National Institute for Health and Care Excellence

Draft for Consultation

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These evidence reviews were developed by the Guideline Development Team

Overweight and obesity management: preventing, assessing and managing overweight and obesity

[G] Evidence review for effectiveness and acceptability of weight management interventions in children and young people living with overweight and obesity

NICE guideline CG189

Evidence reviews underpinning recommendations 1.5.28 to 1.5.25, 1.5.28 to 1.5.29, 1.5.31 to 1.5.55, 1.5.66 to 1.5.73, and 1.12.6, and research recommendations in the NICE guideline

October 2023

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1.1 Review question

What intervention components and approaches are effective, cost effective and acceptable for children and young people living with overweight or obesity?

1.1.1 Introduction

The National Child Measurement Programme (NCMP) report for England highlighted that obesity prevalence increased from 9.9% in 2019/20 to 14.4% in 2020/21, in children in Reception (aged 4-5 years). In children in Year 6 (10-11 years), obesity prevalence increased from 21.0% in 2019/20 to 25.5% in 2020/21. A briefing for NICE guideline developers and committee members on obesity, weight management and health inequalities also highlighted that childhood obesity is a strong predictor of adult obesity and associated ill health. Furthermore, the briefing highlighted that disparities in obesity in childhood is likely to worsen health outcomes and health inequalities in children from more deprived areas.

The 2013 NICE guideline on weight management: lifestyle services for overweight or obese children and young people (PH47) advised how to deliver effective weight management programmes that support children and young people to change their lifestyles and manage their weight. This guideline covered recommendations on the core components of lifestyle weight management programmes, developing a tailored plan to meet individual needs, encouraging adherence and providing ongoing support.

During the surveillance process, evidence was identified that could have an impact on recommendations on the core components of lifestyle weight management programmes. Based on this finding, a decision was made to systematically review evidence for the effectiveness, cost effectiveness and acceptability of multicomponent interventions as part of weight management programmes to help children and young people living with overweight and obesity to develop into a healthier weight.

1.1.2 Summary of the protocol

Table 1: PICO table effectiveness of components and approaches to weight management for children and young people

Population	Inclusion: Children or young people (2-18 years old) who are living with overweight or obesity Stratify by age: • 2-5* years old (pre-school) • 6-11* years old (primary school) • 12-18* years old (secondary school) Studies focusing on parents or carers as the agents of change will be included. Exclusion: • People whose body weight is at or below the healthy range (underweight). • Children under 2 years. • Pregnant women
Intervention	Behaviour changing interventions including: • Diet modification • Physical activity • Behavioural therapy Interventions may be delivered to the parent or carer

Comparator	• Basic support:
	  ○ Usual care
	  ○ No treatment
	• Concomitant intervention (any other behaviour-changing intervention that is eligible to be analysed as an intervention in this review).

Outcomes	Outcomes must be collected at least 6 months after a person has completed the programme and data from the longest timepoint recorded by studies will also be reported.
	
	Primary outcomes:
	• Changes in measured body mass index, BMI z score and weight
	  ○ If a study reports more than one of these measures, data from only 1 measure will be reported to avoid double counting of outcomes. Data on BMI z score will be extracted as the preferred measure, following by BMI and then weight.
	• Measures of central adiposity: Waist-to-height ratio, waist circumference.
	  ○ If a study reports both waist-to-height ratio and waist circumference, only waist-to-height ratio data will be extracted to prevent double counting of outcomes, as this is preferred measure
	
	Secondary outcomes:
	• Health-related quality of life (measured using a validated tool)
	• Weight related morbidity, limited to: insulin sensitivity, blood pressure, liver function.
	• Adverse events, limited to: Eating disorders, serious adverse events

***inclusive of all ages within the category**

Table 2: SPIDER table for acceptability of components and approaches to weight management for children and young people

Sample	Inclusion: Children or young people (2-18 years old) who are living with overweight or obesity Stratify by age: • 2-5* years old (pre-school) • 6-11* years old (primary school) • 12-18* years old (secondary school) Studies focusing on parents or carers as the agents of change will be included. Exclusion: • People whose body weight is at or below the healthy range (underweight). • Children under 2 years. • Pregnant women
Phenomenon of interest	Individual perspectives, values, beliefs, experiences or attitudes that are considered to influence the acceptability of components and approaches to weight management for children and young people
Design	• Published qualitative evidence syntheses Findings from published qualitative evidence syntheses relating to the acceptability of components of weight management programmes will be used directly.
Evaluation	Narrative synthesis and mapping
Research type	Qualitative synthesis

***inclusive of all ages within the category**

1.1.3 Methods and process

This evidence review was developed using the methods and process described in Developing NICE guidelines: the manual. Methods specific to this review question are described in the review protocols in Table 1, Table 2 and appendix A and the methods document.

Declarations of interest were recorded according to NICE's conflicts of interest policy.

Expansion on previous work

This review was conducted to update previous work by Cochrane authors:

- Diet, physical activity and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years (Colquitt 2016)
- Diet, physical activity and behavioural interventions for the treatment of overweight or obesity in children from the age of 6 to 11 years (Mead 2017)
- Diet, physical activity and behavioural interventions for the treatment of overweight or obesity in children from the aged 12 to 17 years (Al-Khudairy 2017)
- Parent-only interventions for childhood overweight or obesity in children aged 5 to 11 years (Loveman 2015)

These reviews were used to identify papers for inclusion and an updated search was used to capture recent studies. As the review papers themselves were all assessed to be low risk of bias and they used similar standard tools, for studies that were identified from these reviews, risk of bias judgements were taken directly from the review papers to ensure that ratings were consistent with the previous work.

Analysis plan

During the development of the review protocol, change in BMI z-score was identified as a critical outcome. It was also agreed at this stage that meta-regression approach would be utilised to analyse this outcome. Additionally, it was agreed that pairwise meta-analysis would be utilised for all other critical and important outcomes.

The protocol specified that outcome data should be at least 6 months post intervention. The follow up was further stratified into short follow up (between 6 months and 12 months post intervention) and longer follow up (≥12 months post intervention).

Population

During protocol development, it was identified that children and young people aged 2 to up to 18 years who are living with overweight or obesity can be stratified by weight according to the following age categories:

- 2 up to and including 5 years old (pre-school age, considered as up to 6 years in the analysis)
- 6 up to and including 11 years old (primary school age)
- 12 up to and including 18 years old (secondary school age)

Based on this discussion, it was agreed that separate analyses would be conducted based on the different age stratifications. In accordance with the decisions made in the previous Cochrane reviews, studies with an age range that fitted into more than one category were assigned based on the which category they overlapped with most and which category contained the mean age of the sample.

Eligible populations could include children and young people living with overweight, children and young people living with obesity, or 'mixed populations' which include children and young people living with overweight or obesity.

Classification of weight management components

During the review protocol stage, it was highlighted that weight management interventions typically include a combination of diet, physical activity and behavioural therapy components. The committee noted that these components can be further divided into sub-components, and these are used differently in practice. For example, the diet component can comprise of diet advice (such as the Eat Well Plate), or it can be tailored to individual needs. Similarly, physical activity component can be general physical activity advice or could be a formal exercise intervention which is done in person as part of the weight management intervention.

The committee highlighted that as advice generally forms part of standard care, it should not be seen as an active intervention. Based on these discussions, the intervention components were refined, and the following definitions were used when identifying intervention components within studies:

- **Diet modification:** A change to diet that is prescribed by the intervention or tailored to the individual, beyond the healthy eating advice provided in basic support conditions.
- **Physical activity:** Sessions that involve physical activity done in person, rather than just physical activity advice provided in basic support conditions.
- **Behaviour change techniques**: Any behavioural intervention components. A subcategorization based on the CALO-RE taxonomy was used to identify which behaviour change techniques were used: Motivation, goals and planning, review and rewards, self-monitoring, strategies, and facilitating change.

For further information on intervention components, see Appendix M.

Comparators

During protocol development, the committee identified no intervention, usual care and other concomitant interventions as the main comparators. Upon further discussion, the committee highlighted that no intervention would not, in practice, be different from usual care as the basic level of diet and exercise advice would be given in both situations. Therefore, these two comparators were combined into a single 'basic support' comparator.

Concomitant intervention comparators were other active intervention arms in a trial. These were used when studies investigated complex multicomponent interventions, to match some components while isolating the effect of adding or changing another component.

Protocol deviation

During the development of the review protocol, it was agreed that change in BMI, BMI z-score and weight were critical outcomes of interest. However, if the study reported more than one of these outcomes, data from 1 measure would be reported to avoid double counting of outcomes. Data on BMI z-score would be extracted as the preferred measure, followed by BMI and then weight.

As BMI z-score was the outcome of interest for the meta-regression, the committee agreed that further pair-wise analysis would not be conducted on change in BMI or change in weight.

A number of studies were identified that only reported change in BMI or change in weight. With a change in the analysis plan, these studies were subsequently excluded. This has been noted in the excluded studies table in appendix K.

Qualitative review

The qualitative review contained a narrative synthesis and mapping between published evidence syntheses. No further interpretive synthesis was appropriate, as this would add to many layers of interpretation over the primary evidence and thus remove it from its original context and meaning. Mapping between overlapping themes allowed for the commonalities to be highlighted without further commentary.

Acknowledgements

We would like to thank the Guidelines Technical Support Unit (TSU) based at the University of Bristol for their support and advice during the development of this evidence review.

1.1.4 Effectiveness evidence

1.1.4.1 Included studies

RCT evidence was identified from the 4 Cochrane reviews outlined in table 4. There were 243 articles identified from these reviews, which were then screened at full text. These studies were reviewed against the inclusion criteria as described in review protocol (Appendix A). 41 articles were suitable for inclusion in the review.

A systematic search was carried out to update the evidence supplied by the review papers. A total of 10,377 articles were identified in the search (see Appendix B for details of the search strategy). Following title and abstract screening 293 articles were identified as being potentially relevant. Full texts of these studies were reviewed against the inclusion criteria as described in review protocol (Appendix A). Twelve articles were suitable for inclusion in the review.

In total, 53 articles were included (41 identified from the Cochrane reviews and 12 identified from the search), which contained 47 studies:

- Seven studies of 2-5 year olds. Five of these were identified from Colquitt's 2016 review and 1 was identified from Loveman's 2015 review of parent only interventions. One was added from the updated search.
- Twenty-eight studies on 6-11 year olds. Fourteen of these were identified from Mead's 2017 review and 5 were identified from Loveman's 2015 review of parent only interventions. Nine were added from the updated search.
- Twelve studies on 12-18 year olds. Ten of these were identified from Al-Khudairy's 2017 review and 2 were added from the updated search.

1.1.5 Qualitative evidence

1.1.5.1 Included studies

A systematic search was carried out to identify systematic reviews of qualitative evidence (see Appendix B for details of the search strategy). A total of 1129 papers were identified in the search. Following title and abstract screening 20 studies were identified as being potentially relevant. These studies were reviewed at full text against the inclusion criteria as described in the review protocol in Table 2 (see Appendix A for full protocol).

Five reviews appeared suitable for inclusion after full text screening. Two of these, Burchett 2018 and Sutcliffe 2017, were separate publications of the same review. Burchett 2018 was included as it was the most recent publication and Sutcliffe 2017 was used for supplementary detail. Kelleher 2017 was also subsequently excluded because the content was only partially relevant to the question and because 6 out of the 8 primary studies they reviewed were already covered by other included reviews, so it was concluded that the review would not add useful content.

Of the 3 remaining reviews (McMaster 2020, Jones 2017 and Burchett 2018), there were only 4 studies which featured in more than one review, as shown in table 3. This was considered acceptable due to the majority of content being unique to each review and so all 3 reviews were included. There were 51 unique studies in total across the 3 reviews.

Table 3: Studies which feature in more than one review paper

	Systematic reviews		
Primary study	**McMaster 2020**	**Jones 2017**	**Burchett 2018**
Owen 2009	X	X	X
Watson 2016		X	X
Woolford 2012	X	X	
Stewart 2008	X		X

1.1.5.2 Excluded studies

See Appendix K for a list of studies excluded at full text and reasons for exclusion.

1.1.6 Summary of studies included in the effectiveness and qualitative evidence

Table 4: Systematic reviews of effectiveness evidence

Author (year)	Primary studies included in review	Population	Intervention[1]	Comparator
2 – 5 years				
Colquitt 2016	Quattrin 2012; 2014	Mixed	BCT + diet + exercise	Concomitant intervention
	Bocca 2012; 2014	Mixed	BCT + exercise	Basic support
	Stark 2011	Obese	BCT + diet + exercise	Basic support
	Stark 2014	Obese	BCT + diet + exercise	Basic support
	Kelishadi 2009	Obese	Diet	Basic support
6 – 11 years				
Mead 2017	Bryant 2011	Obese	BCT + exercise	Basic support
	Davoli 2013	Overweight	BCT	Basic support
	Epstein 2000	Overweight	BCT + diet	Basic support
	Epstein 2005	Mixed	BCT + diet	Concomitant intervention
	Gunnarsdottir 2011	Mixed	BCT + diet	Basic support
	Kalavainen 2007	Obese	BCT + exercise	Basic support
	Kirk 2012	Mixed	BCT + diet + exercise	Basic support
	Lochrie 2013	Mixed	BCT	Basic support
	McCallum 2007	Mixed	BCT	Basic support
	Mirza 2013	Obese	BCT + diet + exercise	Basic support
	Nowicka 2009	Obese	Diet + exercise	Basic support
	Saelens 2013	Overweight	BCT + diet	Concomitant intervention
	Wake 2009	Mixed	BCT	Basic support
	Warschburger 2016	Obese	BCT + diet + exercise	Concomitant intervention
12 – 18 years				

Author (year)	Primary studies included in review	Population	Intervention[1]	Comparator
Al-Khudairy 2017	Debar 2012	Obese	BCT	Basic support
	Ebbeling 2003	Obese	Diet + BCT	Concomitant intervention
	Ebbeling 2012	Mixed	Diet	Basic support
	Grey 2004	Mixed	Diet + Exercise + BCT	Basic support
	Resnicow 2005	Mixed	Exercise + BCT	Concomitant intervention
	Schranz 2013	Mixed	Exercise	Basic support
	Toulabi 2012	Mixed	Exercise	Basic support
	Savoye 2011	Mixed	Exercise + BCT	Basic support
	Vos 2011a and Vos 2012	Obese	Diet + BCT	Basic support
	Hofsteenge 2014 and Hofsteenge 2013	Mixed	BCT	Basic support
	Ford 2010	Obese	Diet + BCT	Concomitant intervention
Parent only interventions (all ages)				
Loveman 2015	Small 2014	Mixed (2-5)	BCT	Basic support
	Boutelle 2011	Mixed (6-11)	BCT + diet	Concomitant intervention
	Collins 2021 and Okely 2010	Obese (6-11)	BCT + diet + exercise	Concomitant intervention
	Estabrooks 2009	Mixed (6-11)	BCT	Basic support
	Golley 2007	Mixed (6-11)	BCT + exercise	Basic support
	Magarey 2012	Obese (6-11)	BCT + exercise	Concomitant intervention

1 [1] Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

2 **Table 5: Included studies of effectiveness in 2-5 year olds**

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Identified in systematic reviews							

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Quattrin 2012; 2014	Paediatric practices USA	N = 96 families Age: 2 - 5 BMI: ≥85th percentile for age and gender	**BCT + diet + exercise** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies • Facilitating change Diet modification Exercise program	Family-based behavioral weight control program Parent + child Group setting Face-to-face + remote delivery Less than weekly frequency	Concomitant intervention: diet + exercise (same diet and physical activity interventions)	Change in BMI z-score Follow up (post intervention): 6 months; 12 months	Moderate
Bocca 2012; 2014	Outpatient clinic Netherlands	N = 75 children Age: 3 - 5 overweight or obese (International Obesity Taskforce)	**BCT + exercise** Behaviour change • Motivation • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies • Facilitating change Exercise program	Multidisciplinary treatment program Parent + child Group + individual setting Face-to-face delivery Weekly frequency	Basic support (advice and paediatrician appointments)	Change in BMI z-score Secondary: Waist-circumference; Quality of life Follow up (post intervention): 8 months; 32 months	High
Stark 2011	Clinic and home based USA	N = 18 children Age: 2 – 5 BMI: ≥ 95th percentile but ≤	**BCT + diet + exercise** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring	LAUNCH (Learning about Activity and Understanding Nutrition for Child Health) Parent + child	Basic support (Paediatrician advice and counselling)	Change in BMI z-score Follow up (post intervention): 6 months	Low

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
		100% above the mean BMI	• Teach strategies • Facilitating change Diet modification Exercise program	Group + individual settings Face-to-face delivery Less than weekly frequency			
Stark 2014	Clinic and home based USA	N = 33 children Age: 2 – 5 BMI: ≥ 95th percentile but ≤ 100% above the mean BMI	**BCT + diet + exercise** Behaviour change • Goals and planning (arms 1&2) • Review and rewards (arm 1) • Improving and monitoring (arm 1) • Teach strategies (arms 1&2) • Facilitating change (arms 1&2) Diet modification (arms 1&2) Exercise program (arms 1&2)	LAUNCH (Learning about Activity and Understanding Nutrition for Child Health) Parent + child Group + individual settings (arm 1) Group setting (arm 2) Face-to-face delivery Less than weekly frequency	Basic support (Paediatrician advice and counselling)	Change in BMI z-score Follow up (post intervention): 6 months	Moderate
Kelishadi 2009	Obesity research clinic Iran	N = 120 children Age: preschool (2-5) BMI: ≥95th percentile	**Diet** Diet modification (dairy rich arm) Diet modification (energy restricted arm)	Diet only intervention Parent + child Group setting Face-to-face delivery Less than weekly frequency	Basic support (healthy lifestyle education sessions)	Change in BMI z-score Secondary: Waist-circumference Follow up (post intervention):	Moderate

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
						6 months; 30 months	
Small 2014	Primary care USA	N = 60 parent-child dyads Age: 4 – 8 (mean=5.58, SD=1.43) Mean BMI = 21.24 (SD=3.25), 69.5% obese.	**BCT** Behaviour change • Motivation • Goals and planning • Review and rewards	A brief motivational interviewing (MI) intervention Parent only Individual setting Face-to-face and remote delivery Less than weekly frequency	Basic support (attention matched MI)	Secondary: Waist-to-height ratio Follow up (post intervention): 6 months	Moderate
Identified in search							
Stark 2019	Clinic and home based USA	N = 167 children Age: 2 – 5 BMI: ≥ 95th percentile but ≤ 100% above the mean BMI	**BCT + diet + exercise** Behaviour change • Motivation (arm 2) • Goals and planning (arms 1&2) • Review and rewards (arms 1&2) • Improving and monitoring (arm 1) • Teach strategies (arm 1) • Facilitating change (arm 1) Diet modification (arms 1&2) Exercise program (arm 1)	LAUNCH (Learning about Activity and Understanding Nutrition for Child Health) (arm 1) and motivational interviewing (arm 2) Parent + child (arm 1) Parent only (arm 2) Group + individual settings (arm 1) Individual setting (arm 2) Face-to-face delivery (arm 1)	Basic support (Paediatrician standard care)	Change in BMI z-score Follow up (post intervention): 6 months; 12 months	Moderate

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
				Face-to-face + remote delivery (arm 2) Less than weekly frequency			

[1] Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

Table 6: Included studies of effectiveness in 6-11 year olds

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Identified in systematic reviews							
Bryant 2011	Primary care UK	N = 70 children Age: 8 - 16 Obese	**BCT + exercise** Behaviour change • Motivation • Goals and planning • Facilitating change Exercise program	WATCH IT community obesity intervention Parent + child Group + individual setting Face-to-face delivery Weekly frequency	Basic support (Usual care while on waitlist)	Change in BMI z-score Secondary outcomes: waist circumference Follow up (post intervention): 8 months	Moderate
Davoli 2013	Family paediatricians Italy	N = 372 families Age: 4 - 7 BMI: ≥ 85th percentile but ≤ 95th - CDC growth charts	**BCT** Behaviour change • Motivation • Goals and planning • Review and rewards	Paediatrician-led motivational interviewing Parent + child Individual setting Face-to-face delivery Less than weekly frequency	Basic support (Advice booklet and paediatrician standard care)	Change in BMI z-score Follow up (post intervention): 12 months	Moderate

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Epstein 2000	Obesity clinic USA	N = 67 families Mean age = 10.3 (SD=1.1) BMI: >20% overweight	**BCT + diet** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies (arm 2 only) • Facilitating change Diet modification	Epstein's family based behavioural treatment Parent + child Group + individual setting Face-to-face delivery Less than weekly frequency	Basic support (Standard treatment program)	Change in BMI z-score Follow up (post intervention): 6 months; 18 months	Moderate
Epstein 2005	Obesity clinic USA	N = 42 families Age: 8 - 11 BMI: ≥ 85th percentile	**BCT + diet** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies (arm 2 only) • Facilitating change Diet modification	Epstein's family based behavioural treatment with additional behavioural strategies Parent + child Individual setting Face-to-face delivery Less than weekly frequency	Concomitant intervention: BCT + diet (Standard program and same diet intervention.)	Change in BMI z-score Follow up (post intervention): 18 months	Moderate
Gunnarsdottir 2011	Hospital outpatient clinic Iceland	N = 13 families Age: 8 - 12 BMI: SDS > 2.4	**BCT + diet** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Facilitating change Diet modification	Epstein's family based behavioural treatment Parent + child Group + individual setting Face-to-face delivery Weekly frequency	Basic support (paediatric endocrinologist and nutritional counselling)	Change in BMI z-score Follow up (post intervention): 8 months	Moderate

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Kalavainen 2007	Hospital outpatient clinic Finland	N = 70 children Age: 7 – 9 Obese	**BCT + exercise** Behaviour change • Goals and planning • Teach strategies Exercise program	Behavioural and solution oriented therapy group program Parent + child Group + individual setting Face-to-face delivery Less than weekly frequency	Basic support (Standard program)	Change in BMI z-score Follow up (post intervention): 18 months; 30 months	Moderate
Kirk 2012	Hospital outpatient clinic USA	N = 85 children Age: 7 - 12 BMI: z-score 1.60 to 2.65	**BCT + diet + exercise** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies Diet modification Exercise program	Carbohydrate modification diets with behavioural program Child only Group + individual setting Face-to-face delivery Weekly frequency	Basic support (Portion control advice)	Change in BMI z-score Follow up (post intervention): 9 months	Moderate
Lochrie 2013	Hospital outpatient clinic USA	N = 130 children Age: 8 - 11 Overweight or obese	**BCT** Behaviour change • Goals and planning • Improving and monitoring • Teach strategies • Facilitating change	Family-based intervention Child only Group setting Face-to-face delivery Less than weekly frequency	Basic support (Dietitian education session)	Change in BMI z-score Follow up (post intervention): 6 months	Moderate
McCallum 2007	GP practices	N = 153 children	**BCT** Behaviour change	LEAP (Live, Eat and Play) trial	Basic support	Change in BMI z-score	Low

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
	Australia	Age: 5 - 10 BMI: overweight or mildly obese	• Motivation • Goals and planning • Facilitating change	Parent + child Individual setting Face-to-face delivery Less than weekly frequency	(Letters sent to parents)	Secondary outcomes: quality of life Follow up (post intervention): 6 months; 12 months	
Mirza 2013	Community clinic USA	N = 113 children Age: 7 - 15 BMI: ≥95th percentile	**BCT + diet + exercise** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies • Facilitating change Diet modification Exercise program	a low glycaemic load or a low-fat dietary intervention Parent + child Group + individual setting Face-to-face delivery Weekly frequency	Basic support (Advice: instruction manual)	Change in BMI z-score Secondary outcomes: insulin sensitivity Follow up (post intervention): 9 months; 21 months	Moderate
Nowicka 2009	Sports camp Sweden	N = 76 children Age: 8 - 12 Obese	**Diet + exercise** Diet modification Exercise program	Summer camp and sports club exercise intervention Child only Group setting Face-to-face delivery Intensive intervention frequency	Basic support (Usual care while on waitlist)	Change in BMI z-score Follow up (post intervention): 6 months	Moderate
Saelens 2013	Hospital outpatient clinic	N = 72 families Age: 7 - 11	**BCT + diet** Behaviour change • Motivation (arm 2 only)	'Prescribed approach' Epstein's family based behavioural treatment	Concomitant intervention: BCT + diet	Change in BMI z-score	Moderate

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
	USA	BMI: ≥ 85th percentile but not >175% above the median BMI	• Goals and planning • Review and rewards (arm 1 only) • Improving and monitoring • Teach strategies • Facilitating change Diet modification	Parent + child Group + individual setting Face-to-face delivery Weekly frequency	('Self-directed approach' Epstein's family based behavioural treatment and same diet intervention)	Follow up (post intervention): 6 months; 24 months	
Wake 2009	GP practices Australia	N = 258 children Age: 5 - 10 Overweight or obese	**BCT** Behaviour change • Motivation • Goals and planning Facilitating change	LEAP2 (Live, Eat and Play) trial Parent only Individual setting Face-to-face delivery Less than weekly frequency	Basic support (Letters to parents)	Secondary outcomes: quality of life Follow up (post intervention): 9 months	Low
Warschburger 2016	Inpatient rehabilitation centre Germany	N = 523 families Age: 7-12 Obese	**BCT + diet + exercise** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring (arm 1 only) • Teach strategies • Facilitating change (arm 1 only) Diet modification Exercise program (arm 1 only)	Parental CBT training group plus child in-patient intervention Parent + child (arm 1) Child only (arm 2) Group setting Face-to-face delivery Intensive intervention frequency	Concomitant intervention: BCT + diet (Parental CBT training group and same diet intervention)	Change in BMI z-score Secondary outcomes: quality of life Follow up (post intervention): 12 months	Moderate

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Boutelle 2011	University research USA	N = 52 families Age: 8 - 12 BMI: ≥ 85th percentile	**BCT + diet** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies • Facilitating change (arm 1 only) Diet modification	Epstein's family based behavioural treatment Parent only (arm 1) Parent + child (arm 2) Group setting Face-to-face delivery Weekly frequency	Concomitant intervention: BCT + diet	Change in BMI z-score Follow up (post intervention): 6 months	Moderate
Collins 2021 and Okely 2010	University research Australia	N = 115 parents Age: 5.5 – 9 Obese	**BCT + diet + exercise** Behaviour change (arms 1,2&3) • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies Diet modification (arms 1&3) Exercise program (arms 2&3)	HICKUPS trial: dietary intervention based on the Health Belief Model Parent only (arm 1) Child only (arm 2) Parent + child (arm 3) Group setting Face-to-face + remote delivery Less than weekly frequency	Concomitant intervention: BCT + diet; BCT + exercise	Change in BMI z-score Secondary outcomes: waist circumference; waist to height ratio; blood pressure; insulin sensitivity Follow up (post intervention): 6 months; 18 months	High
Estabrooks 2009	Home based USA	N = 135 parent-child dyads Age: 8 - 12	**BCT** Behaviour change • Goals and planning • Review and rewards (arm 2 only)	Family Connections: automated telephone counselling Parent only Group setting (arm 1)	Basic support (Advice: healthy lifestyle workbooks)	Change in BMI z-score Secondary outcomes: eating disorder	High

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
		BMI: ≥ 85th percentile	• Improving and monitoring • Teach strategies • Facilitating change	Group + individual setting (arm 2) Face-to-face delivery (arm 1) Face-to-face + remote delivery (arm 2) Weekly frequency		Follow up (post intervention): 6 - 12 months (unclear)	
Golley 2007	Hospital Australia	N = 89 parents Age: 6-9 BMI: mean = 24.3 (SD=2.6)	**BCT + exercise** Behaviour change • Improving and monitoring (arm 2 only) • Teach strategies • Facilitating change Exercise program (arm 2 only)	Parenting skills and intensive lifestyle education Parent only (arm 1) Parent + child (arm 2) Group + individual setting Face-to-face + remote delivery Less than weekly frequency	Basic support (attention matched MI)	Change in BMI z-score Secondary outcomes: waist circumference Follow up (post intervention): 6 months	Moderate
Magarey 2012	Hospital Australia	N = 169 parents Age: 5-9 Moderately obese	**BCT + exercise** Behaviour change • Improving and monitoring • Teach strategies (arm 1 only) • Facilitating change Exercise program	Parenting Eating and Activity for Child Health (PEACH) using the Positive Parenting Program (Triple P) Parent only Group + individual setting Face-to-face + remote delivery	Concomitant intervention: BCT + exercise	Change in BMI z-score Follow up (post intervention): 6 months; 18 months	High

