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Obesity, diet and nutrition evidence review technical report

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

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

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We would welcome feedback on this report and would be interested to hear how it has been used. To provide feedback, or request further information, please contact us:

Public Health Wales Observatory
2 Capital Quarter
Tyndall Street
Cardiff
CF10 4BZ

Email: observatory.evidence@wales.nhs.uk
Web: www.publichealthwalesobservatory.wales.nhs.uk

Report authors:

Amy Hookway, Advanced Evidence and Knowledge Analyst, Kate Heneghan, Advanced Evidence and Knowledge Analyst, Public Health Wales.

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1 Background

This evidence review is an update of the systematic review on obesity, diet and nutrition undertaken for the Transforming Health Improvement Implementation Programme, 2014. It has been produced by the Public Health Wales Observatory Evidence Service for the Health Improvement Directorate. It forms part of the work being undertaken to support Welsh Government on an Obesity Prevention and Reduction Strategy.

2 Methods

For this update of the Transforming Health Improvement Implementation Programme 2014 systematic review only secondary level sources (systematic review and meta-analysis) are included. Reviews of reviews are generally recognised as being useful to aid decision makers.¹ Like a systematic review, this review of reviews will use explicit methods aimed at minimising bias. The protocol for this review is available on request.

2.1 Review questions

Searching and source selection was conducted separately for each question and outlined in individual search technical documents and inclusion/exclusion tables. This research evidence review addressed the questions:

2.1.1 Question 1

- What universal (population level), whole system or settings based programmes and interventions are effective in preventing overweight and obesity in children?

2.1.2 Question 2

- What universal, whole system or settings based interventions are effective in preventing overweight and obesity in adults aged 18 to 65 years?

2.2 Source identification, selection and data extraction

A sensitive search was undertaken using database subject headings and wide ranging free text, keywords and synonyms. The search was limited to English language, systematic reviews and meta-analyses.

¹ Baker P et al. Cochrane Update: The benefits and challenges of conducting an overview of systematic reviews in public health: a focus on physical activity. *J Public Health (Oxf)* 2014; 36(3):518.

The search for question 1 was limited to only include sources published from 2014 onwards. The search for question 2 was limited to include sources published from 2008 onwards (to account for the slight variation in research question from the original 2014 THI review).

Searches were conducted between October and November 2017 for systematic reviews on the following databases and websites:

- NICE
- Cochrane
- Health Evidence
- The Community Guide (Community Preventative Services Taskforce)
- US Preventative Services Task Force
- EPPI Centre Knowledge Library
- MEDLINE
- PsycINFO

Search results were transferred into a Reference Management database and then title screened by one reviewer. Where titles were unclear the articles were retained and screened at abstract.

Both the lead reviewer and a second reviewer independently screened all abstracts against the inclusion/exclusion criteria (decided a priori). A Kappa score was calculated and disagreements were resolved by discussion. Reasons for exclusion were recorded for transparency.

For articles included at abstract, the full-text was retrieved and two reviewers independently screened the full-texts against the same inclusion/exclusion criteria. A kappa score was calculated and disagreements were resolved by discussion. Reasons for exclusion at full-text were recorded for transparency (see figures 1 & 2).

Studies included at full-text screening were then critically appraised independently by two reviewers (for question 1, the second reviewer only screened 50% of the articles) using a critical appraisal checklist. If exclusion occurred at critical appraisal, reasons were recorded for transparency. National Institute for Health and Care Excellence (NICE) Guidance, Cochrane Systematic Reviews, Community Guide, US Preventative Services Taskforce and Evidence for Policy and Practice Information and Coordinating Centre (EPPI) systematic reviews were not subject to critical appraisal, as they are considered to be transparent and have a robust and reproducible method.

Data from included studies was extracted into data extraction tables by the lead reviewer. Each intervention/outcome from the review that met the inclusion criteria was graded according to the quality, strength and direction

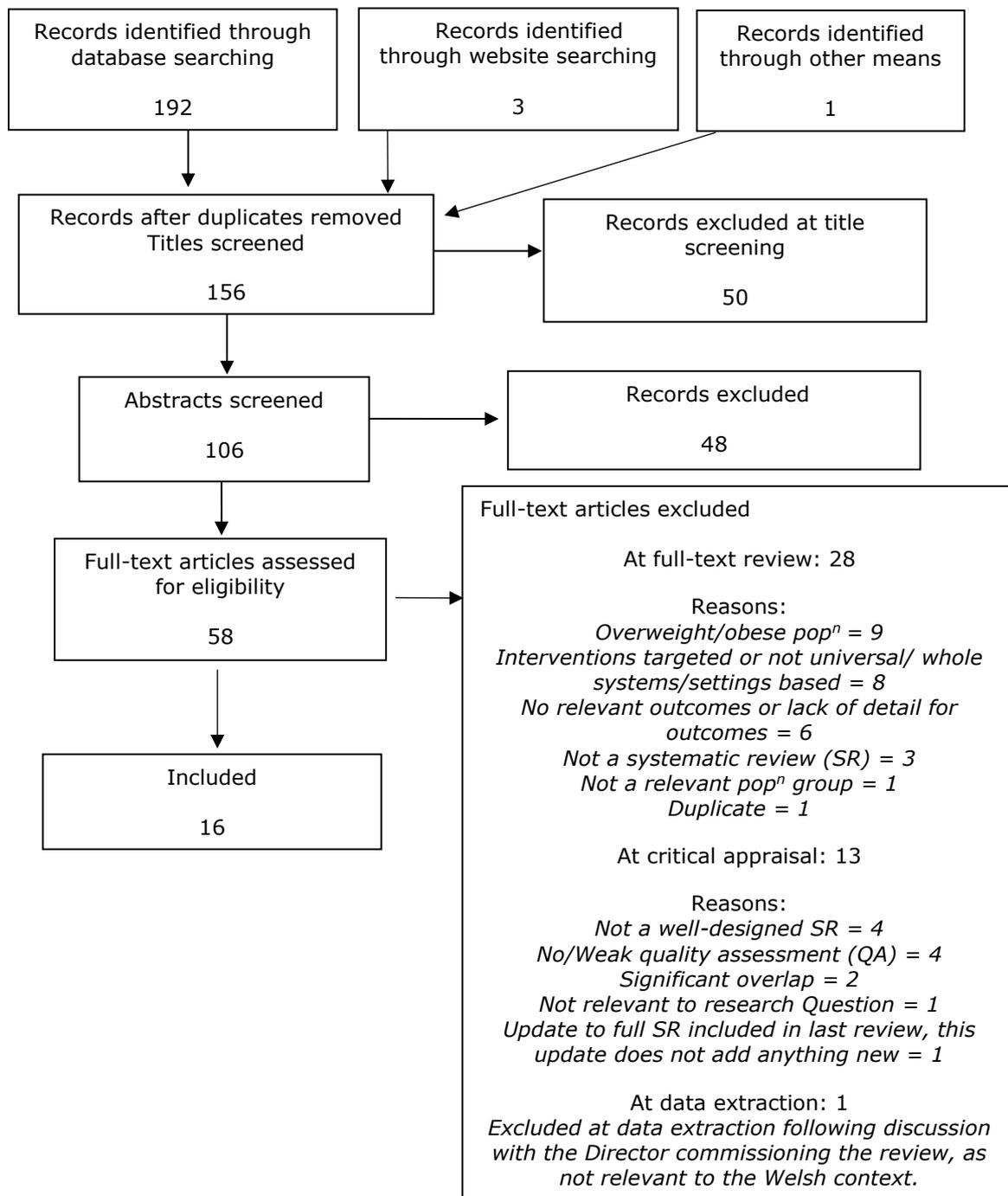
of the evidence (see Appendix II). Repeatability checks on grading were undertaken by the co-reviewer.

Intervention summaries were provided for specific systematic reviews, as requested by the Health Improvement team. These are available in appendix II.

3 Results

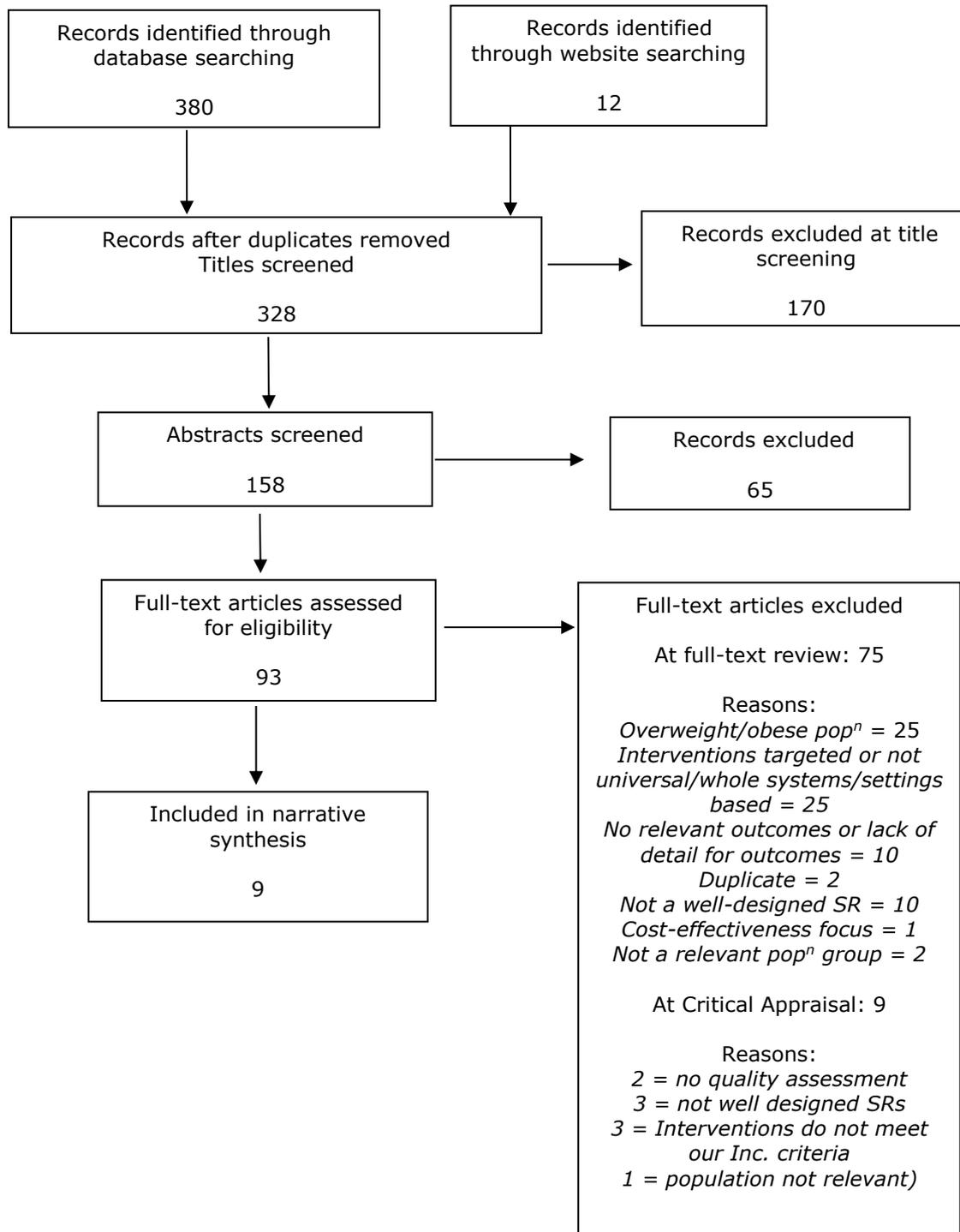
Question 1:

Figure 1: Flow of information through the review process for Question 1.



Question 2:

Figure 2: Flow of information through the review process for Question 2.



Across the two questions, 24 systematic reviews were identified and extracted into data extraction tables. One review (Boelsen-Robinson T et al, 2015) met the inclusion criteria for both the questions.

4 Appendix I Data Extraction Tables

4.1 Reviews meeting the inclusion criteria for Question 1:

Study details	Results of the review	Main findings and evidence grading
<p>1. Aceves-Martins M, et al. Effectiveness of social marketing strategies to reduce youth obesity in European school-based interventions: a systematic review and meta-analysis. <i>Nutr Rev</i> 2016; 74(5):337-351.</p> <p>Type of source: Systematic review.</p> <p>Interventions: School-based interventions to prevent obesity relative to the inclusion of social marketing benchmark criteria (SMBC).</p> <p>Relevant Outcomes: Body mass index (BMI), prevalence of overweight/obesity.</p>	<p>Description of included studies: The systematic search identified 2,187 references. After full-text review, 32 interventions (presented in 38 publications) met the inclusion criteria and were included in the quality appraisal and qualitative analysis. Of these, 27 were RCTs and five were non-RCTS. Twenty studies were included in the meta-analysis. All included interventions were implemented in European schools.</p> <p>Quality of included studies: Quality was assessed using the quality assessment tool for quantitative studies developed by the Effective Public Health Practice Project (EPHPP). Nine studies received a weak quality global rating, 19 a moderate quality global rating and 10 a strong quality global rating.</p> <p>The authors found that those studies which included more SMBC domains generally had a higher quality appraisal rating.</p> <p>Synthesis: Meta-analysis for both BMI and obesity prevalence outcomes were undertaken. A random effects model for both analyses' was used due to I² tests identifying heterogeneity.</p> <p>Findings: Five of the 38 publications reported dietary only interventions, 11 reported physical activity only interventions and 22 described combined</p>	<p>Intervention: School-based interventions to prevent obesity that include characteristics of social marketing benchmark criteria such as customer orientation, behaviour, theory, insight, exchange, competition, segmentation or methods mix.</p> <p>Outcome: Weight change outcomes (BMI, prevalence of overweight and obesity).</p> <p>Evidence statement B: This intervention is supported by moderate quality evidence of its effectiveness. (Meta-analysis BMI SMD, 0.11 [95% CI = -0.20 to -0.02] 18 RCTs; prevalence OR, 0.84 [95% CI, 0.74 - 0.96] 12 RCTs). Interventions with a larger number of SMBC – specifically five or eight domains – were found to be more effective at reducing BMI or the prevalence of overweight and obesity.</p> <p>Authors' conclusions: The inclusion of SMBC when designing interventions represents a valuable</p>

Study details	Results of the review	Main findings and evidence grading
<p>Study Population: Children aged 5-17 years.</p> <p>Studies were included up to: April 2014.</p> <p>Included study types: Non-randomised or randomised controlled trials (RCTs) involving intervention and control groups.</p>	<p>(diet and physical activity) interventions. Twenty-nine studies used a health education method (classes or lessons), in 22 studies the daily physical activity of participants was increased as an intervention, in six studies the number of physical activity lessons was increased as an intervention and in seven studies the availability of fruits, vegetables or both was increased in the school setting.</p> <p>One of the 38 publications reported using four SMBC, nine reported using five, 16 reported using six, 11 reported using seven and one reported using all eight SMBC.</p> <p>BMI: Eighteen RCTs (four weak quality, nine moderate and five strong) were included in the meta-analysis for BMI (n=8,681). The BMI standard mean difference (SMD) estimator showed that the interventions were, overall, minimally effective in reducing BMI in the intervention groups compared with the control groups (BMI SMD, -0.11; 95% CI = -0.20 to -0.02).</p> <p>When the BMI SMD in the intervention studies was analysed according to the number of SMBC reported, a negative effectiveness was reported in the study that utilised only four SMBC (BMI SMD, 0.19; 95% CI, 0.02 - 0.36; 1 RCT - rated weak in quality). Interventions that implemented five SMBC reported a small effect size (BMI SMD, -0.25; 95% CI, -0.45 to -0.04; 7 RCTs, 2 weak, 3 moderate, 2 strong quality). Studies that utilized six or seven SMBC reported a minimal effect size (BMI SMD, -0.06, 95% CI, -0.20 to -0.07; 7 RCTs, 1 weak, 4 moderate, 2 strong quality, & BMI SMD -0.04; 95% CI -0.10 to -0.02; 3 RCTs, 1 strong, 2 moderate quality). In summary, the use of five SMBC is more likely to increase the effectiveness of interventions to reduce BMI.</p> <p>Prevalence: Twelve RCTs (four strong, seven moderate and one weak quality) were included in the meta-analysis for prevalence of overweight and obesity (n=7,298). The Odds Ratio (OR) of prevalence of overweight and obesity</p>	<p>methodological tool that may increase the quality and effectiveness of school-based interventions aimed at improving healthy habits, ultimately resulting in positive changes in outcomes such as weight, BMI, or prevalence of overweight and obesity. The current evidence is sufficient to support the notion that at least five SMBC domains, regardless of which domains are chosen, must be included in the design of school-based interventions so that these interventions can benefit weight related measures in young people. Furthermore, the inclusion of SMBC in school-based interventions will allow the health impact of social marketing to be assessed and validated.</p> <p>Comments: The review authors have not assessed the risk of publication bias.</p> <p>Reviews by Langford⁷ and Oosterhoff¹¹ include 13 studies that also appear in this review. The review by Kellou⁶ includes nine studies appearing in this review. Seven studies also appear in the review by Guerra⁴ and four each in the reviews by Avery² and Kader⁵.</p>

Study details	Results of the review	Main findings and evidence grading
	<p>yielded by the estimator (OR, 0.84; 95% CI, 0.74 - 0.96) implies that, overall, interventions have a 16 per cent greater likelihood of reducing the prevalence of overweight and obesity compared with no intervention.</p> <p>Interventions utilizing five SMBC had a greater likelihood of reducing the prevalence of overweight and obesity. Results imply that studies incorporating five SMBC (OR, 0.72; 95% CI, 0.53 - 0.97; 6 RCTs, 1 weak, 3 moderate and 2 strong quality) were 28 per cent more likely to be effective in reducing the prevalence of overweight and obesity.</p> <p>One school-based intervention included all eight SMBC (OR, 0.80; 95% CI 0.67 - 0.94; 1 RCT, strong quality), which according to the analysis, resulted in a 20 per cent greater likelihood of a reduction in the prevalence of overweight and obesity.</p> <p>Moreover, school-based interventions that included six SMBC corresponded to a 4 per cent likelihood of reducing the prevalence of overweight and obesity (OR, 0.96; 95% CI, 0.81 - 1.14; 3 RCTs, 2 moderate, 1 strong quality), and those that included seven SMBC corresponded to a 7 per cent likelihood of reducing the prevalence of overweight and obesity (OR, 0.93; 95% CI, 0.78 - 1.11; 2 RCTs, both moderate quality).</p>	

Study details	Results of the review	Main findings and evidence grading
<p>2. Avery A et al. A systematic review investigating interventions that can help reduce consumption of sugar-sweetened beverages in children leading to change in body fatness. <i>J Hum Nutr Diet</i> 2015; 28:52-64.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Interventions aimed at children to help reduce the consumption of sugar-sweetened beverages (SSBs).</p> <p>Relevant Outcomes: Change in the consumption of sugary drinks and change in body composition, BMI, BMI z-score (BMIZ), percentage overweight/obese, risk of being overweight, skin</p>	<p>Description of included studies: The review identified eight RCTs which met the inclusion criteria and included interventions focused on reducing the consumption of SSBs with data on changes in body fatness reported. Five studies were undertaken in Europe, one in the USA and two in Brazil. One study was home based and only included overweight and obese participants (<i>data not extracted here as does not fit with our inclusion criteria</i>).</p> <p>Quality of included studies: The quality of included studies was critically assessed using the Jadad scale for reporting RCTs. Studies were scored according to randomisation, method appropriateness, blinding, robustness and reporting/analysis of drop-outs. Quality scores ranged between one and five with higher scores indicating better quality.</p> <p>Synthesis: A narrative synthesis has been undertaken, reasons for this decision are not specified however the authors do state within the strengths and limitations section of the paper that the final studies included in the review are heterogeneous.</p> <p>Findings: Seven studies in our population of interest included anthropometric or behaviour change outcomes (the eighth study took place in an overweight and obese population and is therefore not reported on here):</p> <p>School-based educational programmes (n=5): One primary school-based intervention 'Ditch the Fizz' (quality score - 5/5) resulted in a 25 per cent (p=0.2) reduction in the</p>	<p>Intervention: Interventions aimed at children to help reduce the consumption of sugar-sweetened beverages (SSBs).</p> <p>Outcome: Reduction in consumption of sugar sweetened beverages.</p> <p>Evidence statement B: This intervention is supported by moderate quality evidence of its effectiveness (n=7 studies).</p> <p>Authors' conclusions: The number of RCTs undertaken to date that are designed to reduce the consumption of SSBs and reduce body fatness in children is limited. No studies have been published to date that investigate interventions aimed at preschool aged children. Based on evidence from the studies that have been completed in this field, school-based education programmes focused on reducing SSB consumption and incorporating follow-up modules may offer health professionals the best opportunities for implementing effective and sustainable interventions that are effective in both children and adolescents. Changing the school environment to support such education programmes could improve the effectiveness of these interventions. There is a lack of relevant reported interventions carried out outside of the school environment. It should be noted that the school-based evidence does, however, include certain aspects that may be reproducible and effective in other settings. More rigorously conducted, quality RCTs in this area are</p>

Study details	Results of the review	Main findings and evidence grading
<p>fold thickness or waist circumference (WC).</p> <p>Study Population: Children or adolescents aged 2-18 years.</p> <p>Studies were included up to: August 2013.</p> <p>Included study types: RCTs.</p>	<p>number of glasses of carbonated drinks containing sugar over a three day period in the intervention group compared to the control group. The study also reported a mean difference (MD) of 7.7 per cent (95% CI = 2.2-13.1%) in the percentage overweight/obese at 12 month follow-up.</p> <p>One school-based healthy lifestyle education programme (quality score – 3/5) which encouraged water consumption in place of SSBs resulted in a 23 per cent (p=0.03) decrease in the mean daily intake of carbonated drinks in the intervention group. No significant difference in BMI between intervention and control group was detected.</p> <p>An 8 month educational & environmental health promotion intervention (quality score – 3/5) found that SSB consumption among boys and girls of secondary school age significantly decreased at the end of the intervention (25.5% and 23.9% respectively). This was largely maintained at 12 months but had disappeared at 20 months. No significant difference in BMI was detected. Skin fold thickness was lower in girls in the intervention group at eight months (-2.3mm; 95% CI -4.3 to -0.3mm) and 20 months (-2.0mm; 95% CI -3.9 to -0.1mm).</p> <p>One intervention which delivered nine nutritional education sessions by trained nutritionists (quality score - 2/5) led to a significant variation in the daily frequency of consumption of SSBs, specifically sodas (-0.2 intervention group; -0.08 control group; p=0.02). There was no reduction in BMI gain.</p> <p>A web-based computer-tailored intervention (quality score - 2/5) which included a focus on reducing consumption of SSBs and high energy snacks found that the intervention was associated with 0.54 lower odds of a high daily intake (>400mL day⁻¹) of SSBs compared to control at four months. There was no significant</p>	<p>required to aid the design of effective interventions that can be implemented by health professionals as one strand in the strategy of addressing the childhood obesity epidemic.</p> <p>Comments: The authors of this paper do not address the possibility of publication bias, except to state that using published literature only may be a limitation.</p> <p>Four of the included primary studies in this review also appear in the review by Aceves-Martins¹ and four appear in the review by Guerra.⁴ Three appear in the review by Oosterhoff¹¹, and one appears in the review by Kellou.⁶</p>

