Not specified</p> <p>Environment type/s: Food Physical Micro</p>	<p>Description of included studies: Thirteen articles, including 25 studies.</p> <p>Of these, six were RCTs, five case control studies and 14 case series.</p> <p>Quality of included studies: Studies were rated as good, average or poor using the SIGN critical appraisal checklists for the relevant study design.</p> <p>Five RCTs were rated good, one average; all case control studies were rated good; two case series were rated good, nine average and three poor.</p> <p>Synthesis: Narrative</p> <p>Findings: Priming nudges (subconscious cues to encourage a particular choice) included visibility, accessibility, availability and combinations of these. Salience nudges (used to increase attention to a particular choice) included calories content labels, traffic light labels, descriptive labels and taste testing and verbal invitations to decrease portion.</p> <p>Studies were deemed to be effective if the authors reported a statistically significant increase in healthier choices, negatively effective if the authors reported a significant decrease on healthier food choices or an increase in less healthy choices, mixed effectiveness if the authors reported a significant increase or decrease of both healthier and less healthy choices and, ineffective where authors reported no significant effect on choices.</p> <p>Results were provided for 21 studies.</p> <p>Priming nudges</p> <p>Visibility (n=3) Two nudges altering visibility influenced healthier choices, and one had no effect. In one study (RCT, rated average) the placement of breakfast foods in a buffet line was altered; in one line healthier breakfast foods were placed at the start, and in the other line the less healthy breakfast foods. In both lines, the more visible items comprised 66% of all food selected. When healthier foods were placed first the two healthier items were selected by approximately 29% more consumers, and the three least healthy items were selected by 41% fewer consumers. One average quality case-series study altered the arrangement of healthy and less healthy snack items on a set of four shelves, in both an online experiment and at a checkout counter in a hospital. Placing snacks on either the top two or bottom two shelves did not influence selection of healthy or less healthy snacks. In the laboratory 30% of people chose healthy items when displayed on the top shelf, and 28% chose healthy options when displayed on the bottom shelf. In the hospital canteen there was no main effect of shelf arrangement ($F(1, 6) = 5.03, p = 0.07$). Another average quality case-series study altered the placement of items on menus. Pizzeria menus without prices were tested in a laboratory and coffee shop menus with prices were tested in a coffee shop. Items listed at the top or bottom of the menu were purchased an average of 20% more than items listed in the middle.</p> <p>Accessibility (n=1) One average quality case-series study altered accessibility of ingredients, attempting to reduce portion size by altering the serving utensils provided at a self-service salad bar. The provision of tongs made it harder to pick up a large quantity of the ingredients, and decreased the amount selected by an average of 17% compared to a serving spoon.</p> <p>Availability (n=1)</p>	<p>Authors' conclusions: The literature was limited to evaluating the use of 'priming' and 'salience' nudges for influencing healthier food and beverage choices. The review does provide evidence that nudging can be effective for influencing healthier food and beverage choices. However, the mixed findings suggest the need for further testing of nudging approaches across various populations and contexts, to determine which nudges may be the most effective. A greater understanding of the application of nudging in influencing food and beverage choices may provide a scalable approach to improving dietary behaviours and reducing the prevalence of health conditions arising from poor diets.</p> <p>Limitations: Review authors noted that a meta-analysis could not be conducted, due to the inconsistent outcome measures reported and the range of populations and settings studied. They said there is a need for nudging to be tested across various environments and with different populations to broaden the generalisability of results, and to determine the scope of environments and populations that nudging is effective for. The field also needs to use consistent outcome measures and effect sizes to allow for more conclusive synthesis of results.</p> <p>The review authors commented that the classifications used for nudging interventions were theoretically driven concepts and therefore they may be interpreted differently by different researchers.</p> <p>They noted that most of interventions had been conducted in similar settings, particularly laboratories, cafeterias, convenience stores and restaurants, and it has been suggested that most food comes from supermarket. They recommended that more research of nudging interventions be conducted in these environments.