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
				Less than weekly frequency			
Identified in search							
Gerards 2015	Public health service locations Netherlands	N = 86 parent-child dyads Age: 4 - 8 Overweight or obese	**BCT** Behaviour change • Goals and planning • Improving and monitoring • Teach strategies	The Lifestyle Triple P intervention Parent only Group + individual setting Face-to-face + remote delivery Weekly frequency	Basic support (Advice: healthy lifestyle brochures)	Change in BMI z-score Secondary outcomes: waist circumference Follow up (post intervention): 8 months	Low
Robertson 2016	Primary care UK	N = 115 families Age: 6-11 BMI: ≥91st centile	**BCT + exercise** Behaviour change • Teach strategies • Facilitating change Exercise program	Families for Health (FFH) version 2 Parent + child Group setting Face-to-face delivery Weekly frequency	Basic support (Standard program)	Change in BMI z-score Secondary outcomes: waist circumference; quality of life Follow up (post intervention): 10 months	Low
Janicke 2019	Community services USA	N = 93 parent-child dyads Age: 8 - 14 BMI: ≥ 85th percentile	**BCT + diet + exercise** Behaviour change • Goals and planning • Review and rewards (arm 1 only) • Improving and monitoring	E-FLIP for Kids Trial: behavioral parent-only and family-based interventions Parent + child (arm 1) Parent only (arm 2)	Basic support (Usual care while on waitlist)	Change in BMI z-score Secondary outcomes: quality of life	High

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
			• Teach strategies Diet modification Exercise program	Group setting Face-to-face delivery Less than weekly frequency		Follow up (post intervention): 6 months	
Anderson 2021 and Wild 2020	Healthcare program New Zealand	N = 121 children Age: 5-16 BMI: >91st centile	**BCT + exercise** Behaviour change • Teach strategies • Facilitating change Exercise program	Whanau Pakari trial: high-intensity intervention Parent + child Group setting Face-to-face delivery Weekly frequency	Basic support (advice)	Change in BMI z-score Secondary outcomes: waist to height ratio; insulin sensitivity; liver function Follow up (post intervention): 12 months; 48 months	High
Bohlin 2017	Hospital outpatient clinic Sweden	N = 34 children Age: 5-16 Obese	**BCT** Behaviour change • Goals and planning • Improving and monitoring • Teach strategies • Facilitating change	Telephone coaching Parent only Individual setting Remote delivery Less than weekly frequency	Basic support (Standard clinic treatment)	Change in BMI z-score Follow up (post intervention): varied, Mean = 17.7 (SD4.5) months	Moderate
Fedele 2018	Community health centre paediatricians USA	N = 24 children Age: 6-12 BMI: ≥ 85th percentile	**BCT + exercise** Behaviour change • Motivation • Goals and planning • Review and rewards • Improving and monitoring	Childhood Health and Asthma Management Program (CHAMP) Parent + child Group + individual setting	Basic support (Advice from guidelines on health topics)	Change in BMI z-score Secondary outcomes: quality of life	High

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
		Asthma diagnosis	• Teach strategies • Facilitating change Exercise program	Face-to-face delivery Weekly frequency		Follow up (post intervention): 6 months	
Njardvik 2018	Hospital Iceland	N = 84 families Age: 8-12 BMI: SDS ≥ 2	**BCT + diet** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies (arm 1 only) • Facilitating change Diet modification (arm 1 only)	Epstein's family based behavioural treatment with appetite awareness training Parent + child Group setting Face-to-face delivery Weekly frequency	Concomitant intervention: BCT (Standard Epstein's family based behavioural treatment)	Change in BMI z-score Follow up (post intervention): 12 months; 24 months	Low
Spence 2022	Hospital outpatient clinic Canada	N = 52 families Age: 8-12 BMI: ≥ 85th percentile	**BCT** Behaviour change • Motivation • Goals and planning • Improving and monitoring • Teach strategies • Facilitating change	Cognitive-behavioural therapy and psychoeducational interventions Parent only Group setting Face-to-face delivery Weekly frequency	Basic support (Standard weight management)	Change in BMI z-score Secondary outcomes: insulin sensitivity; blood pressure Follow up (post intervention): 6 months; 12 months	Moderate
Yackobovitch-Gavan 2017	Children's medical centre Israel	N = 247 children Age: 5-11	**BCT** Behaviour change • Motivation • Goals and planning	family-based intervention focused on cognitive behavioural changes	Basic support (standard clinical follow up)	Change in BMI z-score	Moderate

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
		BMI: 85th – 98th percentile	• Improving and monitoring • Teach strategies • Facilitating change	Parent only (arm 1) Parent + child (arm 2) Group setting Face-to-face delivery Weekly frequency		Follow up (post intervention): 21 months	

[1] Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

Table 7: Included studies of effectiveness in 12-18 year olds

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Identified in systematic reviews							
DeBar 2012	Primary care USA	N = 208 Age: 12-17 BMI: percentile of 97.09 (SD 2.27)	**BCT + Diet + Exercise** Behaviour change • Motivation • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies • Facilitating change Diet modification Exercise program	Multicomponent lifestyle intervention Parent + child Group + individual setting Face-to-face delivery Less than weekly frequency	Basic support (Advice: booklet and doctor's appointment)	Change in BMI z-score Secondary outcomes: quality of life; eating disorder Follow up (post intervention): 6 months	High
Ebbeling 2003	Children's Hospital USA	N = 16 Age: 13-21	**Diet + BCT** Behaviour change • Review and rewards	Reduced glycaemic load (GL) dietary treatment Young person only	Concomitant intervention: Diet + BCT	Secondary outcomes: insulin sensitivity	High

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
		BMI: 34.9±1.0 intervention; 37.1±1.2 control	• Improving and monitoring • Teach strategies • Facilitating change Diet modification	Individual setting Face-to-face delivery Less than weekly frequency	(Reduced fat diet and same BCT intervention)	Follow up (post intervention): 6 months	
Ebbeling 2012	Unclear setting USA	N = 224 Age: 14-15 Overweight or obese	**Diet** Diet modification	Multicomponent intervention to reduce the consumption of sugar-sweetened beverages Parent + child Individual setting Face-to-face + remote delivery Less than weekly frequency	Basic support (Retention strategy)	Secondary outcomes: serious adverse event Follow up (post intervention): 12 months	Moderate
Grey 2004	Afterschool program USA	N = 41 Age: 10-14 BMI: ≥ 95th percentile	**BCT + Diet + Exercise** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring • Teach strategies • Facilitating change Diet modification Exercise program	Cognitive skills training to prevent T2 diabetes Parent + child Group + setting Face-to-face + remote delivery Intensive intervention frequency	Concomitant intervention: Diet + Exercise (same diet and exercise interventions)	Secondary outcomes: insulin sensitivity Follow up (post intervention): 6 months	High

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Resnicow 2005	Church USA	N = 123 Age: 12-16 BMI: >90th percentile	**Exercise + BCT** Behaviour change • Motivation Exercise program	'Go Girls' weight control program Parent + child Group + individual setting Face-to-face + remote delivery Weekly frequency	Concomitant intervention: Exercise + BCT (Basic version of 'Go Girls' program with limited contact. Same exercise intervention.)	Secondary outcomes: waist circumference Follow up (post intervention): 6 months	High
Toulabi 2012	High schools Iran	N = 152 Age: 15 - 17 BMI: ≥ 28	**Exercise** Exercise program	Behaviour modification program Parent + child Group + individual setting Face-to-face delivery Intensive intervention frequency	Basic support (Advice: educational booklets)	Secondary outcomes: waist to height ratio Follow up (post intervention): 6 months	Moderate
Savoye 2011	Schools USA	N = 209 Age: 8-16 BMI: ≥ 95th percentile	**Exercise + BCT** Behaviour change • Goals and planning • Improving and monitoring • Teach strategies • Facilitating change Exercise program	'Bright Bodies' Intensive lifestyle intervention Parent + child Group setting Face-to-face delivery Weekly frequency	Basic support (Diet and exercise counselling)	Change in BMI z-score Secondary outcomes: insulin sensitivity; blood pressure Follow up (post intervention): 12 months	High

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
Vos 2011a and Vos 2012	Paediatric hospital The Netherlands	N = 81 Age: 8-17 Obese: Mean BMI = 32.45	**BCT** Behaviour change • Motivation • Teach strategies • Facilitating change	Epstein's family based behavioural treatment Parent + child Group setting Face-to-face delivery Less than weekly frequency	Basic support (Standard advice on diet and exercise)	Change in BMI z-score Secondary outcomes: waist to height ratio; quality of life; insulin sensitivity; blood pressure Follow up (post intervention): 6 months	Moderate
Hofsteenge 2014 and Hofsteenge 2013	Paediatric obesity clinic The Netherlands	N = 122 Age: 11-18 Obese: Mean BMI = 33	**BCT** Behaviour change • Motivation • Goals and planning • Teach strategies • Facilitating change	Go4it multidisciplinary group treatment Parent + child Group + setting Face-to-face delivery Less than weekly frequency	Basic support (Dietitian standard care)	Change in BMI z-score Secondary outcomes: waist circumference; quality of life; insulin sensitivity; blood pressure Follow up (post intervention): 6 months	High
Ford 2010	Childhood Obesity Clinic	N = 106 Age: 9-17	**Diet + BCT** Behaviour change	Mandometer portable food weighing scale	Basic support	Change in BMI z-score	High

Study	Location	Population	Intervention components[1]	Intervention details	Comparison	Outcomes	Risk of bias
	UK	BMI: ≥95th percentile.	• Improving and monitoring • Teach strategies Diet modification	Young person only Individual setting Face-to-face + remote delivery Less than weekly frequency	(Advice: consultation with multidisciplinary team)	Follow up (post intervention): 6 months	
Identified in search							
Arlinghaus 2019	School USA	N= 243 Age:10–17 BMI: ≥85th percentile	**Exercise + BCT** Behaviour change • Goals and planning • Review and rewards • Improving and monitoring Exercise program	Intervention based on social cognitive theory Parent + child Group setting Face-to-face delivery Intensive intervention frequency	Basic support (Standard exercise-focused program)	Change in BMI z-score Follow up (post intervention): 6 months	High
Soltero 2017	YMCA US	N=160 Age:14–16 BMI: ≥ 95th percentile	**Exercise + BCT** Behaviour change • Goals and planning • Improving and monitoring Exercise program	Diabetes Prevention Program (DPP) Parent + child Group setting Face-to-face delivery Intensive intervention frequency	Basic support (Advice: information sheets and follow up)	Secondary outcomes: waist circumference; quality of life; insulin sensitivity Follow up (post intervention): 9 months	High

[1] Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

1 # Qualitative studies

2 **Table 8: Included reviews of qualitative evidence**

Author	Study design	Relevant studies	Objective	Population	Country	Quality[1]
McMaster 2020	Mixed methods systematic review with narrative synthesis	Fjone 2016; Garcia 2017; Kitscha 2009; Nogueira 2013; Owen 2009; Sallinen Gaffka 2013; Skelton 2016; Stewart 2008; Tremblay 2016; Woolford 2012; Zenlea 2017	1. to summarize quantitative, qualitative, and mixed-methods research reporting on satisfaction of parents/carers and patients up to 18 years of age who have attended a secondary or tertiary pediatric weight management service. 2. to ascertain barriers to continued engagement in weight management services.	patients aged <18 years and/or their family who attended an established secondary- or tertiary-level pediatric weight management service for treatment of obesity	Australian review, using worldwide studies	Moderate concerns
Jones 2017	Qualitative systematic review using thematic synthesis	Alm 2008; Banks 2014; Campbell-Voytal 2018; Daley 2008; Engstrom 2016; Hammar 1971; Hemetek 2015; Hester 2009; Holt 2005; Howie 2016; Jogova 2013; Li 2016; Melnyk 2007; Morinder 2011; Nguyen 2014;	to synthesise and explore the views of adolescents who have attended an obesity intervention.	adolescents (12-17 years) who attended an obesity intervention	UK review, using worldwide studies	Minor concerns

		Owen 2009; Peeters 2012; Reece 2015; Riiser 2013; Rudolf 2006; Smith 2014a; Smith 2014b; Staiano 2012; Twiddy 2011; Watson 2016; Woolford 2010; Woolford 2012a; Woolford 2012b				
Burchett 2018	A systematic review using Qualitative Comparative Analysis	Lewis 2014; Lucas 2014; Newson 2013; Owen 2009; Pittson 2013; Robertson 2009; Staniford 2011; Stewart 2008; Trigwell 2011; Visram 2013; Watson 2012; Arai 2015; Robertson 2011; Stewart 2007; Stewart 2006; Goals 2013; Watson 2015	to identify critical features of successful lifestyle weight management interventions for overweight children (0–11 years)	Children (≤11 years) who had experience of a WMP for children. Parents or carers who had experience of a WMP for children aged ≤11 years. Service providers who had delivered a WMP for children aged ≤11 years	UK review, using UK studies	Serious concerns

[1] The quality of the reviews was assessed using the SBU ‘tool to assess methodological limitations of qualitative evidence synthesis’ (ENTREQ)

See appendix D for full evidence tables

1.1.7 Summary of the effectiveness evidence

Standard NMA Model – change in BMI Z-score

The table below summaries the results from the standard meta-network analysis (NMA) for the outcome change in BMI z-score. The columns list the different components of overweight and obesity management interventions identified in the evidence. Within each box, the component listed represent results where there was a statistically significant finding favouring that component (i.e. interventions that are in bold were favoured in the comparison). Boxes with dashes represent cases where the NMA could not differentiate between treatments. For further information see appendix M for the full results of the NMA and appendix F for full GRADE tables.

While the quality of the evidence was either low or very low, it is possible to infer from the results across the full range of age groups and follow ups that interventions which combined BCT with another component seem to produce a stronger effect. BCT + diet was most often favoured against other combinations of components.

Table 9: Summary of standard NMA model evidence

Components							Quality
Basic support	**BCT + Diet**	**BCT+ Diet+ Exercise**	**BCT+ Exercise**	**Diet + Exercise**	**Diet**	**BCT**	
Under 6 years old: 6 -12 months follow up (post-intervention)							
-	-	-	-	-	NA*	NA*	Very low
Under 6 years old: ≥12 months follow up (post-intervention)							
-	-	-	NA*	• **Basic support** • **BCT + Diet** • **BCT + Diet + Exercise**	**Basic support**	NA*	Low
6-11 year olds: 6 -12 months follow up (post-intervention)							
BCT + Diet	-	-	-	-	NA*	**BCT + Diet**	Low
6-11 year olds: ≥12 months follow up (post-intervention)							
-	-	-	**BCT + Diet**	NA*	NA*	-	Low
12- 18 year olds: 6 -12 months follow up (post-intervention)							
-	-	-	-	NA*	NA*	-	Very low

Components	Quality
* Outcome data unavailable Intervention abbreviations used: Diet = diet modification; exercise = exercise programme; BCT = behaviour change techniques	

Component NMA Models: Additive sub-component effect – change in BMI Z-score

The table below summaries the results from the component meta-network analysis (NMA) for the outcome change in BMI z-score. The additive sub-component effect model used network meta-regression to estimate effects of intervention sub-components. This model was only conducted using evidence on children aged 6-11 year olds because the other age groups did not have sufficient data.

The columns list the different sub-components of overweight and obesity management interventions identified in the evidence. The row lists basic support which was compared to each sub-component. Within each box, an 'X' indicates where there was a significant finding favouring that component. Boxes with dashes represent cases where the NMA could not differentiate between treatment. For further information see appendix M for the full results of the NMA and appendix F for full GRADE tables.

No significant effects were found for subcomponents in this very low quality analysis.

Table 10: Summary of component NMA model (additive sub-component effect) evidence

	Sub-components								Quality
	Diet	Exercise	Motivation	Facilitating change	Reward	Goals and planning	Monitoring	Teach strategies	
6-11 year olds - 6–12 months follow-up									
Basic support	-	-	-	-	-	-	-	-	Very low
6-11 year olds - ≥12 months follow-up									
Basic support	-	-	-	-	-	-	-	-	Very low

Component NMA Models: Main effect with additive sub-component effect – change in BMI Z-score

The table below summaries the results from the component meta-network analysis (NMA) for the outcome change in BMI z-score. The main effect additive sub-component model used network meta-regression to estimate effects of intervention sub-components, in which a main effect for the behavioural change intervention component was estimated, plus the addition of the behaviour change techniques, diet, and exercise sub-component specific effects. This model was only conducted using evidence on children aged 6-11 years because the other age groups did not have sufficient data.

The columns list the different sub-components of overweight and obesity management interventions identified in the evidence. The row lists basic support which was compared to each sub-component. Within each box, an 'X' indicates where there was a significant finding favouring that component. Boxes with dashes represent cases where the NMA could not differentiate between treatment. For further information see appendix M for the full results of the NMA and appendix F for full GRADE tables.

There was one significant finding, favouring Diet over basic support. The evidence was of low quality.

Table 11: Summary of component NMA model (main effect with additive sub-component effect) evidence

	Sub-components									**Quality**
	BCT main effect	**Diet**	**Exercise**	**Motivation**	**Facilitating change**	**Reward**	**Goals and planning**	**Monitoring**	**Teach strategies**	
6-11 year olds - 6–12 months follow-up										
Basic support	-	-	-	-	-	-	-	-	-	Very low
6-11 year olds - ≥12 months follow-up										
Basic support	-	**X**	-	-	-	-	-	-	-	Low

Pairwise meta-analysis data

Results that favour the intervention arm are highlighted in green, results that favour the comparator arm are highlighted in red, and null results that do not differentiate between intervention arms and the comparator arm are unhighlighted. For further information see appendix E for Forest plots and appendix F for full GRADE tables.

Under 6 years old

Table 12: Diet modification vs basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist circumference (6-12 months follow up (post intervention))				
1 (Kelishadi 2009)	109	MD -1.7 (-4.64 to 1.24)	Very low	Evidence could not differentiate between arms
Change in waist circumference – dairy rich diet group (6-12 months follow up (post intervention))				
1 (Kelishadi 2009)	57	MD -3.2 (-3.3 to -3.1)	Very low	**Favours diet modification**
Change in waist circumference – energy restricted diet group (6-12 months follow up (post intervention))				
1 (Kelishadi 2009)	52	MD -0.2 (-0.32 to -0.08)	Very low	**Favours diet modification**
Change in waist circumference (≥12 months follow up (post intervention))				
1 (Kelishadi 2009)	99	MD -0.15 (-1.23 to 0.93)	Very low	Evidence could not differentiate between arms
Change in waist circumference – dairy rich diet group (≥12 months follow up (post intervention))				
1 (Kelishadi 2009)	52	MD -0.7 (-0.84 to -0.56)	Very low	**Favours diet modification**
Change in waist circumference – energy restricted diet group (≥12 months follow up (post intervention))				

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
1 (Kelishadi 2009)	47	MD 0.4 (0.23 to 0.57)	Very low	**Favours basic support**

Table 13: Behaviour change techniques + exercise program vs basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist circumference (6-12 months follow up (post intervention))				
1 (Bocca 2012 and 2014)	57	MD 0.6 (-1.93 to 3.13)	Very low	Evidence could not differentiate between arms

Table 14: Behaviour change techniques vs basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist circumference (6-12 months follow up (post intervention))				
1 (Small 2014)	60	MD -0.97 (-2.96 to 1.02)	Very low	Evidence could not differentiate between arms
Change in waist to height ratio (6-12 months follow up (post intervention))				
1 (Small 2014)	60	MD -0.01 (-0.05 to 0.03)	Very low	Evidence could not differentiate between arms

6-11 year olds

Table 15: Exercise program + vs Basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist circumference (6-12 months follow up (post intervention))				

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
2 (Bryant 2011; Robertson 2016)	141	MD 1.2 (-2.48 to 4.88)	Low	Evidence could not differentiate between arms
Change in quality of life (PedsQL child; 6-12 months follow up (post intervention))				
1 (Robertson 2016)	87	MD 3.05 (-3.54 to 9.64)	Moderate	Evidence could not differentiate between arms
Change in quality of life (PedsQL adult; 6-12 months follow up (post intervention))				
1 (Robertson 2016)	87	MD -0.96 (-8.45 to 6.53)	Moderate	Evidence could not differentiate between arms
Change in quality of life (Asthma specific PAQLQ; 6-12 months follow up (post intervention))				
1 (Fedele 2018)	12	MD 0.41 (-0.86 to 1.68)	Very low	Evidence could not differentiate between arms
Change in waist to height ratio (≥12 months follow up (post intervention))				
1 (Anderson 2021)	121	MD 0 (-0.02 to 0.01)	Very low	Evidence could not differentiate between arms
Change in insulin sensitivity (HbA1c (mmol/mol); ≥12 months follow up (post intervention))				
1 (Anderson 2021)	121	MD 0.4 (-4.3 to 3.5)	Very low	Evidence could not differentiate between arms

Table 16: Behaviour change techniques vs Basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist circumference (≥12 months follow up (post intervention))				
2 (Gerards 2015; Golley 2007)	127	MD -0.24 (-0.57 to 0.1)	High	Evidence could not differentiate between arms
Change in quality of life (PedsQL parent; 6-12 months follow up (post intervention))				

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
2 (McCallum 2007; Wake 2009)	369	MD 2.96 (0.22 to 5.7)	High	**Favours behaviour change techniques**
Adverse events: eating disorders (KEDS child; ≥12 months follow up (post intervention))				
1 (Estabrooks 2009)	220	MD 0.54 (-6.73 to 7.81)	Moderate	Evidence could not differentiate between arms
Change in insulin sensitivity (fasting insulin (pmol/L); 6-12 months follow up (post intervention))				
1 (Spence 2022)	52	MD 1.3 (-8.62 to 11.22)	Very low	Evidence could not differentiate between arms
Change in insulin sensitivity (fasting insulin (pmol/L); ≥12 months follow up (post intervention))				
1 (Spence 2022)	52	MD 4.7 (-16.75 to 26.15)	Very low	Evidence could not differentiate between arms
Change in blood pressure: systolic (≥12 months follow up (post intervention))				
1 (Spence 2022)	52	MD 3 (-6.82 to 12.82)	Very low	Evidence could not differentiate between arms
Change in blood pressure: diastolic (≥12 months follow up (post intervention))				
1 (Spence 2022)	52	MD 2.3 (-10.12 to 14.72)	Very low	Evidence could not differentiate between arms

Table 17: Diet modification + Exercise program + Behaviour change techniques vs Basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in insulin sensitivity (HOMA-IR; 6-12 months follow up (post intervention))				
1 (Mirza 2013)	113	MD -0.41 (-1.17 to 0.35)	Low	Evidence could not differentiate between arms
Change in insulin sensitivity (HOMA-IR; ≥12 months follow up (post intervention))				

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
1 (Mirza 2013)	113	MD -0.5 (-1.25 to 0.25)	Low	Evidence could not differentiate between arms

Table 18: Diet modification + Exercise program + Behaviour change techniques vs Concomitant intervention

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist circumference (6-12 months follow up (post intervention))				
1 (HICKUPS trial: Okely 2010)	123	MD -1.3 (-3.57 to 0.97)	Moderate	Evidence could not differentiate between arms
Change in quality of life (KID KINDL-R parent; ≥12 months follow up (post intervention))				
1 (Warschburger 2016)	523	MD -0.44 (-2.58 to 1.7)	Moderate	Evidence could not differentiate between arms
Change in quality of life (GW-LQ-KJ parent; ≥12 months follow up (post intervention))				
1 (Warschburger 2016)	523	MD -0.33 (-3.47 to 2.81)	Moderate	Evidence could not differentiate between arms
Change in waist circumference (≥12 months follow up (post intervention))				
1 (HICKUPS trial: Collins 2011)	123	MD 0.58 (-1.97 to 3.13)	High	Evidence could not differentiate between arms
Change in waist to height ratio (≥12 months follow up (post intervention))				
1 (HICKUPS trial: Collins 2011)	123	MD 0 (-0.02 to 0.02)	High	Evidence could not differentiate between arms
Change in insulin sensitivity (insulin (mU/mL); ≥12 months follow up (post intervention))				
1 (HICKUPS trial: Collins 2011)	123	MD -2.58 (-8.91 to 3.75)	High	Evidence could not differentiate between arms
Change in blood pressure: systolic (≥12 months follow up (post intervention))				

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
1 (HICKUPS trial: Collins 2011)	123	MD 4.4 (-1.55 to 10.35)	Moderate	Evidence could not differentiate between arms
Change in blood pressure: diastolic (≥12 months follow up (post intervention))				
1 (HICKUPS trial: Collins 2011)	123	MD 2.6 (-1.04 to 6.24)	Moderate	Evidence could not differentiate between arms

12-18 year olds

Table 19: Diet modification vs basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Number of serious adverse events (≥12 months follow up (post intervention))				
1 (Ebbeling 2012)	209	OR 15.91 (0.9 to 282.33)	Very low	Evidence could not differentiate between arms

Table 20: Exercise program vs basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist to height ratio (6-12 months follow up (post intervention))				
1 (Toulabi 2012)	152	MD 0.01 (-0.01 to 0.03)	Very low	Evidence could not differentiate between arms

1 **Table 21: Behaviour change techniques + diet modification vs concomitant intervention**

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in insulin sensitivity (HOMA; 6-12 months follow up (post intervention))				
1 (Ebbeling 2003)	16	MD -3 (-5.94 to -0.06)	Very low	Evidence could not differentiate between arms

2

3 **Table 22: Behaviour change techniques + diet modification vs basic support**

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist to height ratio (6-12 months follow up (post intervention))				
1 (Vos 2011 and 2012)	67	MD -0.03 (-0.05 to -0.01)	Very low	Evidence could not differentiate between arms
Change in quality of life (PedsQL parent; 6-12 months follow up (post intervention))				
2 (Vos 2011 and 2012; Hofsteenge 2013 and 2014)	303	MD 4.42 (1.27 to 7.56)	Very low	**Favours Behaviour change techniques + diet modification**
Change in quality of life (DISABKIDS; 6-12 months follow up (post intervention))				
1 (DeBar 2012)	67	MD 3.8 (-1.85 to 9.45)	Very low	Evidence could not differentiate between arms
Change in insulin sensitivity (HOMA; 6-12 months follow up (post intervention))				
2 (Vos 2011 and 2012; Hofsteenge 2013 and 2014)	189	MD 0.52 (-1.24 to 2.29)	Very low	Evidence could not differentiate between arms
Change in blood pressure: systolic (mmHg; 6-12 months follow up (post intervention))				
2 (Vos 2011 and 2012; Hofsteenge 2013 and 2014)	189	MD -2.17 (-4.84 to 0.51)	Very low	Evidence could not differentiate between arms

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in blood pressure: diastolic (mmHg; 6-12 months follow up (post intervention))				
2 (Vos 2011 and 2012; Hofsteenge 2013 and 2014)	189	MD -0.74 (-3.34 to 1.86)	Very low	Evidence could not differentiate between arms
Change in waist circumference (6-12 months follow up (post intervention))				
1 (Hofsteenge 2013 and 2014)	122	MD -2.1 (-6.84 to 2.64)	Very low	Evidence could not differentiate between arms
Change in insulin sensitivity (HOMA; ≥12 months follow up (post intervention))				
1 (Savoye 2011)	174	MD -2.05 (-3.32 to -0.78)	Very low	**Favours Behaviour change techniques + diet modification**
Change in blood pressure: systolic (mmHg; ≥12 months follow up (post intervention))				
1 (Savoye 2011)	174	MD -0.6 (-4.14 to 2.94)	Very low	Evidence could not differentiate between arms
Change in blood pressure: diastolic (mmHg; ≥12 months follow up (post intervention))				
1 (Savoye 2011)	174	MD -2 (-5.21 to 1.21)	Very low	Evidence could not differentiate between arms

Table 23: Behaviour change techniques + exercise program vs concomitant intervention

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist circumference (6-12 months follow up (post intervention))				
1 (Resnicow 2005)	107	MD -0.7 (-5.77 to 4.37)	Very low	Evidence could not differentiate between arms

Table 24: Behaviour change techniques + exercise program vs basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in waist circumference (6-12 months follow up (post intervention))				
1 (Soltero 2018)	136	MD -2 (-6.66 to 2.66)	Very low	Evidence could not differentiate between arms
Change in quality of life (YQOL-W; 6-12 months follow up (post intervention))				
1 (Soltero 2018)	136	MD 2.2 (-2.38 to 6.78)	Very low	Evidence could not differentiate between arms

Table 25: Behaviour change techniques + diet modification + exercise program vs basic support

No. of studies	Sample size	Effect estimate (95% CI)	Quality	Interpretation of effect
Change in insulin sensitivity (HOMA; 6-12 months follow up (post intervention))				
1 (Grey 2004)	41	MD -0.5 (-2.61 to 1.61)	Very low	Evidence could not differentiate between arms