Study details	Results of the review	Main findings and evidence grading
	<p>difference at 24-month follow-up and no difference in anthropometric measures.</p> <p>School-based educational programmes combined with environmental change (n=1):</p> <p>One study (quality score 3/5) introduced environmental and educational interventions into schools to promote increased water consumption among primary school-aged children in socially deprived areas in two German cities. It combined the provision of water fountains and water bottles with educational sessions delivered by teachers as part of the curriculum. There was no significant effect on soft drink or juice consumption but the intervention significantly increased water consumption (1.1 glasses day⁻¹ or more; 95% CI = 0.07-1.4 glasses day⁻¹; p<0.001) compared to control. The change in BMI standard deviation (SD) did not differ between intervention and control.</p> <p>School-delivered drinks (n=1):</p> <p>One intervention (quality score 5/5) involved replacing SSBs with non-energy drinks for 18 months. Participating children were provided with one can each day of either a non-carbonated, non-energy drink or a non-carbonated sugar-containing alternative. After 18 months the intervention group had significant reductions in BMIz score (-0.13 p=0.001) compared to control.</p>	

Study details	Results of the review	Main findings and evidence grading
<p>3. Buchanan L et al. Reducing recreational sedentary screen time: A community guide systematic review. <i>Am J Prev Med</i> 2016; 50(3): 402-415.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Behavioural interventions focused on: (i) reducing recreational sedentary screen time only; and (ii) reducing recreational sedentary screen time and increasing physical activity or improving diet.</p> <p>Relevant Outcomes: Screen time (commercial TV viewing and composite screen time (TV plus one other form of screen time)). Diet (intake of total energy, snacks, SSBs, fruit and vegetables and</p>	<p>Description of included studies: The review include 49 studies. Twenty two included studies were RCTs, 18 were group RCTs, four were controlled before-after studies, one was a non-randomised trial and four were uncontrolled before-after studies. Some of the data from RCTs and group RCTs was classified as pre-post study arms, with or without comparison group when analysed.</p> <p>Of these studies, 32 were conducted in the United States, six in Australia, four in the UK, two in Canada and one study each in France, the Netherlands, New Zealand, Sweden and Switzerland.</p> <p>Forty six of these studies targeted children aged ≤13 years, one study targeted the whole family and two studies targeted only adults. Nine studies targeted low-income populations and seven studies targeted overweight or obese participants.</p> <p>Quality of included studies: Assessment of potential threats to validity were conducted using standardised abstraction forms for Community Guide reviews. Quality of execution was rated as good (zero to one limitation), fair (two to four), or limited (five or more). Limitations were counted in the following nine categories:</p> <ul style="list-style-type: none"> • Description of the study population and intervention • Sampling • Measurement of exposure • Measurement of outcome and independent variables • Confounding bias • Data analysis • Participation 	<p>Intervention: Behavioural interventions that focus on reducing recreational screen time, or that focus on reducing recreational screen time and increasing physical activity, in children aged 13 years and under.</p> <p>Outcome: Recreational screen time (composite measure)</p> <p>Evidence statement B: This intervention is supported by moderate quality evidence of its effectiveness (n= 34 study arms).</p> <hr/> <p>Intervention: Behavioural interventions that focus on reducing recreational screen time, or that focus on reducing recreational screen time and increasing physical activity, in children aged 13 years and under.</p> <p>Outcome: Total energy intake</p> <p>Evidence statement B: This intervention is supported by moderate quality evidence of its effectiveness (n=6 study arms).</p> <hr/> <p>Intervention: Behavioural interventions that focus on reducing recreational screen time, or that focus on reducing recreational screen time and increasing physical activity, in children aged 13 years and under.</p> <p>Outcome: Snack intake</p> <p>Evidence statement B:</p>

Study details	Results of the review	Main findings and evidence grading
<p>meals or snacks with the TV on) Weight related outcomes (BMI, BMI z -score, body fat percentage) Obesity prevalence.</p> <p>Study Population: Not specifically stated but included children and adults.</p> <p>Studies were included up to: June 2013.</p> <p>Included study types: Primary research published in a peer-reviewed journal, technical report, or government report; primary investigations of interventions rather than guidelines or review.</p>	<ul style="list-style-type: none"> • Comparability and bias • Other biases <p>Review authors only included studies they considered to be of good or fair quality execution, but with any level of design suitability. Five studies with limited quality of execution were excluded from the review.</p> <p>Of the relevant studies, the most common limitations were in sampling and description.</p> <p>Synthesis: Narrative synthesis. Authors reported for each primary outcome measure, the median of effect estimates from individual studies and the interquartile interval (IQI); the interval between the first and third quartiles.</p> <p>Findings: Screen time only and screen time plus (increasing physical activity) interventions teach behavioural self-management skills through one or more of the following components:</p> <ol style="list-style-type: none"> 1. Classroom-based education 2. Tracking and monitoring 3. Coaching and counselling sessions; or 4. Family based or peer social support <p>Interventions could also include one or more additional components: use of an electronic monitoring device to limit screen time, TV Turnoff Challenge (campaign to turn off TV for a specified number of days), screen time contingent on physical activity, or education through mass or small media.</p>	<p>There is some evidence supporting the use of this intervention but it is not conclusive (n=3 study arms).</p> <p>Intervention: Behavioural interventions that focus on reducing recreational screen time, or that focus on reducing recreational screen time and increasing physical activity, in children aged 13 years and under.</p> <p>Outcome: Obesity prevalence, BMIz-score, body fat percentage, skin fold thickness</p> <p>Evidence statement B: There is some evidence supporting the use of this intervention but it is not conclusive (n=14 study arms (obesity prevalence), n=14 study arms (BMI z-score), n=8 study arms (body fat percentage), n=4 study arms (skin fold thickness)).</p> <p>Authors' conclusions: Among children, such behavioural interventions demonstrated reduced screen time, increased physical activity, and improved diet and weight related outcomes. More research is needed among adolescents and adults.</p> <p>Limitations: Authors note the potential for publication bias as most of the articles were from peer-reviewed literature. In addition, a formal meta-analysis was not possible, owing to varied study designs and few studies reporting CIs or standard errors (SEs). The review team reported the data point closest to the conclusion of the intervention because too few studies reported</p>

Study details	Results of the review	Main findings and evidence grading									
	<p>Interventions were classified as high or low intensity. High intensity interventions included an electronic monitoring device or three interactions with a person /computer generated feedback. Low intensity interventions included no more than two interactions with a person/computer generated feedback.</p> <p>Family-based social support (e.g. parent given materials to facilitate reducing their child's screen time) was the most common intervention component.</p> <p>Of the 49 included studies, 12 studies assessed interventions only targeting screen time whilst 37 studies assessed interventions targeting screen time and increasing physical activity.</p> <p>Findings relating to physical activity outcomes are reported in the sister Observatory Evidence Service (OES) technical report and are not included here.</p> <p>Screen time (n=49 study arms from 39 studies)</p> <p>Composite screen time is defined as the sum of TV viewing plus at least one other form of recreational screen time.</p> <p>Children:</p> <table border="1" data-bbox="499 1098 1377 1391"> <thead> <tr> <th data-bbox="499 1098 680 1197">No. study arms</th> <th data-bbox="680 1098 1115 1197">Median decrease min/ day</th> <th data-bbox="1115 1098 1377 1197">Outcome</th> </tr> </thead> <tbody> <tr> <td data-bbox="499 1197 680 1295">27</td> <td data-bbox="680 1197 1115 1295">-22.2 (IQI= -76.8, -0.60)</td> <td data-bbox="1115 1197 1377 1295">Commercial TV viewing</td> </tr> <tr> <td data-bbox="499 1295 680 1391">34</td> <td data-bbox="680 1295 1115 1391">-26.4 (IQI= -74.4, -12.0)</td> <td data-bbox="1115 1295 1377 1391">Composite screen time</td> </tr> </tbody> </table>	No. study arms	Median decrease min/ day	Outcome	27	-22.2 (IQI= -76.8, -0.60)	Commercial TV viewing	34	-26.4 (IQI= -74.4, -12.0)	Composite screen time	<p>maintenance. Therefore, review results do not reflect maintenance of outcome. Additionally, much of the screen time, dietary, and physical activity data were self-reported, and warrant cautious interpretation of results. Finally, no screen time-only studies reported obesity prevalence, resulting in an obesity prevalence effect estimate based solely on screen time-plus studies.</p> <p>Comments:</p> <p>All of the studies were conducted in high or medium income nations. The findings from this review may be generalisable to the local Welsh population.</p>
No. study arms	Median decrease min/ day	Outcome									
27	-22.2 (IQI= -76.8, -0.60)	Commercial TV viewing									
34	-26.4 (IQI= -74.4, -12.0)	Composite screen time									

Study details	Results of the review	Main findings and evidence grading																		
	<p>Adults</p> <table border="1" data-bbox="499 352 1375 647"> <thead> <tr> <th data-bbox="499 352 680 448">No. study arms</th> <th data-bbox="680 352 1115 448">Median decrease min/ day</th> <th data-bbox="1115 352 1375 448">Outcome</th> </tr> </thead> <tbody> <tr> <td data-bbox="499 448 680 549">1</td> <td data-bbox="680 448 1115 549">-33</td> <td data-bbox="1115 448 1375 549">Commercial TV viewing</td> </tr> <tr> <td data-bbox="499 549 680 647">3</td> <td data-bbox="680 549 1115 647">-130.2 (IQI= -142.8, -128.4)</td> <td data-bbox="1115 549 1375 647">Composite screen time</td> </tr> </tbody> </table> <p data-bbox="499 683 1375 746">Composite screen time outcomes in children ≤13 years (pre-post arms removed)</p> <p data-bbox="499 783 1375 874">Screen time only studies had a greater effect on reducing composite screen time with high intensity screen time only showing the greatest effect.</p> <table border="1" data-bbox="499 940 1375 1302"> <thead> <tr> <th data-bbox="499 940 680 1038">No. study arms</th> <th data-bbox="680 940 1115 1038">Median decrease min/ day</th> <th data-bbox="1115 940 1375 1038">Intervention type</th> </tr> </thead> <tbody> <tr> <td data-bbox="499 1038 680 1171">6</td> <td data-bbox="680 1038 1115 1171">-69.6 (IQI= -99.6, -27.9)</td> <td data-bbox="1115 1038 1375 1171">Screen time only</td> </tr> <tr> <td data-bbox="499 1171 680 1302">18</td> <td data-bbox="680 1171 1115 1302">-22.8 (IQI= -29.7, -2.3)</td> <td data-bbox="1115 1171 1375 1302">Screen time plus increasing physical activity</td> </tr> </tbody> </table>	No. study arms	Median decrease min/ day	Outcome	1	-33	Commercial TV viewing	3	-130.2 (IQI= -142.8, -128.4)	Composite screen time	No. study arms	Median decrease min/ day	Intervention type	6	-69.6 (IQI= -99.6, -27.9)	Screen time only	18	-22.8 (IQI= -29.7, -2.3)	Screen time plus increasing physical activity	
No. study arms	Median decrease min/ day	Outcome																		
1	-33	Commercial TV viewing																		
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No. study arms	Median decrease min/ day	Intervention type																		
6	-69.6 (IQI= -99.6, -27.9)	Screen time only																		
18	-22.8 (IQI= -29.7, -2.3)	Screen time plus increasing physical activity																		

Study details	Results of the review	Main findings and evidence grading															
	<p>Composite screen time outcomes with and without electronic monitoring devices</p> <p>Studies with electronic monitoring reported greater reductions than those without devices</p> <table border="1" data-bbox="499 547 1375 1230"> <thead> <tr> <th data-bbox="499 547 680 647">No. study arms</th> <th data-bbox="680 547 1115 647">Median decrease min/ day</th> <th data-bbox="1115 547 1375 647">Intervention type</th> </tr> </thead> <tbody> <tr> <td data-bbox="499 647 680 748">6</td> <td data-bbox="680 647 1115 748">-91.8 (IQI= -125.4, -70.8)</td> <td data-bbox="1115 647 1375 748">Screen time only (monitoring)</td> </tr> <tr> <td data-bbox="499 748 680 906">1</td> <td data-bbox="680 748 1115 906">-37.1</td> <td data-bbox="1115 748 1375 906">Screen time only (no monitoring)</td> </tr> <tr> <td data-bbox="499 906 680 1064">5</td> <td data-bbox="680 906 1115 1064">-52.8 (IQI= -119.4, -19.2)</td> <td data-bbox="1115 906 1375 1064">Screen time plus increasing physical activity (monitoring)</td> </tr> <tr> <td data-bbox="499 1064 680 1230">11</td> <td data-bbox="680 1064 1115 1230">-17.4 (IQI= -28.2, -4.8)</td> <td data-bbox="1115 1064 1375 1230">Screen time plus increasing physical activity (no monitoring)</td> </tr> </tbody> </table> <p>Dietary behaviours (n=40 study arms from 32 studies)</p>	No. study arms	Median decrease min/ day	Intervention type	6	-91.8 (IQI= -125.4, -70.8)	Screen time only (monitoring)	1	-37.1	Screen time only (no monitoring)	5	-52.8 (IQI= -119.4, -19.2)	Screen time plus increasing physical activity (monitoring)	11	-17.4 (IQI= -28.2, -4.8)	Screen time plus increasing physical activity (no monitoring)	
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Study details	Results of the review	Main findings and evidence grading												
	<p>Six study arms reported a median reduction in total energy intake of 121 Kcal/day (IQI= - 268.0, 0.59).</p> <p>Three study arms reported a median decrease in snack intake of 233.7 Kcal/day (range = -281.9, -123.7).</p> <p>For the remaining outcomes, the body of evidence for both interventions was generally positive, though the magnitude of effect was often small.</p> <p>Among adults, one study reported a significant decrease in eating meals with the TV on, snack intake, and sugar sweetened beverage intake.</p> <p>Weight outcomes (n=39 study arms from 33 studies)</p> <p>Children</p> <table border="1" data-bbox="499 871 1379 1267"> <thead> <tr> <th data-bbox="499 871 680 970">No. study arms</th> <th data-bbox="680 871 1115 970">All types of intervention</th> <th data-bbox="1115 871 1379 970">Outcome</th> </tr> </thead> <tbody> <tr> <td data-bbox="499 970 680 1067">14</td> <td data-bbox="680 970 1115 1067">-0.13 (IQI= -0.23, -0.01)</td> <td data-bbox="1115 970 1379 1067">Median decrease BMI z-score</td> </tr> <tr> <td data-bbox="499 1067 680 1166">8</td> <td data-bbox="680 1067 1115 1166">-3.5 (IQI= -5.4, -0.90)</td> <td data-bbox="1115 1067 1379 1166">Body fat percentage (%)</td> </tr> <tr> <td data-bbox="499 1166 680 1267">4</td> <td data-bbox="680 1166 1115 1267">-1.0 (range= -2.5, -0.44)</td> <td data-bbox="1115 1166 1379 1267">Skin fold thickness (mm)</td> </tr> </tbody> </table>	No. study arms	All types of intervention	Outcome	14	-0.13 (IQI= -0.23, -0.01)	Median decrease BMI z-score	8	-3.5 (IQI= -5.4, -0.90)	Body fat percentage (%)	4	-1.0 (range= -2.5, -0.44)	Skin fold thickness (mm)	
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Study details	Results of the review	Main findings and evidence grading												
	<p>Adults</p> <p>Among adults two studies reported BMI decreases of -0.18 Kg/m² and -0.19Kg/m²</p> <p>Obesity prevalence</p> <table border="1" data-bbox="499 579 1375 1233"> <thead> <tr> <th data-bbox="499 579 672 679">No. study arms</th> <th data-bbox="672 579 1070 679">Median decrease obesity prevalence %</th> <th data-bbox="1070 579 1375 679">Intensity/baseline obesity</th> </tr> </thead> <tbody> <tr> <td data-bbox="499 679 672 842">10</td> <td data-bbox="672 679 1070 842">-2.1 (IQI= -3.9, -1.1)</td> <td data-bbox="1070 679 1375 842">High intensity Median baseline obesity of 10.3%</td> </tr> <tr> <td data-bbox="499 842 672 1038">4</td> <td data-bbox="672 842 1070 1038">-4.6 (range= -7.6, -1.1)</td> <td data-bbox="1070 842 1375 1038">Low intensity Median baseline prevalence 12.3%</td> </tr> <tr> <td data-bbox="499 1038 672 1233">14</td> <td data-bbox="672 1038 1070 1233">-2.3 (IQI= -4.5, -1.2)</td> <td data-bbox="1070 1038 1375 1233">High and low intensity Median baseline prevalence 10.3%</td> </tr> </tbody> </table> <p>Other findings</p> <p>Interventions were found to be effective regardless of weight status. Three of four studies which performed a stratified analysis</p>	No. study arms	Median decrease obesity prevalence %	Intensity/baseline obesity	10	-2.1 (IQI= -3.9, -1.1)	High intensity Median baseline obesity of 10.3%	4	-4.6 (range= -7.6, -1.1)	Low intensity Median baseline prevalence 12.3%	14	-2.3 (IQI= -4.5, -1.2)	High and low intensity Median baseline prevalence 10.3%	
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Study details	Results of the review	Main findings and evidence grading
	<p>to examine the effectiveness on socioeconomic disparities, and which also reported on weight-related outcomes, showed greater reductions in low-income participants. The systematic review also identified two economic studies relevant to screen time interventions. Both modelled a screen time plus increasing physical activity intervention and found it to be cost effective when using a threshold of \$50,000 per QALY. One of the economic studies modelled a screen time-only intervention and found the intervention not to be cost effective. Follow-up research should examine how long intervention effects are maintained, other outcomes including substitution of other sedentary behaviours. Evidence about the effects of more recent mobile devices such as smartphones and tablets were rarely reported in the included studies.</p>	

Study details	Results of the review	Main findings and evidence grading
<p>4. Driessen CE, et al. Effect of changes to the school food environment on eating behaviours and/or body weight in children: a systematic review. <i>Obes Rev</i> 2014; 15(12): 968-982.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Interventions that change the school food environment. For example, interventions in which a material change was made to the school food environment, with or without a relevant school policy directing this.</p> <p>Relevant Outcomes: Anthropometric measures including BMI, BMIz and WC. Eating-related behaviours (including both the purchase and consumption of food).</p> <p>Study Population: Children in school settings (primary or secondary</p>	<p>Description of included studies: A total of 18 papers met the inclusion criteria and were assessed in this review. The majority of studies were conducted in the USA (n=14), with the remaining four conducted in the UK (n=4). A large number of the included studies (n=11) could be described as natural experiments, where the research is reporting on the effect of state or national policy changes that impact the school environment.</p> <p>Quality of included studies: Quality was assessed using the EPHPP tool. A rating of strong, moderate or weak was given for each of the following categories: selection bias, study design, confounders, blinding, data collection methods and withdrawals and dropouts.</p> <p>Synthesis: A narrative systematic review was conducted. A formal meta-analysis was not possible because of heterogeneity in the study design, intervention type and outcomes assessed.</p> <p>Findings: Fourteen studies reported changes to food or beverage availability in canteens or other food provision/sales areas such as snack bars. Of these, five also made simultaneous changes to vending machine content. Two studies made changes to vending machine food availability only. One study introduced a new 'fruit only' tuck shop in the school and the final study was an analysis of a new state policy (with no specific in-school locations specified). Seventeen of the studies reported a positive outcome on either BMI (or change in BMI) or the healthfulness of food sold or consumed.</p>	<p>Intervention: Interventions that change the school food environment. For example, interventions in which a material change was made to the school food environment, with or without a relevant school policy directing this.</p> <p>Outcome: Eating behaviour outcomes.</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=14 studies).</p> <p>Outcome: Weight change outcomes (BMI, BMIz).</p> <p>Evidence Statement D: The evidence is inconsistent and it is not possible to draw a conclusion (n=4 studies).</p> <p>Author's conclusions: With 17 of the 18 included papers (from 16 separate studies) reporting a statistically significant increase in healthy eating behaviours or decrease in BMI of children, it is clear from this review that improving the school food environment has the potential to be an important strategy for obesity prevention in children. The methodological limitations of the included studies and the lack of high-quality study designs does, however, temper the strength of these findings.</p>

Study details	Results of the review	Main findings and evidence grading
<p>schools, not preschool or childcare).</p> <p>Studies were included up to: 30 November 2013.</p> <p>Included study types: All studies included regardless of design.</p>	<p>In one study (quality score moderate), intake of saturated fat, vitamin A, calcium, sodium and milk were higher and servings of vegetables and sweetened soft drinks were lower post-intervention. Sales of chips decreased, and ice cream increased. No change in sales of sweetened beverages, milk, sweets or fruit and vegetables.</p> <p>One study (quality score moderate) found that overall servings of fruits & vegetables increased from 1.1 to 1.4 servings per student per day. Sales of sweetened beverages and chips declined by 28 per cent and 16 per cent, respectively. Sales of water and reduced fat chips increased by 51.0 per cent and 77.5 per cent, respectively.</p> <p>An increase in milk (2.4–6.5 oz), and vegetable (0.3–0.9 serves) consumption and a decrease in sweetened beverage (5.4–1.5 oz), soft drink (4.8–0.1 oz), and snack chip (0.2–0.04 serves) consumption was observed in one study (quality score weak). Total energy consumed increased from 2,646 to 2,990 kj per day. Protein, fibre, vitamins A and C, calcium, and sodium also increased (all $P < 0.025$). No change in fruit or juice, high-fat vegetables, candy consumption, iron or percentage of kj from fat or saturated fat.</p> <p>One study (quality score weak) where schools were analysed by type (low and middle socio-economic position (SEP)) found an Increase in protein intake in middle schools only. An increase in milk consumption and decrease in soft drink consumption was greater in middle SEP schools (all $P < 0.005$).</p> <p>One study (quality score weak) found that a price reduction of 25 and 50 per cent (but not 10%) resulted in increased sales of low-fat snacks by 39 and 93 per cent, respectively. Promotional</p>	<p>The few studies reporting change in BMI in this review were natural experiments involving state policy changes. The association between interventions and BMI change may therefore be confounded by other changes occurring over the same time period.</p> <p>Even though the design of the included studies may not be optimal, numerous studies reported the effect of state-level, district-level or national-level policy changes in this review. This provides important evidence suggesting that high-level policy changes impacting the school food environment are possible and can simultaneously impact a large number of children. While American and British researchers should be highly commended for their efforts in this area, the school food environment clearly differs in other contexts based on cultural, policy and structural differences. The absence of studies from other countries and settings (including students from a wider age range) is therefore a serious evidence gap.</p> <p>Comments: Findings may not be generalisable to the Welsh context since review authors note that the majority of studies were conducted in the United States where a highly privatised food service exists alongside a government funded lunch programme.</p> <p>The review only includes peer-reviewed published literature and assessment of publication bias is not reported.</p>