</p> <p>Comment: Authors have only included studies where original authors referred to the intervention as one of nudging or choice architecture- there are probably many more similar studies not identified by this terminology. As the subject area is very broad, the likelihood is that these authors have only identified a subset of the available evidence the studies included have not been graded. We have retained the systematic review as a means to access references to individual study references that have not been included in other systematic reviews. It is not clear which countries studies were conducted in. Settings were limited; university, hospital and laboratory cafeteria settings mainly therefore there may be implications for generalisation. Search terms were brief, there was no discussion of publication bias and a single author undertook critical appraisal.</p> <p>Overlaps in included studies: Bucher T et al. Nudging consumers towards healthier choices: a systematic review of positional influences on food choice. <i>B J Nutr</i> 2016; 115 (12): 2252-2263 on 5 studies. One study with both Sinclair SE et al. The influence of menu labeling on calories selected or consumed: a systematic review and meta-analysis. <i>J Acad Nutr Diet</i> 2014; 114(9): 1375-1388 and Fernandes A et al. Influence of menu labeling on food choices in real-life settings: a systematic review. <i>Nutr Rev</i> 2016; 74 (8): 534-548 and with Gittelsohn J et al. Pricing strategies to encourage availability, purchase, and consumption of healthy foods and beverages: a systematic review. <i>Prev Chronic Dis</i> 2017; 14: E107 on one study.</p>

Source details	Results	Conclusions
	<p>One average quality case-control study altered the assortment of snack items on a set of four shelves, in both an online experiment and at a checkout counter in a hospital canteen. When there was a greater assortment of healthier snacks (75% healthy vs. 25% less healthy), consumers were 2.9 times more likely to purchase a healthy snack in the online study and 3.5 times more likely in the canteen.</p> <p>Visibility and accessibility combined (n=6) Results were mixed, with three healthy outcomes, one unhealthy outcome, one mixed outcomes, and one study showing no effect.</p> <p>In a good quality randomized control trial healthy sandwich items listed on a more visible, 'featured' menu were selected 35–44% more often than when they were listed in two less visible and accessible menus (a menu on the next page, or a menu in an envelope). The total meal calories increased when healthy items were on the featured menu and when less healthy items were only slightly less visible and accessible (listed on the second page). Conversely, total meal calories decreased when healthy items were on a featured menu and less healthy sandwiches were much less visible and accessible (on a menu in an envelope, which only 38% of people opened). If consumers knew they were selecting a healthier sandwich (by viewing the less healthy sandwich options on the next page) they compensated for their healthier selection by choosing less healthy sides and drinks.</p> <p>One good quality case-series study rearranged hospital cafeterias, placing healthier food and beverages at the eye level (more visible and accessible) and less healthy items below the eye level (less visible and accessible). Less healthy overall purchases decreased by 4%, as did sales of healthier purchases, decreasing by 2%. Nudging had a greater effect on beverages with a 14% decrease in sales of less healthy beverage and a 2% increase in sales of healthier beverages.</p> <p>One average quality case-series study altered the presentation of salad ingredients at a circular self-service salad bar by manipulating the position, size or number of trays with salad ingredients (Ingredients placed in a tray in the middle of the bar were less accessible (harder to reach) and selection decreased significantly by 9% compared to food from trays placed closer to the edge. When there was only one tray in the middle and two trays on the edge, selection from the middle tray decreased significantly by 14%. Comparing food selection from two small trays with that from one large tray, all positioned in the middle, there was no significant effect on selection. Thus, ease of reach had a greater influence than the number of opportunities to access.</p> <p>Another average quality case-series study altered the placement of fruit and confectionery items in a university canteen. Sales of fruit decreased by 26% when they were placed by the checkout (compared to being placed on a sideboard). Similarly sales of confectionery increased by 14% when placed on a sideboard away from the checkout.</p> <p>Visibility, accessibility and availability combined (n=1) One good quality case-series study rearranged hospital cafeterias, placing healthier food and beverages at the eye level (more visible and accessible) and less healthy items below the eye level (less visible and accessible), and increased availability of water. Sales of overall less healthy items decreased by 5%, and sales of less healthy beverages decreased by 11%. There was a smaller effect on healthy items, with sales of healthier items overall decreasing by 0.5%, but sales of healthier beverages increasing by 4%. There was a substantial change in sales of bottled water, increasing by 26%.</p> <p>Salience nudges</p> <p>Calorie content labels (n=4)</p>	