See appendix E for forest plots and appendix F for full GRADE tables

1 ### 1.1.8 Summary of the qualitative evidence

2 **Table 26: Summary of the qualitative evidence**

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
McMaster 2020: Acceptability of Hospital-Based Pediatric Weight Management Services among Patients and Families (2-18 years)				
Aspects of weight management service: Education Nutrition recommendations, information about diet, exercise, and the long-term effects of obesity; healthy lifestyle messages being delivered and reinforced.	None provided	Jones 2017 • Physical activity vs. Diet: Enjoyment from learning to eat healthily Burchett 2018 • Learning how to change	Woolford 2012; Owen 2009; Zenlea 2017	Low confidence From a review with moderate concerns about quality[1]
Aspects of weight management service: Strategies to facilitate behaviour change Interactive demonstrations and visual activities, home visits, weekly weight checks, tips/tools, peer support; regular clinic contact; time together as a family	None provided	Burchett 2018 • Learning how to change	Woolford 2012; Owen 2009; Skelton 2016	Very low confidence From a review with moderate concerns about quality[1]
Aspects of weight management service: Weight management service staff Supportive, nonjudgmental environment. Support from team members. Relationship between caregiver, health team and child.	None provided	Jones 2017 • Support: Professional support valued	Woolford 2012; Owen 2009; Zenlea 2017; Garcia 2017	Low confidence From a review with moderate concerns about quality[1]
Outcomes of attending weight management service: Health outcomes Weight outcome	None provided	Jones 2017 • Motivations: Weight loss as primary motivation	Stewart 2008	Very low confidence From a review with moderate concerns about quality[1]
Outcomes of attending weight management service: Psychological outcomes	None provided	Jones 2017	Skelton 2016; Stewart 2008	Very low confidence

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
Self-esteem (child more confident and happier); self confidence		• Barriers to attending a weight management programme and being healthy: Obesity treatment bringing about feelings of failure, guilt and shame • Motivations: Being a healthy weight as 'normal' and socially desirable		From a review with moderate concerns about quality[1]
Reasons for attrition: Practical barriers Physical barriers, organizational barriers; logistical issues; scheduling, transportation; difficulty adjusting schedules of consultations.	None provided	-	Kitscha 2009: Sallinen Gaffka 2013; Skelton 2016; Nogueira 2013	Low confidence From a review with moderate concerns about quality[1]
Reasons for attrition: Content and results of program Educational content or delivery; unsuccessful treatment, new treatment	None provided	Jones 2017 • Motivations: Weight loss as primary motivation	Kitscha 2009;; Nogueira 2013	Very low confidence From a review with moderate concerns about quality[1]
Reasons for attrition: Patient/family motivation Family readiness to change/motivation; barriers to implementation of recommendations	None provided	Jones 2017 • Support: Importance of family support • Motivations: Adolescents recognising personal responsibility and personal motivation for weight loss Burchett 2018 • Getting all the family 'on-board'	Kitscha 2009;	Very low confidence From a review with moderate concerns about quality[1]

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
Reasons for attrition: Mismatched expectations of treatment/treatment outcomes Mismatched expectations; expecting greater weight loss	None provided	Jones 2017 • Motivations: Weight loss as primary motivation	Skelton 2016;	Very low confidence From a review with moderate concerns about quality[1]
Reasons for attrition: Families choosing not to return to treatment No follow-up visit; no discussion with treatment team; refusal by children; unforeseen circumstances	None provided	-	Kitscha 2009; Nogueira 2013; Sallinen Gaffka 2013	Low confidence From a review with moderate concerns about quality[1]
Barriers to behaviour change: Perceived inadequate support from weight management service Lack of provider support; need for ongoing support; difficulty identifying lifestyle changes, parental anxieties	None provided	Jones 2017 • Maintenance: Transferring skills learnt into a home environment and routine • Maintenance: Longer term support	Owen 2009; Zenlea 2017; Stewart 2008	Low confidence From a review with moderate concerns about quality[1]
Barriers to behaviour change: Perceived inadequate support from wider family Lack of support from family; interfering extended families; family congruence, continuous negotiation	None provided	Jones 2017 • Support: Importance of family support Burchett 2018 • Getting all the family 'on-board'	Owen 2009; Stewart 2008; Fjone 2011	Low confidence From a review with moderate concerns about quality[1]
Barriers to behaviour change: Under-recognition/underestimation of problem Parents were either aware of a weight problem or unaware of weight problem	None provided	-	Stewart 2008	Very low confidence From a review with moderate concerns about quality[1]
Burden and stigma: Shared burden	None provided	Jones 2017	Fjone 2011	Very low confidence

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
Shared family burden of shame, guilt, and failure to stick to a diet or exercise plan		• Barriers to attending a weight management programme and being healthy: Obesity treatment bringing about feelings of failure, guilt and shame		From a review with moderate concerns about quality[1]
Burden and stigma: Guilt and blame Parents felt fear, anger, guilt, confusion around their child's weight problem; feeling blamed for causing their children's obesity.	None provided	Jones 2017 • Barriers to attending a weight management programme and being healthy: Obesity treatment bringing about feelings of failure, guilt and shame	Zenlea 2017; Stewart 2008	Very low confidence From a review with moderate concerns about quality[1]
Service content: Program content Emphasis on physical activity, disease-specific information; coaching techniques for parents; child psychology; nutrition education, exercise and behaviour education; medical examination; progress tracking.	None provided	Jones 2017 • Intervention content: Tailored intervention • Intervention content: Active engagement	Zenlea 2017; Sallinen Gaffka 2013; Tremblay 2016	Moderate confidence From a review with moderate concerns about quality[1]
Service content: Delivery of weight management intervention Interactive elements, peer contact; family-centred approach, group appointments, a child-friendly environment; manageable goals	None provided	Jones 2017 • Intervention content: Active engagement	Tremblay 2016;	Very low confidence From a review with moderate concerns about quality[1]
Service content: Individualized treatment Adolescent-specific program; individualized care; tailored treatments; diverse menu of treatment recommendations	None provided	Jones 2017 • Intervention content: Tailored intervention	Tremblay 2016; Zenlea 2017;	Low confidence From a review with moderate concerns about quality[1]

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
Communication and therapeutic relationship Enhance family participation; motivate the child to encourage therapeutic alliance	None provided	Jones 2017 • Support: Importance of family support Burchett 2018 • Getting all the family 'on-board'	Sallinen Gaffka 2013	Very low confidence From a review with moderate concerns about quality[1]
Organizational: Clinic hours Expanded clinic hours; scheduling alternative times for visits; transportation and financial needs	None provided	-	Fjone 2011;	Very low confidence From a review with moderate concerns about quality[1]
Organizational: Clinic accessibility Additional clinic locations in the community, transportation and parking; access to care	None provided	-	Fjone 2011; Tremblay 2016	Very low confidence From a review with moderate concerns about quality[1]
Jones 2019: Viewpoints of adolescents with overweight and obesity attending lifestyle obesity treatment interventions (12-18 years)				
Intervention content: Tailored intervention Tailoring it to the individual, including different ethnicities, cultures, and to the specific age group. There is a lack of services aimed at adolescents.	"7 o'clock in the morning would be better for me because it's just before I go to school. It's when you check your phone." "No, no, no, no, no. If you text messaged me before school I would absolutely call you and go off at you because you ain't texting me before school."	McMaster 2020 • Service content: Program content • Service content: Individualized treatment	Reece 2015; Morinder 2011; Holt 2005; Woolford 2012b; Banks 2014; Jogova(2013; Woolford 2012a; Smith 2014b; Staiano 2012; Woolford 2010	High confidence From a review with minor concerns about quality[2]
Intervention content: Active engagement	"She [the exercise physiologist] was fun about	McMaster 2020 • Service content:	Watson 2016; Woolford 2012b;	Moderate confidence

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
Enjoyment and fun are of large importance to adolescents when attending an obesity intervention. This sense of fun appears to be driven by hands on activities and is important for reducing anxiety about attending an intervention.	it. She made sure we got a really good work out, but yet she would try to incorporate, you know, little fun activities, and she made it more than just going in to work out and sweat. She made it into more fun so that we would be interested in doing it."	Program content • Service content: Delivery of weight management intervention Burchett 2018 • Learning how to change	Howie 2016	From a review with minor concerns about quality[2]
Support: Professional support valued Adolescents valued personal attention from professionals, more so than support from peers and family. They valued support with self-esteem and well-being, especially when the professional specialises in childhood obesity. Adolescents wanted to work more closely with regular professionals.	"I felt like . . . at last someone is paying attention." "you can talk to someone about your situation . . . at the beginning it was like this ''I am the only one . . . but these people [clinic staff] meet people like you . . . many every day that are at least as ... um . . . overweight as you are…"	McMaster 2020: • Aspects of weight management service: Weight management service staff	Reece 2015; Peeters 2012; Rudolf 2006; Hester 2009; Twiddy 2011; Morinder 2011; Holt 2005; Woolford 2012b; Alm 2008; Owen 2009; Li 2016; Nguyen 2014; Daley 2008; Riiser 2013; Hammar 1971	High confidence From a review with minor concerns about quality[2]
Support: Importance of family support Family support gave adolescents continued motivation and encouragement to continue with their weight loss attempts, together. The absence of understanding and knowledge from family members can lead to frustration, despair and can create a sense of self-blaming.	"Losing weight is hard, but my mom and coach believe in me. They are great and supportive. I need the support to keep me going." "I took a picture of my mom because she always reminds me to exercise and says, 'Oh make sure you're eating healthy.' My mom's	McMaster 2020 • Reasons for attrition: Patient/family motivation • Barriers to behaviour change: Perceived inadequate support from wider family • Communication and therapeutic relationship Burchett 2018	Reece 2015; Peeters 2012; Hester 2009; Watson 2016; Morinder 2011; Smith 2014a; Melnyk 2007; Woolford 2012b; Alm 2008; Howie 2016; Engström 2016;	High confidence From a review with minor concerns about quality[2]

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
	the only person who really helps me."	• Getting all the family 'on-board'	Campbell-Voytal 2018; Li 2016; Jogova 2013; Woolford 2012a	
Support: Peer support valued Peer support gave adolescents a sense of belonging by allowing them to talk to adolescents in a similar position to them, sharing their struggles and issues, make friends and improve their social skills. They enjoyed exercising with others.	"I like being around people who know exactly how you feel. If you're at home you can't really talk to anyone about your weight. I don't know why but when you come here you feel like you can talk to people. It's a lot easier to talk to people, to be around people. Everyone was in the same kind of situation, everyone knew what you were going through."	Burchett 2018 • Social support	Reece 2015; Peeters 2012; Hester 2009; Watson 2016; Morinder 2011; Smith 2014a; Holt 2005; Melnyk 2007; Woolford 2012b; Alm 2008; Engstrom 2016; Li 2016; Jogova 2013; Woolford 2012a; Smith 2014b; Owen 2009; Staiano 2012; Hammar 1971	High confidence From a review with minor concerns about quality[2]
Barriers to attending a weight management programme and being healthy: Prior fears of attending interventions Adolescents reported prior fears of attending an intervention, related to the intensity of weight loss activities, type of food on offer or incorrect preconceptions.	"I heard about an American camp where they make you do it [i.e. exercise and control diet] and that if you don't want to do it they get angry and stuff, I was worried about that."	-	Rudolf 2006; Hester 2009; Smith 2014a; Holt 2005; Woolford 2012b; Engstrom 2016; Daley 2008	High confidence From a review with minor concerns about quality[2]
Barriers to attending a weight management programme and being healthy: Obesity treatment bringing about feelings of failure, guilt and shame	"Some told their friends where they were going, others created alternative explanations such as having to go to the dentist.	McMaster 2020 • Outcomes of attending weight management service: Psychological outcomes	Morinder 2011; Alm 2008; Banks 2014; Hester 2009; Smith 2014a;	High confidence From a review with minor concerns about quality[2]

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
Adolescents feared being told off by a health professional for not losing weight and feeling like a failure. The focus on weight could lead to lower self-esteem. Longer-term support that considers the mental health of adolescents is needed.	However, 'cloaking' their attendance was harder for older adolescent children." ". . . that they [clinic staff] might scold you . . . you know they will not . . . but it feels like that."	• Burden and stigma: Shared burden • Burden and stigma: Guilt and blame	Smith 2014b; Peeters 2012	
Physical activity vs. Diet: Enjoyment from learning to eat healthily Adolescents highlighted the benefits of understanding the nutritional content of different foods and drinks, and what foods should be eaten in moderation. They preferred activities that were more practical and hands-on.	*"I remember one particular one was cool where [the dietician] brought in different foods, different foods that people commonly eat, and then showed how much, like she had a stack of rubbery stuff and it represented the fat that was in like the cheeseburger or something. So I thought that was interesting because it was in your face, showing you what's in the foods."*	McMaster 2020 • Aspects of weight management service: Education Burchett 2018 • Learning how to change	Hester 2009; Melnyk 2007; Howie 2016; Woolford 2012b; Morinder 2011;	Low confidence From a review with minor concerns about quality[2]
Physical activity vs. Diet: Enjoyment of sports and physical activity Adolescents enjoyed gym facilities, sports and other activities. They commented on how physical activity made them feel a sense of accomplishment.	"I really like the gym. I like the way that you can see the improvements on your body and you can feel them as well."	Burchett 2018 • Learning how to change	Peeters 2012; Hester 2009; Holt 2005; Woolford 2012b; Hemetek 2015; Alm 2008; Owen 2009; Howie 2016; Engstrom 2016;	Moderate confidence From a review with minor concerns about quality[2]

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
			Nguyen 2014; Woolford 2012a; Daley 2008	
Motivations: Weight loss as primary motivation Adolescents commented on weight loss being their primary goal for taking part in an intervention. Some wanted to prevent health sequelae due to having family members with a health condition.	"To lose weight. That's the main goal and it was the reason I went – to lose weight." "My dad has diabetes. I don't want to have diabetes like him."	McMaster 2020 • Outcomes of attending weight management service: Health outcomes • Reasons for attrition: Content and results of program • Reasons for attrition: Mismatched expectations of treatment/treatment outcomes	Peeters 2012; Hester 2009; Twiddy 2011; Morinder 2011; Holt 2005; Alm 2008; Nguyen 2014; Daley 2008; Hammar 1971; Woolford 2012b; Woolford 2012a	Moderate confidence From a review with minor concerns about quality[2]
Motivations: Being a healthy weight as 'normal' and socially desirable Adolescents viewed a healthy weight as 'normal' and important for being accepted socially. Some felt that losing weight would reduce bullying.	"I just don't want to get bullied anymore, then I can lead a normal life." "Well my own wish was actually to be normal, and not to be excluded by others…"	McMaster 2020 • Outcomes of attending weight management service: Psychological outcomes	Reece 2015; Peeters 2012; Hester 2009; Twiddy 2011; Holt 2005; Hemetek 2015; Alm 2008; Daley 2008	Moderate confidence From a review with minor concerns about quality[2]
Motivations: Adolescents recognising personal responsibility and personal motivation for weight loss Adolescents liked gaining evidence-based knowledge, bringing the responsibility back to the individual. They spoke of a desire to lose weight to feel proud, by taking their own responsibility in following a healthy lifestyle.	"They appeared to be motivated by a desire to feel pride in their ability to lose weight, to please the health care professionals and in some cases, to prove that they could succeed."	McMaster 2020 • Reasons for attrition: Patient/family motivation	Reece 2015; Peeters 2012; Twiddy 2011; Morinder 2011; Hemetek 2015; Alm 2008; Owen 2009; Woolford 2012a;	Moderate confidence From a review with minor concerns about quality[2]

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
			Hammar 1971; Smith 2014b; Daley 2008;	
Maintenance: Transferring skills learnt into a home environment and routine With many interventions taking place in a clinical or artificial setting and with professional support being more regular, the transition from an intense intervention back to a normal routine can be difficult.	“I feel there’s lots of advice on how to do it . . . I mean what to do . . . many manuals and papers and stuff . . . but I don’t believe they have suggestions on how I can make it outside the hospital.”	McMaster 2020 • Barriers to behaviour change: Perceived inadequate support from weight management service	Reece 2015; Hester 2009; Morinder 2011; Holt 2005; Melnyk 2007; Woolford 2012b; Hemetek 2015; Alm 2008; Li 2016;	Low confidence From a review with minor concerns about quality[2]
Maintenance: Longer term support Adolescents suggested that they would have benefited from more sessions as part of an intervention and post intervention. They struggled with motivation after an intervention had finished and relapsing back into old habits.	“Yeah, but then because it [weight management programme] stops after a bit doesn’t it, then I just like, fell back into what I was doing before, because it were only like, I can’t remember how long it were but it were short and I just fell back into what I were doing before.”	McMaster 2020 • Barriers to behaviour change: Perceived inadequate support from weight management service	Reece 2015; Peeters 2012; Hester 2009; Morinder 2011; Melnyk 2007; Woolford 2012b; Hemetek 2015; Alm 2008; Howie 2016; Li 2016; Nguyen 2014; Daley 2008	Moderate confidence From a review with minor concerns about quality[2]
Technology: Adolescents enjoy using technology and do so with ease Adolescents enjoyed using technologies, such as exergames, internet and taking photographs.	“Most participants found the technical aspects of taking pictures and sending them as a text message from their phone to the research assistant very easy. Only one participant found it difficult to text the pictures, but that individual still gave a high rating to the idea of thinking about the	-	Jogova 2013; Nguyen 2014; Woolford 2012a; Woolford 2010; Smith 2014b; Riiser 2013; Staiano 2012	Very low confidence From a review with minor concerns about quality[2]

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
	questions and taking the pictures."			
Burchett 2018: Lifestyle weight management programmes for children: A systematic review using Qualitative Comparative Analysis to identify critical pathways to effectiveness				
Learning how to change Practical experiences, as opposed to didactic information giving, were valued: Practical physical activity sessions; interactive healthy eating sessions; health behaviour change strategies	"It wasn't just like 'you need to do more exercise and you need to eat better' – it actually taught us like how to" Child "The challenge charts you gave us, he loved it, loved it. Yeah he absolutely thought that was brilliant, and it was competition cause his brother joined in" Parent	McMaster 2020 • Aspects of weight management service: Education • Aspects of weight management service: Strategies to facilitate behaviour change Jones 2017 • Intervention content: Active engagement • Physical activity vs. Diet: Enjoyment from learning to eat healthily • Physical activity vs. Diet: Enjoyment of sports and physical activity	Watson 2012; Pittson 2013; Robertson 2009	Low confidence From a review with serious concerns about quality[3]
Getting all the family 'on-board' Engaging the wider family was felt to enable shared understanding across family members, responsibility for making changes and creation of a healthy home environment.	"They've got to have the support of the others in the family otherwise it's almost impossible" Health professional "How can I tell her "this is what you need to do" if she's not seeing me do it" Parent	McMaster 2020 • Reasons for attrition: Patient/family motivation • Barriers to behaviour change: Perceived inadequate support from wider family • Communication and therapeutic relationship Jones 2017	Staniford 2011; Lucas 2014; Watson 2012; Stewart 2008	Low confidence From a review with serious concerns about quality[3]

Summary of review finding	Supporting quotes	Overlap with other reviews	Studies	Confidence
		• Support: Importance of family support		
Social support A safe space with similar others in which to gain confidence and skills, which provided a positive contrast to experiences of prejudice and bullying.	“finding out you weren't alone in this […] having an open forum to say my kid does that too, cause you feel so guilty” Parent “I found them fun because I was surrounded by different people who were in the situation that I was in” Child	Jones 2017 • Support: Peer support valued	Pittson 2013; Staniford 2011; Lucas 2014; Watson 2012	Low confidence From a review with serious concerns about quality[3]

[1] McMaster 2020 was assessed as having moderate concerns (on a scale of minor, moderate, or serious) using the SBU 'tool to assess methodological limitations of qualitative evidence synthesis'. (ENTREQ)

[2] Jones 2019 was assessed as having minor concerns (on a scale of minor, moderate, or serious) using the SBU 'tool to assess methodological limitations of qualitative evidence synthesis'. (ENTREQ)

[3] Burchett 2018 was assessed as having serious concerns (on a scale of minor, moderate, or serious) using the SBU 'tool to assess methodological limitations of qualitative evidence synthesis'. (ENTREQ)

See appendix F for full GRADE-CERQual tables.

1.1.9 Economic evidence

A single search was performed to identify published economic evaluations of relevance to this review question in this guideline update (see Appendix B). The search retrieved 1,700 results and after removing duplicates, 1,036 were screened. 1,023 studies were excluded after the title and abstract screening, and an additional 11 studies were excluded following the full-text review.

1.1.9.1 Included studies

Table 27 provides summary details of the included studies. See Appendix I for a full evidence table and assessment of applicability and limitations.

1.1.9.2 Excluded studies

See Appendix K for excluded studies and reasons for exclusion.

1.1.10 Summary of included economic evidence

Table 27: Summary of economic evidence

Applicability & limitations	Other comments	Intervention	Absolute		Incremental			Uncertainty
			Cost (£)	QALYs	Cost (£)	QALYs	ICER	
Panca. et al (2018)								
Directly applicable (Appendix I; table 4) with minor limitations (Appendix I ; table 5))	**Approach to analysis:** A within-trial cost-utility analysis based on a randomised controlled trial of the HELP (Healthy Eating Lifestyle Programme) intervention, a community-delivered evidence-based multicomponent intervention focusing on enhancing motivation to change, developing self-efficacy and self-esteem for	Enhanced standard care	-	-	-	-		**Deterministic:** Three sensitivity analyses were presented – no adjustment, complete case analysis, and complete case analysis with no adjustment. In the base case analysis, data included values imputed using multiple imputation with SEs corrected to account for uncertainty in the imputed values. The QALYs gained were adjusted for age, gender and baseline utility values. The incremental costs were adjusted for age, gender costs in the 6-month period prior to baseline. The no adjustment analysis was the same as the base case analysis except the QALYs gained and incremental costs were unadjusted. The complete case analysis was the same as the base case except there was not multiple imputation of missing values. The complete case analysis with no adjustment was the same as the base case analysis except the QALYs gained and the incremental costs were
		HELP - Healthy Eating Lifestyle Programme			£1003	0.008	£120,630	

	individuals with obesity. **Perspective:** UK NHS perspective **Time horizon:** 12 months **Costs:** Cost of the life style intervention and the cost of follow-up was calculated for every participant. Cost of follow-up was calculated based on resource use data collected retrospectively in the trial via questionnaires. **Effectiveness:** Effects were measured in QALYs using the EQ-5D-3L **Price year and discount rate:** All prices were		unadjusted and there was no multiple imputation of missing values. The incremental costs and QALYs gained for HELP versus enhanced standard care remained not significantly different from zero when re-running the base case analysis without adjustment and using complete cases. **Probabilistic:** Bootstrapping was conducted to generate a cost-effectiveness acceptability curve. For each of the 20 imputed datasets, 1000 bootstrap replications were run. The results were combined using published equations to calculate standard errors around the mean values – accounting for uncertainty in imputed values, the skewed nature of the cost data and utility values and sampling variation. The cost-effectiveness acceptability curve shows that the probability of HELP being cost-effective is 0.002 at a threshold of £20,000 per QALY and 0.046 at a threshold of £30,000 per QALY.

	provided in 2013/14 and costs/QALYs. No discounting was required due to the 1 year time-horizon.		

Robertson et al. (2018).								
Directly applicable (Appendix I; table 4) with minor limitations (Appendix I; table 5)	**Approach to analysis:** a within trial economic evaluation of the Families for Health V2 (FFH) programme. **Perspective:** a UK NHS and personal social services perspective Time horizon: 12 months post randomisation **Costs:** A programme-specific estimate of cost per session per child was calculated based on their attendance. **Effectiveness:** BMI-z scores and QALYs. QALY profiles were estimated for each child using health utilities generated from EQ-5D-Y responses from children and parents. **Price year and discount rate:** All prices were provided in 2013/14. No discounting was required due to the 1 year time-horizon.	**Health outcomes: BMI z-score**						**Deterministic:** Four scenarios were investigated to identify the impact on the main cost-effectiveness results. For scenario 1, analysing programme completers separately, produced a mean ICER of £27,790 which is closer to the NICE threshold of £20,000 and the probability of cost-effectiveness at £20,000 was 43% whereas for non-completers usual care is dominant. For scenario 2, using multiple imputation to address missing data resulted in an ICER of £9,119 and a probability of cost-effectiveness at £20,000 was 67%. Scenario 3 where parent-reported values for their children's health-related quality of life were used, the probability of cost-effectiveness was 23%. Scenario 4 incorporated parents own health-related quality of life when generating QALYs which reduced the probability of cost-effectiveness to 2%. **Probabilistic:** The cost-effectiveness plane shows all estimates are in the north-west (greater costs and fewer health benefits) or north-east quadrant (greater costs
		Usual Care	£548 (£73)	-	-	-	-	
		FFH	£998 (£72)	-	£450 (bootstrap 95% CI £249, £650; p<0.001)	0.114 diff in BMI z-score	£3935 per unit change in BMI z score	
		Health outcomes: QALYs						
		Usual Care	£507	-				
		FFH	£1,019	-	£512	0.0009 QALYs	£552,175 per QALY	

								and more health benefits). The cost-effectiveness acceptability curve showed the probability of FFH being cost effective at £20,000 is 28% and regardless of the threshold value, the probability of cost-effectiveness does not exceed 40%.

1.1.11 Economic model

No economic modelling was conducted for this topic.

1.1.12 Unit costs

Not applicable.

1.1.13 The committee's discussion and interpretation of the evidence

The outcomes that matter most

Quantitative: Primary outcomes

During the development of the protocol, change in BMI, BMI z-score and weight were identified as critical outcomes. Out of these outcomes, BMI z-score was agreed upon as the crucial outcome for measuring the success of weight management in children and young people. This measure is standardised for age and gender, so is the most commonly used and most appropriate measure for children and young people. It allows for direct comparison of changes in adiposity across populations of children and young people at different ages while their height is still changing.

It was not possible to meaningfully combine change in BMI and change in weight measures with BMI z-score for the main network meta-analysis. The committee agreed that any further pair-wise analysis on change in BMI or change in weight would be unnecessary and would not add any useful insight beyond the main BMI z-score analysis. For this reason, these outcomes were not reported in the review.

In addition to the main BMIz analysis, measures central adiposity were also considered valuable, however these are less frequently reported. For this reason, waist circumference and waist to height ratio, where possible, were examined as additional primary outcomes.

The other secondary outcomes the committee were interested in were quality of life, insulin sensitivity liver function, blood pressure, eating disorders and serious adverse events. However, these were generally not well reported, the committee found it difficult to use these outcomes to consider the wider effects of weight management beyond changes to BMI z-score and quality of life.

Quantitative: Timepoints and age groups

The committee were interested in outcomes that reported data at least 6 months post intervention to examine whether changes in BMI z-score made during weight management interventions were sustainable. Follow up was stratified into short follow up (between 6 months and 12 months post intervention) and longer follow up (longest time point ≥12 months post intervention) to compare outcomes across interventions with different timelines. The short and long follow up results were consistent with each other so the committee did not preference one over the other.

It was also important for the committee to consider data for different age groups separately, as the provision of and content of weight management interventions are known to differ for the distinct needs of different age groups. Data were stratified into 2-5 years (pre-school), 6-11 years (primary school) and 12-18 years (secondary school).The largest pool of data available was for 6-11 years, so the committee chose to focus on most closely on this age group.

Qualitative outcomes

During the development of the review protocol, the committee were interested in exploring individual perspectives, values, beliefs, experiences or attitudes that were considered to influence the acceptability of weight management programmes for children and young people. The qualitative findings emphasised the value participants placed on psychological and social outcomes of weight management, as well as the physical outcomes. The quantitative evidence considered quality of life measures and eating disorders, but not the full range of psychological and social impacts such as stigma, bullying and self-esteem.

Maintenance of weight management for a period of 6 months or more was not well explored in the qualitative evidence, which focused on the experiences during participation in weight management interventions. The value of different combinations of behaviour change, diet modification and physical activity components was also not explored in depth. The committee did not base any recommendations directly on the qualitative evidence, but used the ideas it highlighted as context for the recommendations and how they would be experienced by children and young people and their parents and carers.

The quality of the evidence

Quantitative evidence

For the quantitative review, an update was conducted of existing Cochrane reviews which explored the effectiveness of diet, physical activity and behavioural interventions for the treatment of overweight or obesity in children aged up to 6 years (Colquitt 2016), 6 to 11 years (Mead 2017), 12 to 17 years (Al-Khudairy 2017) and parent-only interventions for childhood overweight or obesity in children aged 5 to 11 years (Loveman 2015). These reviews were directly applicable and of low risk of bias. The key difference between the Cochrane reviews and the approach utilised in the NICE evidence review was that follow-up was limited to at least 6 months post-intervention. This meant that a number of studies that were included in the Cochrane reviews were subsequently excluded due to insufficient follow up.

The quantitative findings were assessed using GRADE. The network meta analyses of BMI z-scores were all rated either low quality (2-5 year olds at ≥12 months follow up and 6-11 year olds at 6-12 months follow up) or very low quality (2-5 year olds and 12-18 year olds at 6-12 months follow up and 6-12 year olds at ≥12 months follow up). Downgrading was mostly due to issues with risk of bias and imprecision.

Of the 45 pairwise comparisons conducted for all other outcomes, 5 were high quality (all from 6-11 age group), 8 were moderate quality (all from 6-11 age group), 2 were low quality (all from 6-11 age group), and 30 were very low quality (5 from 2-5 age group, 8 from 6-11 age group, and 17 from 12-18 age group).