Study details	Results of the review	Main findings and evidence grading
	<p>signage had little effect on sales and average profit per vending machine was not impacted by the intervention.</p> <p>One study (quality score moderate) observed changes in energy density ($P = 0.01$) of food sold, but not grams of fat per item. There was a significant increase in percentage of kilocalories from protein ($P = 0.03$) and amount of water sold per student ($P = 0.01$), and decrease in amount of sweetened beverages ($P = 0.01$) and regular chips sold ($P = 0.03$).</p> <p>No change in BMI ($-1.19, P > 0.05$) or unhealthy beverage consumption ($-0.08, P > 0.05$) was found in one study (quality score weak).</p> <p>Fruit & vegetable intake increased from 12 to 30 g ($P < 0.001$) in one study (quality score weak). Total energy, fat and saturated fat intake, as well as zinc, calcium and vitamin A lower post-intervention (all $P < 0.01$).</p> <p>In one study (quality score weak) energy density of foods consumed decreased from 2.80 to 2.17 kcal g⁻¹ ($P < 0.0001$). Significant differences were observed for schools regardless of SEP.</p> <p>One study (quality score moderate) found no significant change in the consumption of fruit or other snacks. However, in intervention schools that also had a policy of bringing fruit as snacks the intervention increased fruit consumption (i.e. children used the tuck shop where fruit but no other snacks were permitted in school).</p> <p>One study (quality score weak) found an improvement in the healthfulness of foods being provided in secondary schools since 2004 (less high-fat foods, confectionery, desserts, cakes and</p>	

Study details	Results of the review	Main findings and evidence grading
	<p>biscuits, non-permitted snacks, non-permitted drinks and condiments [all $P < 0.005$]. Average student meals had lower energy, carbohydrate, sugar, fat, saturated fat, sodium, vitamin C and folate and more protein, fibre, vitamin A and calcium (all $P < 0.001$) compared with 2004.</p> <p>Twenty-six per cent less milk ($P < 0.01$) was sold on plain milk only days and consumption was 37.4 per cent lower ($P < 0.001$) in one study (quality score weak).</p> <p>One study (quality score weak) found a statistically significant decline in the rate of increase of overweight prevalence. Mean BMIz increased by 0.05 in both LA and California between 2001–2004. Mean BMIz decreased by 0.02 and 0.01 between 2005–2008 in LA and California, respectively. The change in the odds of overweight/year pre and post-intervention was significantly different in fifth graders, but not seventh graders in LA, and in fifth-grade boys (but not girls) and all seventh graders in California.</p> <p>One study (quality score weak) found a change in the proportion of food available by colour between 2005 and 2007: (green, 25–22%; yellow, 18–47%; red, 57–30%). Change in proportion of food purchased by colour between 2005 and 2007 (green, 11–20%; yellow 6–34%; red 83–46%).</p> <p>One study (quality score moderate) found that post-implementation, children eating school lunches consumed a lower percentage energy from fat (MD between intervention effects = -1.8%, 95% CI -2.8 to -0.9) and saturated fat (-1.0%; -1.6 to -0.5) than children eating packed lunches. Children eating school lunches post-implementation consumed significantly more carbohydrate (16.4 g, 5.3–27.6), protein (3.6 g, 1.1–6.0), non-starch polysaccharides (1.5 g, 0.5–1.9),</p>	

Study details	Results of the review	Main findings and evidence grading
	<p>vitamin C (0.7 µg, 0.6–0.8) and folate (12.3 µg, 9.7–20.4) in their total diet than children eating packed lunches.</p> <p>There was a reduction in soda consumption when a policy was directed at concession stands (0.09 fewer servings per day, 95% CI = –0.17–0.01) and parties (0.07 fewer servings per day, 95% CI = –0.13–0.00), but not vending machines or snack bars in one study (quality score weak). No change in BMI associated with policy change directed at any setting.</p> <p>Students in states with new laws had lower increases in BMI than students in states with no laws at baseline or follow-up in one study (quality score strong). The probability of being overweight decreased by 4.5% where new laws were ‘strong’, and by 2.8% where new laws were ‘weak’. BMI change between 2003–6 was lower (–0.25 kg m⁻² (95% CI –0.54–0.03) in states with strong laws at baseline compared with states with no laws at baseline.</p> <p>In one study (quality score strong) students from intervention schools were less likely to consume pastries (OR = 0.44, <i>P</i> < 0.001) and juice (OR = 0.73, <i>P</i> = 0.02) at school and more likely to consume milk (OR = 1.24, <i>P</i> = 0.04) at home. No difference in consumption at school of milk, fruit, vegetables, sweet drinks (not defined further), chips, candy or energy drinks.</p>	

Study details	Results of the review	Main findings and evidence grading
<p>5. Guerra PH, et al. School-based physical activity and nutritional education interventions on body mass index: a meta-analysis of randomised community trials – project PANE. <i>Prev Med</i> 2014; 6:181-189.</p> <p>Type of source: Systematic review and meta-analysis.</p> <p>Interventions: School-based physical activity and nutritional education interventions (either combined or alone).</p> <p>Relevant Outcomes: BMI.</p> <p>Study Population: Children and adolescents.</p> <p>Studies were included up to: 30 September 2012.</p> <p>Included study types: RCTs.</p>	<p>Description of included studies: Thirty-eight physical activity & nutritional education combination studies met the inclusion criteria for this review. Over half the included studies were conducted in the USA (n=20). The remainder were from Germany (n=3), Greece (n=2), Belgium (n=2), the Netherlands (n=2), England (n=2), Australia (n=2), and one each from Israel, Spain, New Zealand, India and China.</p> <p>A further 19 that included physical activity or nutritional education alone were also analysed.</p> <p>Quality of included studies: Thirteen combined physical activity and nutritional education interventions were rated as high quality, 16 as average quality and nine as low quality.</p> <p>Synthesis: A random-effects model was used to construct the summary effect due to the wide sampling and methodological variation among the included studies. Outcomes were reported as the SMD.</p> <p>Findings:</p> <p>Combined physical activity and nutritional education strategies: The primary result effect for BMI was SMD -0.03 (95% CI: -0.09 to 0.04, p=0.4), which was calculated from the data of 28,870 children and adolescents participating in 38 original studies, of whom 15,627 were allocated to the intervention</p>	<p>Intervention: School-based physical activity and nutritional education interventions (either combined or alone).</p> <p>Outcome: Weight change outcomes (BMI).</p> <p>Evidence statement F: There is moderate to good quality evidence that this intervention is unlikely to be effective. (Meta-analysis: -0.03 [95% CI: -0.09 to 0.04, p=0.4] n=28,870 children).</p> <p>Authors' conclusions: The evidence regarding the effectiveness of school-based PA and NE interventions to reduce the BMI in children and adolescents is still mixed. More studies are needed in order to provide an effective framework to be implemented in the school setting. Based on our synthesis of evidence, none of the meta-analyses performed showed statistically significant reduction in the SMD between exposed and non-exposed groups. The high heterogeneity among studies requires caution in the generalisation of our results.</p> <p>Comments: Seven of the included studies included samples representative of overweight/obese schoolchildren. However, when meta-analysis was performed excluding these studies the summarised effect was not changed in the statistical perspective: -0.02 (95% CI: -0.08 to 0.04; p=0.6, I²=88%).</p>

Study details	Results of the review	Main findings and evidence grading
	<p>group and 13,603 to the control group. The I^2 index was 83%, indicating high heterogeneity among the individual results.</p> <p>All strategies using either PA or NE combined or alone: By clustering all 57 studies included, the authors obtained a synthesis based on the data corresponding to 41,634 schoolchildren, with a BMI SMD of -0.03 (95% CI: -0.09 to 0.03, $p=0.3$). The heterogeneity among the results was high ($I^2= 87\%$).</p>	<p>The authors note that subjective assessment of the distribution of the studies by funnel plot indicated publication bias in the primary synthesis, due to the presence of a high-precision study, which exhibited great efficacy in the reduction of BMI.</p> <p>Nineteen of the primary studies included in this review also appear in the review by Oosterhoff.¹¹ Twelve also appear in the review by Kellou⁶, nine in the review by Langford⁷, six in the review by Aceves-Martins¹, three in the review by Kader⁶, two in the review by Avery², and one each in the reviews by Singh¹², and Wu.¹⁴ The actual number of overlap between reviews may be underestimated because there is only a list of studies included in the first meta-analysis on combined physical activity and nutritional education strategies available, and no discernible list of the 19 additional studies used in the second meta-analysis that included all strategies.</p>

Study details	Results of the review	Main findings and evidence grading
<p>6. Kader M, et al. Effectiveness of universal parental support interventions addressing children's dietary habits, physical activity and bodyweight: a systematic review. <i>Prev Med</i> 2015; 77:52-67.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Any type of intervention to address children's dietary habits, physical activity and bodyweight where the main component was parental involvement.</p> <p>Relevant Outcomes: BMIz or BMI percentile, percentage body fat (%BF) or prevalence of overweight and obesity. Studies examining children's intake of various food items (e.g. fruits, vegetables, fish,</p>	<p>Description of included studies: Thirty-five intervention studies were included in this systematic review including 27 unique interventions. Four main types of parental involvement were identified:</p> <ol style="list-style-type: none"> 1) Individual counselling face to face, group education or training 2) Information sent home 3) Individual telephone counselling 4) Combinations of these <p>Twenty-one studies were RCTs, 11 were C-RCTs and 3 were quasi-experimental studies. Fifteen studies were conducted in Europe, 13 in the USA, four in Australia, two in Canada and one in China.</p> <p>Quality of included studies: Study quality was scored according to minimal requirements used by the Swedish Council on Health Technology Assessment (2010) by four quality assessment criteria addressing selection & attrition bias, fidelity to intervention and outcome assessment methodology.</p> <p>Synthesis: Because of the large variability in intervention format, study design, study quality, outcomes, and outcome assessment methodology, a meta-analysis was not undertaken.</p> <p>Findings:</p>	<p>Intervention: Interventions to address children's dietary habits, physical activity and bodyweight where the main component was face-to-face counselling of parents.</p> <p>Outcome: Behaviour change outcomes (dietary change).</p> <p>Evidence statement B: This intervention is supported by moderate quality evidence of its effectiveness (n=10 studies)</p> <p>Outcome: Weight change outcomes.</p> <p>Evidence Statement D: The evidence is inconsistent and it is not possible to draw a conclusion (n=4 studies).</p> <p>Intervention: Interventions to address children's dietary habits, physical activity and bodyweight where the main component was telephone counselling delivered to parents.</p> <p>Outcome: Behaviour change outcomes (dietary change).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=3 studies).</p> <p>Outcome:</p>

Study details	Results of the review	Main findings and evidence grading
<p>energy-dense food, macronutrients and macro-minerals).</p> <p>Study Population: The study had to include at least one parent or caregiver of a child aged 2-18 years, either with or without the child.</p> <p>Studies were included up to: November 2013.</p> <p>Included study types: RCTs, Cluster RCTs (C-RCTs) & Quasi-experimental trials.</p>	<p>Face-to-face counselling:</p> <p>Thirteen studies (10 RCTs & 3 C-RCTs) used face-to-face counselling to engage parents. Two were graded as weak in quality, nine as moderate and two as strong.</p> <p>Nine out of 10 of the studies reporting dietary outcomes achieved statistically significant changes in dietary habits.</p> <p>One out of four studies which measured weight outcomes found a significant decrease. This was a decrease in the prevalence of overweight in girls after counselling twice a year for several years. No significant change in boys was detected.</p> <p>Telephone counselling:</p> <p>Four studies (2 RCT & 2 C-RCT) delivered telephone counselling to engage parents. One was graded as weak quality, two as moderate quality and one as strong quality.</p> <p>All those which measured dietary outcomes (n=3) found significant changes in dietary habits.</p> <p>Two studies measured weight change outcomes. One reported a significant decrease in BMIz and the other found no significant difference.</p> <p>Group education/training:</p>	<p>Weight change outcomes.</p> <p>Evidence Statement D: The evidence is inconsistent and it is not possible to draw a conclusion (n=2 studies).</p> <p>Intervention: Interventions to address children’s dietary habits, physical activity and bodyweight where the main component was group education and/or training for parents.</p> <p>Outcome: Behaviour change outcomes (dietary change).</p> <p>Evidence Statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=6 studies).</p> <p>Outcome: Weight change outcomes.</p> <p>Evidence Statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=7 studies).</p> <p>Intervention: Interventions to address children’s dietary habits, physical activity and bodyweight where the main component was information given to parents (via newsletters, CD-ROMs etc.).</p> <p>Outcome: Behaviour change outcomes (dietary change).</p>

Study details	Results of the review	Main findings and evidence grading
	<p>Nine studies (6 RCTs, 2 C-RCTs and 1 Quasi-experimental study) used group education/training to engage parents. Four were graded as weak quality and five as moderate quality.</p> <p>Three out of six studies reporting dietary outcomes found significant changes, and a further study found mixed results with significant effects for promoting fruit, vegetable and low-fat milk consumption but not meat consumption.</p> <p>Four out of seven studies which measured weight change outcomes reported significant improvements.</p> <p>Information sent home:</p> <p>Nine studies (3 RCTs, 4 C-RCTs & 2 Quasi-experimental studies) used information sent home to engage parents. Seven were graded as weak in quality and two as moderate quality.</p> <p>Two out of seven studies with dietary outcomes found significant effects.</p> <p>No overall effect was found in four studies which measured weight change outcomes.</p>	<p>Evidence statement G: There is some evidence suggesting that this intervention is ineffective but it is not conclusive (n=7 studies).</p> <p>Outcome: Weight change outcomes</p> <p>Evidence Statement E: There is some evidence suggesting that this intervention is ineffective but it is not conclusive (n=4 studies).</p> <p>Authors' conclusions: This review, based on 35 studies of universal parental support interventions, has revealed some new findings, which may be of use in the further development of such programmes. In general, it appears that individual long-term counselling is the intervention of choice when it comes to diet, and that diet is more effectively changed through parental counselling than is physical activity. Group-based activities seem equally effective for diet, physical activity and obesity prevention. Further, our review confirms that parental support interventions work better the younger the children are. Involving parents through sending home information is not effective. With regard to groups with low SEP, group-based approaches of relatively high intensity appear to be effective, but low participation and high attrition remains a challenge. More studies should test an individual counselling approach in disadvantaged groups in order to see if this will improve participation and lead to lower attrition. A major limitation of most studies is that study power is not reported and that follow-up times are too short. Efforts should be made in the future to improve reporting of intervention content, include a power calculation for the main outcome, use of high quality outcome assessment methodology, and a follow-up period of at least six months.</p>

Study details	Results of the review	Main findings and evidence grading
		<p>Limitations: The authors have noted that one limitation of their review might be that they only included articles published in English, and that publication bias cannot be excluded.</p> <p>The authors also note that when assessing study quality, they only accounted for selection and attrition bias, not performance and reporting bias as described by the Cochrane Handbook.</p> <p>Comments: Ten studies included in the review were conducted in settings not of interest to this review (healthcare clinics).</p> <p>Four primary studies in this review also appear in the review by Aceves-Martins¹, four in the review by Ling⁸, three in the reviews by Langford⁷ & Guerra⁴ two in the reviews by Kellou⁶ and Oosterhoff¹¹, and one each in the reviews by Singh¹², Mikkelsen¹⁰, and Wu.¹⁴</p>

Study details	Results of the review	Main findings and evidence grading
<p>7. Kellou N, et al. Prevention of unhealthy weight in children by promoting physical activity using a socio-ecological approach: what can we learn from intervention studies? <i>Diabetes Metab</i> 2014; 40(4): 258-271.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Interventions likely to prevent overweight, with a focus on the different levels of the socio-ecological model of behaviour and health.</p> <p>Relevant Outcomes: Indicators of weight status (e.g. weight and height, BMI, %BF, skinfold thickness, prevalence of overweight or obesity).</p> <p>Study Population:</p>	<p>Description of included studies: A total of 54 studies met our inclusion criteria, comprising nine controlled trials, 40 RCTs (including 36 C-RCTs with schools as random units) and five quasi-experimental community studies. Twenty-three interventions targeted Physical Activity determinants at one or two levels, 26 at three or four levels and five community-based interventions targeted PA determinants at three or four levels.</p> <p>Twenty-four studies were conducted in North America (USA/Canada), 15 in Europe, eight in New Zealand, Australia and the Pacific Islands, three in Asia, one in South America and one in Israel.</p> <p>Five studies were conducted in girls only, eight in minorities and five in low socio-economic groups. Settings were preschools or schools (n=42), community centres (n=2), home (n=1), primary care (n=1), schools and the community (n=4), and communities (n=5).</p> <p>Quality of included studies: Study quality was evaluated using the Avenel 20 item quality assessment form and the Green and Glasgow quality score for external validity (the full results of the assessment are not provided).</p> <p>Across the whole review, the authors graded the majority of studies as of satisfactory or high quality (individual grading's not available), and the external validity of the included studies was mostly graded as moderate. The authors state that more recent studies were of better methodological quality than earlier ones. Most studies provided few or no details regarding</p>	<p>Intervention: Childhood obesity prevention programs targeting physical activity determinants at three or four levels of the socio-ecological model, with at least one environmental component at an institutional level.</p> <p>Outcomes: Weight change outcomes (BMI, %BF, prevalence of overweight/obesity).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=26 studies).</p> <p>Intervention: Quasi-experimental community intervention studies, targeting physical activity determinants at three or four levels of the socio-ecological model of behaviour and health.</p> <p>Outcome: Weight change outcomes (BMI, %BF, prevalence of overweight/obesity).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=5 studies).</p> <p>Intervention: Childhood obesity prevention programs targeting physical activity determinants at one to two levels of the socio-ecological model, including individual and/or interpersonal levels.</p>

Study details	Results of the review	Main findings and evidence grading
<p>Children between the ages of 2-18.</p> <p>Studies were included up to: December 2012.</p> <p>Included study types: Controlled design (with or without randomisation).</p>	<p>the actual implementation of the planned actions and components, and many of the interventions were of short duration.</p> <p>Synthesis: Studies were stratified according to the degree of integration of constitutive dimensions of the ecological model into the intervention design and process. The final stratification was:</p> <ul style="list-style-type: none"> • Interventions targeting physical activity determinants at one or two levels, mainly individual and interpersonal levels • Interventions targeting physical activity determinants at three or four levels, with at least one component focused on the environment (either built or organisational) at the institutional level • Community-based interventions focusing on physical activity determinants at three to four levels <p>Studies were also grouped according to target age group (0-5 years, 6-12 years, 13-18 years) and the final impact on adiposity was considered positive if at least one of the anthropometric measures was significantly and beneficially impacted by the intervention at the latest follow-up.</p> <p>Findings: Multilevel studies implemented at the institutional or community level showed greater potential for preventing excess weight gain.</p> <p>Seventy-three per cent of institution-based multilevel studies and 100 per cent of community-wide multilevel studies were associated with a significant improvement in at least one adiposity proxy. This is compared with only 39 per cent of</p>	<p>Outcome: Weight change outcomes (BMI, %BF, prevalence of overweight/obesity).</p> <p>Evidence statement E: There is some evidence suggesting that this intervention is ineffective but it is not conclusive (n=23 studies).</p> <p>Authors' conclusions: The body of evidence from the present review provides encouraging data for the successful prevention of overweight through comprehensive physical activity interventions that at the same time address individual attitudes, skills and motivation for physical activity, and the social context and the environment. The incorporation of multiple components in interventions may be a key success factor for increasing overall physical activity levels in a large proportion of the targeted population and for achieving changes in body composition. It is now crucial that studies evaluate the maintenance of positive effects, as that it is an important issue for health promotion in general and obesity prevention in particular, yet one that has been examined in a few studies, with mixed results. There is also a need to perform mediating analyses to better understand the working mechanisms underlying the behavioural changes due to the successful interventions and to better inform the decision-makers. Future studies should also look whether such strategies apply to younger children or older adolescents, to other cultural contexts, or to countries using different school systems.</p> <p>Comments:</p>

Study details	Results of the review	Main findings and evidence grading
	<p>interventions targeting physical activity determinants at one or two levels ($p < 0.01$).</p> <p>Interventions targeting determinants of physical activity at three or four levels with at least one environmental component at the institutional level:</p> <p>All multilevel interventional studies with at least one environmental component at the institutional level included information or health-education lessons and interpersonal support. A family component (using information or more formal interventions) was reported in approximately 75 per cent of studies.</p> <p>BMI/BMIz:</p> <ul style="list-style-type: none"> • Age 0-5: 2 studies. N=1 significant effect; n=1 non-significant effect • Age 6-12: 19 studies. n=7 significant effect; n=12 non-significant effect • Age >13: 1 study, significant effect <p>%BF:</p> <ul style="list-style-type: none"> • Age 6-12: 11 studies. n=6 significant effect; n=5 non-significant effect <p>Overweight/obesity prevalence:</p> <ul style="list-style-type: none"> • Age 0-5: 1 study, significant effect • Age 6-12: 10 studies. n=8 significant effect; n=2 non-significant effect • Age > 13: 1 study, non-significant effect <p>Quasi-experimental community intervention studies:</p> <p>The five community-wide intervention studies included changes in policies and PA opportunities at community level, social marketing through local mass-media campaigns,</p>	<p>The authors state that "BMI was derived from height and weight measurements in 38 studies, and from reported height and weight in the remainder", therefore there is the possibility of reporting bias (the selective revealing or suppression of information by participants, with regards to their reported weight and height).</p> <p>The authors note that all quasi-experimental community studies were conducted in high-risk populations. Therefore the results may not be generalisable beyond high risk groups.</p> <p>Despite including details of the quality assessment undertaken, the authors have not provided a breakdown of results from the assessment.</p> <p>Review authors do not mention or assess for publication bias.</p> <p>Twenty-five of the included studies in this review also appear in the review by Oosterhoff¹¹, 13 appear in the review by Langford⁷, 12 in the review by Guerra⁴, eight in the review by Aceves-Martins¹, five in the reviews by Ling⁸, and Wolfenden¹³, two in the review by Kader⁵, and one each in the reviews by Avery², Boelsen-Robinson¹⁵, and Wu¹⁴.</p>