Source details	Results	Conclusions
	<p>Calorie content labels had mixed effectiveness, with two healthy outcomes, one unhealthy outcome, and one with no effect.</p> <p>A RCT (rated good) where labels displaying either the number of calories in an item (sandwich, side dish or beverage) or a daily calorie recommendation decreased the overall calories purchased at a fast-food sandwich restaurant. Combining the two labels decreased total calories purchased by almost 100 calories.</p> <p>Two good quality case-control studies introduced calorie content labels across four hospital cafeterias and three hospital convenience stores. Labels displaying the number of calories in beverages significantly increased less healthy (sugared) beverages sales by 7.3% but had no significant influence on sales of healthier (zero-calorie) beverages. Labels indicating the amount of exercise required to expend the calories in the beverage (e.g. "50 min to burn off the 260 calories in a 20-oz soda") had no significant influence on beverage purchases. Combining both types of labels also failed to significantly influence purchases.</p> <p>Traffic light labels (n=3) Traffic light labels produced healthy outcomes in one study, and showed mixed effects in another.</p> <p>Two good quality studies (a case-control and a case-series study) introduced traffic light labels onto food and beverage items in two hospital cafeterias. Sales of healthier (green coded) items increased significantly by between 5% and 10% and sales of less healthy (red coded) items decreased significantly between 9% and 24% – with a stronger influence on beverages</p> <p>A RCT compared sales in the intervention cafeteria with two comparator cafeterias that did not introduce traffic light labels). Compared to the comparator sites, the intervention decreased less healthy sandwiches and bags of potato crisps (red item) (between groups differences of -0.3% and -4% respectively), and sales of healthier sandwiches increased (between groups difference of 2%). However, sales of bottled water decreased in the intervention site, with a between groups difference of -1%. Overall</p> <p>Descriptive labels (n=3) One poor quality case-series study tested labels describing the taste of foods (i.e. "sweet and juicy") and positive and negative health claims (i.e. "high in calories" or "low fat content") on healthy and less healthy items in an online experiment. Taste labels increased the selection of food items that were perceived to be tastier, while the addition of health labels resulted in fewer choices of less healthy foods.</p> <p>An average quality case-series study introduced 'fun' descriptive labels (i.e. "wacky wundermelon slushie" and "funky chicken teriyaki wrap") on healthier food and beverage items at a cafeteria near an outdoor pool. Size of signage was also manipulated – larger signage promoted the healthier items. Sales and number of calories purchased from healthy and less healthy items did not change significantly. A second study on the same intervention (average quality case-series) combined the 'fun labels' was conducted and taste-testing of healthy items. Observation of a subsample of adult's purchases during lunch and overall canteen sales over the whole intervention period showed no influence on the sales of healthy and less healthy items or total calories purchased.</p> <p>When staff asked customers to downsize their main meal at a Chinese fast-food restaurant, this resulted in an increased number of downsized meals by one third (case-series rated average) and the purchasing of a smaller portion did not lead consumers to purchase higher calorie side dishes and drinks. The overall decrease in calories purchased was approximately 100 calories).</p>	

Source details	Results	Conclusions
	<p>Salience and priming nudges combined (n=3)</p> <p>Two studies were good quality case-control studies, and one was a good quality case-series study. All three studies were conducted in hospital cafeterias serving hospital staff and visitors. Sales of healthier food and beverages increased between 3% and 12%, and sales of less healthy foods and beverages decreased between 2% and 39%. The number of calories per beverage purchased also decreased in one study. One of the studies compared sales with two comparator cafeterias that made no changes to the arrangement or availability of items. The intervention increased sales of bottled water by 3% more, and healthier sandwiches by 4% more, and decreased sales of bags of potato crisps (less healthy option) by 11% more and less healthy sandwiches by 0.7% more, compared to sales in comparator cafeterias.</p>	