Notable factors that limited to the quality of the evidence were the age and location of the included studies. There were no limits on the country (including non-OECD countries) or date (including pre-2000 studies) which meant that some of the evidence lacked generalisability to a modern UK context. For example, Kelishadi 2009, which was a study that was conducted in Iran and included a number of critical outcomes. This study compared basic support with energy-restricted diet and a dairy-rich diet. The study demonstrated a significant difference between the diet interventions and basic support. The committee discussed this result and the context of the study and concluded that it was not applicable to a UK setting as the diet intervention was a dairy rich diet intended for an Iranian population who consumed very little diary. Based on this discussion, the dairy-rich study arm was not included in the network meta-analysis.

Furthermore, the analysis was also limited in which variables could be analysed. The original analysis plan involved conducting a network meta regression, however there was insufficient suitable data to conduct this analysis. Therefore, no examination of the covariates (intervention target, setting, delivery and contact) was possible.

Qualitative evidence

The evidence was collected from existing thematic syntheses of qualitative data. This added a layer of abstraction to the findings and made it harder to assess quality. A modified GRADE CerQUAL was applied to the themes taken from the reviews, which criteria adapted to use the available information. As a result, most themes were rated as very low quality evidence.

As the evidence was presented via the interpretation of the review authors, the quality of the findings also needed to be considered in relation to the quality of the reviews themselves. The quality of the reviews was assessed using the SBU 'tool to assess methodological limitations of qualitative evidence synthesis' (ENTREQ). Jones 2017 was rated high quality, McMaster 2020 moderate quality, and Burchett 2018 low quality.

The qualitative evidence did not differentiate between different approaches to weight management or look at the combinations of components, therefore it could not explain differences across the quantitative studies.

Integration of qualitative and quantitative

The quantitative findings appear contradictory in that the majority of views expressed in the qualitative evidence were supportive of the weight management interventions and indicated that participants often felt well supported and happy with the programs they attended. This is at odds with the finding that they are very rarely effective and so participants do not obtain the outcomes they are working for. This may be explained by the different time points used for data collection. The quantitative evidence looked only at follow up after 6 months or more, whereas the qualitative evidence may have been collected during the interventions or at a shorter follow up. Participants views may have been different had they been interviewed at a longer follow up when they had experienced the poor long-term outcomes.

The qualitative evidence suggests a variety of barriers to the acceptability of weight management interventions; however these barriers would impact willingness to participate and adhere to the intervention programme. They are not sufficient to explain the poor long term effectiveness of weight management for individuals who engaged with or completed the programs. Evidence from Jones 2017 offers the possibility that a lack of ongoing support once the program has finished contributes to poor long term outcomes. The other reviews did not highlight this theme though.

Benefits and harms

Drivers of overweight and obesity

Overweight and obesity are complex conditions. While the evidence primarily focused on components of weight management interventions and their impact on BMI z-score, the committee noted that this update can also allow some of the narratives around overweight and obesity to be updated. The committee felt it was important to acknowledge that overweight and obesity is a chronic relapsing condition that is affected and driven by a multitude of circumstances and factors. Taking this into consideration, they felt that while weight management programmes may be of some benefit, it was more important to address the drivers of obesity first, which may allow individuals and healthcare professionals to understand the cause of overweight and obesity, and subsequently plan the treatment accordingly which may allow weight loss to be sustained into adulthood.

Based on their experience and expertise, they drafted a non-exhaustive list of examples of the wider determinants and the context of overweight and obesity and that should be taken into consideration. Many of these reflect health inequalities that may limit a child or young person's ability to address overweight or obesity and are outside of the child or young person and their parent or carer's control.

This recommendation was established as an overarching general principle of care and then referred to in multiple other recommendations to emphasise that weight cannot be addressed in isolation and overweight or obesity is highly likely to recur throughout the child or young person's life. The committee agreed that this holistic lifelong approach is critical to providing interventions for overweight or obesity.

Other services and support

Following on from the discussions about the wider determinants of overweight and obesity, the committee further noted while weight management programmes may be of benefit, these don't serve as the right place to address the drivers of obesity. They noted that there are other services in the pathway that should be utilised and that intervention should take a multidisciplinary approach. Based on this discussion, the committee recommended that it may be more appropriate to refer children and young people to other services such as social care, physiotherapy, medical assessments for any comorbidity, and early help services (for example, youth work or parenting) before referring on the behavioural overweight and obesity management interventions. They also recommended that local mental health pathways should be used to access support if there are concerns about the child or young person's mental health.

The value and purpose of weight management interventions

The 2013 guidance on weight management: lifestyle services for overweight and obese children and young people (PH47) recommended that all lifestyle weight management programmes for overweight and obese children and young people should be multi-component and should focus on diet and healthy eating habits, physical activity, reducing the amount of time spent being sedentary and strategies for changing the behaviour of the child or young person and all close family members. The guideline also went on to detail the core components of the weight management programme.

The data from the network meta-analyses (NMAs) (see Appendix M), showed that in children aged under 6 years, we could not differentiate between the effectiveness of different components when compared to each other or with basic support. However, ≥ 12 months post intervention follow up, the analysis did demonstrate that behaviour change techniques (BCT) + diet and BCT + diet+ exercise, resulted in a reduction in BMI z-score when compared to diet+ exercise. In children aged 6- 11 years, evidence showed that 6-12 months post-intervention, BCT+ diet demonstrated a reduction in BMI z-score when compared to basic support and BCT alone. At ≥ 12 months post intervention follow up, BCT+ diet demonstrated a reduction in BMI z-score when compared to BCT+ exercise. Further analysis in this age group in the form of a component NMA, also demonstrated that the diet component resulted in the reduction in BMI z-score at ≥ 12 months post intervention follow up. In children and young people aged 12- 18 years, we could not differentiate between different components when compared to each other or with basic support, at 6- 12 months post-intervention.

The qualitative evidence indicated that participants in overweight and obesity management interventions did find them valuable. There was an emphasis on psychological and social outcomes of weight management in terms of improved self-esteem, confidence, and forming a group of others with shared experiences. This prompted a discussion about the purpose and benefits of referring children to weight management interventions.

While some evidence was identified that demonstrated some components reduce BMI z-score in the long term, the committee noted that the overall change in most cases was small and showed very little meaningful impact of weight management interventions on BMI z-score after 6 months or longer follow up post intervention. Similar results were also seen in the Cochrane reviews. For example, in Mead 2017, the subgroup analysis split up by post-intervention follow -up found that in children aged 6-11 years, studies which did not include a post-intervention follow up demonstrated a reduction in BMI z-score [mean difference: -0.09 (CI:-0.15, -0.04)]. The analysis further showed that at post-intervention follow up of less than 6 months, between 6 -12 months and greater than 12 months, there was no difference in change in BMI z-score. While the overall, effect estimate demonstrated a small reduction in BMI z-score [mean difference: -0.06 (CI:-0.10, -0.02)], the subgroup analysis suggested that the overall reduction in BMI z-score could be attributed to the studies that included no post intervention follow-up, which were not included in our analyses.

As improvement to BMI z-score is the primary purpose of weight management interventions, this lack of a sustained benefit undermined the original reason for recommending these interventions. Furthermore, when considered in the context of an individual’s weight trajectory, a small change in BMI z-score over a long follow up may not be clinically meaningful or personally valuable to the individual if it is reflective of weight regain after a larger change during the intervention period. The committee discussed whether this would mean that the potential harms would outweigh the benefits, both in terms of the resource costs of commissioning interventions and the personal impact on children and young people and their parents and carers.

They considered the possibility of no longer recommending weight management interventions for children and young people but decided that without a direct alternative to recommend, this would be too radical a change to services which would cause more harm overall. The committee also concluded that weight management could be recommended on the merits of the wider benefits, as long as it is accompanied by other forms of support, alongside other health and social care services that can help address the drivers of obesity. They felt strongly that it should be made clear that there are unlikely to be any long-term improvements to BMI and weight management should not be recommended with BMI as a focus. They drafted a recommendation based on this in order to retain the benefits of these interventions and minimise the potential harm of false expectations.

Core components of behavioural overweight and obesity management interventions

Based on the evidence from the NMAs, the committee recommended that weight management interventions should contain a diet and a behaviour change component, as there was some evidence for their effectiveness. They added that a physical activity component could also be considered, but there was no evidence of it being an effective component of overweight and obesity management interventions. They also adapted existing recommendations from PH47 that emphasised offering maintenance advice after completion of overweight and obesity management interventions and offering interventions that are multi-component and tailored to meet individual needs. They used the behaviour change components identified from the included studies (motivational techniques; setting goals and planning how to achieve them; giving feedback or rewards for progress; encouraging self-monitoring and building on success; teaching people strategies to implement changes; making it easier to make changes) as the basis for expanding on what multicomponent interventions could include, within the context of wider NICE guidelines on behaviour change.

Developing a tailored plan to meet individual needs

The committee agreed that a tailored plan was important, so retained the majority of recommendations pertaining to this from PH47. The qualitative evidence supported the idea of tailoring and individual patient centred care, appropriate to the child or young person's age, sex, ethnicity, cultural background, economic and family circumstances, any special needs and degree of overweight and obesity. The committee viewed this as the best way to meet families' needs, and the concerns highlighted in this evidence also reinforced the need to accommodate any issues around mental health and wellbeing. The committee also agreed that involving the wider family in interventions, using the support available and making sensible sustainable changes constituted good advice based on their experience. Therefore, they decided by consensus to continue to recommend the same established practice.

The committee made some changes to elaborate on some of these recommendations and to ensure that they are consistent with how services are offered and less prescriptive in their description of interventions. They committee expanded on a recommendation about mental wellbeing to acknowledge that this may be affected by the child or young person's weight and may in turn affect their weight, as this was a concern reflected in the qualitative evidence. They also added further recommendations ensure that the tailored plan for dietary changes is age-appropriate, affordable, culturally sensitive, consistent with healthy eating advice and by committee consensus added reduction in sedentary behaviour to the recommendations.

Encouraging adherence to interventions

The committee agreed on consensus to base recommendations on encouraging adherence to behavioural overweight and obesity management interventions on previous recommendations from PH47. Many of these were retained in principle, with changes to split them into separate recommendations, merge similar recommendations, simplify the wording, or reorder the points they made. The qualitative evidence in this review and in review 1.3 on uptake of weight management interventions showed how the accessibility and convenience of the interventions could act as barriers or facilitators to attendance. The need for suitable venues, times, flexibility, and consistency were the same as what had been recommended in PH47, so the committee decided to continue to recommend these same factors. They also used their expertise and experience to agree that maintaining contact with families and following up on any problems with attendance were valuable recommendations, so they also based these in the established guidance from PH47.

The committee discussed how best to address concerns or barriers that may affect the child or young person's attendance and participation in the intervention. They agreed it was useful to repeat the discussion points from the initial referral to ensure consistency. Likewise, when reviewing progress towards meeting goals they agreed it was important to continue to focus on achievable health goals, rather than focusing solely on weight goals (which are less likely to be met), and to address any difficulties that affect the person's attendance and participation. If difficulties cannot be resolved, they agreed that alternative options such as referral to another service could help the child or young person maintain adherence. Recommendations on resolving a family's issues with attendance and on alternative options if they cannot be resolved were adapted the mirror the corresponding recommendations made for adults. The committee agreed by consensus that based on their experienced these recommendations applied equally to children and young people.

Providing ongoing support

Ongoing support for overweight and obesity management was an important consideration, as the evidence showed no sustained change in weight once interventions ended. There was discussion on how strongly to recommend longer term support and what support this should be. Some committee members felt that a strong recommendation to provide this support would restrict services that are unable to provide it from being commissioned, which may have a greater negative impact on provision of services overall. Some lay members felt that while overweight or obesity is a long term condition, they would not necessarily want to recommend long term interventions with no endpoint, so instead emphasised the need for long term support with the drivers of overweight and obesity along with follow-up support in overweight and obesity management interventions. Additionally, the level of support offered in the long term varied across the studies, therefore it was difficult to state how long support should be provided. As weight maintenance is an important factor and based on their expertise in supporting children and young people through their path to adulthood, the committee recommended that children and young people should be referred to interventions that can offer ongoing maintenance advice.

They agreed that it is important to continue to measure and monitor the child or young person's weight, as overweight and obesity can be a recurring condition and that further support is needed if the child or young person's BMI begins to increase. They also agreed it was not practical to specify a timeframe for how long a child or young person should continue to be measured because that will depend on their age and needs. For this reason, they drew on recommendations that had been made in previous guidance (PH47) which they felt were still necessary to guide how long term follow up should be done. They recommended that after the intervention has been completed, healthcare professionals should give children, young people, their parents and carers information about any additionally local sources of long-term support. The committee discussed what other support should be specifically recommended and they decided upon a non-exhaustive list of examples: support from a dietitian, youth worker, school nurse, family support worker, local support group, online groups or networks, friends and family, Talking Therapies, healthcare endorsed apps, national programs, and community groups (for example, local leisure services or sports clubs).

Additionally, due to the lack of information on long term support, the committee made a research recommendation on the effectiveness and cost effectiveness of behavioural overweight and obesity management interventions with long term support. The committee held the view that obesity is a chronic condition so there is an expectation that people will need ongoing support over the long term, however the majority of RCTs used fixed term interventions with very little in the post intervention period. The committee decided it was important to explore this directly in further research to fill this gap in the evidence. Based on their experience, the committee still felt it was necessary for ongoing support to be offered where possible by intervention providers directly and by telling families about other services that can offer additional support.

Cost effectiveness and resource use

Two economic studies were identified in the review that examined the cost-effectiveness of weight management interventions for children and young people with overweight and obesity in the UK. Both studies conducted a cost-utility analysis alongside a randomised controlled trial with sufficient follow-up period (more than 6 months from the end of the interventions). Panca et al. (2018) was based on motivational multicomponent lifestyle-modification intervention in a community setting (the Healthy Eating Lifestyle Programme (HELP)) that involved 174 young people with obesity aged 12-19 years. At 12-month evaluation, there were no differences in quality-adjusted life years (QALYs) between the intervention and control groups, so HELP was found to be neither effective nor cost-effective. Notice that the HELP trial was not included in the clinical review as it did not report BMI-z score, but the economic analysis was still considered to be relevant. Robertson et al. (2018) was based on the 'Families for Health V2 programme' (FFH), a 10-week group-based family intervention for overweight or obese children aged 6–11 years, that focused on parenting skills, relationship skills and emotional and social development. At 12-month evaluation, there was no significant difference in BMI z-score, while the mean costs were significantly higher for FFH than usual care (UC). FFH was therefore neither effective nor cost-effective for the management of obesity compared with UC. However, there was some evidence on improvement of QALYs, indicating that the benefits of interventions might be related to other health and wellbeing outcomes.

No economic modelling was conducted as there was no sufficient evidence on the clinical effectiveness of lifestyle weight management interventions, either from the NMA or meta-regression. The economic modelling study that was used to inform the previous recommendations in the guideline showed that lifestyle weight management interventions costing up to £500 per child and achieving a weight loss of as little as 0.5% could be cost-effective for children and young people who are overweight (BMI 25-30 kg/m²) and obese (BMI 30-40 kg/m). However, the analyses only focused on the immediate effect of the interventions on BMI and assumed that the post-intervention weight trajectory was maintained for life. More specifically, if children managed to move to a lower BMI-percentile after the interventions, the analyses assumed that they stayed on the same BMI-percentile and would not suffer from weight regain relative to their peers for the rest of their life. This is unlikely to be true though as there was little clinical evidence that suggested weight loss achieved during a lifestyle weight management programme can be maintained for the long term. If the weight was regained quickly, the interventions were unlikely to be cost effective.

The committee suggested that it is key to address the drivers of overweight and obesity (e.g. mental health issues, socio-economic differences, environmental factors) so that weight management interventions should be embedded into wider programmes that involve multi-partnership and integration of care. There might be some cost implications associated with the system-level approach, but it is likely to increase the effectiveness and cost-effectiveness of the interventions.

The committee pointed out that there was a lack of well-conducted large-scale trials on the effectiveness and cost-effectiveness of lifestyle weight management interventions for children and young people with overweight and obesity in the UK, and therefore a research recommendation was made on this point. A particular emphasis was given to the long-term support component as obesity is a chronic and relapsing condition and maintaining weight loss over long-term has always been challenging.

The committee also highlighted the importance of wider benefits of these interventions on health and wellbeing outcomes as many programmes did not intend for weight reduction alone. This is in line with what the previous studies that showed some improvement in quality of life even without any significant BMI reductions. Future economic evaluations need to consider how to incorporate the wider benefits into the standard evaluation framework.

Other factors the committee took into account

Weight management programmes in practice

The 2013 NICE guidance on weight management: lifestyle services for overweight and obese children and young people (PH47) included recommendations on weight managements services and lifestyle weight management programmes in children and young people. This guideline defined lifestyle weight management programmes as programmes that focus on diet, physical activity, behaviour change or any combination of these elements. While the committee agreed with the general definition of the programme, they highlighted that this terminology was no longer applicable when considering, how these programmes are used in practice, and the focus of these programmes.

The committee considered how overweight and obesity management interventions are commissioned and delivered in current practice. They noted that in some areas, established programmes are being utilised which are provider-led, however these can be expensive. In other areas, local authorities have been using NICE guidance, in particular PH47, to establish their own interventions, or applying the principles outlined in the guidance to their care pathways. They commented that the situation had changed since the last version of the weight management guideline, and that recommendations throughout should be amended to be flexible rather than prescriptive about how integrated care pathways are described and how the links between GPs, paediatric specialists, weight management interventions, and other healthcare professionals are organised. Additionally, as evidence looked at various types of programmes, we could not recommend a single weight management programme for consideration, therefore a flexible approach to overweight and obesity management interventions has been detailed in the recommendations.

Secondly, the committee noted that as these programmes focus on the management of overweight and obesity as well as the behaviours around managing overweight and obesity. They highlighted that it was important to move away from the ideology that lifestyle is the key driver of overweight and obesity. Based on these discussions, they highlighted that it was important that these programmes are referred as ‘behavioural overweight and obesity management services and interventions. This terminology is now used throughout the guideline.

Impact on recommendations for uptake of weight management interventions in children and young people

In light of the limited long term effectiveness of weight management interventions, the committee revisited the recommendations made regarding increasing uptake of these services. They decided it was important to weaken the recommendations so as not to imply that weight management was a comprehensive approach to addressing overweight or obesity. They also emphasised uptake and referral to other services that may better suit the needs of children and young people with overweight or obesity, by addressing the determinants of overweight and obesity.

Recommendations on encouraging adherence to lifestyle weight management programmes had previously been discussed during evidence review E on uptake of weight management interventions, however the committee felt that the recommendations considered in that discussion were more appropriate in the context of this review. They chose to retain and adapt existing recommendations from PH47, as recommendations targeted at providers of weight management interventions. They also added a recommendation on using professional judgement when it is necessary to intervene as part of the duty of care to ensure safeguarding for children and young people at higher risk from weight or weight related comorbidities. This was based on committee consensus and linked to NICE guidance on babies, children and young people's experience of healthcare (NG204).

Equality impact assessment

- Ethnicity and family background: No evidence was identified that specifically addressed these populations. The committee emphasised the importance of well informed cultural tailoring in weight management interventions to make these accessible to children and young people and their parents and carers from a range of family backgrounds.
- Children and young people with disabilities, learning disabilities and neurodevelopmental disabilities. These factors were included in the list of the wider determinants and the context of overweight and obesity and central adiposity that was referred to throughout as an important consideration when addressing an individual child of young person.
- Younger and older groups: The evidence covered children and young people from age 2 to 18 and sufficient evidence was found for all age groups to be represented. Therefore it is unlikely that any group will be disadvantaged by the recommendations.
- Looked after children and young people: Family circumstances were listed among the wider determinants and the context of overweight and obesity and central adiposity that was referred to throughout as an important consideration when addressing an individual child of young person.

1.1.14 Recommendations supported by this evidence review

This evidence review supports recommendations [add recommendation numbers] and the research recommendation on [add topic of research recommendation]. Other evidence supporting these recommendations can be found in the evidence reviews on [add topic of evidence review and review letter (A, B, C, etc)].

1.1.15 References – included studies

Effectiveness studies from Cochrane reviews

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1 **Effectiveness studies from updated search**

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Appendices

Appendix A – Review protocols

Review protocol for weight management programmes to support children and young people with obesity.

Review title	Weight management programmes to support children and young people living with overweight and obesity
Review question	What intervention components and approaches are effective, cost effective and acceptable for children and young people living with overweight or obesity?
Objective	To find and systematically review evidence for the effectiveness, cost effectiveness and acceptability of multicomponent interventions as part of weight management programmes to help children and young people (living with overweight and obesity) to develop into a healthier weight.
Searches	The included studies from the following Cochrane reviews will be assessed against the review protocol for inclusion in this review: Mead (2017, Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years) Al-Khudairy (2017, Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years)

	Colquitt (2016, Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years) Loveman (2015, Parent-only interventions for childhood overweight or obesity in children aged 5 to 11 years) The following databases will be searched: • Cochrane Central Register of Controlled Trials (CENTRAL) • Cochrane Database of Systematic Reviews (CDSR) • Embase • MEDLINE Searches will be restricted by: • Date: the search will be limited to dates after March 2015 (the earliest search dates of the Cochrane reviews that will be used as a source of data for this evidence review) • English language only • Human studies only • RCTs (A search filter will be used to limit results to those from OECD countries) • Qualitative evidence syntheses (Country limit: UK. Expand to Australia, Canada, Ireland, the Netherlands, and Scandinavia (Denmark, Norway, and Sweden) if insufficient UK studies are found)

	• The Cochrane RCT classifier will be used (as implemented in EPPI reviewer 5) Other searches: • None The searches will be re-run 6 weeks before final submission of the review and further studies retrieved for inclusion. The full search strategies for MEDLINE database will be published in the final review.
Condition or domain being studied	Overweight and obesity in children and young people
Population	Inclusion: Children or young people (2-18 years old) who are living with overweight or obesity Stratify by age: • 2-5 years old (pre-school) • 6-11 years old (primary school) • 12-17 years old (secondary school) Studies focusing on parents or carers as the agents of change will be included.

	Exclusion: • People whose body weight is at or below the healthy range (underweight). • Children under 2 years. • Pregnant women
Intervention	Behaviour changing interventions including: • Diet • Physical activity • Behavioural therapy Interventions may be delivered to the parent or carer
Comparator	• Usual care • No treatment • Concomitant intervention (another behaviour-changing intervention, which was also delivered in the intervention group).

Types of study to be included	• Randomised controlled trials • Published qualitative evidence syntheses Findings from published qualitative evidence syntheses relating to the acceptability of components of weight management programmes will be used directly.
Other exclusion criteria	• Studies investigating the effectiveness of healthy living programmes that focus on the prevention of overweight and obesity and are not specifically targeted at people living with overweight and obesity. • Studies only reported outcomes at less than 6 months follow up. • Studies with pregnant participants • Studies that included critically ill participants • Interventions that specifically dealt with the treatment of eating disorders or type 2 diabetes • Studies that included participants with a secondary or syndromic cause of obesity
Context	This question forms part of an update and amalgamation of the following guidelines: • Obesity: identification, assessment and management (2014) NICE guideline CG189 • Weight management: lifestyle services for overweight or obese children and young people (2013) NICE guideline PH47

	• BMI: preventing ill health and premature death in black, Asian and other minority ethnic groups (2013) NICE guideline PH46 • Obesity prevention (2006) NICE guideline CG43. This review covers the effective components of weight management programmes in children and young people.

Primary outcomes (critical outcomes)	Outcomes must be collected at least 6 months after a person has completed the programme and data from the longest timepoint recorded by studies will also be reported.
	• Changes in measured body mass index, BMI z score and weight
	  ○ If a study reports more than one of these measures, data from only 1 measure will be reported to avoid double counting of outcomes. Data on BMI z score will be extracted as the preferred measure, following by BMI and then weight.
	• Measures of central adiposity: Waist-to-height ratio, waist circumference
	  ○ If a study reports both waist-to-height ratio and waist circumference, only waist-to-height ratio data will be extracted to prevent double counting of outcomes, as this is preferred measure.

Secondary outcomes (important outcomes)	• Health-related quality of life (measured using a validated tool) • Weight related morbidity, limited to: insulin sensitivity, blood pressure, liver function. • Adverse events, limited to: Eating disorders, serious adverse events

Data extraction (selection and coding)	All references identified by the searches and from other sources will be uploaded into EPPI reviewer and de-duplicated. 10% of the abstracts will be reviewed by two reviewers, with any disagreements resolved by discussion or, if necessary, a third independent reviewer. This review will make use of the priority screening functionality within the EPPI-reviewer software. At least 50% of the data set will be screened and we will stop screening after that if we screen more than 2.5% of the database without an include. This review will use the included studies from 4 Cochrane reviews, as detailed in section 4. Data, evidence tables and quality assessments produced as part of these reviews will be used directly. The individual studies included in the Cochrane reviews will be examined only where there are insufficient details in the evidence tables of the Cochrane reviews to allow the components in the interventions to be categorised. A systematic search will be carried out to identify studies published after the search dates for the Cochrane reviews (see section 4). The full text of potentially eligible studies will be retrieved and will be assessed in line with the criteria outlined above. A standardised form will be used to extract data from studies (see Developing NICE guidelines: the manual section 6.4). The data extraction form will be aligned with the data extraction forms used in the Cochrane reviews for consistency. Study investigators may be contacted for missing data where time and resources allow.
Risk of bias (quality) assessment	Risk of bias will be assessed using the Cochrane RoB 1.0 checklist.

Strategy for data synthesis	**Meta-regression** Analysis of the outcome 'BMI z score' will use meta-regression to investigate the effective components of the intervention, as well as the aspects of the intervention that mediate effectiveness. Intervention components will be classified using the following scheme. This may be refined on discussion with the committee once included studies are available (for example, categories may be combined if there are too few studies in each category to produce a meaningful analysis. Diet: • Healthy eating advice • Tailored advice on daily intake Exercise: • Physical activity advice • Exercise programme Behavioural: • Parenting skills

	• Skills training (for example on speed of eating, reading food labels) • Behaviour change techniques (as defined by the Behaviour Change Technique taxonomy) for example: goal setting, self-monitoring Aspects of the intervention that may mediate effectiveness will also be investigated. Analyses will be prioritised as follows, depending on the availability of data: • Who the intervention is delivered to (parent vs parent and child for age groups 2-5 and 6-11, young person vs parent and young person for age group 12-17) • Intervention intensity (<26 hrs vs 26 hrs+). Twenty-six hours was chosen to dichotomise the data because it corresponds to the minimum duration of weight management programme recommended by the US preventative services task force (https://jamanetwork.com/journals/jama/fullarticle/2632511?amp;utm_source=JAMALatestIssue&utm_campaign=20-06-2017) • Mode of delivery: Group vs individual, Virtual vs face to face **Pair-wise meta-analysis** Evidence on other outcomes will be synthesised using pair-wise meta-analysis. Meta-regression will not be used for these outcomes, as insufficient data is anticipated, but the components included in interventions in each study will be presented alongside the meta-analysis.

	Meta-analyses of outcome data will be conducted for all comparators that are reported by more than one study, with reference to the Cochrane Handbook for Systematic Reviews of Interventions (Higgins et al. 2011). Fixed- and random-effects models (der Simonian and Laird) will be fitted for all comparators, with the presented analysis dependent on the degree of heterogeneity in the assembled evidence. Fixed-effects models will be the preferred choice to report, but in situations where the assumption of a shared mean for fixed-effects model is clearly not met, even after appropriate pre-specified subgroup analyses is conducted, random-effects results are presented. Fixed-effects models are deemed to be inappropriate if one or both of the following conditions was met: • Significant between study heterogeneity in methodology, population, intervention or comparator was identified by the reviewer in advance of data analysis. • The presence of significant statistical heterogeneity in the meta-analysis, defined as $I^2 \geq 50\%$. Meta-analyses will be performed in Cochrane Review Manager V5.3. **Qualitative review** The aim of the qualitative review is to establish the acceptability of interventions included in this protocol. Findings relating to the acceptability of interventions from qualitative studies will be included. CERQual will be used to assess the confidence we have in the summary findings from the included qualitative evidence syntheses. This will be conducted at the level of the included qualitative evidence synthesis with no further synthesis across reviews. Evidence from all qualitative study designs (interviews, focus groups etc.) is

	initially rated as high confidence and the confidence in the evidence for each theme will be downgraded from this initial point.
Analysis of sub-groups	**Quantitative review:** Analysis will be stratified by age: • Age (2-5, 6-11, 12-18) If data is available, subgroup analysis will be conducted based on: • Ethnicity • Weight classification (Overweight/Obesity) • Gender **Qualitative review:** Data will be stratified according to the mean age of the study population: • Age (2-5, 6-11, 12-18) If data is available, it will also be stratified by: • Ethnicity • Weight classification (Overweight/Obesity)

	• Gender • Socioeconomic background • People with the following eating behaviours: binge eating, night eating, emotional eating • People with a learning disability • People with a severe mental health problem • Sexual orientation If a qualitative evidence synthesis reports finding for these population groups specifically, these findings will be reported separately alongside findings for the more general population for comparison.
Conflicts of interest	All guideline committee members and anyone who has direct input into NICE guidelines (including the evidence review team and expert witnesses) must declare any potential conflicts of interest in line with NICE's code of practice for declaring and dealing with conflicts of interest. Any relevant interests, or changes to interests, will also be declared publicly at the start of each guideline committee meeting. Before each meeting, any potential conflicts of interest will be considered by the guideline committee Chair and a senior member of the development team. Any decisions to exclude a person from all or part of a meeting will be documented. Any changes to a member's declaration of interests will be recorded in the minutes of the meeting. Declarations of interests will be published with the final guideline.
Collaborators	Development of this systematic review will be overseen by an advisory committee who will use the review to inform the development of evidence-based recommendations in line with section 3 of Developing NICE guidelines: the

	manual. Members of the guideline committee are available on the NICE website: https://www.nice.org.uk/guidance/indevelopment/gid-ng10182

Appendix B – Literature search strategies

Background and development

Search design and peer review

A NICE information specialist conducted the literature searches for the evidence review. The clinical searches were run on 12th September 2022. The economic searches were run 14th and 15th September 2022. This search report is compliant with the requirements of PRISMA-S.