Study details	Results of the review	Main findings and evidence grading
	<p>actions with government and non-governmental partners, environmental change strategies for the general population, and in at least four cases, additional actions at school, family, and individual levels.</p> <p>All the quasi-experimental community studies were conducted in high-risk populations.</p> <p>BMI/BMIz:</p> <ul style="list-style-type: none"> • Age 0-5: 1 study, significant effect • Age 6-12: 1 study, significant effect • Age >13: 3 studies. n=1 significant effect; n=2 non-significant effect <p>%BF:</p> <ul style="list-style-type: none"> • Age >13: 3 studies. n=2 significant effect, n=1 non-significant effect <p>Overweight/obesity prevalence:</p> <ul style="list-style-type: none"> • Age 0-5: 1 study, significant effect • Age >13 years: 2 studies, non-significant effects <p>Interventions targeting determinants of physical activity at one or two (individual and/or interpersonal levels):</p> <p>Studies dealing with physical activity determinants at one or two levels mostly included information or health-education lessons (18 out of 23 studies).</p> <p>BMI/BMIz:</p> <ul style="list-style-type: none"> • Age 0-5: 5 studies. n=2 significant effect; n=3 non-significant effect • Age 6-12: 17 studies. n=7 significant effect; n=10 non-significant effect • Age >13: 1 study, non-significant effect 	

Study details	Results of the review	Main findings and evidence grading
	<p>%BF:</p> <ul style="list-style-type: none"> • Age 0-5: 2 studies. n=2 non-significant effect. • Age 6-12: 10 studies. n=5 significant effect; n=5 non-significant effect. <p>Overweight/obesity prevalence:</p> <ul style="list-style-type: none"> • Age 6-12: 3 studies. n=1 significant effect; n=2 non-significant effect 	

Study details	Results of the review	Main findings and evidence grading
<p>8. Langford R et al. The WHO Health Promoting School framework for improving health and well-being of students and their academic achievement. <i>Cochrane Database Syst Rev</i> 2014; Issue 4. Art. No.: CD008958.</p> <p>Type of source: Cochrane Systematic Review.</p> <p>Interventions: Interventions (of any duration) based upon the Health Promoting Schools (HPS) framework that demonstrate active engagement of the school in health promotion activities in each of the following areas:</p> <ul style="list-style-type: none"> • School curriculum • Ethos or environment of the school or both 	<p>Description of included studies: Sixty-seven C-RCTs met the eligibility criteria for inclusion in this review.</p> <p>Nineteen studies reported obesity or overweight or body size outcomes. Of these 19 studies, eight were conducted in the USA, eight in Europe and one each in Australia, New Zealand and Mexico.</p> <p>Twenty-three studies reported on nutrition or diet-related outcomes. Of these, 13 were conducted in the USA, seven in Europe, one in Australia and two in Mexico.</p> <p>Quality of included studies: The risk of bias within each included study was assessed using the tool outlined in the Cochrane Handbook for Systematic Reviews of Interventions. Overall quality of the body of evidence for each outcome was assessed using the grading of recommendations assessment, development and evaluation (GRADE) approach.</p> <p>The quality of evidence overall, as determined by the GRADE approach, was low to moderate. RCT evidence was often downgraded on the basis of high levels of unexplained heterogeneity or high risk of bias (particularly for blinding of participants and for attrition).</p> <p>Synthesis:</p>	<p>Intervention: Physical activity only interventions based upon the HPS framework that demonstrate active engagement of the school in health promotion activities in each of the following areas:</p> <ul style="list-style-type: none"> • School curriculum • Ethos or environment of the school or both; • Engagement with families or communities or both. <p>Outcome: Weight change outcomes (BMI, BMIZ).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (BMI meta-analysis 3 C-RCTs = MD -0.38 [95% CI -0.73, -0.03] I² = 86%; BMIZ meta-analysis 1 C-RCT = MD -0.47 [95% CI, -0.69, -0.25]).</p> <p>Intervention: Nutrition only interventions based upon the HPS framework that demonstrate active engagement of the school in health promotion activities in each of the following areas:</p> <ul style="list-style-type: none"> • School curriculum • Ethos or environment of the school or both; • Engagement with families or communities or both. <p>Outcome: Behaviour change outcomes (fruit and vegetable intake).</p> <p>Evidence statement D:</p>

Study details	Results of the review	Main findings and evidence grading
<ul style="list-style-type: none"> Engagement with families or communities or both <p>Relevant Outcomes: BMI, height-for-age, weight-for-age, and weight-for-height z-scores, skin fold thickness measures, WC. Fruit, vegetable and self-reported fat intake.</p> <p>Study Population: Children and young people aged 4-18 years attending schools or colleges.</p> <p>Studies were included up to: 22 April 2013.</p> <p>Included study types: C-RCTs where randomisation took place at the level of school, district or other geographical area.</p>	<p>The included meta-analyses present summaries of the results of different intervention types on separate subgroups; as the authors felt it was inappropriate to pool data overall, given the heterogeneity of approaches used to target different health outcomes.</p> <p>Findings:</p> <p>Physical activity only interventions:</p> <p><i>BMI:</i> Three studies (1,430 participants), MD -0.38 (95% CI -0.73, -0.03) I² = 86%.</p> <p><i>BMIz:</i> One study (196 participants), MD -0.47 (95% CI, -0.69, -0.25).</p> <p>Nutrition only interventions:</p> <p><i>BMI:</i> One study (843 participants), MD -0.04 (95% CI -0.28, 0.20).</p> <p><i>BMIz:</i> One study (843 participants), MD -0.01 (95% CI -0.09, 0.07).</p> <p><i>Increasing fruit and vegetable intake:</i> Nine studies (6,210 participants) SMD 0.15 (95% CI 0.02 to 0.29) I² = 83%.</p> <p><i>Reducing self-reported fat intake:</i></p>	<p>The evidence overall is inconsistent and it is not possible to draw a conclusion (fruit and veg intake meta-analysis 9 C-RCT = SMD 0.15 [95% CI 0.02 to 0.29] I² = 83).</p> <p>Outcome: Behaviour change outcomes (self-reported fat intake).</p> <p>Evidence Statement E: There is some evidence suggesting that this intervention is ineffective but it is not conclusive (fat intake meta-analysis 7 C-RCT = SMD -0.08 [95% CI -0.21 to 0.05] I² = 68%).</p> <p>Outcome: Weight change outcomes (BMI, BMIz).</p> <p>Evidence Statement E: There is some evidence suggesting that this intervention is ineffective but it is not conclusive (BMI meta-analysis 1 C-RCT = MD -0.04 [95% CI -0.28, 0.20]; BMIz meta-analysis 1 C-RCT = MD -0.01 [95% CI -0.09, 0.07]).</p> <p>Intervention : Nutrition and physical activity combined interventions based upon the HPS framework that demonstrate active engagement of the school in health promotion activities in each of the following areas:</p> <ul style="list-style-type: none"> School curriculum Ethos or environment of the school or both; Engagement with families or communities or both. <p>Outcome: Weight change outcomes (BMI, BMIz).</p> <p>Evidence statement E:</p>

Study details	Results of the review	Main findings and evidence grading
	<p>Seven studies (4,216 participants) SMD -0.08 (95% CI -0.21 to 0.05) I² = 68%.</p> <p>Nutrition and Physical Activity interventions:</p> <p><i>BMI:</i> Nine studies (13,628 participants), MD -0.11 (95% CI -0.24, 0.02) I² = 84%.</p> <p><i>BMIz:</i> Seven studies (11,184 participants), MD -0.00 (95% CI, -0.04, 0.03) I² = 41%.</p> <p><i>Increasing fruit and vegetable intake:</i> Four studies (6,612 participants) SMD 0.04 (95% CI -0.18 to 0.26) I² = 79%</p> <p><i>Reducing self-reported fat intake:</i> 10 studies (12,460 participants) SMD -0.04 (95% CI -0.20 to 0.12) I² = 95%.</p>	<p>There is some evidence suggesting that this intervention is ineffective but it is not conclusive (BMI meta-analysis 9 C-RCTs = MD -0.11 [95% CI -0.24, 0.02] I² = 84%; BMIz meta-analysis 7 C-RCTs = MD -0.00 [95% CI, -0.04, 0.03] I² = 41%).</p> <p>Outcome: Behaviour change outcomes (self-reported fat intake).</p> <p>Evidence statement E: There is some evidence suggesting that this intervention is ineffective but it is not conclusive (fat intake meta-analysis 10 C-RCTs = SMD -0.04 [95% CI -0.20, 0.12] I² = 95%).</p> <p>Outcome: Behaviour change outcomes (fruit and vegetable intake).</p> <p>Evidence statement E: There is some evidence suggesting that this intervention is ineffective but it is not conclusive (fruit and veg intake meta-analysis 4 C-RCTs = SMD 0.04 [95% CI, -0.18, 0.26] I² = 79%).</p> <p>Author's conclusions: The findings suggest that physical activity interventions reduce BMI (3 trials, 1,430 participants). This represents a small but important shift in BMI at the school population level and is comparable with results from another recent review focusing on the prevention of obesity in childhood (Waters 2011; 34 school-based interventions, including four from this review). The only physical activity intervention reporting an alternative measure of adiposity in children (BMIz) also reported a positive effect. However, no evidence of effect for BMIz was found for combined physical activity and nutrition interventions. It is important that future research in this area includes both BMI and BMIz as measures of childhood adiposity.</p>

Study details	Results of the review	Main findings and evidence grading
		<p>Comments: The study authors used funnel plots to assess for publication bias. For BMI and fat intake, studies were unevenly distributed indicating that there may be small study bias. This could potentially lead to an inflated estimate of intervention effectiveness as small negative studies appear to be under-represented.</p> <p>This systematic review includes fifteen primary studies which also appear in the review by Oosterhoff¹¹, 13 which appear in the review by Kellou⁶, 12 in the review by Aceves-Martins¹, nine in the review by Guerra⁴ and three in the review by Singh.¹²</p>

Study details	Results of the review	Main findings and evidence grading
<p>9. Ling J, Robbins LB, Wen F. Interventions to prevent and manage overweight or obesity in preschool children: a systematic review. <i>Int J Nurs Stud</i> 2016; 53:270-289.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Prevention and management interventions for obesity among preschool children.</p> <p>Relevant Outcomes: BMI, WC, skinfold thickness, and %BF.</p> <p>Study Population: Preschool children aged 2-5 years.</p> <p>Studies were included up to: February 2015.</p> <p>Included study types:</p>	<p>Description of included studies: Twenty-nine unique interventions from 32 studies were included in this review. Studies were conducted in the United States (n=16), Mexico (n=2), Canada (n=2), the Netherlands (n=2), Switzerland (n=2), Germany (n=2), Israel (n=2), Belgium (n=1), France (n=1), Scotland (n=1), and Australia (n=1). Ten were RCTs and 22 were C-RCTs.</p> <p>Quality of included studies: Approximately half of the studies failed to provide sufficient information in each of the following areas to permit judgment of risk of bias: random sequence generation (n=14), blinding of outcome assessment (n=15), and intent-to-treat analysis (n=18). Eighteen studies reported clearly the random sequence generation method, such as using a computer random number generator (n=11), employing minimisation techniques (n=3), shuffling envelopes (n=2), coin tossing (n=1), and referring to a random number table (n=1). Five studies did not include blinding of the outcome measurement, and eight studies did not offer a clear explanation for dropouts or withdrawal. Based on information reported in the published papers, only five studies met all four criteria for low risk of bias.</p> <p>Synthesis: Narrative synthesis was used to distinguish intervention effects related to preventing versus managing overweight/obesity. Meta-analysis was not possible due to variety across the included studies.</p> <p>Findings:</p>	<p>Intervention: School-based interventions for the prevention of obesity among preschool aged children.</p> <p>Outcome: Weight change outcomes.</p> <p>Evidence statement F: There is moderate to good quality evidence that this intervention is unlikely to be effective (n=16 studies).</p> <p>Intervention: Community-based interventions for the prevention of obesity among preschool aged children.</p> <p>Outcome: Weight change outcomes.</p> <p>Evidence statement D: The evidence is inconsistent and it is not possible to draw a conclusion (n=5 studies).</p> <p>Intervention: Home-based interventions for the prevention of obesity among preschool aged children.</p> <p>Outcome: Weight change outcomes.</p> <p>Evidence statement D: The evidence is inconsistent and it is not possible to draw a conclusion (n=2 studies).</p>

<p>RCTs.</p>	<p>Twenty-six studies describing 23 unique interventions focused on overweight/obesity prevention, while six studies describing six unique interventions only enrolled overweight or obese children or children at risk of overweight, and aimed to address overweight/obesity management (these are not discussed here as they are not in our population of interest).</p> <p>School-based interventions: Sixteen prevention interventions were school-based. Five (31%) had significant effects on at least one anthropometric outcome.</p> <p>School-based interventions were implemented in preschools, daycare, or childcare centers and nurseries.</p> <p>Community-based interventions: Five prevention interventions were community-based. Two (40%) had significant effects on at least one anthropometric outcome.</p> <p>Community-based interventions were conducted in community centers, churches and primary care clinics.</p> <p>Home-based interventions: Two prevention interventions were home-based. One (50%) had a significant effect on at least one anthropometric outcome.</p> <p>Among the eight effective interventions (across all settings), seven targeted both physical activity and nutrition. Two of these (both school-based) also modified the school environment by providing equipment, displaying posters and altering lunch policy.</p>	<p>Authors' conclusions: Because of the heterogeneity of the included interventions, drawing definitive conclusions from this review is challenging. Overall, management interventions show greater effects on weight loss than prevention interventions. Targeting both parents and children on physical activity and nutrition through interactive education and hands-on experiences with physical activity may be promising approaches for prevention interventions. For management interventions, targeting parents as the "agents of change" on physical activity and nutrition with behavioural therapy techniques and interactive education is recommended. No study has collected data on cost effectiveness, which will be critical to explore in future research.</p> <p>Limitations: Review authors report the inclusion of only published articles and those written in English as a limitation.</p> <p>Comments: Review authors do not test for publication bias.</p> <p>Five of the included studies in this review also appear in the review by Kellou⁶, four in the reviews by Kader⁵ and Wu¹⁴ and three appear in the review by Mikkelsen.¹⁰</p>
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Study details	Results of the review	Main findings and evidence grading
<p>10. Martin R, Murtagh EM. Effect of active lessons on physical activity, academic and health outcomes: a systematic review. <i>Res Q Exerc Sport</i> 2017; 88(2):149-168.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Interventions deliberately teaching academic content using physically active methods.</p> <p>Relevant Outcomes: Health outcomes including BMI.</p> <p>Study Population: School-aged children (5-18 years).</p> <p>Studies were included up to: March 2015.</p> <p>Included study types:</p>	<p>Description of included studies: Fifteen articles met the inclusion conditions and were examined in the systematic review. Of these only three studies included an outcome of interest (BMI) and are described here; two were C-RCTs and one was a non-randomised control trial. One C-RCT was from the USA and involved 1,527 students. The other two studies were from China and included 753 students (Non RCT), and 4,700 students (C-RCT). All studies took place in primary school settings.</p> <p>Quality of included studies: Studies were scored for risk of bias using the Cochrane collaboration risk of bias assessment tool. High, unclear and low risks of bias were awarded in each category.</p> <p>One study had a high risk of bias for four of the seven categories (including random sequence generation and allocation concealment) and an unclear risk for the remaining three categories.</p> <p>Another study had a low risk of bias for three categories and an unclear risk for the remaining four (including allocation concealment, random sequence generation and blinding of participants).</p> <p>The final study had a high risk of bias for one category (blinding of participants) an unclear risk for three categories (including random sequence generation and allocation concealment) and a low risk of bias for the remaining three categories.</p> <p>Synthesis: Reported results were assessed in terms of Cohen's ES standard (≥ 0.8 = large; < 0.8 to > 0.2 = medium; ≤ 0.2 = small).</p> <p>Findings:</p>	<p>Intervention: Classroom based interventions in primary schools of at least one week in duration that integrated physical activity and academic content.</p> <p>Outcome: Weight change outcomes (BMI).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=3 studies).</p> <p>Authors' conclusions: This review illustrates the important role that physically active academic lessons can play in increasing physical activity levels of school children. Additionally, potential benefits for education and health outcomes and facilitators of learning were observed. Several recommendations with regard to study design and reporting have been identified. Specifically, this review demonstrates the need for future research to involve more robust designs (i.e. RCTs) and to adhere to reporting standards (e.g., Consolidated Standards of Reporting Trials [CONSORT]).</p> <p>The results reported are of relevance for policymakers, educational administrators,</p>

Study details	Results of the review	Main findings and evidence grading
<p>Controlled intervention studies.</p>	<p>Two studies implemented the Happy 10! Intervention and one study implemented physical activity across the curriculum (PAAC).</p> <p>Although no significant difference was identified in the prevalence of overweight and obesity between control and intervention groups in the two Happy 10! studies, a small effect size was calculated for change in both BMI and BMIz between the groups in one of the studies. In one study, Happy 10! was found to have a similar effect on boys (-0.06) and girls (-0.08) with a more pronounced effect among obese children at baseline (-0.07). The other Happy 10! study did not provide sufficient information to compute effect size.</p> <p>In the PAAC study, a small effect was found for change in BMI between PAAC and control schools from baseline to Year 3. However, change in BMI was influenced by exposure to PAAC, with a moderate correlation reported for BMI change and average weekly PAAC minutes. Schools that participated in 75 min or more of PAAC per week had statistically significant lower increases in BMI at 3 years in comparison with those that participated in less than 75 min of PAAC per week ($r^2=0.42$, $p= 0.02$).</p> <p>Findings relating to physical activity outcomes are reported in the sister Observatory Evidence Service (OES) technical report and are not included here.</p>	<p>and teachers. The findings provide evidence for the valuable contribution that physically active teaching methods can make to school-based health promotion.</p> <p>Limitations: The authors note that conclusions about BMI have been drawn from a small number of studies. Results are only generalisable to primary school aged children (no studies in 12+ age group included).</p> <p>The search strategy was limited to English only publications and so there may be a risk of publication bias as the findings are only based on the available published evidence.</p> <p>Comments: Findings may not be generalisable to Welsh/UK context as studies were undertaken in schools in mainland China and the USA.</p>

Study details	Results of the review	Main findings and evidence grading
<p>11. Mikkelsen MV, et al. A systematic review of types of healthy eating interventions in preschools. <i>Nutr J</i> 2014; 13:56.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Interventions with the objective of treating or preventing the occurrence of obesity by influencing preschool children's eating habits. Interventions had to take place in preschool institutions.</p> <p>Relevant Outcomes: Anthropometric outcomes including BMI, z-scores for height and weight, waist to height measurements, skin-fold measurements or prevalence of overweight and obesity. Food consumption patterns.</p> <p>Study Population:</p>	<p>Description of included studies: Twenty-six studies were included in the review. Eight studies were single intervention studies (involving modification of a single factor in the environment in order to promote fruit or vegetable intake and preferences in children), 11 were educational interventions and seven were multicomponent studies (involving more than one strategy to influence eating behaviour).</p> <p>Seventeen of the 26 included studies were North American, three of the studies were carried out in Asia, five in a European context and one study was conducted in South America. Thirteen of the interventions took place in preschools, ten in kindergartens and three in other facilities where three to six year-olds were cared for by non-parents.</p> <p>Quality of included studies: Four studies were rated as weak quality, nine as moderate quality, ten as strong quality and three as very strong. The quality rating scheme was adapted from the Cochrane guidelines on quality assessment.</p> <p>Random sampling occurred in five of the 26 studies. Most were based on convenience sampling.</p> <p>Synthesis: Narrative. A meta-analysis was intended, however due to a lack of sufficient data, a meta-analytical comparison was difficult to employ.</p> <p>Findings:</p> <p>Single intervention: Eight single intervention studies were identified. These involved the modification of a single factor in the environment in order to promote</p>	<p>Intervention: Single-component interventions with the objective of treating or preventing the occurrence of obesity by influencing preschool children's eating habits.</p> <p>Outcome: Behavioural change outcomes (fruit and vegetable consumption & food/energy intake).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=8 studies).</p> <p>Intervention: Multicomponent interventions with the objective of treating or preventing the occurrence of obesity by influencing preschool children's eating habits. Multicomponent interventions included more than one strategy to influence eating behaviour.</p> <p>Outcome: Behaviour change outcomes (fruit and vegetable intake).</p> <p>Evidence statement B: This intervention is supported by moderate quality evidence of its effectiveness (n=6 studies).</p> <p>Outcome: Weight change outcomes</p>

Study details	Results of the review	Main findings and evidence grading
<p>Children aged 3-6 years.</p> <p>Studies were included up to: Spring 2014.</p> <p>Included study types: RCTs, C-RCTs, quasi-experimental.</p>	<p>fruit or vegetable intake and preferences in children. The majority of studies (n=6) made changes to the serving of vegetables by serving novel or non-preferred vegetables and looked at the effect on vegetable preferences as well as whether peer-models had an influence on the children's intake during lunch.</p> <p>Two studies were graded as weak quality, five as moderate quality and one as strong quality.</p> <p><i>Fruit and vegetable intake (6 studies):</i> One RCT (moderate quality) found a significant, short-term increase in fruit intake. One study (weak, design unclear) reported a significant, short term increase in vegetable preference. One RCT (strong quality) found no significant increase in vegetable consumption. One randomised crossover study (moderate quality) reported a significant increase in fruit intake for one type of intervention, but no effect on vegetable intake. One quasi-experimental study (moderate quality) found no effect at one month. One quasi-experimental study (moderate quality) found a short term significant increase in consumption of the test vegetable.</p> <p><i>BMI:</i> One single intervention study (moderate quality) measured anthropometric outcomes, but the results were not reported in the systematic review.</p> <p><i>Energy/food intake (2 studies)</i> One quasi-experimental study (moderate quality) found increasing the energy density of a meal significantly decreased energy intake at lunch but that participants consumed significantly more of the 'less energy dense' version of the meal.</p>	<p>Evidence statement E: There is some evidence suggesting that this intervention is ineffective, but it is not conclusive (n=4 studies).</p> <p>Intervention: Educational interventions with the objective of treating or preventing the occurrence of obesity by influencing preschool children's eating habits. Educational interventions were generally carried out in the preschool by teachers who had undergone training or nutritional educators provided by the research program and aimed to increase children's knowledge of healthy eating.</p> <p>Outcome: Behaviour change outcomes (fruit and vegetable intake).</p> <p>Evidence statement B: This intervention is supported by moderate quality evidence of its effectiveness (n=5 studies).</p> <p>Outcome: Weight change outcomes.</p> <p>Evidence statement F: There is moderate to good quality evidence that this intervention is unlikely to be effective (n=4 studies).</p> <p>Authors' conclusions:</p>