The MEDLINE strategy below was quality assured (QA) by a trained NICE information specialist. All translated search strategies were peer reviewed to ensure their accuracy. Both procedures were adapted from the 2016 PRESS Checklist.

The principal search strategy was developed in MEDLINE (Ovid interface) and adapted, as appropriate, for use in the other sources listed in the protocol, taking into account their size, search functionality and subject coverage.

Review management

The search results were managed in EPPI-Reviewer v5. Duplicates were removed in EPPI-R5 using a two-step process. First, automated deduplication is performed using a high-value algorithm. Second, manual deduplication is used to assess 'low-probability' matches. All decisions made for the review can be accessed via the deduplication history.

Prior work

- The search strategy for this review question was taken from the Cochrane systematic review: Al-Khudairy L et al. Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years. Cochrane Database of Systematic Reviews 2017, Issue 6. Art. No.: CD012691. DOI: 10.1002/14651858.CD012691. The search strategy can be found in appendix 1 of the Cochrane review.

Limits and restrictions

English language limits were applied in adherence to standard NICE practice and the review protocol.

Limits to exclude letters, editorials, news, conferences were applied in adherence to standard NICE practice and the review protocol.

The search was limited from 1st January 2015 to 12th September 2022 as defined in the review protocol.

The limit to remove animal studies in the searches was the standard NICE practice, which has been adapted from: Dickersin, K., Scherer, R., & Lefebvre, C. (1994). Systematic Reviews: Identifying relevant studies for systematic reviews. *BMJ*, 309(6964), 1286.

Search filters and classifiers

Clinical/public health searches

- RCT filters:
  - McMaster Therapy – Medline - "best balance of sensitivity and specificity" version.
    Haynes RB et al. (2005) Optimal search strategies for retrieving scientifically strong studies of treatment from Medline: analytical survey. *BMJ*, 330, 1179-1183.

  - McMaster Therapy – Embase "best balance of sensitivity and specificity" version.

    Wong SSL et al. (2006) Developing optimal search strategies for detecting clinically sound treatment studies in EMBASE. Journal of the Medical Library Association, 94(1), 41-47.

- RCT Classifier:

  - The Cochrane RCT classifier (Thomas et al, 2021) was used to further refine the list of references retrieved using the RCT filter. Our deduplication workflow retains other relevant study designs that would normally be rejected by the RCT classifier.

    Thomas J, McDonald S, Noel-Storr A et al. (2021) Machine learning reduced workload with minimal risk of missing studies: development and evaluation of a randomized controlled trial classifier for Cochrane Reviews. *Journal of Clinical Epidemiology*. 133, 140-51.

- Systematic reviews filters:
  - Lee, E. et al. (2012) An optimal search filter for retrieving systematic reviews and meta-analyses. *BMC Medical Research Methodology,* 12(1), 51.

    In MEDLINE, the standard NICE modifications were used: pubmed.tw added; systematic review.pt added from MeSH update 2019.

    In Embase, the standard NICE modifications were used: pubmed.tw added to line medline.tw.

- OECD filter:
  - The OECD countries filters were used without modification:

Ayiku, L., Hudson, T., Williams, C., Levay, P., & Jacob, C. (2021). The NICE OECD countries' geographic search filters: Part 2 - Validation of the MEDLINE and Embase (Ovid) filters. *Journal of the Medical Library Association*, 109(4), 583–589. https://doi.org/10.5195/jmla.2021.1224

Cost effectiveness searches

- Cost Utility filter (sensitive version) was applied to the search strategies in MEDLINE and Embase to identify cost-utility studies:

  Hubbard, W, Walsh N, Hudson T, Heath A, Dietz J, and Rogers G. (2022) Development and validation of paired Medline and Embase search filters for cost-utility studies. Manuscript submitted for publication.

Key decisions

- The search strategy was a direct re-run of the Cochrane strategy referenced in the prior work section. The strategy was not modified.
- 2 papers were identified by the analysts and added after the main search. The papers were identified as conflicts of interest by the committee, the papers were therefore added to the evidence review to be excluded (with reason).
- For the clinical searches, the results from the MEDLINE ALL and the Embase searches were exported into two separate files so that the RCT classifier could be applied to the RCT records

Clinical/public health searches

Main search – Databases

Database	Date searched	Database Platform	Database segment or version	No. of results downloaded
Cochrane CDSR	12/09/2022	Wiley	Issue 9 of 12	68
CENTRAL	12/09/2022	Wiley	Issue 9 of 12	5080
Embase	12/09/2022	OVID	1974 to 2022 September 09	5603
Medline All	12/09/2022	OVID	1946 to September 09, 2022	4375
PsycInfo	12/09/2022	OVID	2002 to September Week 1 2022	4569

Re-run search – Databases

Re-runs were not carried out for this review question, due to the approach taken by the guideline to publish some questions before others.

Search strategy history

Database name: Cochrane CDSR and CENTRAL

#1 [mh ^Obesity] 13097
#2 [mh ^"Obesity, Morbid"] 1422
#3 [mh ^"Obesity, Abdominal"] 440
#4 [mh ^"Pediatric Obesity"] 1536
#5 [mh ^Overweight] 5952
#6 [mh ^"Weight Loss"] 6869
#7 (adipos* or obes*):ti,ab 47202
#8 (overweight* or ("over" next weight*)):ti,ab 18406
#9 ("weight" near/1 (reduc* or los* or control* or manage*)):ti,ab 25421
#10 {or #1-#9} 64396
#11 [mh "Behavior Therapy"] 18893
#12 [mh "Counseling"] 6008
#13 [mh ^"Family Therapy"] 1007
#14 [mh ^"Social Support"] 3466
#15 [mh ^"Program Evaluation"] 6407
#16 [mh "Exercise"] 28693
#17 [mh "Exercise Therapy"] 16366
#18 [mh "Physical Education and Training"] 1648
#19 [mh "Exercise Movement Techniques"] 2540
#20 [mh ^"Motor Activity"] 3782
#21 [mh Diet] 20412
#22 [mh "Diet Therapy"] 6640
#23 [mh ^"Patient Education as Topic"] 9239
#24 [mh ^"Health Education"] 4208
#25 [mh "Health Behavior"] 38218
#26 [mh "Health Promotion"] 7170
#27 [mh ^"School Health Services"] 1579
#28 [mh ^"School Nursing"] 84
#29 [mh ^"Life style"] 3692
#30 (("obesity" near/4 "intervention") or "program" or "programme" or "camp" or "camps"):ti,ab 118692
#31 ("lifestyle" or "life style"):ti,ab 22430
#32 exercis*:ti,ab 107740
#33 (physic* next (activ* or fit*)):ti,ab 38007
#34 (walk* or jog* or swim* or ("weight" next lift*) or danc* or "aerobics"):ti,ab 38291
#35 ((physic* or strength* or resist* or "circuit" or "weight" or aerob* or "cross" or "endurance" or structur*) near/4 train*):ti,ab 26207
#36 ("behavioral" or "behavioural" or (("behavior" or "behaviour") next "modification") or psychoth* or "psychosocial"):ti,ab 75919
#37 (("group" or "family" or cognit* or behav*) next therap*):ti,ab 20150
#38 (counseling or counselling):ti,ab 21362
#39 educat*:ti,ab 75518
#40 (("parent" or "parents" or "family") next ("based" or "focused" or "directed" or "centered" or "only" or "led")):ti,ab 3221
#41 (diet* or "healthy nutrition" or (nutrition* next ("knowledge" or educat* or therap* or program* or intervention*))):ti,ab 79335
#42 {or #11-#41} 427176
#43 #10 and #42 38782

#44 [mh ^Obesity] or [mh ^"Obesity, Morbid"] or [mh ^Overweight] 17656
#45 [mh /DH,PC,RH,TH,PX] 248875
#46 #44 and #45 8959
#47 #43 or #46 39903
#48 [mh ^Adolescent] 110535
#49 [mh Child] 61855
#50 [mh ^Infant] 23729
#51 [mh ^Pediatrics] 675
#52 "minors":ti,ab 287
#53 ("boy" or "boys" or "boyhood"):ti,ab 7360
#54 girl*:ti,ab 8282
#55 ("kid" or "kids"):ti,ab 1365
#56 infant*:ti,ab 44019
#57 ("baby" or "babies"):ti,ab 10095
#58 ("toddler" or "toddlers"):ti,ab 1990
#59 ("child" or "childs" or children* or childhood* or childcare* or schoolchild*):ti,ab 137031
#60 adolescen*:ti,ab 31748
#61 juvenil*:ti,ab 2145
#62 youth*:ti,ab 8902
#63 (teen* or preteen*):ti,ab 3188
#64 (underage* or ("under" next age*)):ti,ab 563
#65 pubescen*:ti,ab 68
#66 (paediatric* or pediatric*):ti,ab 37047
#67 {or #48-#66} 294535
#68 #47 and #67 9440
#69 [mh ^"Pediatric Obesity"] 1536
#70 [mh /DH,PC,RH,TH,PX] 248875
#71 #69 and #70 869
#72 #68 or #71 with Publication Year from 2015 to 2022, in Trials 5080
#73 #68 or #71 with Cochrane Library publication date Between Jan 2015 and Dec 2022, in Cochrane Reviews 68

Database name: Embase

1 obesity/ or abdominal obesity/ or morbid obesity/ or childhood obesity/ or obesity/ or body weight loss/ (592593)
2 (adipos* or obes* or overweight* or over weight*).tw. (648758)
3 (weight adj1 (reduc* or los* or control* or manage*)).tw. (200859)
4 or/1-3 (905092)
5 exp behavior therapy/ or cognitive therapy/ or exp counseling/ or family therapy/ or social support/ or exp program evaluation/ or exp exercise/ or exp kinesiotherapy/ or exp physical education/ or exp motor activity/ or training/ or exp diet/ or exp diet therapy/ or nutritional health/ or child nutrition/ or feeding behavior/ or patient education/ or health promotion/ or health literacy/ or health education/ or school health education/ or school health service/ or lifestyle/ or lifestyle modification/ (2541088)
6 ((obesity adj3 intervention) or program or programme or camp?).tw. (949863)
7 (lifestyle or life style).tw. (172304)
8 (physic* adj (activ* or fit*)).tw. (202212)
9 (exercis* or walk* or jog* or swim* or weight lift* or danc* or aerobics).tw. (665868)
10 ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw. (80083)
11 (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw. (705325)
12 ((group or family or cognit* or behav*) adj therap*).tw. (52866)
13 (counsel?ing or educat*).tw. (1051376)
14 ((parent? or family) adj (based or focused or directed or centered or only or led)).tw. (19008)
15 (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw. (823207)
16 or/5-15 (5041698)
17 4 and 16 (356497)
18 obesity/ or morbid obesity/ (514016)
19 (pc or rh or th).fs. (2852102)
20 18 and 19 (63793)
21 17 or 20 (378005)
22 juvenile/ or adolescent/ or child/ or infant/ or baby/ or toddler/ or preschool child/ or school child/ or pediatrics/ (3423520)
23 (minors or boy or boys or boyhood or girl* or infant* or baby or babies or toddler? or kid or kids or child or childs or children* or childhood* or childcare* or schoolchild* or adolescen* or juvenil* or youth* or teen* or preteen* or underage* or under age* or pubescen* or p?ediatric*).tw. (3045891)
24 22 or 23 (4341045)
25 21 and 24 (80319)
26 childhood obesity/ (19101)
27 (pc or rh or th).fs. [prevention.fs. or rehabilitation.fs. or therapy.fs.] (2852102)
28 26 and 27 (3339)
29 25 or 28 (80842)
30 limit 29 to english language (75902)
31 30 not (letter or editorial).pt. (74449)
32 nonhuman/ not (human/ and nonhuman/) (5048794)
33 31 not 32 (72744)
34 33 and (2015* or 2016* or 2017* or 2018* or 2019* or 202*).dc. (38693)
35 afghanistan/ or africa/ or "africa south of the sahara"/ or albania/ or algeria/ or andorra/ or angola/ or argentina/ or "antigua and barbuda"/ or armenia/ or exp azerbaijan/ or

bahamas/ or bahrain/ or bangladesh/ or barbados/ or belarus/ or belize/ or benin/ or bhutan/ or bolivia/ or borneo/ or exp "bosnia and herzegovina"/ or botswana/ or exp brazil/ or brunei darussalam/ or bulgaria/ or burkina faso/ or burundi/ or cambodia/ or cameroon/ or cape verde/ or central africa/ or central african republic/ or chad/ or exp china/ or comoros/ or congo/ or cook islands/ or cote d'ivoire/ or croatia/ or cuba/ or cyprus/ or democratic republic congo/ or djibouti/ or dominica/ or dominican republic/ or ecuador/ or el salvador/ or egypt/ or equatorial guinea/ or eritrea/ or eswatini/ or ethiopia/ or exp "federated states of micronesia"/ or fiji/ or gabon/ or gambia/ or exp "georgia (republic)"/ or ghana/ or grenada/ or guatemala/ or guinea/ or guinea-bissau/ or guyana/ or haiti/ or honduras/ or exp india/ or exp indonesia/ or iran/ or exp iraq/ or jamaica/ or jordan/ or kazakhstan/ or kenya/ or kiribati/ or kosovo/ or kuwait/ or kyrgyzstan/ or laos/ or lebanon/ or liechtenstein/ or lesotho/ or liberia/ or libyan arab jamahiriya/ or madagascar/ or malawi/ or exp malaysia/ or maldives/ or mali/ or malta/ or mauritania/ or mauritius/ or melanesia/ or moldova/ or monaco/ or mongolia/ or "montenegro (republic)"/ or morocco/ or mozambique/ or myanmar/ or namibia/ or nauru/ or nepal/ or nicaragua/ or niger/ or nigeria/ or niue/ or north africa/ or oman/ or exp pakistan/ or palau/ or palestine/ or panama/ or papua new guinea/ or paraguay/ or peru/ or philippines/ or polynesia/ or qatar/ or "republic of north macedonia"/ or romania/ or exp russian federation/ or rwanda/ or sahel/ or "saint kitts and nevis"/ or "saint lucia"/ or "saint vincent and the grenadines"/ or saudi arabia/ or senegal/ or exp serbia/ or seychelles/ or sierra leone/ or singapore/ or "sao tome and principe"/ or solomon islands/ or exp somalia/ or south africa/ or south asia/ or south sudan/ or exp southeast asia/ or sri lanka/ or sudan/ or suriname/ or syrian arab republic/ or taiwan/ or tajikistan/ or tanzania/ or thailand/ or timor-leste/ or togo/ or tonga/ or "trinidad and tobago"/ or tunisia/ or turkmenistan/ or tuvalu/ or uganda/ or exp ukraine/ or exp united arab emirates/ or uruguay/ or exp uzbekistan/ or vanuatu/ or venezuela/ or viet nam/ or western sahara/ or yemen/ or zambia/ or zimbabwe/ (1573255)
36 exp "organisation for economic co-operation and development"/ (2162)
37 exp australia/ or "australia and new zealand"/ or austria/ or baltic states/ or exp belgium/ or exp canada/ or chile/ or colombia/ or costa rica/ or czech republic/ or denmark/ or estonia/ or europe/ or exp finland/ or exp france/ or exp germany/ or greece/ or hungary/ or iceland/ or ireland/ or israel/ or exp italy/ or japan/ or korea/ or latvia/ or lithuania/ or luxembourg/ or exp mexico/ or netherlands/ or new zealand/ or north america/ or exp norway/ or poland/ or exp portugal/ or scandinavia/ or sweden/ or slovakia/ or slovenia/ or south korea/ or exp spain/ or switzerland/ or "Turkey (republic)"/ or exp united kingdom/ or exp united states/ or western europe/ (3623619)
38 european union/ (29784)
39 developed country/ (34748)
40 or/36-39 (3655215)
41 35 not 40 (1429983)
42 34 not 41 (34363)
43 Qualitative Research/ (104308)
44 exp Interview/ (339437)
45 exp Questionnaire/ (853140)
46 exp Observational Method/ (7226)
47 Narrative/ (18915)
48 (qualitative$ or interview$ or focus group$ or questionnaire$ or narrative$ or narration$ or survey$).tw. (2377240)
49 (ethno$ or emic or etic or phenomenolog$ or grounded theory or constant compar$ or (thematic$ adj4 analys$) or theoretical sampl$ or purposive sampl$).tw. (155850)
50 (hermeneutic$ or heidegger$ or husser$ or colaizzi$ or van kaam$ or van manen$ or giorgi$ or glaser$ or strauss$ or ricoeur$ or spiegelberg$ or merleau$).tw. (15349)

51 (metasynthes$ or meta-synthes$ or metasummar$ or meta-summar$ or metastud$ or meta-stud$ or metathem$ or meta-them$).tw. (2428)
52 "critical interpretive synthes*".tw. (167)
53 (realist adj (review* or synthes*)).tw. (815)
54 (noblit and hare).tw. (102)
55 (meta adj (method or triangulation)).tw. (47)
56 (CERQUAL or CONQUAL).tw. (356)
57 ((thematic or framework) adj synthes*).tw. (1742)
58 or/43-51 (2641377)
59 (MEDLINE or pubmed).tw. (358825)
60 exp systematic review/ or systematic review.tw. (439777)
61 meta-analysis/ (256008)
62 intervention$.ti. (243882)
63 or/59-62 (864147)
64 42 and 58 and 63 (1214)
65 random:.tw. (1831381)
66 placebo:.mp. (500916)
67 double-blind:.tw. (233437)
68 or/65-67 (2101186)
68 42 and 67 (4805)
69 42 and 58 and 63 (1214)
70 68 or 69 (5603)

Database name: MEDLINE ALL

1 obesity/ or obesity, abdominal/ or obesity, morbid/ or pediatric obesity/ or Overweight/ or weight loss/ (274695)
2 (adipos* or obes* or overweight* or over weight*).tw. (451647)
3 (weight adj1 (reduc* or los* or control* or manage*)).tw. (127395)
4 or/1-3 (578444)
5 exp Behavior Therapy/ or exp Counseling/ or Family Therapy/ or Social Support/ or Program Evaluation/ or exp Exercise/ or exp Exercise Therapy/ or exp "Physical Education and Training"/ or exp Exercise Movement Techniques/ or Motor Activity/ or exp Diet/ or exp Diet Therapy/ or Patient Education as Topic/ or Health Education/ or exp Health Behavior/ or exp Health Promotion/ or School Health Services/ or School Nursing/ or Life Style/ (1425940)
6 ((obesity adj3 intervention) or program or programme or camp?).tw. (703388)
7 (lifestyle or life style).tw. (123178)
8 (physic* adj (activ* or fit*)).tw. (151676)
9 (exercis* or walk* or jog* or swim* or weight lift* or danc* or aerobics).tw. (502582)
10 ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw. (60684)
11 (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw. (556229)
12 ((group or family or cognit* or behav*) adj therap*).tw. (37559)
13 (counsel?ing or educat*).tw. (787924)
14 ((parent? or family) adj (based or focused or directed or centered or only or led)).tw. (15522)
15 (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw. (655440)
16 or/5-15 (3646241)
17 4 and 16 (218985)
18 Obesity/ or Obesity, Morbid/ or Overweight/ or Weight Loss/ (262294)
19 (diet therapy or prevention & control or rehabilitation or therapy or psychology).fs. (4481289)
20 18 and 19 (80131)
21 17 or 20 (245522)
22 Adolescent/ or exp Child/ or Infant/ or Pediatrics/ (3567570)
23 (minors or boy or boys or boyhood or girl* or infant* or baby or babies or toddler? or kid or kids or child or childs or children* or childhood* or childcare* or schoolchild* or adolescen* or juvenil* or youth* or teen* or preteen* or underage* or under age* or pubescen* or p?ediatric*).tw. (2450125)
24 22 or 23 (4344878)
25 21 and 24 (62819)
26 Pediatric Obesity/ (12688)
27 (diet therapy or prevention & control or rehabilitation or therapy or psychology).fs. (4481289)
28 26 and 27 (6147)
29 25 or 28 (63797)
30 limit 29 to english language (59405)
31 limit 30 to (letter or historical article or comment or editorial or news or case reports) (2690)
32 30 not 31 (56715)
33 Animals/ not (Animals/ and Humans/) (5010113)
34 32 not 33 (55896)
35 34 and (2015* or 2016* or 2017* or 2018* or 2019* or 202*).ed,dt. (27987)

36 afghanistan/ or africa/ or africa, northern/ or africa, central/ or africa, eastern/ or "africa south of the sahara"/ or africa, southern/ or africa, western/ or albania/ or algeria/ or andorra/ or angola/ or "antigua and barbuda"/ or argentina/ or armenia/ or azerbaijan/ or bahamas/ or bahrain/ or bangladesh/ or barbados/ or belize/ or benin/ or bhutan/ or bolivia/ or borneo/ or "bosnia and herzegovina"/ or botswana/ or brazil/ or brunei/ or bulgaria/ or burkina faso/ or burundi/ or cabo verde/ or cambodia/ or cameroon/ or central african republic/ or chad/ or exp china/ or comoros/ or congo/ or cote d'ivoire/ or croatia/ or cuba/ or "democratic republic of the congo"/ or cyprus/ or djibouti/ or dominica/ or dominican republic/ or ecuador/ or egypt/ or el salvador/ or equatorial guinea/ or eritrea/ or eswatini/ or ethiopia/ or fiji/ or gabon/ or gambia/ or "georgia (republic)"/ or ghana/ or grenada/ or guatemala/ or guinea/ or guinea-bissau/ or guyana/ or haiti/ or honduras/ or independent state of samoa/ or exp india/ or indian ocean islands/ or indochina/ or indonesia/ or iran/ or iraq/ or jamaica/ or jordan/ or kazakhstan/ or kenya/ or kosovo/ or kuwait/ or kyrgyzstan/ or laos/ or lebanon/ or liechtenstein/ or lesotho/ or liberia/ or libya/ or madagascar/ or malaysia/ or malawi/ or mali/ or malta/ or mauritania/ or mauritius/ or mekong valley/ or melanesia/ or micronesia/ or monaco/ or mongolia/ or montenegro/ or morocco/ or mozambique/ or myanmar/ or namibia/ or nepal/ or nicaragua/ or niger/ or nigeria/ or oman/ or pakistan/ or palau/ or exp panama/ or papua new guinea/ or paraguay/ or peru/ or philippines/ or qatar/ or "republic of belarus"/ or "republic of north macedonia"/ or romania/ or exp russia/ or rwanda/ or "saint kitts and nevis"/ or saint lucia/ or "saint vincent and the grenadines"/ or "sao tome and principe"/ or saudi arabia/ or serbia/ or sierra leone/ or senegal/ or seychelles/ or singapore/ or somalia/ or south africa/ or south sudan/ or sri lanka/ or sudan/ or suriname/ or syria/ or taiwan/ or tajikistan/ or tanzania/ or thailand/ or timor-leste/ or togo/ or tonga/ or "trinidad and tobago"/ or tunisia/ or turkmenistan/ or uganda/ or ukraine/ or united arab emirates/ or uruguay/ or uzbekistan/ or vanuatu/ or venezuela/ or vietnam/ or west indies/ or yemen/ or zambia/ or zimbabwe/ (1243919)
37 "organisation for economic co-operation and development"/ (471)
38 australasia/ or exp australia/ or austria/ or baltic states/ or belgium/ or exp canada/ or chile/ or colombia/ or costa rica/ or czech republic/ or exp denmark/ or estonia/ or europe/ or finland/ or exp france/ or exp germany/ or greece/ or hungary/ or iceland/ or ireland/ or israel/ or exp italy/ or exp japan/ or korea/ or latvia/ or lithuania/ or luxembourg/ or mexico/ or netherlands/ or new zealand/ or north america/ or exp norway/ or poland/ or portugal/ or exp "republic of korea"/ or "scandinavian and nordic countries"/ or slovakia/ or slovenia/ or spain/ or sweden/ or switzerland/ or turkey/ or exp united kingdom/ or exp united states/ (3436182)
39 european union/ (17357)
40 developed countries/ (21215)
41 or/37-40 (3451743)
42 36 not 41 (1155813)
43 35 not 42 (24719)
44 randomized controlled trial.pt. (576616)
45 randomi?ed.mp. (1020978)
46 placebo.mp. (239066)
47 or/44-46 (1084267)
48 Qualitative Research/ (76509)
49 Nursing Methodology Research/ (16406)
50 Interview.pt. (30386)
51 exp Interviews as Topic/ (66803)
52 Questionnaires/ (544066)
53 Narration/ (9780)
54 Health Care Surveys/ (33966)

55 (qualitative$ or interview$ or focus group$ or questionnaire$ or narrative$ or narration$ or survey$).tw. (1832644)
56 (ethno$ or emic or etic or phenomenolog$ or grounded theory or constant compar$ or (thematic$ adj4 analys$) or theoretical sampl$ or purposive sampl$).tw. (129721)
57 (hermeneutic$ or heidegger$ or husser$ or colaizzi$ or van kaam$ or van manen$ or giorgi$ or glaser$ or strauss$ or ricoeur$ or spiegelberg$ or merleau$).tw. (12611)
58 (metasynthes$ or meta-synthes$ or metasummar$ or meta-summar$ or metastud$ or meta-stud$ or metathem$ or meta-them$).tw. (2199)
59 "critical interpretive synthes*".tw. (164)
60 (realist adj (review* or synthes*)).tw. (799)
61 (noblit and hare).tw. (89)
62 (meta adj (method or triangulation)).tw. (44)
63 (CERQUAL or CONQUAL).tw. (344)
64 ((thematic or framework) adj synthes*).tw. (1575)
65 or/48-64 (2061841)
66 (MEDLINE or pubmed).tw. (289180)
67 systematic review.tw. (235202)
68 systematic review.pt. (206453)
69 meta-analysis.pt. (167078)
70 intervention$.ti. (185123)
71 or/66-70 (618250)
72 43 and 65 and 71 (936)
73 43 and 47 (3772)
74 72 or 73 (4375)

Database name: PsycInfo

1 exp overweight/ (25047)
2 (adipos* or obes* or overweight* or over weight*).tw. (45445)
3 or/1-2 (45760)
4 Weight Control/ or Weight Loss/ or Aerobic Exercise/ or Diets/ or exp Exercise/ or Movement Therapy/ or Dance Therapy/ or exp Physical Activity/ or Physical Fitness/ or Health Behavior/ or Health Promotion/ or Health Knowledge/ or Health Literacy/ or Health Education/ or Client Education/ or Lifestyle/ or Physical Education/ or exp Program Evaluation/ or Educational Programs/ or Educational Therapy/ or exp Program Development/ or School Based Intervention/ or School Counseling/ or Counseling/ or Group Counseling/ or Family Therapy/ or Support Groups/ or Social Support/ or School Counselors/ or exp Behavior Modification/ or Cognitive Behavior Therapy/ or Cognitive Therapy/ (276583)
5 ((obesity adj3 intervention) or program or programme or camp?).tw. (189343)
6 (lifestyle or life style).tw. (26167)
7 (physic* adj (activ* or fit*)).tw. (41629)
8 (exercis* or walk* or jog* or swim* or weight lift* or danc* or aerobics).tw. (94400)
9 ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw. (8775)
10 (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw. (399042)
11 ((group or family or cognit* or behav*) adj therap*).tw. (50665)
12 (counsel?ing or educat*).tw. (460435)
13 ((parent? or family) adj (based or focused or directed or centered or only or led)).tw. (9302)
14 (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw. (39327)
15 or/4-14 (1109914)
16 3 and 15 (28820)
17 (minors or boy or boys or boyhood or girl* or infant* or baby or babies or toddler? or kid or kids or child or childs or children* or childhood* or childcare* or schoolchild* or adolescen* or juvenil* or youth* or teen* or preteen* or underage* or under age* or pubescen* or p?ediatric*).tw. (683554)
18 16 and 17 (11356)
19 english.lg. or "first posting".ps. (3127301)
20 18 and 19 (11146)
21 20 and (2015* or 2016* or 2017* or 2018* or 2019* or 202*).up. (5615)
22 limit 21 to ("0200 book" or "0240 authored book" or "0280 edited book" or "0300 encyclopedia" or "0400 dissertation abstract") (1046)
23 21 not 22 (4569)

Cost-effectiveness searches

Main search – Databases

• Database	• Date searched	• Database platform	• Database segment or version	• No. of results downloaded
Econlit	14/09/2022	OVID		
Embase	15/09/2022	OVID		
HTA	14/09/2022	CRD York	N/A	
INAHTA	14/09/2022	INAHTA	N/A	
NHS EED	14/09/2022	CRD York	N/A	
MEDLINE ALL	15/09/2022	OVID		

Re-run search – Databases

Re-runs were not carried out for this review question, due to the approach taken by the guideline to publish some questions before others.

Search strategy history

Database name: Econlit

1 (adipos* or obes* or overweight* or over weight*).tw. (2587)
2 (weight adj1 (reduc* or los* or control* or manage*)).tw. (282)
3 or/1-2 (2778)
4 ((obesity adj3 intervention) or program or programme or camp?).tw. (40003)
5 (lifestyle or life style).tw. (1485)
6 (physic* adj (activ* or fit*)).tw. (623)
7 (exercis* or walk* or jog* or swim* or weight lift* or danc* or aerobics).tw. (18759)
8 ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw. (269)
9 (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw. (17657)
10 ((group or family or cognit* or behav*) adj therap*).tw. (57)
11 (counsel?ing or educat*).tw. (70843)
12 ((parent? or family) adj (based or focused or directed or centered or only or led)).tw. (243)
13 (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw. (2843)
14 or/4-13 (142757)
15 3 and 14 (1071)
16 J13.cc. (27074)
17 (minors or boy or boys or boyhood or girl* or infant* or baby or babies or toddler? or kid or kids or child or childs or children* or childhood* or childcare* or schoolchild* or adolescen* or juvenil* or youth* or teen* or preteen* or underage* or under age* or pubescen* or p?ediatric*).tw. (43642)
18 16 or 17 (52003)
19 15 and 18 (376)
20 limit 19 to english (368)
21 20 and (2015* or 2016* or 2017* or 2018* or 2019* or 202*).up. (163)

Database name: Embase

1 obesity/ or abdominal obesity/ or morbid obesity/ or childhood obesity/ or obesity/ or body weight loss/ (562164)
2 (adipos* or obes* or overweight* or over weight*).tw. (604182)
3 (weight adj1 (reduc* or los* or control* or manage*)).tw. (183596)
4 or/1-3 (840279)
5 exp behavior therapy/ or cognitive therapy/ or exp counseling/ or family therapy/ or social support/ or exp program evaluation/ or exp exercise/ or exp kinesiotherapy/ or exp physical education/ or exp motor activity/ or training/ or exp diet/ or exp diet therapy/ or nutritional health/ or child nutrition/ or feeding behavior/ or patient education/ or health promotion/ or health literacy/ or health education/ or school health education/ or school health service/ or lifestyle/ or lifestyle modification/ (2228177)
6 ((obesity adj3 intervention) or program or programme or camp?).tw. (812008)
7 (lifestyle or life style).tw. (165288)
8 (physic* adj (activ* or fit*)).tw. (192567)
9 (exercis* or walk* or jog* or swim* or weight lift* or danc* or aerobics).tw. (573451)
10 ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw. (71134)
11 (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw. (617870)
12 ((group or family or cognit* or behav*) adj therap*).tw. (46096)
13 (counsel?ing or educat*).tw. (942073)
14 ((parent? or family) adj (based or focused or directed or centered or only or led)).tw. (18145)
15 (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw. (686706)
16 or/5-15 (4334301)
17 4 and 16 (336358)
18 obesity/ or morbid obesity/ (483537)
19 (pc or rh or th).fs. (2363738)
20 18 and 19 (59866)
21 17 or 20 (356323)
22 juvenile/ or adolescent/ or child/ or infant/ or baby/ or toddler/ or preschool child/ or school child/ or pediatrics/ (2669209)
23 (minors or boy or boys or boyhood or girl* or infant* or baby or babies or toddler? or kid or kids or child or childs or children* or childhood* or childcare* or schoolchild* or adolescen* or juvenil* or youth* or teen* or preteen* or underage* or under age* or pubescen* or p?ediatric*).tw. (2502174)
24 22 or 23 (3409475)
25 21 and 24 (76826)
26 childhood obesity/ (19109)
27 (pc or rh or th).fs. [prevention.fs. or rehabilitation.fs. or therapy.fs.] (2363738)
28 26 and 27 (3339)
29 25 or 28 (77349)
30 limit 29 to english language (73252)
31 30 not (letter or editorial).pt. (71839)
32 nonhuman/ not (human/ and nonhuman/) (3769750)
33 31 not 32 (70217)
34 33 and (2015* or 2016* or 2017* or 2018* or 2019* or 202*).dc. (38728)
35 afghanistan/ or africa/ or "africa south of the sahara"/ or albania/ or algeria/ or andorra/ or angola/ or argentina/ or "antigua and barbuda"/ or armenia/ or exp azerbaijan/ or bahamas/ or bahrain/ or bangladesh/ or barbados/ or belarus/ or belize/ or benin/ or bhutan/

or bolivia/ or borneo/ or exp "bosnia and herzegovina"/ or botswana/ or exp brazil/ or brunei darussalam/ or bulgaria/ or burkina faso/ or burundi/ or cambodia/ or cameroon/ or cape verde/ or central africa/ or central african republic/ or chad/ or exp china/ or comoros/ or congo/ or cook islands/ or cote d'ivoire/ or croatia/ or cuba/ or cyprus/ or democratic republic congo/ or djibouti/ or dominica/ or dominican republic/ or ecuador/ or el salvador/ or egypt/ or equatorial guinea/ or eritrea/ or eswatini/ or ethiopia/ or exp "federated states of micronesia"/ or fiji/ or gabon/ or gambia/ or exp "georgia (republic)"/ or ghana/ or grenada/ or guatemala/ or guinea/ or guinea-bissau/ or guyana/ or haiti/ or honduras/ or exp india/ or exp indonesia/ or iran/ or exp iraq/ or jamaica/ or jordan/ or kazakhstan/ or kenya/ or kiribati/ or kosovo/ or kuwait/ or kyrgyzstan/ or laos/ or lebanon/ or liechtenstein/ or lesotho/ or liberia/ or libyan arab jamahiriya/ or madagascar/ or malawi/ or exp malaysia/ or maldives/ or mali/ or malta/ or mauritania/ or mauritius/ or melanesia/ or moldova/ or monaco/ or mongolia/ or "montenegro (republic)"/ or morocco/ or mozambique/ or myanmar/ or namibia/ or nauru/ or nepal/ or nicaragua/ or niger/ or nigeria/ or niue/ or north africa/ or oman/ or exp pakistan/ or palau/ or palestine/ or panama/ or papua new guinea/ or paraguay/ or peru/ or philippines/ or polynesia/ or qatar/ or "republic of north macedonia"/ or romania/ or exp russian federation/ or rwanda/ or sahel/ or "saint kitts and nevis"/ or "saint lucia"/ or "saint vincent and the grenadines"/ or saudi arabia/ or senegal/ or exp serbia/ or seychelles/ or sierra leone/ or singapore/ or "sao tome and principe"/ or solomon islands/ or exp somalia/ or south africa/ or south asia/ or south sudan/ or exp southeast asia/ or sri lanka/ or sudan/ or suriname/ or syrian arab republic/ or taiwan/ or tajikistan/ or tanzania/ or thailand/ or timor-leste/ or togo/ or tonga/ or "trinidad and tobago"/ or tunisia/ or turkmenistan/ or tuvalu/ or uganda/ or exp ukraine/ or exp united arab emirates/ or uruguay/ or exp uzbekistan/ or vanuatu/ or venezuela/ or viet nam/ or western sahara/ or yemen/ or zambia/ or zimbabwe/ (1416578)
36 exp "organisation for economic co-operation and development"/ (2168)
37 exp australia/ or "australia and new zealand"/ or austria/ or baltic states/ or exp belgium/ or exp canada/ or chile/ or colombia/ or costa rica/ or czech republic/ or denmark/ or estonia/ or europe/ or exp finland/ or exp france/ or exp germany/ or greece/ or hungary/ or iceland/ or ireland/ or israel/ or exp italy/ or japan/ or korea/ or latvia/ or lithuania/ or luxembourg/ or exp mexico/ or netherlands/ or new zealand/ or north america/ or exp norway/ or poland/ or exp portugal/ or scandinavia/ or sweden/ or slovakia/ or slovenia/ or south korea/ or exp spain/ or switzerland/ or "Turkey (republic)"/ or exp united kingdom/ or exp united states/ or western europe/ (2936676)
38 european union/ (27597)
39 developed country/ (20882)
40 or/36-39 (2965955)
41 35 not 40 (1286695)
42 34 not 41 (34391)
43 cost utility analysis/ (11354)
44 quality adjusted life year/ (32313)
45 cost*.ti. (156160)
46 (cost* adj2 utilit*).tw. (11357)
47 (cost* adj2 (effective* or assess* or evaluat* or analys* or model* or benefit* or threshold* or quality or expens* or saving* or reduc*)).tw. (327830)
48 (economic* adj2 (evaluat* or assess* or analys* or model* or outcome* or benefit* or threshold* or expens* or saving* or reduc*)).tw. (57405)
49 (qualit* adj2 adjust* adj2 life*).tw. (24561)
50 QALY*.tw. (24105)
51 (incremental* adj2 cost*).tw. (25977)
52 ICER.tw. (11645)
53 utilities.tw. (13183)

54 markov*.tw. (35516)
55 (dollar* or USD or cents or pound or pounds or GBP or sterling* or pence or euro or euros or yen or JPY).tw. (61060)
56 ((utility or effective*) adj2 analys*).tw. (33155)
57 (willing* adj2 pay*).tw. (12853)
58 (EQ5D* or EQ-5D*).tw. (22935)
59 ((euroqol or euro-qol or euroquol or euro-quol or eurocol or euro-col) adj3 ("5" or five)).tw. (4509)
60 (european* adj2 quality adj3 ("5" or five)).tw. (840)
61 or/43-60 (530334)
95 42 and 61 (780)

Database name: HTA and NHS EED

Line	Search	Hits
1	MeSH DESCRIPTOR obesity	775
2	MeSH DESCRIPTOR obesity, abdominal	3
3	MeSH DESCRIPTOR obesity, morbid	228
4	MeSH DESCRIPTOR pediatric obesity	38
5	MeSH DESCRIPTOR Overweight	172
6	MeSH DESCRIPTOR weight loss	464
7	(adipos* or obes* or overweight* or over weight*)	1655
8	(weight adj1 (reduc* or los* or control* or manage*))	1063
9	#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8	2053
10	MeSH DESCRIPTOR Behavior Therapy EXPLODE ALL TREES	692
11	MeSH DESCRIPTOR Counseling EXPLODE ALL TREES	490
12	MeSH DESCRIPTOR Family Therapy	78
13	MeSH DESCRIPTOR Social Support	331
14	MeSH DESCRIPTOR Program Evaluation	799
15	MeSH DESCRIPTOR Exercise Movement Techniques EXPLODE ALL TREES	249
16	MeSH DESCRIPTOR Exercise EXPLODE ALL TREES	1137
17	MeSH DESCRIPTOR Exercise Therapy EXPLODE ALL TREES	1055
18	MeSH DESCRIPTOR Physical Education and Training EXPLODE ALL TREES	37
19	MeSH DESCRIPTOR motor activity	276
20	MeSH DESCRIPTOR Diet EXPLODE ALL TREES	681
21	MeSH DESCRIPTOR Diet Therapy EXPLODE ALL TREES	256
22	MeSH DESCRIPTOR Patient Education as Topic	814
23	MeSH DESCRIPTOR Health Education	350
24	MeSH DESCRIPTOR Health Behavior EXPLODE ALL TREES	2941
25	MeSH DESCRIPTOR Health Promotion EXPLODE ALL TREES	889
26	MeSH DESCRIPTOR School Health Services	159
27	MeSH DESCRIPTOR School Nursing	8
28	MeSH DESCRIPTOR Life Style	302

29	((obesity adj3 intervention) or program or programme or camp or camps)	8132
30	(lifestyle or life style)	793
31	(physic* adj (activ* or fit*))	1110
32	(exercis* or walk* or jog* or swim* or weight lift* or danc* or aerobics)	6760
33	((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*)	558
34	(behavioral or behavioural or behavior modification or behaviour modification or psychoth* or psychosocial)	3710
35	((group or family or cognit* or behav*) adj therap*)	2598
36	(counseling or counselling or educat*)	5497
37	((parent or parents or family) adj (based or focused or directed or centered or only or led))	211
38	(diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*)))	2988
39	#10 OR #11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17 OR #18 OR #19 OR #20 OR #21 OR #22 OR #23 OR #24 OR #25 OR #26 OR #27 OR #28 OR #29 OR #30 OR #31 OR #32 OR #33 OR #34 OR #35 OR #36 OR #37 OR #38	22479
40	#9 AND #39	1273
41	#1 OR #3 OR #5 OR #6	1155
42	(diet therapy or prevention & control or rehabilitation or therapy or psychology)	36227
43	#41 AND #42	512
44	#40 OR #43	1361
45	MeSH DESCRIPTOR Adolescent	4594
46	MeSH DESCRIPTOR Child EXPLODE ALL TREES	4935
47	MeSH DESCRIPTOR infant	1853
48	MeSH DESCRIPTOR pediatrics	112
49	#45 OR #46 OR #47 OR #48	7645
50	(minors or boy or boys or boyhood or girl* or infant* or baby or babies or toddler or toddlers or kid or kids or child or childs or children* or childhood* or childcare* or schoolchild* or adolescen* or juvenil* or youth* or teen* or preteen* or underage* or under age* or pubescen* or pediatric* or paediatric)	13539
51	#49 OR #50	13539
52	#44 AND #51	435
53	MeSH DESCRIPTOR Pediatric Obesity	38
54	(diet therapy or prevention & control or rehabilitation or therapy or psychology)	36227
55	#53 AND #54	16

56	#52 OR #55	438
57	(#56) IN NHSEED FROM 2015 TO 2022	0
58	(#56) IN HTA FROM 2015 TO 2022	7

Database name: INAHTA

#1	"Obesity"[mh]	222
#2	"Obesity Abdominal"[mh]	0
#3	"Obesity Morbid"[mh]	83
#4	"Pediatric Obesity"[mh]	8
#5	"Overweight"[mh]	15
#6	"Weight loss"[mh]	80
#7	(adipos* or obes* or overweight* or over weight*)	2013
#8	(weight) AND (reduc* or los* or control* or manage*)	328
#9	#8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1	2030
#10	"Behavior Therapy"[mhe]	117
#11	"Counseling"[mhe]	49
#12	"Family Therapy"[mh]	7
#13	"Social Support"[mh]	44
#14	"Program Evaluation"[mh]	50
#15	"Exercise Movement Techniques"[mhe]	6
#16	"Exercise"[mhe]	159
#17	"Exercise Therapy"[mhe]	88
#18	"Physical Education and Training"[mhe]	2
#19	("Motor Activity"[mh])	12
#20	"Diet"[mhe]	185
#21	"Diet Therapy"[mhe]	21
#22	"Patient Education as Topic"[mh]	79
#23	"Health Education"[mh]	37
#24	"Health Behavior"[mhe]	298
#25	"Health Promotion"[mhe]	91
#26	"School Health Services"[mh]	16
#27	"Life Style"[mh]	24
#28	(Obesity AND Intervention) OR (program or programme or camp or camps)	2933
#29	lifestyle OR life style	1871
#30	(physic*) AND (activ* or fit*)	286
#31	(exercis* or walk* or jog* or swim* or weight lift* or danc* or aerobics))	909
#32	((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) AND train*)	259

#33	(behavioral or behavioural or behavior modification or behaviour modification or psychoth* or psychosocial)	768
#34	((group or family or cognit* or behav*) AND therap*)	1063
#35	counseling or counselling or educat*	577
#36	(parent or parents or family) AND (based or focused or directed or centered or only or led)	361
#37	(diet* or healthy nutrition or (nutrition* AND (knowledge or educat* or therap* or program* or intervention*))	594
#38	"School Nursing"[mh]	1
#39	#38 OR #37 OR #36 OR #35 OR #34 OR #33 OR #32 OR #31 OR #30 OR #29 OR #28 OR #27 OR #26 OR #25 OR #24 OR #23 OR #22 OR #21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 OR #13 OR #12 OR #11 OR #10	6496
#40	#39 AND #9	1387
#41	("Weight loss"[mh]) OR ("Overweight"[mh]) OR ("Obesity Morbid"[mh]) OR ("Obesity"[mh])	239
#42	diet therapy or prevention & control or rehabilitation or therapy or psychology	4714
#43	#42 AND #41	65
#44	#43 OR #40	1393
#45	"Adolescent"[mh]	313
#46	"Child"[mhe]	813
#47	"Infant"[mh]	373
#48	"Pediatrics"[mh]	24
#49	#48 OR #47 OR #46 OR #45	1157
#50	minors or boy or boys or boyhood or girl* or infant* or baby or babies or toddler or toddlers or kid or kids or child or childs or children* or childhood* or childcare* or schoolchild* or adolescen* or juvenil* or youth* or teen* or preteen* or underage* or under age* or pubescen* or pediatric* or paediatric	6702
#51	#50 OR #49	6870
#52	#51 AND #44	775
#53	"Pediatric Obesity"[mh]	8
#54	diet therapy or prevention & control or rehabilitation or therapy or psychology	4714
#55	#54 AND #53	3
#56	#55 OR #52	775
#57	#56 LIMIT TO 2015-2022	244
#58	#57 LIMIT TO ENGLISH LANGUAGE	161

Database name: MEDLINE ALL

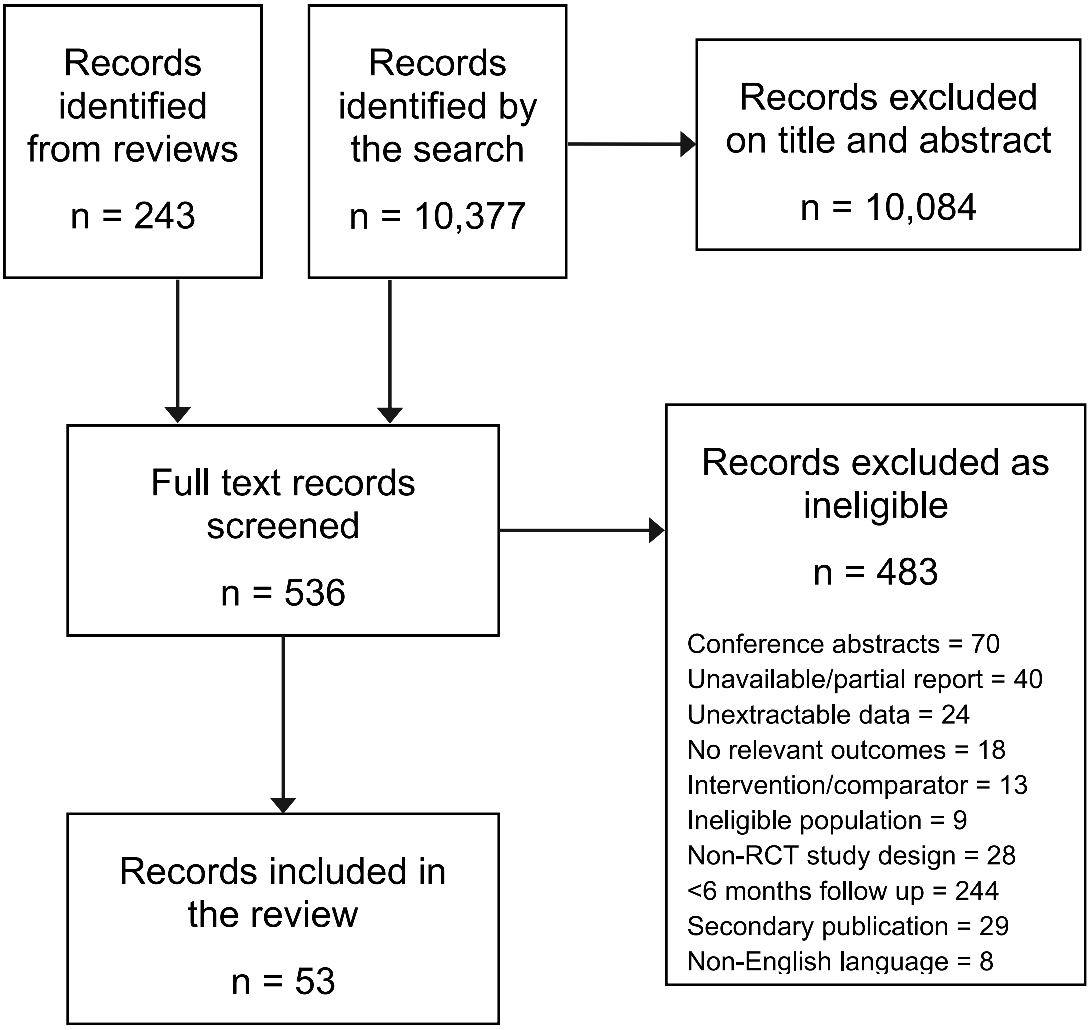
1 obesity/ or obesity, abdominal/ or obesity, morbid/ or pediatric obesity/ or Overweight/ or weight loss/ (275032)
2 (adipos* or obes* or overweight* or over weight*).tw. (452022)
3 (weight adj1 (reduc* or los* or control* or manage*)).tw. (127496)
4 or/1-3 (578898)
5 exp Behavior Therapy/ or exp Counseling/ or Family Therapy/ or Social Support/ or Program Evaluation/ or exp Exercise/ or exp Exercise Therapy/ or exp "Physical Education and Training"/ or exp Exercise Movement Techniques/ or Motor Activity/ or exp Diet/ or exp Diet Therapy/ or Patient Education as Topic/ or Health Education/ or exp Health Behavior/ or exp Health Promotion/ or School Health Services/ or School Nursing/ or Life Style/ (1426932)
6 ((obesity adj3 intervention) or program or programme or camp?).tw. (703958)
7 (lifestyle or life style).tw. (123304)
8 (physic* adj (activ* or fit*)).tw. (151863)
9 (exercis* or walk* or jog* or swim* or weight lift* or danc* or aerobics).tw. (503065)
10 ((physic* or strength* or resist* or circuit or weight or aerob* or cross or endurance or structur*) adj3 train*).tw. (60748)
11 (behavio?ral or behavio?r modification or psychoth* or psychosocial).tw. (556775)
12 ((group or family or cognit* or behav*) adj therap*).tw. (37593)
13 (counsel?ing or educat*).tw. (788793)
14 ((parent? or family) adj (based or focused or directed or centered or only or led)).tw. (15537)
15 (diet* or healthy nutrition or (nutrition* adj (knowledge or educat* or therap* or program* or intervention*))).tw. (655930)
16 or/5-15 (3649205)
17 4 and 16 (219162)
18 Obesity/ or Obesity, Morbid/ or Overweight/ or Weight Loss/ (262605)
19 (diet therapy or prevention & control or rehabilitation or therapy or psychology).fs. (4484270)
20 18 and 19 (80186)
21 17 or 20 (245713)
22 Adolescent/ or exp Child/ or Infant/ or Pediatrics/ (3569634)
23 (minors or boy or boys or boyhood or girl* or infant* or baby or babies or toddler? or kid or kids or child or childs or children* or childhood* or childcare* or schoolchild* or adolescen* or juvenil* or youth* or teen* or preteen* or underage* or under age* or pubescen* or p?ediatric*).tw. (2452083)
24 22 or 23 (4347080)
25 21 and 24 (62853)
26 Pediatric Obesity/ (12723)
27 (diet therapy or prevention & control or rehabilitation or therapy or psychology).fs. (4484270)
28 26 and 27 (6159)
29 25 or 28 (63835)
30 limit 29 to english language (59443)
31 limit 30 to (letter or historical article or comment or editorial or news or case reports) (2690)
32 30 not 31 (56753)
33 Animals/ not (Animals/ and Humans/) (5012497)
34 32 not 33 (55933)
35 34 and (2015* or 2016* or 2017* or 2018* or 2019* or 202*).ed,dt. (28024)

36 afghanistan/ or africa/ or africa, northern/ or africa, central/ or africa, eastern/ or "africa south of the sahara"/ or africa, southern/ or africa, western/ or albania/ or algeria/ or andorra/ or angola/ or "antigua and barbuda"/ or argentina/ or armenia/ or azerbaijan/ or bahamas/ or bahrain/ or bangladesh/ or barbados/ or belize/ or benin/ or bhutan/ or bolivia/ or borneo/ or "bosnia and herzegovina"/ or botswana/ or brazil/ or brunei/ or bulgaria/ or burkina faso/ or burundi/ or cabo verde/ or cambodia/ or cameroon/ or central african republic/ or chad/ or exp china/ or comoros/ or congo/ or cote d'ivoire/ or croatia/ or cuba/ or "democratic republic of the congo"/ or cyprus/ or djibouti/ or dominica/ or dominican republic/ or ecuador/ or egypt/ or el salvador/ or equatorial guinea/ or eritrea/ or eswatini/ or ethiopia/ or fiji/ or gabon/ or gambia/ or "georgia (republic)"/ or ghana/ or grenada/ or guatemala/ or guinea/ or guinea-bissau/ or guyana/ or haiti/ or honduras/ or independent state of samoa/ or exp india/ or indian ocean islands/ or indochina/ or indonesia/ or iran/ or iraq/ or jamaica/ or jordan/ or kazakhstan/ or kenya/ or kosovo/ or kuwait/ or kyrgyzstan/ or laos/ or lebanon/ or liechtenstein/ or lesotho/ or liberia/ or libya/ or madagascar/ or malaysia/ or malawi/ or mali/ or malta/ or mauritania/ or mauritius/ or mekong valley/ or melanesia/ or micronesia/ or monaco/ or mongolia/ or montenegro/ or morocco/ or mozambique/ or myanmar/ or namibia/ or nepal/ or nicaragua/ or niger/ or nigeria/ or oman/ or pakistan/ or palau/ or exp panama/ or papua new guinea/ or paraguay/ or peru/ or philippines/ or qatar/ or "republic of belarus"/ or "republic of north macedonia"/ or romania/ or exp russia/ or rwanda/ or "saint kitts and nevis"/ or saint lucia/ or "saint vincent and the grenadines"/ or "sao tome and principe"/ or saudi arabia/ or serbia/ or sierra leone/ or senegal/ or seychelles/ or singapore/ or somalia/ or south africa/ or south sudan/ or sri lanka/ or sudan/ or suriname/ or syria/ or taiwan/ or tajikistan/ or tanzania/ or thailand/ or timor-leste/ or togo/ or tonga/ or "trinidad and tobago"/ or tunisia/ or turkmenistan/ or uganda/ or ukraine/ or united arab emirates/ or uruguay/ or uzbekistan/ or vanuatu/ or venezuela/ or vietnam/ or west indies/ or yemen/ or zambia/ or zimbabwe/ (1245250)
37 "organisation for economic co-operation and development"/ (471)
38 australasia/ or exp australia/ or austria/ or baltic states/ or belgium/ or exp canada/ or chile/ or colombia/ or costa rica/ or czech republic/ or exp denmark/ or estonia/ or europe/ or finland/ or exp france/ or exp germany/ or greece/ or hungary/ or iceland/ or ireland/ or israel/ or exp italy/ or exp japan/ or korea/ or latvia/ or lithuania/ or luxembourg/ or mexico/ or netherlands/ or new zealand/ or north america/ or exp norway/ or poland/ or portugal/ or exp "republic of korea"/ or "scandinavian and nordic countries"/ or slovakia/ or slovenia/ or spain/ or sweden/ or switzerland/ or turkey/ or exp united kingdom/ or exp united states/ (3437649)
39 european union/ (17364)
40 developed countries/ (21220)
41 or/37-40 (3453218)
42 36 not 41 (1157107)
43 35 not 42 (24741)
44 Cost-Benefit Analysis/ (90696)
45 Quality-Adjusted Life Years/ (15101)
46 Markov Chains/ (15800)
47 exp Models, Economic/ (16144)
48 cost*.ti. (137361)
49 (cost* adj2 utilit*).tw. (7098)
50 (cost* adj2 (effective* or assess* or evaluat* or analys* or model* or benefit* or threshold* or quality or expens* or saving* or reduc*)).tw. (255264)
51 (economic* adj2 (evaluat* or assess* or analys* or model* or outcome* or benefit* or threshold* or expens* or saving* or reduc*)).tw. (42884)
52 (qualit* adj2 adjust* adj2 life*).tw. (16373)
53 QALY*.tw. (13188)