Study details	Results of the review	Main findings and evidence grading
	<p>One RCT (strong quality) found that children’s intake of chicken nuggets was greater when they were not given a choice of portion size (suggesting that serving larger portions increases intake) but there was no indication of whether this finding was significant.</p> <p>Multicomponent interventions: Seven multicomponent interventions were identified. Multicomponent interventions included more than one strategy to influence eating behaviour. This was usually an education activity alongside other changes or activities such as changes to the availability of fresh water and fruits, having children grow their own vegetables, newsletters for parents, food modifications in the canteen, and healthy school policies.</p> <p>One study was graded as moderate quality, five as strong quality and one as very strong quality.</p> <p><i>Fruit and vegetable intake (6 studies):</i> One C-RCT (very strong quality) found an increase in the proportion of children with high fruit and vegetable consumption after 6 months. One RCT (moderate quality) found an increase in consumption when children were served an addition quarter serving of vegetables. One C-RCT (strong quality) found that children’s fruit and vegetable intakes increased significantly. One RCT (strong quality) found that familiarity with and stated willingness to eat 16 tested foods increased significantly. One RCT (strong quality) found an increase in fruit and vegetable intake at one year follow-up, but at two years a difference was only found on fruit intake. One RCT (strong quality) found increased fresh fruit intake among children and parents (but this was only a significant effect for parents).</p> <p><i>Anthropometric outcomes (4 studies):</i></p>	<p>The effectiveness of the interventions on anthropometric change was more inconclusive, the single interventions did not include measures of BMI and considering how short the duration of their interventions were, it might also be difficult to find change in anthropometric measures. All but one of the other intervention types that did in fact use anthropometric measurements found an effect on BMI.</p> <p>This review highlights the scarcity of properly designed healthy eating interventions using clear indicators and verifiable outcomes. The potential of preschools as a potential setting for influencing children’s food choice at an early age should be more widely recognised and utilised.</p> <p>Comments: Results may not be generalisable to the UK/Wales context as many have been conducted in countries which may have a different preschool system e.g. Turkey, China, USA, Israel, Germany.</p> <p>Publication bias is not reported in this review.</p> <p>Three primary studies which appear in this review are also included in the review by Ling⁸, and one is also included in the review by Kader.⁵</p>

Study details	Results of the review	Main findings and evidence grading
	<p>Four multicomponent interventions (2 C-RCTs, 1 RCT, and 1 quasi-experimental study) measured anthropometric outcomes of interest. Neither C-RCT (strong and very strong quality) found an effect. The anthropometric outcomes (weight and height) in the other two studies were not reported in the review.</p> <p>Educational interventions: Eleven educational interventions were identified. The educational interventions were carried out in kindergartens, either by teachers that had undergone a teaching program or by nutritional educators provided by the research program aiming to increase children's knowledge of healthy eating.</p> <p>Two of the educational interventions were graded as weak quality, three as moderate quality, four as strong quality and two as very strong quality.</p> <p><i>Fruit and vegetable intake (5 studies):</i> One RCT (strong quality) found a significant increase in the consumption of milk, yoghurt, white meat and green leafy vegetables. One pre-test post-test study (moderate quality) found a significant improvement in the frequency of fruit, vegetable, meat and dairy consumption. One quasi-experimental study (moderate quality) found no evidence of an effect on fruit consumption as a replacement for candy (parental self-report). One quasi-experimental study (weak quality) found that the use of food experience, multimedia and role models were effective at increasing fruit and vegetable consumption. One RCT (strong quality) found evidence that the 'colour me healthy' program increased fruit and vegetable consumption among the intervention group compared to the control group.</p>	

Study details	Results of the review	Main findings and evidence grading
	<p><i>Anthropometric outcomes (4 studies):</i> Three educational interventions (2 RCTs; both strong quality, 1 quasi-experimental study, weak quality) measured no change in anthropometric outcomes.</p> <p>One RCT (strong quality) observed a significant decrease in the number of overweight children but no sign in BMI percentiles. At one year follow-up the BMI and BMIz percentiles were significantly lower in the intervention group compared to the control group.</p>	

Study details	Results of the review	Main findings and evidence grading
<p>12. Oosterhoff M, Joore M, Ferreira I. The effects of school-based lifestyle interventions on body mass index and blood pressure: a multivariate meta-analysis of randomized controlled trials. <i>Obes Rev</i> 2016; 17(11): 1131-1153.</p> <p>Type of source: Systematic review and meta-analysis.</p> <p>Interventions: School-based lifestyle interventions defined as any including changes towards healthier eating, physical (in) activity levels and/or education for healthier dietary and activity behaviours. They could be single or multicomponent.</p> <p>Relevant Outcomes: BMI/BMIz.</p>	<p>Description of included studies: The meta-analysis includes data retrieved from 91 papers, published between 1985 and 2013, reporting on 85 unique RCTs. Thirty-seven RCTs took place in Europe, 33 in North America, seven in Oceania, five in Asia, two in South America and one in North Africa.</p> <p>The majority of RCTs included pupils irrespective of their weight status at baseline, three RCTs targeted only overweight/obese children.</p> <p>Quality of included studies: The authors evaluated quality with the use of the Cochrane Collaboration's tool for assessing risk of bias, specifically selection, detection and attrition biases and they also explored the contribution of methodological aspects of study quality and of the population and intervention characteristics to the heterogeneity of the pooled effect sizes, by means of meta-regression analyses (vide-infra).</p> <p>Synthesis: Univariate random-effects three-level meta-analysis of the effects of school-based interventions on each of the outcomes of interest, separately (i.e. standardized mean changes in BMI) were conducted first. Meta-analyses using the "traditional" two-level random effects model were also conducted and their results presented for purposes of model comparisons. Heterogeneity in these models was tested by means of the Q statistic and quantified at level 2 and/or level 3 by estimating the T² and I² values.</p> <p>Findings: One hundred and fifty-one effect sizes on BMI/BMIz accounting for their interdependence within the 83 unique RCTs from which they were retrieved were pooled.</p>	<p>Intervention: School-based lifestyle interventions defined as any including changes towards healthier eating, physical (in) activity levels and/or education for healthier dietary and activity behaviours. They could be single or multicomponent.</p> <p>Outcomes: Weight change outcomes (BMI/BMIz).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive. (Meta-analysis 83 RCTs: -0.072 (95% CI: -0.106 to -0.038), p<0.001.)</p> <p>Authors' conclusions: In conclusion, the present meta-analysis shows that school-based lifestyle interventions lead to favourable changes in BMI and Blood Pressure (BP) and that such changes in BP may be induced beyond changes in BMI. It also stresses the importance of evaluating effects on outcomes metabolic (e.g. glucose metabolism, lipid levels) risk factors, to enable a more comprehensive appreciation of the effects of school-based lifestyle intervention programmes on children's health.</p> <p>Comments:</p>

Study details	Results of the review	Main findings and evidence grading
<p>Study Population: School children aged 4-12 years.</p> <p>Studies were included up to: December 2013.</p> <p>Included study types: RCTs.</p>	<p>Most of the RCTs (n=80) compared only one intervention arm with a control group; specifically, 32 of these RCTs evaluated the effects of one intervention comprising only one component, i.e., education (n=15) physical activity (n=16) whereas 48 RCTs evaluated the effects of one intervention combining two or more of these components such as PA and education (n=21) diet and education (n=7), diet and PA (n = 3), or a combination of diet, PA and education (n=17). Five RCTs compared more than one intervention arm (consisting of single and/or multi-components) with the same control group. Fifty-three RCTs also included a parental involvement component (e.g. by newsletters, information sessions, via homework tasks for children) in addition to the single or multi lifestyle components delivered directly to the children.</p> <p>The estimated average effect under a two-level (random effects) model was -0.063 (-0.089 to -0.038), p<0.001. The Q (df=150) statistic was 897.7 p<0.001 and the estimated amount of heterogeneity (per definition only at level 2) were T²=0.019 and I²=86.7%.</p> <p>Under a three-level model, the estimated average effect was -0.072 (95% CI: -0.106 to -0.038), p<0.001. The estimated level of heterogeneity at level 2 T²₍₂₎ was nearly 0 and at level 3 T²₍₃₎ was 0.020, and the respective I² were I²₍₂₎=0% and I²₍₃₎=87.3%.</p> <p>Meta-regression was undertaken with a view to understanding the large heterogeneity of the effects of school-based interventions on pupils' changes in BMI. A set of population, intervention and study quality characteristics were analysed. Review authors found that only parental involvement interventions and interventions with activities exclusively after school time seemed to affect (in this case accentuate) the BMI outcome. Population and intervention characteristics considered explained 29.3 per cent of the heterogeneity of the effects between studies.</p>	<p>Three of the included RCTs targeted only overweight/ obese children and this should be taken into account when interpreting the results.</p> <p>With such high levels of heterogeneity evident from the statistical analysis it is questionable whether combining results was appropriate. The effect size is small, and the results should be treated with caution due to the amount of heterogeneity.</p> <p>This review includes 25 studies which also appear in the review by Kellou⁶, 19 which also appear in the review by Guerra⁴, 15 that appear in the review by Langford⁷, and 12 that appear in the review by Aceves-Martins¹. Three primary studies also appear in the reviews by Avery² and Singh¹², two appear in the reviews by Wu¹⁴ and Kader⁵, and one in the review by Wolfenden.¹³</p>

Study details	Results of the review	Main findings and evidence grading
	Review authors did not find evidence of significant funnel plot asymmetry (p=0.749) indicating that the pooled effect sizes seemed not to have been threatened by publication bias.	

Study details	Results of the review	Main findings and evidence grading
<p>13. Singh A, et al. Impact of school policies on non-communicable disease risk factors – a systematic review. <i>BMC Public Health</i> 2017; 17(1):292.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Policies that modify the four identified risk factors (unhealthy diet, physical inactivity, alcohol and tobacco use) and associated health related behaviours amongst the students either alone or as part of any intervention program (note: we are only interested in those studies modifying unhealthy diet and physical inactivity).</p> <p>Relevant Outcomes: Anthropometric measures including BMI, WC, and prevalence of overweight/obesity.</p>	<p>Description of included studies: Twenty-seven studies were included in the review (8 RCTs, 7 quasi-experimental, 11 observational, & 1 natural experiment). The majority were from high income countries: USA (n=15), Australia (n=4), UK (n=2), Canada (n=2), Spain (n=1), Greece (n=1), combined USA and Australia (n=1) and India (n=1). Five out of the 27 studies were based in schools from socio-economically deprived areas.</p> <p>Quality of included studies: Based on the quality assessment of the selected studies, 18 were categorised as having weak methodological quality, six with moderate quality and three with strong methodological quality.</p> <p>Synthesis: Due to heterogeneity in the policy components of the interventions included, outcomes and effect measures, a meta-analysis was not considered appropriate. A description of effectiveness measures and a narrative review were considered appropriate to present the findings of the study.</p> <p>Findings:</p> <p>Weight change outcomes: Seven studies assessed the effectiveness of policy interventions on their association with changes in anthropometric measures (some of the seven assessed multiple anthropometric outcomes). The policy interventions targeting anthropometric measures included school nutrition initiatives, comprehensive legislation at state level, brisk walking lessons, teacher trainings, developing activities related to food habits and/or physical activity, fitness guidance, fitness and school nutrition, school-based nutrition,</p>	<p>Intervention: School policy interventions to reduce obesity.</p> <p>Outcome: Weight change outcomes (anthropometric measures and prevalence of overweight/obesity)</p> <p>Evidence Grade D: The evidence for school policy interventions effect on weight change outcomes is inconsistent and it is not possible to draw a conclusion (n=7 studies)</p> <p>Outcome: Behaviour change outcomes (SSB reduction, fruit and vegetable intake).</p> <p>Evidence Grade C: There is some evidence supporting the use of school policy interventions for behaviour change outcomes, but it is not conclusive (n=15 studies).</p> <p>Authors' conclusions: Mixed findings were observed concerning effectiveness of school policies in reducing risk factors of non-communicable disease (NCD). More good quality evidence is required to conclude on the effectiveness of school level policies in reduction of NCD risk factors. Additionally, further research is required to assess whether healthy changes are sustained over long-term to reduce NCD risk in later life.</p> <p>Comments:</p>

Study details	Results of the review	Main findings and evidence grading
<p>Dietary behaviour change (including sugar sweetened beverage intake, fruit and vegetable intake, salt intake and fat intake).</p> <p>Study Population: Children or adolescents between 6-18 years.</p> <p>Studies were included up to: January 2014</p> <p>Included study types: Any experimental or observational study design including RCTs, controlled before-after study, quasi-experimental, interrupted time series, cohort studies, cross-sectional studies.</p>	<p>multicomponent workbooks covering dietary issues and physical activity and integration of health promotion into the existing curriculum.</p> <p><i>BMI:</i> Mixed results were reported for the effects of school policies on BMI (n=5; 4 RCT, 1 cross-sectional design, 2 weak, 1 moderate and 2 strong quality). Non-significant differences or associations with BMI for policy interventions were reported by three studies; while two studies reported significantly lower progression of BMI among those exposed to policy interventions compared to those who were not. The studies that showed policies to be effective in reduction of BMI were assessed to have moderate and strong methodological quality.</p> <p><i>WC:</i> Decreased levels of elevated WC as a result of brisk walking lessons was reported in one quasi-experimental study; this study scored weak in quality assessment.</p> <p><i>Prevalence overweight/obesity:</i> Mixed results were reported for school nutrition policies to reduce overweight/obesity prevalence. One study (RCT – strong quality) was effective in reduction of overweight/obesity prevalence, where as another (quasi-experimental study – moderate quality) recorded an increase in the prevalence.</p> <p>Behaviour change outcomes: Fifteen studies assessed the effectiveness of policy interventions in changing unhealthy dietary behaviours.</p> <p><i>Sugar sweetened beverage intake:</i> Six out of seven studies (4 cross sectional, 1 quasi-experimental, 1 natural experiment) which assessed policy effectiveness in</p>	<p>Age range for inclusion of studies was 6-18 years with no sub group analysis.</p> <p>The likelihood of publication bias is not assessed in this paper. Review authors note the lack of grey literature search as a limitation.</p> <p>This systematic review includes three studies which appear in the review by Langford⁷ and three studies which appear in the review by Oosterhoff¹¹. Two studies also appear in the reviews by Guerra⁴ and Kellou⁶, and one each in the reviews by Aceves-Martins¹ and Kader.⁵</p>

Study details	Results of the review	Main findings and evidence grading
	<p>relation to reducing sugar sweetened beverage intake reported desirable changes and reduction in the consumption of SSBs. These effective policies included elimination of SSB and other junk food in schools' food policy, having a school food and nutrition policy in place, school district SSB policies, school nutrition and food services, nutrition-based standards and fitness guidance, fitness and school nutrition, school-based nutrition, school and home nutrition and homebased nutrition. Among these policy interventions, studies with moderate methodological quality evaluated school food and nutrition policies and school district SSB policies, while the remaining studies were judged to have weak methodological quality.</p> <p><i>Fruit and vegetable intake:</i> Increases in fruit and vegetable intake were found in four out of five studies (3 RCT, 2 quasi-experimental). Desirable effects of increased fruit and vegetable intakes were noted with the policy interventions of integration of health promotion in the curriculum, change in canteen policies, nutrition education and gardening program, teacher training and development of activities related to food habits and/or physical activity and fruit truck shops. Out of these effective interventions, teacher training and development of activities related to food habits and/or physical activity and fruit truck shops were observed to be reported from studies with moderate and strong methodological quality.</p> <p><i>Fat and salt reduction:</i> School policies reduced prevalence with regards to fat and salty snack consumption (n=3; 1 cross sectional, 1 Quasi-experimental, 1 natural-experiment). All studies were judged to be of weak methodological quality.</p>	

Study details	Results of the review	Main findings and evidence grading
<p>14. Wolfenden L et al. A systematic review and meta-analysis of whole-of-community interventions to prevent excessive population weight gain. <i>Prev Med</i> 2014; 62:193-200.</p> <p>Type of source: Systematic review and meta-analysis.</p> <p>Interventions: Population based, whole-of-community interventions defined as those targeting the weight status of a population characterised along geographical boundaries such as cities, villages or regions.</p> <p>Relevant Outcomes: BMI, BMIz, WC, %BF, skin fold thickness, objectively measured population prevalence of overweight or obesity.</p>	<p>Description of included studies: Eight trials were included in the review. Three studies were conducted in Australian communities, two in New Zealand, one in Fiji, one in Tonga and one in the USA.</p> <p>All studies were described as quasi-experimental.</p> <p>All interventions were multicomponent and targeted both nutrition and physical activity. Schools or childcare services were the primary intervention setting in most of the community-based trials. Other settings included sporting clubs, churches, home, local farmers market, and the media.</p> <p>Quality of included studies: Risk of bias was assessed by review authors using the Cochrane Collaboration tool. Review authors did not comment on the quality of individual studies however they concluded that all included trials were at risk of selection bias due to the non-random assignment of community to intervention or control groups, and performance bias due to a lack of blinding of participants and personnel.</p> <p>Synthesis: Meta-analysis was performed for BMIz as the measure was common to all included trials. Analyses reported mean differences in BMIz and a random effects model and the generic inverse variance method was used. Heterogeneity was assessed using the I² statistic and sub-group analysis was performed based on age group.</p> <p>Findings: Of the multicomponent population whole-of-community interventions targeting both nutrition and physical activity primarily in childcare settings, one intervention reported no significant effects and six reported a significant effect</p>	<p>Intervention: Multicomponent population based, whole-of-community interventions targeting both nutrition and physical activity in children.</p> <p>Outcome: Weight change outcomes.</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive. (Meta-analysis, MD 6 quasi-experimental studies: MD -0.09 [95% CI: -0.16 to -0.02]).</p> <p>Authors' conclusions: The conduct and evaluation of comprehensive population-based community interventions require a comprehensive understanding of the contextual, environmental, sociocultural and other local community determinants of weight gain. The studies reviewed reported that extended lead-in and implementation time to build relationships, trust and community capacity for action, research culture and infrastructure were also important. Such factors present considerable challenges to traditional research designs and funding models, and are further complicated by the diverse</p>

Study details	Results of the review	Main findings and evidence grading
<p>Study Population: Participants from community samples of children and/or adults or specific population groups within a community defined based on their demographic, ethnic or socio-economic characteristics.</p> <p>Studies were included up to: 2011.</p> <p>Included study types: Quasi-experimental trials.</p>	<p>favouring the intervention group on at least one measure of adiposity. The remaining study appeared to have a positive effect on weight loss and BMIz but not in BMI or percentage overweight or obesity, this was reported for an intervention sub-sample that ran for three and a half years. Review authors note an absence of analysis adjusted for demographic or other sample characteristics comparing changes in group over time in this article.</p> <p>BMI: Two trials were excluded from the main meta-analysis as they did not report an adjusted effect estimate for changes in BMI or BMIz. Meta-analysis of the remaining six trials revealed a small reduction in BMIz among participants in intervention communities (MD -0.09; 95% CI: -0.16 to -0.02). However there was evidence of considerable heterogeneity ($I^2=93\%$). The effect remained significant when unadjusted estimates of intervention effects of the remaining two trials were included in the pooled analysis as part of a sensitivity analysis (MD -0.08 95% CI -0.13 to -0.02).</p> <p>Sub group analyses:</p> <p>12-18 years: Meta-analysis of three trials providing adjusted estimates of intervention effects found no overall significant benefit of the intervention in reducing BMIz (MD -0.02, 95% CI -0.08 to 0.03). There was evidence of heterogeneity ($I^2=70\%$).</p> <p>5-11 years: Meta-analysis of three trials indicated a significant reduction in BMIz among children in intervention communities relative to comparison communities (MD -0.16, 95% CI -0.27 to -0.05). There was evidence of considerable heterogeneity ($I^2=92\%$).</p> <p><5 years: Only one trial examined the impact of an intervention targeting children in early childhood. Weight, BMI, BMIz and proportion of participants who are overweight or obese at 2 and 3.5 years of age were significantly greater among</p>	<p>needs of policy makers, practitioners and researchers. Additional challenges are likely to face programmes in low to middle income countries, where community infrastructure for intervention implementation and evaluation is more limited. Notwithstanding these challenges the findings of the review suggesting that population reductions in weight are achievable through community-based intervention and this approach may represent an effective strategy to reduce the burden of excessive population weight gain, particularly among primary-school aged children.</p> <p>Comments: There could be some issues around generalisability of the included studies to the Welsh/UK context.</p> <p>Review authors do not discuss the possibility of publication bias in the paper.</p> <p>It should be noted that in sub-group analysis of studies in the 12-18 year age group the effect was no longer statistically significant.</p> <p>With such high levels of heterogeneity between studies evident from the statistical analysis it is questionable whether combining results was appropriate.</p>

Study details	Results of the review	Main findings and evidence grading
	children in the intervention area at baseline. At follow-up however, these differences were no longer significant for the 3.5 year olds.	Five of the primary studies included in this review also appear in Kellou. ⁶ Two of the primary studies are also included in the review by Boelsen-Robinson ¹⁵ and one in the review by Oosterhoff. ¹¹

Study details	Results of the review	Main findings and evidence grading
<p>15. Wu L et al. The effect of Interventions targeting screen time reduction: a systematic review and meta-analysis. <i>Medicine</i> 2016; 95(27).</p> <p>Type of source: Systematic review and meta-analysis.</p> <p>Interventions: Interventions with a main aim of reducing screen time (studies with co-interventions could be included).</p> <p>Relevant Outcomes: BMI.</p> <p>Study Population: Looks at both adults and children (only studies in children are extracted in this table).</p> <p>Studies were included up to: August 24, 2015.</p> <p>Included study types:</p>	<p>Description of included studies: Fourteen RCTs were identified for this systematic review. Age of participants ranged from three to 54 years. None of the 14 trials reported significant differences in the baseline characteristics between treatment and control groups. Ten trials were conducted in the USA, two in New Zealand, one in Canada and one in Turkey.</p> <p>Quality of included studies: Twelve trials provided a detailed description of the random sequence generation, and ten trials reported the appropriate allocation concealment. Six trials reported that the participants and personnel were blinded to the nature of products. Seven trials reported blinding of the outcome assessment. One trial lost more than 20 per cent of the participants in the follow-up period. All of the included trials were judged to have a low risk of reporting bias and other biases.</p> <p>Synthesis: Meta-analysis. Mean differences with 95 per cent confidence intervals were calculated for the continuous outcome data. A random effects model was used to pool the outcome data regardless of heterogeneity by taking into account between-study and within-study differences. Studies with an I^2 statistic of >50% were identified as having significant heterogeneity.</p> <p>Findings: Three of the studies included in this review included co-interventions (consisting of physical activity and/or healthy diet interventions) alongside the screen time interventions. Seven of the included studies used monitoring devices to assist with allocating screen time or television time.</p>	<p>Intervention: Interventions to reduce screen time in children. Interventions typically included the use of an automated screen time monitoring device and/or health promotion education sessions.</p> <p>Outcome: Weight change outcomes (BMI).</p> <p>Evidence statement E: There is some evidence suggesting that this intervention is ineffective but it is not conclusive (sub-analysis in <6yrs -0.20 [95% CI = -0.43 to 0.03] 2 RCTs. Sub-analysis in 6-17yrs -0.02 [95% CI = -0.18 to 0.15] 5 RCTs).</p> <p>Authors' conclusions: The authors conclude that, consistent with a meta-analysis by Wahi et al, no significant evidence was found that interventions aimed at reducing screen time effectively reduced BMI and screen time among participants aged 18 years or younger.</p> <p>Comments: This study looked at both adults and children, and the main meta-analysis for BMI includes one study in adults. When split into age sub-groups, the meta-analysis for age 6 and under is only comprised of two studies and therefore the results should be treated with caution.</p> <p>Publication bias was not assessed for the primary outcome BMI. Review authors note this was due to the</p>