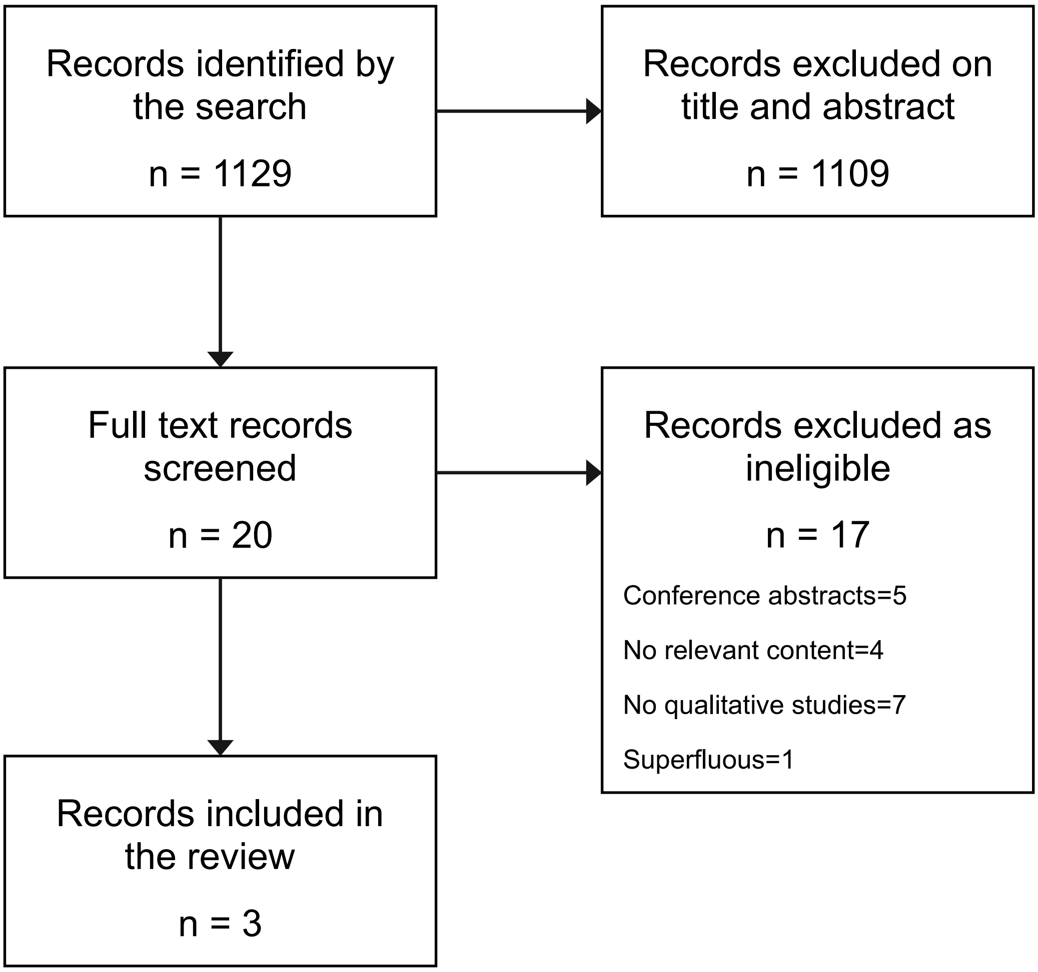
54 (incremental* adj2 cost*).tw. (15972)
55 ICER.tw. (5364)
56 utilities.tw. (8661)
57 markov*.tw. (29465)
58 (dollar* or USD or cents or pound or pounds or GBP or sterling* or pence or euro or euros or yen or JPY).tw. (51055)
59 ((utility or effective*) adj2 analys*).tw. (23063)
60 (willing* adj2 pay*).tw. (8745)
61 (EQ5D* or EQ-5D*).tw. (11815)
62 ((euroqol or euro-qol or euroquol or euro-quol or eurocol or euro-col) adj3 ("5" or five)).tw. (3344)
63 (european* adj2 quality adj3 ("5" or five)).tw. (610)
64 or/44-63 (466772)
65 43 and 64 (652)

Appendix C – Effectiveness and Qualitative Evidence study selection

Effectiveness evidence



Qualitative evidence



Appendix D – Effectiveness and Qualitative evidence

Effectiveness evidence

Systematic reviews

Al-Khudairy, 2017

Bibliographic Reference	Al-Khudairy L; Loveman E; Colquitt JL; Mead E; Johnson RE; Fraser H; Olajide J; Murphy M; Velho RM; O'Malley C; Azevedo LB; Ells LJ; Metzendorf MI; Rees K; Diet, physical activity and behavioural interventions for the treatment of overweight or obese adolescents aged 12 to 17 years.; The Cochrane database of systematic reviews; 2017; vol. 6 (no. 6)

Study Characteristics

Study design	Systematic review
Dates searched	Up to July 2016
Databases searched	Cochrane Central Register of Controlled Trials (CENTRAL) (2016, Issue 6). • Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) (from 1946). • Embase Ovid (1974 to 2016 week 28). • PsycINFO (1806 to July week 1 2016). • CINAHL. • LILACS (Latin American and Caribbean Health Science Information database) (last update 8 July 2016). • ClinicalTrials.gov (www.clinicaltrials.gov). • WHO International Clinical Trials Registry Platform (ICTRP) (www.who.int/trialsearch/).
Sources of funding	No information provided
Inclusion criteria	Randomised controlled clinical trials with at least six months of follow-up.

	For cross-over trials, we only analysed the first phase before cross-over (if this was six months or more) to avoid the potential of carry over effects. Overweight or obese adolescents with a mean study age of 12 to 17 years at the commencement of the intervention
Exclusion criteria	Critically ill, or children with a syndromic cause for their obesity (for example Prader-Willi) Studies with pregnant participants • Studies that included critically ill participants
Intervention(s)	No treatment (including wait-list control) • Usual care • Concomitant intervention (another behaviour-changing intervention, which was also delivered in the intervention group). Any form of behaviour changing intervention with a primary aim to treat overweight or obesity. Behaviour changing interventions included any form of dietary, physical activity, behavioural therapy, or a combination of these delivered as a single or multicomponent intervention, in any setting, using any delivery meth
Outcome(s)	Primary • Changes in measured BMI or body weight. • Adverse events. Secondary • Health-related quality of life. • Self-esteem. • All-cause mortality. • Morbidity. • Anthropometric measures other than BMI. • Behaviour change. • Participants' views of the intervention. • Socioeconomic effects. • Parenting skill and relationships.
Number of studies included in the systematic review	39
Studies from the systematic review	included studies:

that are relevant for use in the current review	• Debar 2012 • Ebbeling 2003 • Ebbeling 2012 • Grey 2004 • Resnicow 2005 • Schranz 2013 • Toulabi 2012 • Savoye 2011 • Vos 2011a and Vos 2012 • Hofsteenge 2014 and Hofsteenge 2013 • Ford 2010
Studies from the systematic review that are not relevant for use in the current review. See appendix K for exclusion reasons	• Bean 2014 • Boodai 2013 • Brennan 2013 • Brownell 1983 • Carraway 2014 • Carrel 2005 • Chandra 1968 • Christie 2011 • Daley 2005 • Gourlan 2013 • Jiang 2005 • Kong 2013 • Kong 2014 • Love Osborne 2014 • Luna-Pech 2014 • Nguyen 2012 • Norman 2016 • Pakpour 2015 • Patrick 2013 • Patsopoulou 2017 • Pbert 2013

	• Pitetti 2007 • Sigal 2014 • van Egmond-Frohlich 2006 • Vissers 2008 • Visuthranukul 2015 • Walpole 2013 • Wengle 2011 • Wong 2015

ROBIS Critical appraisal

Section	Question	Answer
Overall study ratings	Overall risk of bias	Low
Overall study ratings	Applicability as a source of data	Fully applicable

Colquitt, 2016

Bibliographic Reference	Colquitt JL; Loveman E; O'Malley C; Azevedo LB; Mead E; Al-Khudairy L; Ells LJ; Metzendorf MI; Rees K; Diet, physical activity, and behavioural interventions for the treatment of overweight or obesity in preschool children up to the age of 6 years.; The Cochrane database of systematic reviews; 2016; vol. 3 (no. 3)

Study Characteristics

Study design	Systematic review

Dates searched	up to March 2015
Databases searched	Cochrane Library, MEDLINE, EMBASE, PsycINFO, CINAHL, and LILACS, as well as in the trial registers ClinicalTrials.gov and ICTRP Search Portal
Sources of funding	Not specified
Inclusion criteria	Randomised controlled clinical trials with at least six months of follow-up. Overweight or obese children with a mean trial age of 0 to 6 years at the commencement of the intervention. Any form of lifestyle intervention with a primary aim to treat overweight or obesity in children (any form of dietary, physical activity and/or behavioural therapy delivered as single- or multicomponent interventions) The comparison could be no intervention, usual care (however defined), or an alternative concomitant therapy providing it is delivered in the intervention arm. Concomitant interventions had to be the same in the intervention and comparator groups to establish fair comparisons.
Exclusion criteria	critically ill, or children with a syndromic cause for their obesity (for example Prader-Willi)
Outcome(s)	Primary 1. Changes in body mass index (BMI) and body weight. 2. Adverse events. Secondary 1. Health-related quality of life and self esteem. 2. All-cause mortality.

	3. Morbidity. 4. Anthropometric measures other than BMI. 5. Behaviour change. 6. Participant views of the intervention. 7. Parent-child relationship or assessment of parenting. 8. Socioeconomic eGects by validated measures.
Number of studies included in the systematic review	5 trials with 15 publications
Studies from the systematic review that are relevant for use in the current review	Included studies: • Bocca 2012 • Kelishadi 2009 • Quattrin 2012 • Stark 2011 • Stark 2014
Studies from the systematic review that are not relevant for use in the current review. See appendix K for exclusion reasons	• Lanigan 2010 • Taveras 2011

ROBIS Critical appraisal

Section	Question	Answer
Overall study ratings	Overall risk of bias	Low
Overall study ratings	Applicability as a source of data	Fully applicable

Loveman, 2015

Bibliographic Reference	Loveman E; Al-Khudairy L; Johnson RE; Robertson W; Colquitt JL; Mead EL; Ells LJ; Metzendorf MI; Rees K; Parent-only interventions for childhood overweight or obesity in children aged 5 to 11 years.; The Cochrane database of systematic reviews; 2015; vol. 2015 (no. 12)

Study Characteristics

Study design	Systematic review
Dates searched	Up to March 2015
Databases searched	Cochrane Library,MEDLINE, EMBASE, PsycINFO,CINAHL and LILACS as well trial registers.
Sources of funding	No information provided
Inclusion criteria	randomised controlled clinical trials with at least six months of follow-up. randomised controlled trials (RCTs) of diet, physical activity, and behavioural interventions (behaviour-changing interventions)

	children with a mean study age of 5 to 11 years at the commencement of the intervention.
Exclusion criteria	critically ill, or children with a syndromic cause for their obesity (for example Prader-Willi)
Intervention(s)	No treatment (including wait-list control) • Usual care • Concomitant intervention (another behaviour-changing intervention, which was also delivered in the intervention group). Any form of behaviour changing intervention with a primary aim to treat overweight or obesity. Behaviour changing interventions included any form of dietary, physical activity, behavioural therapy, or a combination of these delivered as a single or multicomponent intervention, in any setting, using any delivery meth
Outcome(s)	Primary • Changes in body mass index (BMI) and body weight. • Adverse events. Secondary • Health-related quality of life and self esteem. • • All-cause mortality. • • Morbidity. • • Measures of body fat distribution • Behaviour change. • • Participants' views of the intervention. • • Parent-child relationship or assessment of parenting. • • Socioeconomic eEects by validated measures
Number of studies included in the systematic review	14 studies from 32 publications
Studies from the systematic review that are relevant	included studies:

for use in the current review	• Small 2014 • Boutelle 2011 • Collins 2021 and Okely 2010 • Estabrooks 2009 • Golley 2007 • Magarey 2012
Studies from the systematic review that are not relevant for use in the current review. See appendix K for exclusion reasons	• Aragona 1975 • Esfarjani 2013 • Golan 2006 • Janicke 2008 • Jansen 2011 • Mazzeo 2014 • Moens 2012 • Munsch 2008 • Raynor 2012 • Resnick 2009 • Resnicow 2015 • van Grieken 2013 • West 2010

ROBIS Critical appraisal

Section	Question	Answer
Overall study ratings	Overall risk of bias	Low
Overall study ratings	Applicability as a source of data	Fully applicable

Mead, 2017

Bibliographic Reference	Mead E; Brown T; Rees K; Azevedo LB; Whittaker V; Jones D; Olajide J; Mainardi GM; Corpeleijn E; O'Malley C; Beardsmore E; Al-Khudairy L; Baur L; Metzendorf MI; Demaio A; Ells LJ; Diet, physical activity and behavioural interventions for the treatment of overweight or obese children from the age of 6 to 11 years.; The Cochrane database of systematic reviews; 2017; vol. 6 (no. 6)

Study Characteristics

Study design	Systematic review
Dates searched	Up to July 2016
Databases searched	CENTRAL, MEDLINE, Embase, PsycINFO, CINAHL, LILACS as well as trial registers ClinicalTrials.gov and ICTRP Search Portal
Sources of funding	The author received funding from WHO to complete this review
Inclusion criteria	randomised controlled clinical trials with at least six months of follow-up. overweight or obese children aged 6 to 11 years randomised controlled trials (RCTs) of diet, physical activity, and behavioural interventions (behaviour-changing interventions)
Exclusion criteria	d interventions that specifically dealt with the treatment of eating disorders or type 2 diabetes, or included participants with a secondary or syndromic cause of obesity Studies with pregnant participants • Studies that included critically ill participants

Intervention(s)	diet, physical activity, and behavioural interventions (behaviour-changing interventions) No treatment (including wait-list control) • Usual care • Concomitant intervention (another behaviour-changing intervention, which was also delivered in the intervention group).
Outcome(s)	Primary • Changes in measured (not self-reported) body mass index (BMI), BMI z score and weight • Adverse events Secondary • Health-related quality of life • • Self-esteem • • All-cause mortality • • Morbidity • • Anthropometric measures other than change in BMI, BMI • z score and weight • • Behaviour change • • Participants' views of the intervention • • Socioeconomic effects
Number of studies included in the systematic review	55
Studies from the systematic review that are relevant for use in the current review	included studies: • Bryant 2011 • Davoli 2013 • Epstein 2000 • Epstein 2005 • Gunnarsdottir 2011

	• Kalavainen 2007 • Kirk 2012 • Lochrie 2013 • McCallum 2007 • Mirza 2013 • Nowicka 2009 • Saelens 2013 • Wake 2009 • Warschburger 2016
Studies from the systematic review that are not relevant for use in the current review	• Alves 2008 • Arauz-Bordreau 2013 • Barkin 2011 • Bathrellou 2010 • Berry 2007 • Berry 2014 • Coppins 2011 • Crocker 2012 • Davis 2013 • de Niet 2012 • Diaz 2010 • Duffy 1993 • Duggins 2010 • Eddy Ives 2012 • Epstein 1984 • Epstein 1985 a;b;c • Epstein 2001 • Epstein 2015 • Faude 2010 • Flodmark 1993 • Gillis 2007 • Hamilton-Shield 2014 • Ho 2016

	• Hughes 2008 • Kalarchian 2009 • Larsen 2015 • Lison 2012 • Looney 2014 • Maddison 2011 • Maddison 2014 • Markert 2014 • Nemet 2005 • Nova 2001 • O'Connor 2013 • Reinehr 2010 • Rodearmel 2007 • Sacher 2010 • Satoh 2007 • Schwingshandl 1999 • Serra Paya 2015 • Siwik 2013 • Taveras 2015 • Taylor 2015 • Vann 2013 • Wafa 2011 • Waling 2012 • Weigel 2008 • Weintraub 2008 • Wilfey 2007 • Woo 2004 • Wright 2012

Critical appraisal

Section	Question	Answer
Overall study ratings	Overall risk of bias	Low
Overall study ratings	Applicability as a source of data	Fully applicable

Risk of bias assessments for RCTs identified in Cochrane reviews

Table 28: Full evidence tables can be found in the reviews by Al-Khudairy (2017), Colquitt (2016), Loveman (2015) and Mead (2017)

Age group/review	Study	Risk of bias
2-5: Colquitt 2016	Quattrin 2012; 2014	Moderate
	Bocca 2012; 2014	Low
	Stark 2011	Low
	Stark 2014	Moderate
	Kelishadi 2009	Moderate
6-11: Mead 2017	Bryant 2011	Moderate
	Davoli 2013	Moderate
	Epstein 2000	Moderate
	Epstein 2005	Moderate
	Gunnarsdottir 2011	Moderate
	Kalavainen 2007	Moderate

	Kirk 2012	Moderate
	Lochrie 2013	Moderate
	McCallum 2007	Low
	Mirza 2013	Moderate
	Nowicka 2009	Moderate
	Saelens 2013	Moderate
	Wake 2009	Low
	Warschburger 2016	Moderate
12-18: Al-Khudairy 2017	Debar 2012	High
	Ebbeling 2003	High
	Ebbeling 2012	Moderate
	Grey 2004	High
	Resnicow 2005	High
	Schranz 2013	High
	Toulabi 2012	Moderate
	Savoye 2011	High
	Vos 2011a and Vos 2012	Moderate
	Hofsteenge 2014 and Hofsteenge 2013	High
	Ford 2010	Moderate

2-5 parent only: Loveman 2015	Small 2014	Moderate
6-11 parent only: Loveman 2015	Boutelle 2011	Moderate
	Collins 2021 and Okely 2010	High
	Estabrooks 2009	High
	Golley 2007	Moderate
	Magarey 2012	Low

RCTs identified in the updated search

Arlinghaus, 2019

Bibliographic Reference	Arlinghaus, K.R.; O'Connor, D.P.; Johnston, C.A.; Frequency of school-based intervention needed to improve weight outcomes of Mexican-American adolescents with overweight or obesity: a randomized controlled trial; Pediatric Obesity; 2019; vol. 14 (no. 12); e12568

Study details

Trial registration number and/or trial name	NCT03797105
Study type	Randomised controlled trial (RCT)
Study location	United States
Study setting	A charter school in Houston, Texas
Study dates	August 2013 - August 2015

Sources of funding	This work was supported by federal funds from the United States Department of Agriculture/Agricultural Research Service 6250-51000
Weight classification	Mixed
Inclusion criteria	Participants who self-identified as Mexican-American, were between the ages of 10 and 17, and had overweight status or obesity according to the Centres for Disease Control and Prevention's classification (ie, BMI percentile =85th percentile) were included in the analysis.
Exclusion criteria	Participants were excluded from the study if they were pregnant, the school identified them as having a cognitive impairment significantly below average age or grade level, they used weight loss medication, or they had a medical diagnosis of type 1 or 2 diabetes.
Intervention(s)	**Intervention description:** The intervention was developed based on social cognitive theory and was specifically designed to intervene on behavioural factors through the interaction of social and environmental influences on physical activity and dietary behaviours. The intervention lasted 24 weeks and occurred during student's 40-minute physical education (PE) class. No matter the frequency at which the intervention was received (1, 3, or 5 d a week), 80% of time was spent on physical activity, and 20% was spent on nutrition, as this 4:1 ratio has established efficacy among this population. **Diet component:** Basic support (healthy eating advice) - nutrition lessons based on the traffic light diet **Physical activity component:** Exercise program - circuit-based physical activity **Behavioural component:** Behaviour modification techniques (token economy system, goal setting, and self-monitoring), and parental involvement (materials sent home and monthly parent meetings). Behaviour modification was incorporated into both physical activity and nutrition time.
Comparator	**Basic support:** Students and their parents in the control condition (0 d) received treatment as usual. Specifically, students participated in a traditional PE class with sports-based skill development and practice.
Target population	Parent and young person
Mode of delivery: Recipients	Group
Mode of delivery: Proximity	Face-to-face

Intervention intensity	The intervention lasted 24 weeks and occurred during student's 40-minute physical education (PE) class for 5 days/week. 26 hours +
Outcome measures	Change in BMI Z-score
Number of participants	N=243 at baseline N=203 at follow-up
Duration of follow-up	12 months from baseline (approximately 6 months after 24 week intervention)
Loss to follow-up	N=40
Methods of analysis	Completers analysis and intention to treat analysis
Additional comments	Completers analysis extracted for outcome data

Study arms

Basic support (N = 49)
Control arm

Intervention (1d/week) (N = 53)
Exercise + BCT

Intervention (3d/week) (N = 51)
Exercise + BCT

Intervention (5d/week) (N = 50)
Exercise + BCT

Characteristics

Study-level characteristics

Characteristic	Study (N = 203)
% Female	50.7
Mean age (SD)	12.02 (0.57)

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	Moderate
Overall risk of bias and directness	Directness	Directly applicable

Bohlin, 2017

Bibliographic Reference	Bohlin, A.; Hagman, E.; Klaesson, S.; Danielsson, P.; Childhood obesity treatment: telephone coaching is as good as usual care in maintaining weight loss - a randomized controlled trial; Clinical Obesity; 2017; vol. 7 (no. 4); 199-205

Study details

Study type	Randomised controlled trial (RCT)
Study location	Sweden
Study setting	outpatient paediatric clinic
Study dates	Between May 2007 and May 2009
Sources of funding	This study was funded by the Stockholm County Council
Weight classification	Mixed

Inclusion criteria	families with children aged 5–14 years
Exclusion criteria	Exclusion criteria were obesity-related syndromes (Laurence Moon Bardet Biedl and Prader Willi) and non-Swedish-speaking parents due to potential interpretation issues within telephone sessions
Intervention(s)	In the TC group, the goal was to stay in contact every month, excluding the summer vacation. During each TC session, the treating nurse spoke with one of the parents, and the timing of the next TC session was agreed upon at the end of each conversation. Including paperwork, each call was estimated to last a duration of 15 min
Comparator	The number of visits in the UC group followed the UC (15) model, and the sessions were led by the treating nurse. Including paperwork, each visit took approximately 45 min for the treating nurse, and at the end of the visit, the patient was placed on a waiting list for their next appointment.
Target population	Parent only
Mode of delivery: Recipients	Individual
Mode of delivery: Proximity	Phone/virtual
Intervention intensity	Less than weekly
Outcome measures	Change in BMI Z-score
Number of participants	37
Duration of follow-up	Variable: The mean (standard deviation, SD) follow-up from enrolment to treatment to post-study follow-up was 3.7 (0.8) years.
Loss to follow-up	3 from BCT group
Methods of analysis	The primary outcome variable, change in BMI SDS, was evaluated using t-test and analysis of variance (ANOVA). In the ANOVA, covariates were gender, age and degree of obesity at the start of the intervention; ethnicity; parental

	weight status; and whether parents cohabited. Betweengroup differences were tested using the t-test and the Chisquare test. Analyses were performed using SAS Statistical software (version 9.4, SAS Institute Inc, Cary, NC, USA).

Study arms

Behaviour change (N = 19)

Basic support (N = 18)

Characteristics

Arm-level characteristics

Characteristic	Behaviour change (N = 19)	Basic support (N = 18)
% Female	47.4	22.2
Mean age (SD)	9.8 (2.56)	9.3 (2.59)
Ethnicity % non-Scandinavian	26.3	38.9
BMIz	2.97 (0.8)	2.91 (0.58)

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	Moderate *(Unclear how self measurements were used)*

Overall risk of bias and directness	Directness	Partially directly applicable *(Non-UK)*

Fedele, 2018

Bibliographic Reference	Fedele, David A; Janicke, David M; McQuaid, Elizabeth L; Abu-Hasan, Mutasim; Baker, Dawn; Zou, Baiming; Netz, Mallory; Lawless, Casey; A Behavioral Family Intervention for Children with Overweight and Asthma.; Clinical practice in pediatric psychology; 2018; vol. 6 (no. 3); 259-269

Study details

Trial registration number and/or trial name	The Childhood Health and Asthma Management Program (CHAMP)
Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	local community health center or local pediatrician’s office
Study dates	Not provided
Sources of funding	: This work was supported by grant ALASB88692 from the American Lung Association and UL1TR001427 from the National Institutes of Health.
Inclusion criteria	children were 6–12 years-old, had a physician-verified persistent asthma diagnosis, and had a BMI ≥ 85th percentile for Centers for Disease Control and Prevention age and gender norms (
Exclusion criteria	if they had history positive for dietary restrictions, medical conditions in which physical activity is contraindicated, prescribed antipsychotic agents, or significant developmental delay. Families could not be enrolled in another weight loss program.
Intervention(s)	—Dyads randomized to CHAMP were asked to attend 12 group-based sessions (3 sessions per month) and 4 individual family sessions (1 session per month) that occurred on weekday evenings. Groups emphasized modeling and providing support to work together to establish healthier eating and exercise patterns.

Comparator	Basic care: Dyads randomized to the control condition received national guidelines on asthma management, proper nutrition, physical activity, stress management, dental hygiene, and school-related difficulties, among other health-related topics
Target population	Parent and child
Mode of delivery: Recipients	Both
Mode of delivery: Proximity	Face-to-face
Intervention intensity	Weekly
Outcome measures	Change in BMI Z-score Quality of life
Number of participants	24
Duration of follow-up	6 months from end of intervention
Loss to follow-up	13
Methods of analysis	We examined feasibility by calculating enrollment and session attendance rates; acceptability was assessed via descriptive statistics of satisfaction surveys. We also examined feedback from one-on-one exit interviews at the post-intervention assessment visit in an attempt to extract themes related to: 1) the perceived value of CHAMP, 2) recommendations for improving CHAMP, 3) appropriateness of CHAMP for their family, 4) behavioral changes since completing CHAMP, and 5) barriers to making changes. Analysis of covariance (ANCOVA), with baseline values entered as covariates, was used to assess changes in outcome variables. Due to the small samples size in our pilot study, we relied on standardized mean difference effect sizes (i.e., Cohen's d; Cohen, 1988) and 95% confidence intervals (CIs) to interpret findings (Coe, 2002). Participants attending ≥ 9 sessions (n = 12) were categorized as completers and were included in analyses. Given the pilot nature of the current study, this post hoc decision was made in order to investigate the efficacy of CHAMP among families who received a reasonable dose of the intervention. Cell sizes vary slightly due to missing data.

Study arms

Behaviour change + exercise (N = 14)

Basic support (N = 10)

Characteristics

Arm-level characteristics

Characteristic	Behaviour change + exercise (N = 14)	Basic support (N = 10)
% Female	57	50
Mean age (SD)	8.64 (1.78)	8.7 (2.16)
White %	21	10
Black %	71	60
Other	1	30

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	High *(Due to sample and attrition)*
Overall risk of bias and directness	Directness	Partially directly applicable *(non-UK)*

Njardvik, 2018

Bibliographic Reference	Njardvik, U.; Gunnarsdottir, T.; Olafsdottir, A.S.; Craighead, L.W.; Boles, R.E.; Bjarnason, R.; Incorporating Appetite Awareness Training Within Family-Based Behavioral Treatment of Pediatric Obesity: A Randomized Controlled Pilot Study; Journal of pediatric psychology; 2018; vol. 43 (no. 9); 1017-1027

Study details

Study type	Randomised controlled trial (RCT)
Study location	Iceland
Study setting	Hospital
Study dates	from March 2006 to December 2007
Sources of funding	This work was supported by the Landspitali University Hospital Research Fund (to RB); The Doctoral Grants of The University of Iceland Research Fund (to TG); the University of Iceland Research Fund (to ASO); and a grant from the Thorvaldsen Society (to RB).
Inclusion criteria	Inclusion criteria for study participation were a child with obesity, defined as Body Mass Index Standard Deviation Score (BMISDS) >2, one parent agreed to participate in treatment, and the child being able to comprehend written material and complete self-monitoring tasks
Exclusion criteria	child obesity was not because of an identifiable medical cause, no significant dietary or exercise restrictions, no family member taking part in another weight control program
Intervention(s)	r an experimental group receiving the same treatment with the integration of an appetite awareness training component (FBT-AAT) delivered as part the FBT. r an experimental group receiving the same treatment with the integration of an appetite awareness training component (FBT-AAT) delivered as part the FBT
Comparator	the standard condition receiving Epstein’s family-based treatment for pediatric obesity (FBT)
Target population	Parent and child
Mode of delivery: Recipients	Group

Mode of delivery: Proximity	Face-to-face
Intervention intensity	weekly
Outcome measures	Change in BMI Z-score Quality of life
Number of participants	84
Duration of follow-up	1 year; 2 years post intervention
Loss to follow-up	25
Methods of analysis	After assessing variables for outliers and normality, differences in baseline variables between the two conditions (FBT-AAT and FBT) were tested using independent t-tests and v2 -tests (categorical variables). Changes in dependent variables over time (pretreatment, posttreatment, 1-year, and 2-year posttreatment) by condition were evaluated by mixed design analysis of variances (ANOVAs) where group membership (FBT vs. FBT-AAT) served as the betweensubjects factor and time (pretreatment, posttreatment, 1 year, and 2 years) served as the within-subjects factor. Main effects were followed up by tests of withinsubjects contrasts, one-way ANOVA and dependent samples t-tests. Using an intent-to-treat approach, missing values were treated with multiple imputation analysis (m ¼ 5) and a pooling procedure with the standard error estimates combined for all posttest analyses. Data were analyzed by the PASW Statistics 25 (SPSS, Inc., 2017, Chicago, IL).