Study details	Results of the review	Main findings and evidence grading
RCTs.	<p>The main meta-analysis in this study included both adults and children, however the study in adults was undertaken in an overweight population and so did not meet our inclusion criteria, therefore only the sub-analyses in populations of children have been included in this data extraction.</p> <p>In sub-group analysis by age, the pooled MD in BMI for two trials in age <6 was -0.20 (95% CI = -0.43 to 0.03) I²=0%.</p> <p>The pooled mean difference for BMI in five trials in ages 6-17 was -0.02 (95% CI = -0.18 to 0.15) I²=0%.</p>	<p>low number of trials which may limit the interpretability of findings.</p> <p>Four of the primary studies in this review also appear in the review by Ling⁸, two in the review by Oosterhoff¹¹, and one each in the reviews by Kader⁵, Kellou⁶ and Guerra.⁴</p>

4.2 Reviews meeting the inclusion criteria for Questions 1 and 2:

Study details	Results of the review	Main findings and evidence grading
<p>16. Boelsen-Robinson T, et al. A systematic review of the effectiveness of whole-of-community interventions by socioeconomic position. <i>Obes Rev</i> 2015; 16: 806-816.</p> <p>Type of source: Systematic Review.</p> <p>Interventions: Whole-of-community interventions aimed at the prevention of weight gain.</p> <p>Relevant Outcomes: Anthropometric outcomes according to any measure of SEP. Energy balance behaviours.</p> <p>Study Population: Adults and/or children.</p> <p>Studies were included up to:</p>	<p>Description of included studies: Twelve articles were included in the final review, representing 13 different studies. Eight evaluations were conducted amongst adults, with five in children (age range 4 to 14 years at baseline). All studies were undertaken in developed countries, with five in the United States, two in France, and one each in Wales, Australia, Sweden, Norway, Finland, and the Netherlands.</p> <p>Review authors excluded any papers looking at whole-of-community interventions that did not report results by a measure of SEP.</p> <p>Quality of included studies: An adapted version of the EPHPP tool was used to assess quality. Study quality is not assessed by the authors of the included review for the three interventions which demonstrated no effect. Of the 10 studies demonstrating an effect on behavioural change indicators, energy balance behaviours or anthropometric outcomes, one was rated as strong, four as moderate and five as weak quality. Weak ratings were given due to high attrition rates, lack of description for controlling of confounders or lack of a comparison group within a cross-sectional design.</p> <p>Synthesis: Synthesis was narrative. Studies were categorised according to whether the intervention was more effective among low SEP groups, equally effective among low and high SEP groups or more effective for higher SEP groups.</p> <p>Findings:</p>	<p>Intervention: Whole-of-community interventions using a variety of strategies aimed at the prevention of weight gain. Strategies included; policy change, structural change to the environment, school nutrition education, physical activity programmes and social marketing.</p> <p>Outcome: Anthropometric outcomes/ behaviour change indicators.</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=13 studies).</p> <p>Authors' conclusions: Whole-of-community interventions targeting physical activity and nutrition behaviours represent an effective and equitable policy focus for the reduction of population weight. Structural components, a larger number of settings and community engagement were common in equitable whole-of-community interventions and</p>

Study details	Results of the review	Main findings and evidence grading
<p>2013.</p> <p>Included study types: All study designs included. Final inclusions included longitudinal studies and cross-sectional studies.</p>	<p>Of the 13 interventions, three (one cohort pre-post test with two intervention arms and one cross-sectional design) reported neither a statistically significant effect of the overall intervention, or within SEP groups, on behavioural change indicators, energy balance behaviours and/or anthropometric outcomes, and were therefore not analysed or reported for characteristics that may have impacted on their differential effectiveness by SEP. One of these studies reported estimates only.</p> <p>Of the remaining 10 interventions demonstrating an effect on behavioural change indicators, energy balance behaviours or anthropometric outcomes (six cohort pre-post evaluations and five cross-sectional designs), two reported a significant effect for low SEP groups only, seven reported significant effects for both high and low SEP groups with a similar magnitude of effect (statistically significant differences in the magnitude of effect between SEP group not tested) and one reported a significant effect for the higher SEP group only.</p>	<p>should be considered in future whole-of-community interventions. Advocating for more whole-of-community interventions to be evaluated by SEP is essential to assess their impact on the socio-economic gradient in obesity.</p> <p>Limitations: The authors' state that it is possible that the systematic review may have suffered from publication bias, but that this should have been minimised by their search strategy which included searching for grey literature.</p> <p>Comments: Three interventions showing no effect were not analysed or reported on.</p> <p>Two of the included primary studies in this systematic review also appear in the review by Wolfenden¹³ and one also appears in the review by Kellou.⁶</p>

4.3 Reviews meeting the inclusion criteria for Question 2:

Study details	Results of the review	Main findings and evidence grading
<p>17. Anderson LM et al. (2009). The effectiveness of worksite nutrition and physical activity interventions for controlling employee overweight and obesity. A systematic review. <i>Am J Prev Med</i>, 37(4), 340-357.</p> <p>Type of source: Community guide systematic review.</p> <p>Interventions: Workplace health promotion programs aimed at improving nutrition, physical activity or both.</p> <p>Relevant Outcomes: BMI, %BF.</p> <p>Study Population: Adult employee's ≥ 18 years.</p>	<p>Description of included studies: Forty-seven studies (with 80 study arms) qualified for analysis. Half the studies were conducted in the USA, with the remainder conducted in Europe, Australia, New Zealand, Japan, Canada, India and Iceland. Twenty-five studies were RCTs, six were C-RCTs, 12 were non-RCTs, three were cohort studies and one was a time series study.</p> <p>Quality of included studies: This review was conducted for the US Community Preventative Services Task Force. Each study was assessed for suitability of study design and quality of study execution. Only studies considered to have greatest or moderate design suitability and good or fair quality of execution were included.</p> <p>Synthesis: Where effect estimates with variance data were pooled, the aggregation of effect sizes was based on a random-effects model. Homogeneity of effects was tested using the Q statistic. Statistical pooling of effects was done only when the studies and effect sizes were sufficiently similar to justify integration (i.e. the Q statistic was nonsignificant at the .10 level).</p> <p>Findings: Programs could include components such as worksite environmental change and policy strategies, behavioural strategies or information and learning experiences.</p> <p>Most studies combined informational and behavioural strategies to influence diet and physical activity. The behavioural focus of 27 studies (57%) was diet and physical activity behaviour; 10 (21%) addressed diet only and 10 (21%) physical activity only.</p>	<p>Intervention: Worksite health promotion programs aimed at improving nutrition, physical activity or both.</p> <p>Outcome: Weight change outcomes (BMI, %BF).</p> <p>Evidence Statement B: This intervention is supported by moderate quality evidence of its effectiveness (meta-analysis: n=6 RCTs - 0.47 BMI units (95% CI=-0.75, -0.19 in favour of the intervention group).</p> <p>Authors' conclusions: This review addressed the effects of worksite nutrition and physical interventions on employee weight outcomes. According to <i>Community Guide</i> rules, there is strong evidence of a consistent, albeit modest, effect. Although this intervention approach may be expected to have only a modest effect on weight change, viewed from a population level it can potentially prevent and control overweight and obesity when applied to a substantial proportion of the employee population and used in concert with other clinical and community approaches.</p>

<p>Studies were included up to: December 2005</p> <p>Included study types: RCTs, C-RCTs, non-randomised studies, cohort designs, time-series designs.</p>	<p>Thirty-two studies (69%) had both informational and behavioural skills program components; among these, four included an environment or policy component.</p> <p>In their pooled analysis for relevant outcomes review authors did not differentiate by intervention type</p> <p>BMI: <i>Among all study designs (n=16):</i> Sixteen studies reported a change in BMI, the pooled summary effect on change in BMI favoured the intervention groups except at 48 months.</p> <p><i>Among RCTs only (n=6):</i> There were six RCTs included in the meta-analysis for BMI. The pooled effect at 6-12 month follow-up was -0.47 BMI units (95% CI=-0.75, -0.19) in favour of the intervention group.</p> <p><i>Among C-RCTs only (n=3):</i> A pooled effect of -0.25 (95% CI= -0.64, +0.14) was found among C-RCTs reporting changes in BMI at 6 months.</p> <p>%BF: Twelve studies (7 RCT, 2 C-RCT & 3 Non-RCT) reported change in %BF, measured most often as change in skinfold thickness. The summary effect suggests a 1% decrease at 12 months.</p>	<p>Limitations: The review authors noted limited reporting of study population characteristics which included no ethnicity data, age was reported in only 30% of studies and socio-economic data (including blue versus white-collar jobs) were not reported in 40% of studies. Review authors noted that only two of the included RCTs reported intention to treat analysis.</p> <p>Comments: The authors' state that based on the data available, the results of this review may be generalized to a white-collar workforce where both overweight and other chronic disease conditions exist.</p> <p>This review includes 43 studies which are also included in the review by Archer¹⁷, 18 studies which are also included in the review by Verweij²², three studies which are also included in the review by Vuillemin²³ and one study which is also included in the review by Mhurchu.²⁰</p>
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Study details	Results of the review	Main findings and evidence grading
<p>18. Archer WR, et al. Promising practices for the prevention and control of obesity in the worksite. <i>Am J Health Promot</i> 2011; 25(3): e12-e26.</p> <p>Type of source: Systematic Review.</p> <p>Interventions: Workplace interventions delivered to employees by employers that demonstrate a reduction in a weight related outcome.</p> <p>Relevant Outcomes: Weight related outcomes (e.g. %BF, WC, waist-to-hip ratio, BMI, prevalence of overweight/obesity).</p> <p>Study Population: Adult employees at least 18 years of age (including retirees, spouses or partners, and dependents).</p> <p>Studies were included up to: December 31, 2005</p>	<p>Description of included studies: One hundred and thirty-six studies with 142 arms were included in the review. Interventions could be grouped into one of three categories: Environmental and policy strategies, informational and educational strategies or behavioural strategies.</p> <p>Quality of included studies: Studies were evaluated on the basis of study design suitability, quality of execution, sample size and effect size. A total of nine quality of execution limitations were possible. Studies were classified on the basis of the quality of execution as A (zero to one limitation), B (two to three limitations), C (four to five limitations), D (six to seven limitations), or F (eight to nine limitations). Studies with more than eight limitations were not included in this review.</p> <p>Synthesis: The authors calculated the median effect size for each weight related outcome.</p> <p>Promising practices were determined on the basis of the number of available studies, and the strength of their design and execution, as well as the size and consistency of reported effects for weight related outcomes.</p> <p>Findings: Overall, six promising practices were identified. Four are described here (as they report on outcomes of interest):</p>	<p>Intervention: Enhanced access to opportunities for physical activity combined with health education.</p> <p>Outcome: Percentage relative change in a weight related outcome.</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (median ES -3.24% [IQR: -7.24% to -3.09%] n=5).</p> <p>Intervention: Workplace multicomponent educational practices.</p> <p>Outcome: Weight change outcomes (BMI).</p> <p>Evidence statement B: This intervention is supported by moderate quality statistically significant evidence of its effectiveness (median ES -0.46 kg/m² [IQR: -0.52 to -0.27] n=5).</p> <p>Intervention: Competitions and incentives in the workplace setting.</p> <p>Outcome: Weight change outcomes (%BF).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (median ES -1.58% n=2).</p>

Study details	Results of the review	Main findings and evidence grading
<p>Included study types: No limitation on study design; any in a worksite setting reporting a weight related outcome.</p>	<p>Enhanced access to opportunities for physical activity combined with health education: Interventions include those which enabled or facilitated access to physical activity programs, workshops, classes and other resources in the worksite setting. For example; developing walking trails, building a fitness centre, or creating a fitness trail.</p> <p>Five studies were identified that evaluated the effectiveness of this practice. Review authors considered that one of these studies had the greatest study design suitability (quality of execution graded A), one had moderate suitability (quality of execution C) and three least suitability (quality of execution C). All five studies measured a percentage relative change in a weight related outcome, with a median effect size of -3.24% (interquartile range [IQR], -7.24% to -3.09%).</p> <p>Multicomponent educational practices: Interventions include those aimed at providing information within the curriculum or modules addressing health promotion programs (e.g. healthy lifestyles, physical activity and nutrition) and risk reduction programs (e.g. weight management, cardiovascular risks and diabetes risks). Studies also incorporated components such as exercise prescriptions, nutrition prescriptions and small media (e.g. pamphlets or newsletters conveying health information).</p>	<p>Intervention: Behavioural practices without incentives.</p> <p>Outcome: Weight change outcomes (BMI).</p> <p>Evidence statement F: There is moderate to good quality evidence that this intervention is unlikely to be effective (median ES -0.24 kg/m² [IQR: -0.52 to 0.05] n=7).</p> <p>Authors' conclusions: The purpose of this review was to systematically explore specific strategies and practices for promoting employee weight loss that show promise in the workplace. Previous reviews examined worksite interventions that mostly represent RCTs assessing worksite nutrition or physical activity programs. This review adds a level of specificity to the existing literature and the Community Guide worksite recommendation by examining interventions by environmental and policy, health education, and behavioural strategies. This resulted in six promising practices that organisations can consider implementing in their worksites. The review included studies with weight outcomes and a broadened method to include before-and-after studies. The authors recognise these as having less suitable study designs and lower quality of execution, but they may allow for future innovation and research to move the field of worksite obesity prevention forward.</p> <p>Given the diversity of worksite types, workforce sizes, and employees included in this review, these promising practices are applicable to a variety of worksites and employees. Programs must be designed to meet employee needs and preferences. Implementation of effective weight loss programs may also</p>

Study details	Results of the review	Main findings and evidence grading
	<p>Five studies were identified that measured BMI. Review authors rated four of these studies as having the greatest suitability of design and quality of execution was graded B. The other study had moderate suitability of design and execution was rated C. They reported a median decrease of -0.46 kg/m² [IQR -0.52 to -0.27 kg/m²].</p> <p>Weight loss competitions and incentives: Interventions consisted of rewards for weight loss or behavioural change to increase physical activity or improve nutrition. The rewards could be in kind, financial, or the honour or pride of winning.</p> <p>Two studies were identified that measured %BF with skin fold measurements. Review authors rated one as having the greatest suitability of design, and quality of execution graded as A and the other as having least suitability of design with the quality of execution graded as B. These reported a median effect size of -1.58%.</p> <p>Behavioural practices without incentives: Interventions included those that taught participants specific behavioural skills enabling them to incorporate physical activity and improve their nutrition through modelling or demonstration, participatory skill development, individual benchmarking, feedback and building social support for behavioural practices. These programs did not offer incentives. Typical programs consisted of one-on-one or group consultations with personalised goals or plans of action to improve nutrition, increase physical activity or help with weight loss.</p>	<p>decrease health care costs associated with obesity and its comorbidities, reduce absenteeism, increase productivity, and over time result in a positive return on investment.</p> <p>Comments: The authors of this review identified behavioural practices without incentives as a promising practice, however much of their evidence is based on studies of weight change in kg in which a significant effect was noted. However, for BMI (an outcome of interest in this review) the pooled effect was not significant, and therefore we have graded the evidence as H for the outcome of BMI.</p> <p>Due to the length of time between the literature search (2005) and publication (2011) the results of the review may be out of date.</p> <p>Forty-three of the primary studies included in this review also appear in the review by Anderson,¹⁶ 18 appear in the review by Verweij²² and one appears in the review by Mhurchu.²⁰</p>

Study details	Results of the review	Main findings and evidence grading
	<p>Seven studies were identified. Review authors rated six of these as having the greatest suitability of design; with quality of execution A (n=1), B (n=4) and D (n=1). The other study was rated moderate, C. These reported a BMI change, with a median effect size of -0.24 kg/m² (IQR -.52 to .05 kg/m²).</p>	

Study details	Results of the review	Main findings and evidence grading
<p>19. Gudzone K, et al. Strategies to prevent weight gain in workplace and college settings: a systematic review. <i>Prev Med</i> 2013; 57:268-277.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Self-management, dietary, physical activity and/or environmental strategies for the prevention of weight gain among adults in work or college settings.</p> <p>Relevant Outcomes: BMI, WC.</p> <p>Study Population: Adults aged 18+ in worksite or college settings.</p> <p>Studies were included up to: May 2011.</p> <p>Included study types: Single or multi-site RCTs or non-randomised trials.</p>	<p>Description of included studies: Nine studies were included in this review, four multisite randomised trials, three multisite non randomised trials and two single site randomised trials. (n=76,465 participants at baseline). Seven intervention trials (n=76,310) were in the workplace, whilst two (n=155) were in college settings.</p> <p>Four workplace studies were conducted in the USA and three in Europe. The two college studies were from Canada and the USA. All studies used a combination of strategies in their interventions to prevent weight gain.</p> <p>Quality of included studies: The strength of evidence was assessed by evaluating the risk of bias (using the Downs and Black methodological quality assessment checklist), consistency of results, directness of study goal towards prevention of weight gain, and precision.</p> <p>Synthesis: Substantial heterogeneity between study populations and interventions was identified and therefore no meta-analysis was performed. Results were summarised as a narrative synthesis.</p> <p>Findings:</p> <p>BMI: The strength of the evidence for the included work/college based interventions with respect to BMI change was graded as low by the review authors.</p>	<p>Intervention: Work or college-based interventions using a combination of strategies to prevent weight gain. Strategies included a variety of self-management, diet, physical activity and environmental components.</p> <p>Outcomes: Weight change outcomes (BMI & WC).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=9 studies).</p> <p>Authors' conclusions: We conclude that low to moderate strength of evidence exists that combining multiple strategies such as self-management, diet, exercise, and/or environmental change in workplace and college setting prevents weight gain in adults. The strength of evidence was limited due to issues with study quality and few studies that met our eligibility criteria. However, future researchers may choose to study the successful interventions that we identified when testing combination strategies to prevent weight gain in workplace and college settings.</p> <p>Limitations: Review authors noted that many of the studies reporting on BMI and WC outcomes had limitations. These included lack of blinding, losses to follow-up and not all studies reported standard errors or confidence intervals for between group differences.</p>

Study details	Results of the review	Main findings and evidence grading
	<p>Five studies (3 RCTs, 2 non-RCTs) measured BMI at 24 months. Two (1 RCT, 1 non-RCT) found a statistically significant effect favouring the intervention group, one (non-RCT) found a non-statistically significant effect in favour of the intervention and two (both RCTs) found non-statistically significant effects favouring the control group.</p> <p>WC: The strength of the evidence for the included work/college based interventions with respect to WC change was graded as low by the review authors.</p> <p>Three studies (2 RCTs, one which included two study arms and 1 non-RCT) measured WC change at 24 months. Two (1 RCT, 1 non-RCT) found a statistically significant effect in favour of the intervention and one (RCT with two study arms) found a non-significant effect favouring the intervention in one study arm and a non-significant effect favouring the control group in the other study arm.</p>	<p>It should be noted that only two of the included studies were in college-settings and the number of participants were small, therefore results should be treated with caution.</p> <p>Comments: The authors do not assess publication bias in this review.</p> <p>This review is a sub-section of a larger review by Huftless¹⁹ also included in this evidence map. The Huftless review includes additional supplementary information to do with this section of the review (for example, detailed search strategies). This review also includes one study that is included in the review by Verweij.²²</p>

Study details	Results of the review	Main findings and evidence grading
<p>20. Huftless S, et al. Strategies to prevent weight gain in adults: a systematic review. <i>Agency for Healthcare Research and Quality Comparative Effectiveness Review</i> 2013; 97.</p> <p>Type of source: Comparative effectiveness review (systematic review).</p> <p>Interventions: Strategies to prevent weight gain among adults at the individual, community or environment level.</p> <p>Relevant Outcomes: BMI, WC.</p> <p>Study Population: Adults (studies may be included with a mixed age population as long as 90% of the total population is 18 years or older).</p> <p>Studies were included up to: June 2012.</p>	<p>Description of included studies: Fifty-eight articles describing data from 51 studies were included in the review. Six studies addressed self-management strategies, 14 studies addressed dietary strategies, 15 studies addressed physical activity strategies, 21 studies addressed combination strategies, and one study addressed built environment or community level strategies. 11 of the studies looked at weight gain prevention in adults.</p> <p>Quality of included studies: Study quality was assessed using the Downs and Black methodologic quality assessment tool. The strength of evidence was low or insufficient for almost all comparison outcome relationships. Trials were frequently downgraded for lack of blinding, not reporting the blinding of outcome assessors or not accounting for losses to follow-up.</p> <p>Synthesis: The authors found that no groups of studies were amenable to pooling with meta-analyses, so mean differences, risk differences or relative risks with 95 per cent confidence intervals for individual studies were displayed, grouped by study population and comparable interventions.</p> <p>A meaningful between group difference threshold in addition to a statistically significant threshold ($p < 0.05$) was selected for reporting on the outcomes. A meaningful difference threshold was defined as 0.5 kg of weight, 0.2 units of BMI (based on a 0.5 kg change for an individual with a BMI of 27), or 1cm of WC relative to the comparison group.</p> <p>Findings: Eleven RCTs (65,562 participants) were identified for weight gain prevention among adults in the general population:</p> <p>Self-management interventions:</p>	<p>Intervention: Low fat dietary interventions to prevent weight gain among adult women.</p> <p>Outcome: Weight change outcomes (BMI, WC).</p> <p>Evidence statement C: There is some evidence supporting the use of low fat dietary interventions compared to educational materials, but it is not conclusive (n=2 studies).</p> <p>Intervention: Physical activity interventions to prevent weight gain among adults.</p> <p>Outcome: Weight change outcomes (BMI, WC).</p> <p>Evidence statement D: The evidence for physical activity interventions compared to advice/educational materials is inconsistent and it is not possible to draw a conclusion. (n=4 studies)</p> <p>Intervention: Combination interventions that include self-management, dietary and/or physical activity to prevent weight gain among adults.</p> <p>Outcome:</p>

Study details	Results of the review	Main findings and evidence grading
<p>Included study types: All study designs including prospective (randomised and non-randomised), retrospective, crossover, and case control studies. Serial cross sectional studies of the same population were eligible for one part of the review.</p>	<p>No self-management interventions were identified which reported on BMI change or WC change.</p> <p>Dietary interventions: Two trials reported on dietary interventions. Both trials included women exclusively. Both trials used group sessions to change consumption of fats, fruits, vegetables, and grains (low fat intervention groups). The comparison groups received printed information on nutritional guidelines in both trials.</p> <p>One dietary trial reported on BMI change. BMI remained within 0.1 units of the baseline in the intervention and control groups at an average of 7.5 years of follow-up. The BMI increased by 0.3 fewer units (95% CI, 0.5 to 0.1) in the low-fat intervention group compared with the group that received nutritional guidelines after adjustment for age, race/ethnicity, baseline BMI, and changes in dietary and physical activity patterns over time. This finding did not meet the threshold for the between group difference (0.2 units of BMI) at 7.5 years of follow-up, despite being statistically significant.</p> <p>Both dietary interventions reported on WC change. The low fat combined with increasing fruits, vegetables and grains diet met the meaningful between group difference threshold (1cm of WC) at one year. The intervention group had a 2cm decrease in WC compared with no change in the nutrition guidelines group (p<0.05). In the study with 7.5 years of follow-up, the low fat diet group had a WC 0.3cm smaller (95% CI 0.1 to 0.5cm less) than the nutritional guidelines group at the end of the study. The 7.5 year study was statistically significant, but did not meet the meaningful between group difference threshold.</p> <p>Physical activity interventions: Four trials reported physical activity interventions effects on BMI. Two of the interventions randomised patients to a supervised exercise program in a community gym compared with education materials, and two took</p>	<p>Weight change outcomes (BMI, WC).</p> <p>Evidence statement D: The evidence for combination interventions compared to no intervention or control is inconsistent and it is not possible to draw a conclusion (n=4 studies)</p> <p>Intervention: Environmental interventions to prevent weight gain among adults.</p> <p>Outcome: Weight change outcomes (BMI, WC).</p> <p>Evidence statement H: Evidence about the effectiveness of the intervention is lacking (n=0 studies).</p> <p>Authors' conclusions: The evidence provides some, although limited, support for strategies to prevent weight gain. Potentially effective strategies included ones that involve minor behaviour change (eating more meals prepared at home) or more major changes (endurance exercise training in a gym at least three times per week). Although there is no strong evidence to promote a particular weight gain prevention strategy, there is no evidence that <i>not</i> adopting a strategy to prevent weight gain is preferable.</p> <p>Comments:</p>

Study details	Results of the review	Main findings and evidence grading
	<p>place within primary care practices. One trial trained physicians to educate patients about an ideal heart rate and evaluated that heart rate at follow up visits compared with no heart rate assessment. This trial found a meaningful and statistically significant effect of the intervention among a population of individuals older than 65 years of age who did not already follow a training program and attended the primary care clinic in Canada. Three trials found no meaningful between group differences or statistically significant differences in BMI change in the gym based or health walks group compared with the educational materials or no intervention control group.</p> <p>One physical activity intervention reported on WC change. Three times weekly endurance exercise training among the elderly produced no significant changes in WC compared to control.</p> <p>Combination strategies: Four trials reported on a combination of self-management, dietary and physical activity interventions. Differences in study populations prevented meta-analysis.</p> <p>One study looked at households, and included multiple strategies addressing diet, physical activity and sedentary behaviour, delivered by trained staff during home visits, group sessions, home activities and monthly newsletters.</p> <p>One study looked at mothers of school children and compared one group which received a thirty minute information session and brochure on diet and PA guidelines with another group who undertook four group sessions over a month on goal setting, self-monitoring, training to prevent weight relapse, diet and physical activity and were distributed pedometers and sent text messages once a month for 11 months after the group sessions.</p>	<p>The authors in this study have not mentioned the possibility of publication bias. The search strategy did however include searching for ongoing /unpublished clinical trials.</p> <p>The authors state that although they have included studies of individuals with a baseline weight in the healthy, overweight and obese range, these findings apply primarily to overweight individuals. No study included healthy weight individuals exclusively.</p> <p>Please note: This paper also reports on interventions in workplace/college settings, however this has been extracted from the review by Gudzone¹⁸ rather than duplicated here, as the paper by Gudzone reports explicitly on that subsection of this larger systematic review.</p>

Study details	Results of the review	Main findings and evidence grading
	<p>One study included only women and included three groups. Each group received an information session to describe the control, clinic based and correspondence-based interventions. One group also received a booklet with information about the benefits of weight maintenance, low fat eating, and regular physical activity (control), one group received sessions with a nutritionist or behavioural interventionist, written materials and homework assignments (clinic-based) and the final group were given the same written materials and homework assignments as the clinic group, but without the group sessions (correspondence-based).</p> <p>One study included couples where one group received one group session and five mailed modules aimed at increasing moderate physical activity, incidental activities, and intake of low fat and high fibre foods, fruits and vegetables. The other group received three group sessions and three mailed modules.</p> <p>Three of the studies (the study in couples, the study in women and the study in households) reported on BMI change. The household study and the couples study both met the between group difference at one year but were not statistically significant. The study in women had no statistical or meaningful between group difference.</p> <p>Two combination interventions (the study in couples and the study in mothers) reported on WC change. In the study in mothers with young children, those who received the intervention lost 1.3cm in WC compared with a 0.1cm gain in the control group over one year, although the baseline weight adjusted decrease was not statistically significant (-1.5cm; 95% CI -4.0 to 1.0). There was no statistical or between group difference in the couples intervention.</p> <p>Environmental level interventions: No environmental level interventions reported on BMI change or WC change.</p>	

Study details	Results of the review	Main findings and evidence grading
<p>21. Mhurchu C, Aston LM, Jebb, SA. Effects of worksite health promotion interventions on employee diets: a systematic review. <i>BMC Public Health</i> 2010; 10:62.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Worksite based weight loss and/or healthy eating interventions with a minimum duration of at least 8 weeks.</p> <p>Relevant Outcomes: Dietary outcomes (e.g. energy, fat, fruit or vegetable intake). BMI.</p> <p>Study Population: Adults in the worksite.</p> <p>Studies were included up to: April 2009.</p>	<p>Description of included studies: Sixteen studies were included in the review. One was a RCT, nine were C-RCTs, one was quasi-experimental and four were pre-test post-test design. Mean age of participants in individual studies ranged from 38 to 49 years, and a variety of worksite settings were represented. One international study involved worksites in 17 countries. Nine took place in North America and six in Europe.</p> <p>Quality of included studies: Study quality was assessed using a checklist adapted by the review authors from a previous review on the same topic. Nine of the RCTs randomised by worksite, the other one randomised individual employees. Nine of the 10 RCTs did not report whether treatment allocation was adequately concealed or if outcome assessors were blinded to treatment allocation. None of the RCTs reported intention-to-treat analysis. One study (6%) was of quasi-experimental design, and five (31%) were uncontrolled intervention studies (pre-test post-test design). Review authors reported that other included study designs meant it was not possible to attribute any effects reported directly to the intervention.</p> <p>Synthesis: A narrative review of studies was undertaken as there was substantial variability in aspects of diet examined and methods of dietary assessment used.</p> <p>Findings: It should be noted that it is unclear from the way the results are reported in the review whether the majority of the findings are statistically significant.</p>	<p>Intervention: Worksite based weight loss/ healthy eating interventions with a minimum duration of at least eight weeks. Interventions tended to implement programmes based on employee education, targeted worksite policy/environment, or both.</p> <p>Outcome: Weight change outcomes (BMI).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention, however it is unclear from the way it is reported in the paper whether the evidence is statistically significant. Therefore it is not conclusive (n=3 studies).</p> <p>Outcome: Behaviour change (fruit and vegetable intake).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention, however it is unclear from the way it is reported in the paper whether the evidence is statistically significant. Therefore it is not conclusive (n=12 studies).</p> <p>Outcome: Behaviour change (total fat intake).</p> <p>Evidence statement C:</p>

Study details	Results of the review	Main findings and evidence grading
<p>Included study types: All study designed were eligible.</p>	<p>Eight studies (50%) implemented programmes focussing on employee education, two (13%) targeted changes to worksite policy and/or environment and six (37%) employed a combination of education and environmental changes. Strategies to deliver education to employees included group and/or individual counselling, shopping tours, individual diet plans, computer-tailored dietary feedback, weekly health promotion email messages, and worker participation in programme planning. Environmental interventions utilised comprised changes to worksite nutrition policies and practices such as nutrition labelling, vending policies, canteen food supply/availability, and menu reformulation.</p> <p>Most studies reported moderate dietary improvements but most were not recorded as having a statistically significant effect.</p> <p>Fruit and vegetable intake: Twelve studies (8 RCTs) measured fruit/vegetable intake. A positive effect in either fruit and/or vegetable intake was found in the intervention group in 11 of the 12 studies, although it is unclear how many of these were statistically significant effects. The authors only explicitly report two studies as having statistically significant increases.</p> <p>Four studies reported effects separately for fruit and vegetable intake while the remainder combined fruit and vegetable intakes into a single outcome. Although all studies used daily servings as the unit measure for fruit and vegetables, two reported proportional change from baseline, one reported proportional change in meeting the target of five servings per day, while others reported absolute change in daily servings (n=5), daily intake in grams (n=2), or daily frequency of consumption (n=2). In two RCTs that measured proportional change in combined fruit and vegetable intakes, average daily increases ranged from +3 per cent to +16 per cent in</p>	<p>There is some evidence supporting the use of this intervention, however it is unclear from the way it is reported in the paper whether the evidence is statistically significant. Therefore it is not conclusive (n=9 studies).</p> <p>Author's conclusions: The findings of this review suggest that worksite interventions have a positive, but small, effect on dietary behaviour. The quality of worksite studies is however often sub-optimal and further, well designed studies are needed in order to reliably determine their effectiveness and cost-effectiveness. Such studies should include well-matched comparison groups, objective measures of environmental and individual dietary change, and sufficiently long periods of follow-up to determine long-term effects of programmes on employee health, absenteeism and productivity. Future programmes to improve employee dietary habits should aim to intervene at multiple levels of the worksite environment, particularly with respect to economic levers to influence food choice; and integrate qualitative methods with traditional study designs in order to provide more insight into reasons for programme success or failure.</p> <p>Comments: The authors have not assessed for publication bias. They have mentioned the search for published literature only as a potential limitation of the review.</p> <p>The outcomes of this review are subjective, as they are self-reported answers to questionnaires.</p>

Study details	Results of the review	Main findings and evidence grading
	<p>intervention groups compared with -2 per cent to +4 per cent in control groups.</p> <p>Total fat intake: Nine studies (of which seven were RCTs) measured total fat intake. A decrease in total fat intake in the intervention group was found in all 9 studies, although it is unclear from the way the authors have reported the information whether any of these were statistically significant.</p> <p>Most studies that measured total fat intake reported effects on per cent energy from total fat but a small number reported results in grams per day, daily fat points, frequency of consumption of high fat foods, or dietary fat scores. In almost all studies, reported improvements in diet quality were greater in intervention groups compared with controls. In five RCTs that measured total fat as a percent of energy by intervention group, average daily reductions ranged from -2.2 per cent to -9.1 per cent in intervention groups compared with to +1.3 per cent to -1.8 per cent in control groups.</p> <p>BMI: Only three studies reported intervention effects on body weight outcomes. One RCT found a reduction of 1.6kg/m² in the intervention group compared to a reduction of 0.03kg/m² in the control group, however another RCT found that the intervention group increased their BMI more than the control group (+0.26 kg/m²), despite reporting greater reductions in energy and total fat intakes. One pre-test post-test design study found a reduction of -0.54kg/m² among those exposed to the intervention.</p> <p>Environmental interventions: Eight studies evaluated the effectiveness of worksite environmental interventions alone (n=2) or in combination with health education (n=6). Findings of these eight studies were generally positive for</p>	<p>Two studies included in this systematic review are also included in the review by Verweij²², and one study is included in the reviews by Archer¹⁷ and Anderson.¹⁶</p>

Study details	Results of the review	Main findings and evidence grading
	<p>dietary outcomes but effect sizes were small. Direct comparison with the eight studies that evaluated employee education interventions is difficult due to variability in study design and outcome measures, but typically individual-level interventions appeared to deliver slightly greater effects than environmental Interventions.</p>	

Study details	Results of the review	Main findings and evidence grading
<p>22. Nour M, et al. A narrative review of social media and game based nutrition interventions targeted at young adults. <i>J Acad Nutr Diet</i> 2016; 117(5):735-752.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Interventions making use of social media, or electronic based experimental games to promote good nutrition.</p> <p>Relevant Outcomes: Change in fat mass and/or BMI. Fruit and vegetable intake. Knowledge and attitude change.</p> <p>Study Population: Young adults aged 18-35 years.</p> <p>Studies were included up to: March 2016.</p> <p>Included study types: All study designs included.</p>	<p>Description of included studies: Seventeen studies (six game-based and 11 social media based) met the inclusion criteria. This included eight RCTs, one non-RCT, 1 randomised comparison study, one case-control study, four pre and post intervention studies, one cross-sectional study and one mixed-methods study.</p> <p>Quality of included studies: Quality was assessed using the Quality criteria checklists for primary research developed by the academy of nutrition and dietetics. A positive (n=3), negative (n=1) or neutral (n=13) rating was given to each study. Common factors that compromised study quality included non-comparable study groups, low validity and reliability of methods of outcome measurement and failure to perform intention-to-treat analysis. Review authors state that due to the low quality and high risk of bias in the included studies, evidence should be interpreted with caution.</p> <p>Synthesis: The included studies were heterogeneous in their design and outcome reporting preventing the pooling of findings. As a result, outcomes and study details have been collated using tables and described narratively.</p> <p>Findings:</p> <p>Social media interventions: Eleven social media studies were identified. Intervention modalities included; internet forums/blogs (n=5), Facebook (n=5), chat rooms (n=1), YouTube (n=1) & Twitter (n=1). One study used gamification techniques and social media, and the remaining studies utilized social media as one strategy in a multicomponent</p>	<p>Intervention: Interventions making use of social media to promote good nutrition in young adults.</p> <p>Outcome: Weight change outcomes (Weight/BMI change).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=7 studies).</p> <p>Outcome: Behaviour change outcomes (fruit and vegetable intake).</p> <p>Evidence Statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=5 studies).</p> <p>Outcome: Knowledge and attitude change.</p> <p>Evidence Statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=2 studies).</p> <p>Intervention: Interventions making use of electronic based experimental games to promote good nutrition in young adults.</p>

Study details	Results of the review	Main findings and evidence grading
	<p>intervention. Other components included email, websites, text messages, fact-to-face or phone coaching.</p> <p><i>Weight/BMI change:</i> Seven studies (5 RCTs, 2 single group pre-post test design) measured changes in weight and/or BMI as their primary outcome. Five (3 RCTs and 2 single group pre-post test design) reported positive outcomes for weight and/or BMI, with significant reductions in the intervention arm relative to control. Three were rated as positive in quality and four as neutral.</p> <p><i>Dietary behaviour change:</i> Five interventions (4 RCTs, 1 single group pre-post test design) measured changes in fruit and vegetable intake. One demonstrated a significant increase in intake by one cup in the intervention arm. One produced a positive outcome for vegetable intake but a non-significant outcome for fruit intake. The remaining three also increased intake, but outcomes were not statistically significant. Three were rated as positive in quality and two as neutral.</p> <p><i>Knowledge & attitude change:</i> Two studies (1 cross sectional study design, 1 RCT) measured knowledge gain. One (Cross-sectional) demonstrated a significant improvement in understanding of kilojoule requirements, but this did not translate into changes in anticipated kilojoule intake. The other (RCT) found social media had a positive effect on nutrition knowledge with greater improvements in the intervention arm.</p> <p>Game-based interventions: Six game-based interventions were identified. Three were virtual reality games, two were web-based games and one was a mobile app game. The three virtual reality games presented a virtual dining experience which aimed to promote knowledge gain and behaviour change. The mobile app game used a quiz to improve nutrition</p>	<p>Outcome: Weight change outcomes (Weight/BMI change).</p> <p>Evidence statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=2 studies).</p> <p>Outcome: Behaviour change outcomes (fruit and vegetable intake).</p> <p>Evidence Statement H: Evidence about the effectiveness of this intervention is lacking (n=1 study).</p> <p>Outcome: Knowledge and attitude change.</p> <p>Evidence Statement C: There is some evidence supporting the use of this intervention but it is not conclusive (n=3 studies).</p> <p>Authors' conclusions: The use of social media and gaming for nutrition promotion is in its infancy. Preliminary evidence suggests that these strategies have some utility for intervening with young adults. Further research using high-quality study designs is required, with measurement of outcomes over longer time periods.</p> <p>Comments: The study authors do caution that it may not be representative of the broader young adult</p>

Study details	Results of the review	Main findings and evidence grading
	<p>knowledge along with other functions such as a diet planner and calorie calculator. One web based game used levels and a point system to encourage plan and the other did not specify any techniques.</p> <p><i>Weight/BMI:</i> Two studies (1 case control study, 1 randomised comparison study) measured weight changes and found significant decreases in body weight. Both were rated as neutral in quality.</p> <p><i>Dietary behaviour change:</i> One randomised comparison study assessed behavioural outcomes. Outcomes indicated that the game-based intervention arm had significantly higher fruit intake at nine months ($p < 0.05$) compared to the game and face-to-face study group. The study was rated as neutral in quality.</p> <p><i>Knowledge and attitude change:</i> Three studies (1 RCT, 1 non-RCT, 1 single pre and post test study design) reported positive outcomes for post-game knowledge of nutrition or health eating concepts. Two of the three also reported positive outcomes in change in self-efficacy to make healthier food choices and engage in healthier eating habits.</p>	<p>population, as studies were predominately conducted in the USA, with small sample size and a large proportion of white participants.</p> <p>The authors did not test for publication bias however the search strategy did look for grey literature/unpublished studies.</p> <p>The authors state that the evidence should be treated with caution due to the high risk of bias in the included studies.</p>

Study details	Results of the review	Main findings and evidence grading
<p>23. Verweij LM, et al. Meta-analyses of workplace physical activity and dietary behaviour interventions on weight outcomes. <i>Obes Rev</i> 2010; 12:406-429.</p> <p>Type of source: Systematic review.</p> <p>Interventions: Workplace interventions targeting physical activity, dietary behaviour or both on weight outcomes.</p> <p>Relevant Outcomes: BMI, %BF, WC, waist-hip ratio and sum of skin folds.</p> <p>Study Population: Employees in a worksite.</p> <p>Studies were included up to: November 2009.</p> <p>Included study types: RCTs.</p>	<p>Description of included studies: Forty-three RCTs met the inclusion criteria. Twenty-two provided sufficient information to be included in the meta-analysis.</p> <p>Ten studies were conducted in the USA, four in Japan, two in Australia, two in Denmark, two in Sweden, one in the Netherlands and one in England.</p> <p>Quality of included studies: The methodological quality of studies was independently assessed by two authors following a predefined checklist based on recommendations of the Cochrane Handbook for Systematic Reviews of Interventions. Each article received a quality judgement based on the number of positively scored criteria: excellent (10-12), good (7-9), fair (5-6), and poor (0-5). Many studies failed to report information on methodological quality. Therefore, the majority of the studies were of fair (11/43) or poor (20/43) quality. Eleven studies were of good quality and one of excellent quality.</p> <p>The overall quality of the evidence for each pooled weight outcome measure was also assessed using Grading of Recommendations Assessment, Development and Evaluation (GRADE). RCTs of all quality levels were included in the review/meta-analysis.</p> <p>Synthesis: For all analyses, a random-effects model was used as mild heterogeneity was present. Sensitivity analyses using a fixed-effects model did not change the results.</p> <p>Findings:</p>	<p>Intervention: Workplace interventions targeting physical activity and dietary behaviour (combined).</p> <p>Outcome: Weight change outcomes (BMI, %BF, WC).</p> <p>Evidence statement B: This intervention is supported by moderate quality evidence of its effectiveness (BMI MD -0.34kg m⁻² [95% CI -0.46 to -0.22] n=11 RCTs; % body fat MD -1.12% [95% CI -1.86 to -0.38] n=3 RCTs).</p> <p>Intervention: Workplace interventions targeting physical activity only.</p> <p>Outcome: Weight change outcomes (BMI, %BF, WC, sum of skin folds, waist-hip ratio).</p> <p>Evidence statement D: The evidence is inconsistent and it is not possible to draw a conclusion (meta-analysis n=2 RCTs, BMI MD -0.50kg m⁻² [95% CI -0.65 to -0.34]).</p> <p>Intervention: Workplace intervention targeting dietary behaviour only.</p> <p>Outcome:</p>

Study details	Results of the review	Main findings and evidence grading
	<p>Study focus:</p> <ul style="list-style-type: none"> Improving physical activity and dietary behaviour (n=26) Physical activity only (n=14) Dietary behaviour only (n=3) <p>Interventions usually included an educational/informational component, a behavioural component, an exercise component or an environmental component</p> <p>PA and dietary behaviour:</p> <p>11 studies (n=4,638) targeting PA and dietary behaviour measured BMI as an outcome. In a pooled analysis, they were found to significantly reduce BMI (MD -0.34kg m⁻² [95% CI -0.46 to -0.22]). Five studies were assessed as good quality, two fair and four as poor. Review authors considered this body of evidence to be of moderate quality.</p> <p>Three studies (n=368) which targeted physical activity and dietary behaviour assessed the impact on %BF calculated from sum of skin-folds. Two studies were rated as high quality and one fair. Pooled analysis found a significant reduction in body fat percentage (MD -1.12% [95% CI -1.86 to -0.38]). Review authors rated this body of evidence as moderate.</p> <p>One study which targeted diet and physical activity assessed the impact on %BF calculated from bioelectrical impedance. This study was rated good and found no significant effect.</p> <p>Two studies (n=85) targeted physical activity and dietary behaviour to reduce WC. Pooled analysis showed no significant effect (MD -1.08cm [95% CI -4.18 to +2.02]). Both were rated</p>	<p>Weight change outcomes (BMI, %BF, WC, sum of skin folds, waist-hip ratio).</p> <p>Evidence statement E: There is some evidence suggesting that this intervention is ineffective but it is not conclusive. (n=3 studies).</p> <p>Authors' conclusions: This meta-analytic review showed interventions focusing on improving physical activity and dietary behaviour are moderately effective in reducing body weight of employees with -1.19kg, and that adding an environmental component may reduce body weight with an additional -0.29kg. Based on the fact that we did not have to downgrade for the item directness, these effects are generalisable to the worksite setting. However, we were not able to assess differences among subgroups of employees.</p> <p>Limitations: Several of the meta-analyses in this study only include a very small number of studies with a very small number of participants and therefore there results should be treated with caution.</p> <p>Comments: In some instances, the authors have graded evidence as low quality evidence of effect even though the meta-analysis is not statistically significant.</p> <p>Eighteen of the included primary studies in this review also appear in the reviews by Anderson¹⁶</p>

Study details	Results of the review	Main findings and evidence grading
	<p>good, but review authors rated this body of evidence as low quality.</p> <p>One study (n=128) targeted physical activity and diet to reduce waist-hip ratio. No significant difference was found. The study was rated poor.</p> <p>Physical activity only:</p> <p>Two studies (n=126) targeting physical activity only measured BMI. One was fair and the other poor quality. The fair quality study did not find a significant effect but the poor quality study did. Pooled analysis of the two studies found a reduction in BMI (MD -0.50kg m⁻² [95% CI -0.65 to -0.34]). Review authors considered this body of evidence to be of low quality</p> <p>Two studies (n=127) targeting physical activity only considered impact on %BF calculated from bioelectrical impedance or hydrostatic weighting. These were rated fair. Pooled analysis showed no significant effect (MD -0.56% [95% CI -2.53 to 1.42]). Review authors rated the quality of this body of evidence as very low.</p> <p>Two studies (n=58) looked at the impact of interventions targeting physical activity to reduce WC. Pooled analysis showed no significant effect (MD -1.31 cm [95% CI -3.62 to +1.00]).</p> <p>Two studies (n=90) targeted physical activity to reduce sum of skin folds. Pooled analysis found no significant effect (MD -0.01mm [95% CI -0.04 to +0.02]). One study was rated fair and one good. The authors rated the overall body of evidence as low quality.</p>	<p>and Archer¹⁷. Five of the studies also appear in the review by Vuillemin²³, two appear in the review by Mhurchu²⁰ and one appears in the review by Gudzone.¹⁸</p>

Study details	Results of the review	Main findings and evidence grading
	<p>Two studies (n=223) targeted physical activity to reduce waist-hip ratio. Pooled analysis found no significant effect (MD 0 [95% CI -0.03 to 0.03]). One was rated as poor and one was rated as good. The authors rated the overall body of evidence as low quality.</p> <p>Dietary behaviour only:</p> <p>Two studies targeted dietary behaviour and reported BMI, (one rated poor and one rated good) neither reported any significant effect.</p> <p>One study (n=770) targeted diet to reduce waist-hip ratio. No significant difference was found. The study was rated good.</p> <p>No studies targeting diet were identified that looked at %BF, WC or sum of skin folds.</p>	

Study details	Results of the review	Main findings and evidence grading
<p>24. Vuillemin A, et al. Worksite physical activity interventions and obesity: a review of European studies (the HOPE project). <i>Obes Facts</i> 2011; 4:479-488.</p> <p>Type of source: Systematic Review.</p> <p>Interventions: Workplace interventions aimed at increasing physical activity of employees in a workplace.</p> <p>Relevant Outcomes: BMI, %BF, WC, and waist-to-hip ratio.</p> <p>Study Population: Working adults (over 18 years).</p> <p>Studies were included up to: December 2009.</p> <p>Included study types: Not restricted.</p>	<p>Description of included studies: Thirty-three European studies met the inclusion criteria. Countries included the UK (n=11, 33%), Finland (n=6, 18%), Belgium (n=3, 9%), Norway (n=3, 9%), Switzerland (n=3, 9%), the Netherlands (n=2, 6%), Sweden (n=2, 6%), Germany (n=1, 3%), Spain (n=1, 3%) and Denmark (n=1, 3%).</p> <p>Twenty out of 33 studies (61%) were RCTs (two used cluster-randomised designs), two (6%) were controlled non-randomised trials, two (6%) were controlled before-and-after studies and nine (27%) had a pre-post design.</p> <p>Quality of included studies: In total, 17 studies (52%) were considered of high methodological quality (16 of 17 were RCTs), and nine among them were exercise training studies (eight of 13 were RCTs).</p> <p>Synthesis: No meta-analysis was undertaken, a narrative synthesis was used.</p> <p>Findings: Six types of interventions were identified: Counselling (n=5), exercise training (n=13), active commuting (n=4), walking (n=4), stair use (n=6) and multicomponent (associating a physical activity educational programme, commuting, walking and counselling) (n=1).</p> <p>Of the 33 included studies only 15 studies (45%) considered obesity-related outcomes. Only 11 of these reported relevant</p>	<p>Intervention: Workplace interventions aimed at increasing the physical activity of employees.</p> <p>Outcome: Weight change outcomes.</p> <p>Evidence statement D: The evidence is inconsistent and it is not possible to draw a conclusion (n=15 studies).</p> <p>Authors' conclusions: In conclusion, based on the evidence gathered in European adults, the authors recommend providing exercise training programmes and facilitating active commuting (walking, cycling) in the worksite setting. These types of intervention were shown to increase components of physical fitness such as cardiorespiratory fitness, an important physiological risk marker. The potential importance of changing parts of the design of working places (e.g. stairs) to increase habitual physical activity level would need further assessment. There is currently too little evidence regarding the effect of worksite interventions on obesity-related outcomes to provide recommendations. However, body weight and body composition outcomes should more systematically be included in workplace health promotion intervention studies. Finally, for translation into practice of worksite physical activity interventions, the authors strongly advocate that the elements of generalisability and dissemination are better reported in future studies.</p>

Study details	Results of the review	Main findings and evidence grading
	<p>outcomes and review authors only reported aggregated weight related outcomes.</p> <p>For studies reporting impact on weight related outcomes</p> <ul style="list-style-type: none"> • Counselling: (n=4, 1 RCT) significant positive relationship found in one study • Exercise training: (n=7, 5 RCTs, 1 C-RCT) significant positive relationship found in two studies. Non-significant relationship found in three studies. • Active commuting: (2 RCTs) both found a non-significant relationship. • Walking: (2 RCTs) significant positive relationship found in one study. Non-significant relationship found in one study. • No multicomponent studies or stair use studies had obesity-related outcomes. <p>The authors graded the evidence of effectiveness for obesity outcomes as inconclusive for counselling, walking, stair use, multicomponent interventions and exercise training, and as no evidence for active commuting.</p>	<p>Comments:</p> <p>Note: studies are grouped via type of intervention and all weight related outcomes are then reported on together within the paper. The counselling interventions and the walking interventions only include outcomes relevant to our study within the synthesis (BMI, % body fat, WC), however the exercise training and active commuting interventions also include other outcomes in the synthesis (weight). It is not possible to split this with the information given in the paper so that we are just reporting on the relevant outcomes for this review.</p> <p>The authors do not appear to have reported on all of the included studies which have obesity related outcomes in their evidence of effectiveness table.</p> <p>This review includes three studies which are also included in the Anderson¹⁶ review, and five studies which are also included in the Verweij²² review.</p>

5 Appendix II Intervention Summaries

Intervention: Social media and game based interventions to improve nutrition

Directional thinking



There is some evidence that using social media as part of multicomponent interventions to promote good nutrition in young adults has positive effects on knowledge and attitudes, fruit and vegetable intake and weight/BMI but it is not conclusive.

[1 systematic review including 2 studies (knowledge and attitude outcomes), 5 studies (fruit and vegetable intake) and 7 studies (weight/ BMI change) all of poor to moderate quality]

There is some evidence that electronic games to promote good nutrition in young adults have positive effects on knowledge and attitudes and weight/BMI but it is not conclusive.

[1 systematic review including 3 studies (knowledge and attitude outcomes and 2 studies (weight/BMI change)]

Other things to consider



- Review authors only included studies where the participants were aged between 18 and 35.
- Included studies among all interventions varied in design.
- Outcome effectiveness was based on a small number of studies, particularly among the game-based interventions.
- Positive changes were seen more often in multi-component social-media interventions compared to social-media only interventions; few studies evaluated the impact of social-media in isolation. Duration of studies assessing social media ranged from two weeks to 21 months.
- Social-media platforms including Facebook, blogs and forums were most commonly used in research studies. Blogs and forums consistently ranked the least popular within the multi-component intervention users.
- Most game-based interventions were stand-alone interventions.
- Interaction time with social media and gaming platforms varied between studies and was not well documented. However, authors state game-based studies were short, and often included using the game on only one occasion.

Limits to what we know



- Review authors note that evidence should be treated with caution due to the high risk of bias in the included studies.
- Sample sizes in studies were small and did not report drop-out rates. Other common factors that compromised study quality included non-comparable study groups, low validity and reliability of methods used to measure outcomes and failure to perform an intention-to-treat analysis.
- Lack of follow-up was an issue in game-based interventions.
- Authors acknowledge most studies involved a convenience sample of college students from the United States limiting generalisability of results.

References

1. M, Nour, et al. A narrative review of social media and game based nutrition interventions targeted at young adults. *Journal of the Academy of Nutrition and Dietetics*. 2016, Vol. 117, 5, pp. 735-732.

Intervention: Using a socio-ecological approach to prevent obesity in children

Directional thinking



There is some evidence that childhood obesity prevention programs, targeting physical activity determinants at three or four levels of the socio-ecological model (including a change in the social and organisational/built environment at either the school or community) have positive effects on weight change outcomes but it is not conclusive.

[1 systematic review including 26 studies of poor to moderate quality]

Other things to consider



- The socio-ecological model levels defined in this review were individual, interpersonal, school environment (social, organisational, built), community environment (social, organisational and built) and also policies and macro-environment (community, regional and national).
- Multilevel studies implemented at the institutional or community level showed greater potential for preventing excess weight gain. Findings across twenty three research studies assessing childhood obesity prevention programs targeting only one to two levels of the socio-ecological model, mainly individual or interpersonal levels, suggests that this is unlikely to be effective.
- Multilevel studies targeting three of four levels of the socioecological model that had an environmental component were mostly school-based. These interventions more frequently promoted additional physical activity outside of compulsory physical education (breaks, lunchtime and after school) and more commonly included the family and supporting children spend less-time doing screen based activities.
- Community-wide intervention studies included changes in policies and physical activity opportunities at community level, social marketing through local mass-media campaigns with government and non-governmental partners, environmental change strategies for the general population and in at least four cases additional actions at school, family and individual levels.

Limits to what we know



- The interventions identified varied considerably. It was not possible to dissociate the contributions of individual elements to overall program effectiveness or identifying elements more common in the multicomponent, multilevel interventions showing positive impact.
- Most of the research studies provided few or no details about the actual implementation of the planned actions.
- Interventions considered by the review had a minimum duration of 3 months and a minimum time to follow up of one academic year; the median duration for included studies was 2 years. Review authors noted that interventions and follow-up may need to be longer to allow policies, the environment and cultural norms to change in schools and targeted communities. Longer would also be necessary to allow assessment of sustained impact over time.
- The studies based in the community rather than school settings were conducted in high-risk populations which limits their generalisability to other lower-risk populations.

References

1. Kellou N, et al (2014) prevention of unhealthy weight in children by promoting physical activity using a socio-ecological approach: what can we learn from intervention studies? *Diabetes & Metabolism* 4094) : 250-271.

Intervention: Universal parent support interventions

Directional thinking



Individual face-to-face counselling of parents to address children's dietary habits, physical activity and bodyweight is supported by moderate evidence of effectiveness in changing diets.

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

There is also some evidence that telephone counselling or group education/ training of parents to address children's dietary habits, physical activity and bodyweight is effective in changing diets but it is not conclusive.

[1 systematic review, including 3 studies (telephone counselling) and 6 studies (group education/training) of poor to moderate quality]

There is some evidence that group education/ training of parents to address children's dietary habits, physical activity and bodyweight is effective in changing weight outcomes but it is not conclusive.

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

The evidence of effectiveness relating to weight change outcomes from face-to-face and telephone counselling delivered to parents to address children's dietary habits, physical activity and bodyweight is inconsistent.

[1 systematic review, including 4 studies (face-to-face counselling) and 2 studies (telephone counselling)].

Other things to consider



- Studies aiming to improve diet were more successful than those aiming to increase physical activity.
- Providing information via newsletters CDs etc. appears to be ineffective in changing diet or weight outcomes.
- Parental support interventions targeting parents of preschool-aged children are more effective than those targeting parents of older children. Review authors note that this is consistent with the observation that children's autonomy and decision-making powers increase with age whilst parental influence may decline.

- Also highlighted was an effectiveness disparity in weight status outcomes between girls and boys, with these interventions being more effective in girls.
- Group-based educational interventions appear promising among low socioeconomic or minority groups, but suffer from low participation and attrition rates. There was a lack of studies testing individual counselling in participants having low socioeconomic position.

Limits to what we know



- Weight status was often a secondary outcome in research studies and studies were often underpowered to detect significant changes.
- Authors identified limitations in their assessment of study quality, outlining they did not consider lack of blinding or the potential of selective reporting of results.
- Few studies included a follow-up duration longer than 6-months; long-term effectiveness is difficult to ascertain.

References

1. Kader, M et al (2015) Effectiveness of universal parent support interventions addressing children's dietary habits, physical activity and body weight: a systematic review. *Preventive Medicine* 77:52-67.

Intervention: School policy and environment interventions

Directional thinking



There is some evidence that changing the school food environment has positive effects on changing purchasing or consumption behaviours but it is not conclusive.¹

[1 systematic review including 14 poor to moderate quality studies]

There is some evidence that school policy interventions addressing unhealthy diet, reduced sugar-sweetened beverage intake, increased fruit and vegetable intake and reduced fat and salt consumption but it is not conclusive.²

[1 systematic review including 15 poor to moderate quality studies]

The evidence that changing school food environments¹ or implementing school policies addressing unhealthy diet and physical inactivity², changes weight outcomes is inconsistent.

[2 systematic reviews, including 11 studies]

Other things to consider



- Research studies on school food environments in the identified review aimed to capture the isolated effects of changes to the school food environment i.e. without additional education, physical activity or other obesity prevention interventions. The food environment changes were in many cases directed by school or regional/national government policies.¹
- Review authors encourage comprehensive food environment changes across a school site to limit the possibility of compensatory purchase/consumption from another school outlet.¹ Assessment of compensatory purchasing or consumption outside of the school environment was extremely limited in the available research.¹
- School policy interventions addressing unhealthy diet and physical inactivity, were heterogeneous; they included school nutrition initiatives, state legislation, brisk walking lessons teacher training, activities related to food and physical activity habits, and fitness guidance.²

Limits to what we know



- The studies assessing changes to the school food environment were mostly of weak design; only three studies involved a control group.¹
- The majority of the studies assessing changes to the school food environment were conducted in the United States where a highly privatised service providing 'competitive foods' exists alongside a government funded lunch programme.¹
- Studies on school policies addressing unhealthy diet and physical inactivity did not report long-term follow-up of participants, therefore, it is unknown whether any beneficial changes were maintained in the longer term.²

References

1. Driessen CE, et al. Effect of changes to the school food environment on eating behaviours and/or body weight in children: a systematic review. *Obes Rev* 2014; 15(12): 968-982.
2. Singh, A et al (2017) Impact of school policies on non-communicable disease risk factors – a systematic review. *BMC Public Health* 17(1):292

Directional thinking



Multicomponent interventions, or educational interventions delivered by trained teachers, intended to treat or prevent obesity by influencing preschool children's eating habits, are supported by moderate quality evidence that they are effective in increasing fruit and vegetable consumption.

[1 systematic review including 6 studies (multicomponent) and 5 studies (educational) of moderate to good quality]

There is also some evidence that single component interventions designed to treat or prevent obesity by influencing preschool children's eating habits are effective in increasing fruit intake.

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

There is moderate to good quality evidence that educational interventions, delivered by trained teachers, intended to treat or prevent obesity by influencing preschool children's eating habits are unlikely to be effective in changing weight outcomes.

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

There is also some evidence that multicomponent interventions intended to treat or prevent obesity by influencing preschool children's eating habits are unlikely to be effective in changing weight outcomes but it is not conclusive.

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

There is moderate to good evidence schools-based interventions targeted at children aged 2-5 years aiming to improve behaviours including screen time, sedentary activity physical activity diet and/or sleep are unlikely to be effective in changing weight outcomes.

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

Other things to consider



- Participants in interventions conducted in preschool settings were limited in age from 3-6 years old.
- Single component interventions in preschool settings started serving novel or non-preferred vegetables and peer models to influence children's intake. They were relatively short in duration (range 3 days to 6 weeks) and conducted in American Caucasians from families with high socio-economic status.
- Multicomponent interventions in preschool settings involved an education activity alongside activities such as changes to the availability of fresh water and fruits, having children grow their own vegetables, newsletters for parents, food modifications in the canteen and healthy school policies. Duration of multicomponent interventions was generally between 4-7 months and up to 1 year. Review authors note that studies of multicomponent interventions were the most well-designed.
- Educational interventions in preschool settings aimed to increase children's knowledge of healthy eating. Educational interventions lasted between 5 weeks and 2 years.

Limits to what we know



- Sixteen of the 26 included interventions set in preschools did not base their interventions on health behavioural theories.
- The majority of studies examining educational and multicomponent interventions groups suffered from high drop-out rates.
- Single component interventions were relatively short in duration (range 3 days to 6 weeks), had a short period of time in-between exposure and follow-up measurements had small sample sizes, lacked control groups.
- Most studies were from North America (n=17). All American multicomponent interventions targeted low-income families or families from African American or Latino backgrounds.
- Five interventions set in preschools were conducted in Europe and these targeted children from middle class families.
- Lack of long term follow up to see whether the outcomes of the interventions are sustainable over time and how they may influence children's eating habits later in life.

References

1. Mikkelsen MV, et al. A systematic review of types of healthy eating interventions in preschools. *Nutr J* 2014; 13:56.

Intervention: Behavioural interventions aimed at reducing recreational screen time and increasing physical activity

Directional thinking



There is moderate quality evidence that behavioural interventions that focus on reducing recreational screen time, or that focus on reducing recreational screen time and increasing physical activity, are effective in reducing recreational screen time in children aged 13 years and under¹.

[1 systematic review including 34 study arms of moderate quality]

There is moderate quality evidence that behavioural interventions that focus on reducing recreational screen time, or that focus on reducing recreational screen time and increasing physical activity, are effective in reducing total energy intake in children aged 13 years and under¹.

[1 systematic review including 6 study arms of moderate quality]

There is moderate quality evidence that behavioural interventions that focus on reducing recreational screen time and increasing physical activity are effective in increasing physical activity in children aged 13 years and under¹.

[1 systematic review including 14 studies of moderate quality]

There is some evidence that behavioural interventions that focus on reducing recreational screen time, or that focus on reducing recreational screen time and increasing physical activity, are effective in reducing obesity prevalence, BMI- z score, body fat percentage, skin fold thickness and snack intake in children aged 13 years and under but it is not conclusive¹.

[1 systematic review including 14 study arms (obesity prevalence), 14 study arms (BMI z-score), 8 study arms (body fat percentage), 4 study arms (skin fold thickness) and 3 study arms (snack intake) of poor to moderate quality]

There is some evidence that behavioural interventions that focus on reducing recreational screen time and increasing physical activity in adults are effective in increasing physical activity, but it is not conclusive¹.

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

Other things to consider



- Two well-conducted systematic reviews relating to screen time interventions were identified in the evidence review. These systematic reviews differed in their conclusions with regard to the effectiveness of interventions to reduce screen time. The directional thinking box reflects the evidence statements established from Buchanan (2016). This decision was made because Buchanan identified a greater number of studies and examined a wider range of outcome measures. Of particular interest was the fact that Buchanan captured data on changes in obesity prevalence and found a consistent direction of effect across different obesity, diet and physical activity measures. Buchanan also captured effects on BMI z-score, rather than BMI, the latter being analysed by Wu. However, Buchanan did not conduct a meta-analysis to determine an overall effect size from different interventions and test the statistical significance of that effect. Instead, effectiveness was summarised by specifying the median of effect estimates from individual studies and the associated interquartile interval.
- The other systematic review Wu (2016) conducted meta-analyses of the mean difference in BMI across 8 randomised controlled trials and mean differences in screen time across 14 randomised controlled trials². Effects in children under 18 across both outcomes were not statistically significant. Most of the studies in Wu (2016) were considered by Buchanan (2016); two new studies were published after the search date of Buchanan.
- Both reviews identified few trials examining effects on weight outcomes in adults. Of these, both reported decreases in BMI; one study was conducted in overweight participants.
- Systematic review authors note that the magnitude of effect on physical activity is often small¹.
- Most studies took place in the USA, but studies were also conducted in Australia the UK and other high-income countries and are likely to be generalisable to the Welsh population.
- Three of four studies reporting on weight outcomes, which also performed a stratified analysis to examine the

effectiveness on socioeconomic disparities, showed greater reductions in low-income participants¹.

- Seven studies targeted overweight and obese participants. Interventions were found to be effective regardless of weight status¹.
- Intervention components varied greatly and included elements such as electronic monitoring device, tracking/monitoring, family social support, coaching/counselling, environmental, classroom based health education and mass or small media¹. Studies with electronic monitoring devices reported greater reductions than those without devices however, authors recommend further research to determine which components are most effective¹. Family-based social support was the most common intervention component¹.
- Intervention settings varied and included schools, home, community, primary care, research facilities or a combination of these¹.
- Authors of one of the reviews only included studies they considered to be of good or fair quality execution, but with any level of design suitability¹.

Limits to what we know



- Authors highlight that outcomes reporting screen time, diet and physical activity were often self-reported and recommended cautious interpretation of the results¹.
- The most common limitations in the included studies were in describing the intervention and study population and sampling the study population¹.
- The meta-analyses by Wu suggests that effects on screen time reduction may not be maintained as shorter interventions tended to show significant differences in contrast with findings for longer interventions². Further research on maintenance of effects is required¹.
- Most included studies were implemented in urban or suburban settings and it remains unknown if similar interventions would be successful in rural settings¹.
- The body of evidence rarely included more recent mobile devices such as smart phones and tablets¹.

References

1. Buchanan L et al. Reducing recreational sedentary screen time: A community guide systematic review. *Am J Prev Med* 2016; 50(3): 402-415.
2. Wu L et al. The effect of Interventions targeting screen time reduction: a systematic review and meta-analysis. *Medicine* 2016; 95(27).

6 Appendix III Evidence Grading

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
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 s 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/or too few relevant studies or because the studies available are of a design inappropriate for assessing effectiveness

7 Appendix IV list of abbreviated terms

%BF:	Percentage body fat
BMI:	Body mass index
BMIz:	Body mass index z-score
BP:	Blood pressure
CI:	Confidence interval
CONSORT:	Consolidated standards of reporting trials
CT:	Controlled trial
C-RCT:	Cluster randomised controlled trial
CVD:	Cardiovascular disease
EPHPP:	Effective public health practice project
EPPI:	Evidence for policy and practice information
ES:	Effect size
GRADE:	Grading of recommendations assessment, development and evaluation
HPS:	Health promoting schools
MD:	Mean difference
NCD:	Non-communicable disease
NE:	Nutritional education
NICE:	National Institute for Health and Care Excellence
OECD:	The Organisation for Economic Co-operation and Development
OES	Observatory Evidence Service
OR:	Odds ratio
PA:	Physical activity
PAAC:	Physical activity across the curriculum

PE:	Physical education
QA:	Quality assessment
RCT:	Randomised controlled trial
RE-AIM:	Reach, Effectiveness, Adoption, Implementation, Maintenance
SE:	Standard error
SEP:	Socio-economic position
SMBC:	Social marketing benchmark criteria
SMD:	Standard mean difference
SR:	Systematic review
SSB:	Sugar-sweetened beverage
THI:	Transforming health improvement
WC:	Waist circumference