Study arms

Behaviour change + diet (N = 41)

Basic support (N = 43)

Characteristics

Study-level characteristics

Characteristic	Study (N =)
% Female	45.24
Mean age (SD)	11 (1.4)
Ethnicity % Icelandic of norse-celtic decent	92
BMI Standardised Mean (SD)	3.11 (0.5)

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	Low
Overall risk of bias and directness	Directness	Partially directly applicable *(Non-UK, with homogenous ethnic group)*

Robertson, 2017

Bibliographic Reference	Robertson, W.; Fleming, J.; Kamal, A.; Hamborg, T.; Khan, K.A.; Griffiths, F.; Stewart-Brown, S.; Stallard, N.; Petrou, S.; Simkiss, D.; Harrison, E.; Kim, S.W.; Thorogood, M.; Randomised controlled trial and economic evaluation of the 'Families for Health' programme to reduce obesity in children; Archives of Disease in Childhood; 2017; vol. 102 (no. 5); 416-426

Study details

Trial registration number and/or trial name	Families for Health
Study type	Randomised controlled trial (RCT)
Study location	West Midlands, UK
Study setting	Three defined areas within the West Midlands, UK, reflecting the varied demographics within the region. Sites A and C were relatively more deprived, whereas site B was less deprived
Study dates	e between March 2012 and March 2015
Sources of funding	Funding Health Technology Assessment Programme (09/127/41).
Weight classification	Mixed
Inclusion criteria	Eligible families had an overweight (≥91st centile for BMI) or obese (≥98th centile for BMI) child aged 6–11 years, based on the UK 1990 definition11; and at least one parent or guardian willing to take part.
Exclusion criteria	Families were excluded if parent or child had insufficient command of English; the child had recognised medical cause of obesity or was unable to participate due to severe learning difficulties and/or behavioural problems.
Intervention(s)	The Families for Health (FFH) version 2 (V2) manualised programme comprises 10 weekly 2½-hour sessions, with children and parents from 8 to 12 families attending parallel groups. The programme combines information on parenting skills, social and emotional development as well as healthy eating including portion size and physical activity. The plan was to run six FFH courses (two in each site).
Comparator	Standard care: Families assigned to UC were offered 'One Body One Life',15 a group-based family intervention in site A, Change4Life advisors offering one-to-one support in site B and either (1) a two-step programme, MEND and Choose It, with taster sessions for physical activity, healthy eating, or (2) Weight Watchers for young people aged 10+ years or (3) referral to the school nurse for children aged 6–9 years in site C. Further details of the UC interventions are available.
Target population	Parent and child
Mode of delivery: Recipients	Group

Mode of delivery: Proximity	Face-to-face
Intervention intensity	Weekly
Outcome measures	Change in BMI Z-score Quality of life
Number of participants	115
Duration of follow-up	12 months (42 weeks from end of intervention)
Loss to follow-up	32 (83 remained)
Methods of analysis	For child outcome measures, linear mixed models with a random family effect were fitted to account for clustering. After approval from the Trial Steering Committee, we did not account for delivery group clustering in the FFH arm as analyses showed no evidence of clustering. Separate models were fitted for differences between baseline and 3-month follow-up (end of FFH programme) and baseline and 12-month follow-up. Models were adjusted for baseline values of outcomes, gender and family-level 'locality' as fixed effects as specified in the Statistical Analysis Plan. Primary analyses were conducted on trial participants with complete relevant data. A preplanned secondary analysis was also conducted with missing values imputed using multiple imputation with fully conditional specification regression.28 We summarised outcomes by trial allocation and follow-up period using means, SDs and CIs for continuous variables and absolute numbers, percentages and CIs for categorical variables. Generally, one parent per family provided data, and parent outcomes were compared using t-tests and χ2 tests. All analyses were performed on an intention-to-treat basis, except where

Study arms

Behaviour change + exercise (N = 45)

Basic support (N = 43)

Characteristics

Study-level characteristics

Characteristic	Study (N =)
% Female	50.8
Mean age (SD)	9.44 (1.59)
Ethnicity % white	61.7
BMI Standardised Mean (SD)	2.71 (0.68)

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	Low
Overall risk of bias and directness	Directness	Directly applicable

Soltero, 2018

Bibliographic Reference	Soltero, E.G.; Olson, M.L.; Williams, A.N.; Konopken, Y.P.; Castro, F.G.; Arcoleo, K.J.; Keller, C.S.; Patrick, D.L.; Ayers, S.L.; Barraza, E.; Shaibi, G.Q.; Effects of a Community-Based Diabetes Prevention Program for Latino Youth with Obesity: A Randomized Controlled Trial; Obesity; 2018; vol. 26 (no. 12); 1856-1865

Study details

Trial registration number and/or trial name	NCT02039141

Study type	Randomised controlled trial (RCT)
Study location	United States
Study setting	A local YMCA in Phoenix, Arizona
Study dates	Recruitment commenced in October 2012 and continued through July 2015. The last participant completed final data collection in August, 2016.
Sources of funding	This research was funded by the National Institutes of Health/National Institute on Minority Health and Health Disparities (P20MD002316; U54MD002316).
Weight classification	Obese
Inclusion criteria	• Self-identification as Latino • Age 14–16 at enrolment • Obesity, defined as a BMI ≥ 95th percentile for age and sex or a BMI ≥30 kg/m2
Exclusion criteria	• Taking medication(s) or diagnosed with a condition that influences carbohydrate metabolism, physical activity, or cognition • Diagnosed with T2D • Currently enrolled (or within previous 6 months) in a formal weight loss program • Diagnosed with depression or any other condition that may impact QoL
Intervention(s)	The comprehensive lifestyle intervention consisted of nutrition and health education, exercise, and behavior change strategies that have been shown to be efficacious in the adult Diabetes Prevention Program (DPP). The curriculum was informed by key constructs from Social Cognitive Theory (SCT) including enhancing self-efficacy for healthy lifestyle behaviors through goal-setting, vicarious experience, role modeling, and verbal encouragement. In addition, building and encouraging social support from family and peers for making healthy behavior changes was offered in the form of appraisal, informational, instrumental, and emotional support. All sessions were held at the YMCA where lifestyle classes (1 day / week for ~60 minutes) were delivered to groups of 8–10 families. **Diet component:** Basic support (healthy eating advice) - nutrition and health education

	Physical activity component: Exercise program - The exercise curriculum was delivered by YMCA fitness instructors (3 days/week for 60 minutes) to groups of 8–10 youth. Structured components included aerobic activities (e.g. running, spinning), anaerobic activities (e.g. athletic drills) and resistance exercises. Unstructured components included team sports and games that promoted social support and bonding among youth. Sessions were designed to elicit an average heart rate of ≥150 beats per minute for the majority of the session. Heart rate was monitored during sessions using a Polar Heart Rate monitor **Behavioural component:** The behaviour change strategies of goalsetting and self-monitoring were integrated and tailored to the psychosocial and developmental characteristics of adolescents. In sessions, families documented and monitored their progress towards weekly behavioral goals and progress towards fitness goals were monitored through monthly fitness assessments. Given the psychosocial consequences associated with pediatric obesity, a class session was dedicated to emotional well-being by discussing self acceptance, body-image, selfaffirmation, and coping mechanisms.
Comparator	**Basic support:** At baseline, the COMP youth were provided their lab results and a handout with general information on healthy lifestyle behaviors. COMP youth were contacted on a monthly basis to maintain a sense of connection with the study team, keep current with contact information, and remind youth of scheduled testing visits in the lab throughout the 12-month study period.
Target population	Parent and young person
Mode of delivery: Recipients	Group
Mode of delivery: Proximity	Face-to-face
Intervention intensity	Lifestyle classes were 1 day/week for 60 minutes. Exercise classes were 3 days/week for 60 minutes. The intervention lasted 3 months. 26 hours +
Outcome measures	Waist circumference Quality of life
Number of participants	N=136

Duration of follow-up	12 months from baseline
Loss to follow-up	N=16
Methods of analysis	Intention-to-treat analysis

Study arms

Intervention (N = 67)

Exercise + behavioural

Comparator (N = 69)

Basic support

Characteristics

Study-level characteristics

Characteristic	Study (N = 136)
% Female	54.4

Arm-level characteristics

Characteristic	Intervention (N = 67)	Comparator (N = 69)
Mean age (SD)	15.4 (1)	15.3 (0.9)

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	High
Overall risk of bias and directness	Directness	Directly applicable

Spence, 2022

Bibliographic Reference	Spence, N.D.; Newton, A.S.; Keaschuk, R.A.; Ambler, K.A.; Holt, N.L.; Jetha, M.M.; Mushquash, A.R.; Rosychuk, R.J.; Sharma, A.M.; Spence, J.C.; Ball, G.D.C.; Parents as Agents of Change in Managing Pediatric Obesity: A Randomized Controlled Trial Comparing Cognitive Behavioral Therapy versus Psychoeducation Interventions; Childhood obesity (Print); 2022

Study details

Trial registration number and/or trial name	NCT01267097
Study type	Randomised controlled trial (RCT)
Study setting	outpatient pediatric obesity management clinic
Study dates	between July 2010 and January 2014
Sources of funding	Missing from paper
Inclusion criteria	To be eligible for the study, children needed to be 8–12 years old with an age- and sex-specific BMI ‡85th percentile,20 and at least one parent had to agree to participate. Families also needed to be fluent in English (verbal and written).
Exclusion criteria	No children in the study had underlying medical conditions or were taking medications that could impact weight change

Intervention(s)	1 Both CBT and PEP interventions were manualized and included the same frequency of contact (16 sessions over 16 weeks), content (identical information), mode (group format), session duration (60–90 minutes), intervention goals related to nutrition and physical activity based on evidence-based recommendations,18 and number of group leaders (two/group). The CBT intervention focused on the role that cognitive processes play in the maintenance of problem behaviors, mood states, and habits. This intervention emphasized the relationship between thoughts, feelings, and actions, and utilized techniques involving motivation, goal setting, problem-solving, and knowledge/skill acquisition to facilitate sustainable behavior changes. The skills learned were designed for parents to identify and change the parenting mechanisms that influence children's unhealthy lifestyle habits.
Comparator	The PEP intervention was a knowledge-based intervention modeled after traditional nutrition and health education programs. It was a more passive intervention, with limited focus on active skill building. Active integration of learned concepts in goal setting and linking cognitions and behaviors to lifestyle changes was not emphasized. PEP was not a true control group, but its content and delivery were consistent with what many clinicians provide for standard weight management.
Target population	Parent only
Mode of delivery: Recipients	Group
Mode of delivery: Proximity	Face-to-face
Intervention intensity	Weekly
Outcome measures	Change in BMI Z-score Weight related morbidity: Insulin sensitivity Weight related morbidity: Blood pressure
Number of participants	53

Duration of follow-up	6 months and 10 months post intervention
Loss to follow-up	33 (all included in analysis)
Methods of analysis	Descriptive statistics were generated for continuous (mean, standard deviation or median, interquartile range) and categorical (percentages) variables. Longitudinal regression analyses were performed on an intention-to-treat basis, and all families were included in the primary and secondary analyses. For the primary analysis, the BMI z-score was compared between the CBT and PEP groups with a linear mixed-effects regression model that constrained preintervention differences between groups on the outcome to zero.27,28 Maximum likelihood estimation was used, and an unstructured covariance matrix was specified to account for statistical dependence among repeated measures of individuals over time. Analyses were adjusted for preintervention age, sex, and cohort. Missing data were handled using maximum likelihood.27,29 Analyses of the secondary outcomes, including anthropometric, lifestyle, psychosocial, and cardiometabolic, were conducted in the same manner as the primary analysis. Statistical significance was set at $p < 0.05$. Analyses were performed with SAS version 9.4, software

Study arms

Behaviour change (N = 27)

Basic support (N = 25)

Characteristics

Study-level characteristics

Characteristic	Study (N =)
% Female	51.9
Mean age (SD)	9.8 (1.7)

Characteristic	Study (N =)
Ethnicity % white	73.1
BMIz	2.2 (0.3)

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	Moderate
Overall risk of bias and directness	Directness	Partially directly applicable *(non-UK)*

Stark, 2019

Bibliographic Reference	Stark, L.J.; Filigno, S.S.; Kichler, J.C.; Bolling, C.; Ratcliff, M.B.; Robson, S.M.; Simon, S.L.; McCullough, M.B.; Clifford, L.M.; Stough, C.O.; Zion, C.; Mara, C.A.; Maintenance Following a Randomized Trial of a Clinic and Home-based Behavioral Intervention of Obesity in Preschoolers; Journal of Pediatrics; 2019; vol. 213; 128-136e3

Study details

Other publications associated with this study included in review	Stark 2011; Stark 2014
Trial registration number and/or trial name	LAUNCH

Study type	Randomised controlled trial (RCT)
Study location	USA
Study setting	27 independent pediatric practices (and referrals from seven practices in a unified health system)
Study dates	March 12, 2012 and followed through December 21, 2016
Sources of funding	Supported by the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) (R01DK091251), the National Center for Advancing Translational Sciences of the NIH (UL1 TR001425), and National Institutes of Health (T32 DK063929)
Inclusion criteria	active patient, age 2 to 5 years, and BMI percentile ≥95th
Exclusion criteria	developmental disability, medical condition promoting obesity or condition that precluded full participation, weight affecting medication, enrolled in a weight management program, or non-English speaking
Intervention(s)	2 arms Duration 6 months delivered over 18 sessions (weekly in months 1–3; every other week in months 4–6) I arm: LAUNCH a family-based, behavioral intervention delivered in sessions that alternated weekly between group clinic sessions (90 minutes) at a medical facility and individual home visits (60 minutes). The clinic sessions included simultaneous parent and child groups. Parent-group sessions provided nutrition education, problem-solving around\monitoring of dietary intake for children and parents and physical activity changes, and child behavior management strategies (across all sessions) such as differential attention, contingency management, limit setting, effective use of time-out to manage tantrums, shaping and exposure to introduce new foods, and implementing stimulus control measures to improve food choices and physical activity. II arm: Motivational interviewing conducted with caregivers and targeted improvement in the child’s dietary and activity behaviors. At the first visit, caregivers met with a pediatrician trained in MI at which time they completed questionnaires to assess their values and motivation for change, were given information about their child’s weight and BMI percentile and a packet of publicly available materials/brochures from the AAP “Let’s Go” program. Subsequent MI intervention sessions were delivered by a licensed clinical psychologist trained in MI in either the family’s home (3 sessions) or over the telephone (14 sessions).
Comparator	Usual care: participants received routine care from their pediatrician and were only seen by the study team at the assessment visits.
Target population	Parent and child
Mode of delivery: Recipients	Both

Mode of delivery: Proximity	Face-to-face
Intervention intensity	18 sessions over 6 months.
Outcome measures	Change in BMI Z-score
Number of participants	167
Duration of follow-up	6 months and 12 months post treatment
Loss to follow-up	38 at 6 months; 40 at 12 months
Methods of analysis	To examine group differences in BMI%50th at 6- and 12-months posttreatment, intent-totreat analysis using regression-based analysis of covariance (ANCOVA) models were conducted in Stata version 15. Baseline BMI%50th was included as a covariate in the analysis. Two dummy variables were created to compare LAUNCH with MI and LAUNCH with STC (both with LAUNCH as the reference category). Both of these dummy variables were included in the models to compare treatment groups on BMI%50th at each time point. Standardized effect sizes estimates of the group differences at each time point (i.e., Cohen d) are presented in addition to statistical significance. The same models were used to examine BMI%95, BMIZ, weight gain and secondary outcomes at each time point. Logistic regression models were used to examine differences between the odds of a child having a TV in their bedroom between the groups at each time point. Maximum likelihood estimation on the full randomized sample (N = 151) was used to address missing data for all models. This estimator does not require the deletion of participants with any missing data, but instead uses all available information when computing the model parameters.17 Previously reported baseline and posttreatment child weight8 and dietary18 outcomes are presented to provide a context for maintenance of the follow-up data

Study arms

Behaviour change + diet + exercise (N = 47)

Behaviour change + diet (N = 50)

Basic support (N = 54)

Characteristics

Study-level characteristics

Characteristic	Study (N =)
% Female	56.95
Mean age (SD) (Months)	55.14 (11.19)
White %	76.16
Black %	9.27
Other	14.57
BMI Standardised Mean (SD)	2.44 (0.6)

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	Moderate
Overall risk of bias and directness	Directness	Partially directly applicable *(Non-UK)*

Yackobovitch-Gavan, 2018

Bibliographic Reference	Yackobovitch-Gavan, M.; Wolf Linhard, D.; Nagelberg, N.; Poraz, I.; Shalitin, S.; Phillip, M.; Meyerovitch, J.; Intervention for childhood obesity based on parents only or parents and child compared with follow-up alone; Pediatric Obesity; 2018; vol. 13 (no. 11); 647-655

Study details

Study location	Israel
Study setting	Children's Medical Center
Study dates	between 2006 and 2012
Sources of funding	This research was supported by a Health Policy Research Grant from the Clalit Research Institute, Chief Physician Office
Inclusion criteria	Inclusion criteria were age 5–11 years and body mass index (BMI) between the 85th and 98th percentiles for age and sex
Exclusion criteria	Exclusion criteria were chronic conditions (e.g. diabetes mellitus, cardiac or renal problems, uncontrolled hypertension, liver enzyme levels more than threefold above the upper normal limit, genetic-syndromes and organic diseases associated with obesity), use of medication that might influence weight.
Intervention(s)	The family-based intervention included 12 onceweekly group meetings of 60 min each (12–15 participants per meeting) with a dietician and psychologist and focused on cognitive behavioural changes in the family lifestyle. Eligible children and their parents were randomly assigned to one of three groups: parents-only, parents–child and control. The parents-only and parents–child groups attended an intensive intervention programme designed to instill behavioural and lifestyle changes. The control group was managed by clinical follow-up alone. Each meeting focused on a different nutritional or lifestyle goal, including eating in accordance with the food pyramid, adequate fruit and vegetable consumption and abstention from sweetened beverages, the importance of drinking water, reducing fast-food consumption, limiting the time spent watching television or using the computer, increasing the time spent in physical activity, special dietary consideration during parties and vacations and strategies to implement an active lifestyle in the family
Comparator	The control group did not participate in group meetings. The control group was managed by clinical follow-up alone.
Target population	Parent and child
Mode of delivery: Recipients	Group

Mode of delivery: Proximity	Face-to-face
Intervention intensity	Weekly
Outcome measures	Weight related morbidity: Insulin sensitivity Weight related morbidity: Blood pressure
Number of participants	247 children (+parents)
Duration of follow-up	24 months total (21 months from end of intervention)
Loss to follow-up	120 (127 remained)
Methods of analysis	gnificant difference with 80% power. The data were analysed using SPSS software v 22 (SPSS, Inc., Chicago, Illinois). The primary outcome measures were the change in BMI-SDS from baseline at completion of the intervention (3 months) and at the end of follow-up (24 months) in each of the groups. To test the primary outcomes, we used paired samples t-test (normally distributed data). To further control for potential confounders, mixedeffects regression models were formulated, adjusted for age, gender and baseline BMI-SDS (which was correlated with the changes in BMISDS over time). Spearman's correlations were used to analyse the correlation between attendance rate (skewed distribution) and the change in BMI-SDS. Other within-group comparisons included changes in lifestyle parameters and in components of MS from baseline to completion of the intervention and to the end of follow-up. We used paired samples t-test for normally distributed data, related samples Wilcoxon signed-rank test for skewed data and related samples McNemar test for categorical data. Comparisons among the groups were analysed using one-way analysis of variance for normally distributed data, independent samples Kruskal–Wallis test for skewed data and chi-squared test for categorical data

Study arms

Behaviour change: Parent only (N = 45)

Behaviour change: Parent and child (N = 45)

Basic support (N = 37)

Characteristics

Study-level characteristics

Characteristic	Study (N =)
% Female	67
Mean age (SD)	8.4 (1.5)
BMI Standardised Mean (SD)	1.79 (0.32)

Critical appraisal – Cochrane risk of bias tool

Section	Question	Answer
Overall risk of bias and directness	Overall risk of bias	Moderate *(Due to attrition and lack of detail on randomisation.)*
Overall risk of bias and directness	Directness	Partially directly applicable *(Non-UK)*

Qualitative evidence

Burchett, 2018

Bibliographic Reference	Burchett, H.E.D.; Sutcliffe, K.; Melendez-Torres, G.J.; Rees, R.; Thomas, J.; Lifestyle weight management programmes for children: A systematic review using Qualitative Comparative Analysis to identify critical pathways to effectiveness; Preventive Medicine; 2018; vol. 106; 1-12

Study Characteristics

Study design	Systematic review Mixed methods
Study details	Dates searched 2012 to December 2015 (Included studies dated 2008 to 2014) Databases searched ASSIA (Proquest), Index to Theses (Proquest), British Education Index (EBSCO), CINAHL Plus(EBSCO), ERIC (EBSCO), Health Management Information Consortium (OVID SP), MEDLINE: Pubmed not Medline (Web of Science), MEDLINE and Medline in process (OVID SP), Psycinfo (OVID SP), Social Policy and Practice (OVID SP) and Social Sciences Citation Index (Web of Science) Sources of funding funded by Public Health England
Inclusion criteria	qualitative studies from the UK reporting the views of children aged ≤ 11 years, parents of children aged ≤ 11 years or service providers on their experiences and views of a LWMP for children
Exclusion criteria	Conference abstracts or poster; Conducted outside of western Europe, North America, Australia or New Zealand (so possibly not applicable to a UK context)
Intervention(s)	n/a
Outcome(s)	Qualitative data
Number of studies included in the systematic review	17
Studies from the systematic review that are relevant for use in the current review	Included studies: • Lewis 2014 • Lucas 2014 • Newson 2013

	• Owen 2009 • Pittson 2013 • Robertson 2009 • Staniford 2011 • Stewart 2008 • Trigwell 2011 • Visram 2013 • Watson 2012 • Arai 2015 • Robertson 2011 • Stewart 2007 • Stewart 2006 • GOALS 2013 • Watson 2015
Studies from the systematic review that are not relevant for use in the current review	n/a

Critical appraisal – SBU Tool to assess methodological limitations of qualitative evidence synthesis (ENTREQ)

Section	Question	Answer
Summary	Summarize the concerns identified during the assessment	High concern
Summary	Reason for concern	Minimal information on themes. Unclear if all included studies were used or fully reported for each theme. Lack of CerQUAL or quality assessment.

Jones, 2017

Bibliographic Reference	Jones, H.M.; Al-Khudairy, L.; Melendez-Torres, G.J.; Oyebode, O.; Viewpoints of overweight and obese adolescents attending lifestyle obesity treatment interventions: A qualitative systematic review; The Lancet; 2017; vol. 390 (no. speciss1); 50

Study Characteristics

Study design	Systematic review
Study details	Dates searched Unrestricted Databases searched MEDLINE, Embase, PsycINFO, ASSIA, CINAHL and Web of Science Sources of funding This research was funded the National Institute for Health Research (NIHR) Collaboration for Leadership in Applied Health Research and Care West Midlands (NIHR CLAHRC WM).
Inclusion criteria	i) Studies must have used qualitative methods for data collection and analyses (these may have been presented alongside quantitative outcomes), (ii) included adolescents with overweight and obesity participating in lifestyle interventions with the primary aim of treating obesity, (iii) mean age of 12-17 years at time of the study commencing (to align with the age range used in the Cochrane childhood obesity treatment review series), (iv) Single or multi-component lifestyle interventions, in any setting, any method of delivery, e.g. group, (v) full text articles only.
Exclusion criteria	(i) Children under 12 years or adults over 18 years, (ii) adolescents who were a healthy weight (>2nd to <85th percentile), pregnant or breastfeeding, (iii). Interventions aiming to treat adolescents with a medical cause for obesity (E.g. Prader Willi syndrome), (iv) conference abstracts. Three exclusion criteria were not originally set out in the protocol but added later: (v) adolescents with an eating disorder, (vi) adolescents with severe long-term mental health conditions, e.g. schizophrenia, (vii) studies where participants had not experienced an actual programme

Intervention(s)	n/a
Outcome(s)	Qualitative data
Number of studies included in the systematic review	28
Studies from the systematic review that are relevant for use in the current review	included studies: • Alm 2008 • Banks 2014 • Campbell-Voytal 2018 • Daley 2008 • Engstrom 2016 • Hammar 1971 • Hemetek 2015 • Hester 2009 • Holt 2005 • Howie 2016 • Jogova 2013 • Li 2016 • Melnyk 2007 • Morinder 2011 • Nguyen 2014 • Owen 2009 • Peeters 2012 • Reece 2015 • Riiser 2013 • Rudolf 2006 • Smith 2014 a and b • Staiano 2012 • Twiddy 2011 • Watson 2016 • Woolford 2010

	• Woolford 2012 a and b
Studies from the systematic review that are not relevant for use in the current review	n/a

Critical appraisal – SBU Tool to assess methodological limitations of qualitative evidence synthesis (ENTREQ)

Section	Question	Answer
Summary	Summarize the concerns identified during the assessment	Minor concern
Summary	Reason for concern	No cause for concern

McMaster, 2020

Bibliographic Reference	McMaster, Caitlin M; Gow, Megan L; Neal, Renee; Alexander, Shirley; Baur, Louise A; Cohen, Jennifer; Acceptability of Hospital-Based Pediatric Weight Management Services among Patients and Families: A Narrative Synthesis.; Childhood obesity (Print); 2020; vol. 16 (no. 2); 129-140

Study Characteristics

Study design	Systematic review
Study details	Dates searched Unrestricted

	Databases searched Systematic searches of Medline through OvidSP; PsychINFO through OvidSP; CINAHL through Ebsco; AMED through OvidSP; and Embase through OvidSP Sources of funding This research was undertaken as part of the CHild and Adolescent weight Management Pathways (CHAMP) Study funded by a NSW Translational Research Grant.
Inclusion criteria	experiences of patients aged £18 years and/or their family who attended an established secondary- or tertiary-level pediatric weight management service for treatment of obesity
Exclusion criteria	e experiences of (1) patients over the age of 18 and/or their families; (2) participants receiving treatment as part of a pediatric weight management clinical trial; (3) patients receiving an intervention aimed at preventing, not treating, overweight or obesity; (4) patients who were referred to a pediatric weight management service but did not attend; or (5) patients receiving treatment as part of a primary-level service
Intervention(s)	n/a
Outcome(s)	Qualitative data
Number of studies included in the systematic review	11
Studies from the systematic review that are relevant for use in the current review	included studies: • Fjone 2016 • Garcia 2017 • Kitscha 2009 • Nogueira 2013 • Owen 2009 • Sallinen Gaffka 2013 • Skelton 2016 • Stewart 2008

	• Tremblay 2016 • Woolford 2012 • Zenlea 2017
Studies from the systematic review that are not relevant for use in the current review	n/a

Critical appraisal – SBU Tool to assess methodological limitations of qualitative evidence synthesis (ENTREQ)

Section	Question	Answer
Summary	Summarize the concerns identified during the assessment	Moderate concern
Summary	Reason for concern	Limited information given for some themes. Quality assessment was limited.

Appendix E – Forest plots

Forest plots for NMA pairwise analysis

Change in BMI z-score

Under 6 years old

6-12 months postintervention follow up

Figure 1: BC+ Exercise vs Basic support

Study or Subgroup	Control Mean	Control SD	Control Total	Experimental Mean	Experimental SD	Experimental Total	Weight	Mean Difference IV, Fixed, 95% CI
Bocca 2014	-0.3	0.5	25	-0.6	0.5	32	100.0%	0.30 [0.04, 0.56]
Total (95% CI)			**25**			**32**	**100.0%**	**0.30 [0.04, 0.56]**

Heterogeneity: Not applicable
Test for overall effect: Z = 2.25 (P = 0.02)

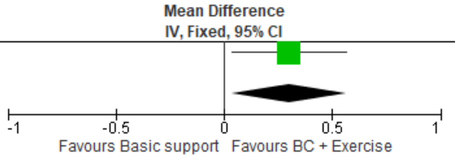


Figure 2: BC+ Diet+ Exercise vs Basic Support

Study or Subgroup	Control Mean	Control SD	Control Total	Experimental Mean	Experimental SD	Experimental Total	Weight	Mean Difference IV, Random, 95% CI
Stark 2011	0.4	0.49	9	-0.37	0.41	7	22.1%	0.77 [0.33, 1.21]
Stark 2014 (Arm 1)	-0.3	0.36	6	-0.5	0.43	10	24.5%	0.20 [-0.19, 0.59]
Stark 2014 (Arm 2)	-0.3	0.36	6	-0.59	0.75	11	18.4%	0.29 [-0.24, 0.82]
Stark 2019	-0.13	0.4	47	-0.2	0.54	43	35.0%	0.07 [-0.13, 0.27]
Total (95% CI)			**68**			**71**	**100.0%**	**0.30 [-0.01, 0.60]**

Heterogeneity: Tau² = 0.06; Chi² = 8.18, df = 3 (P = 0.04); I² = 63%
Test for overall effect: Z = 1.91 (P = 0.06)

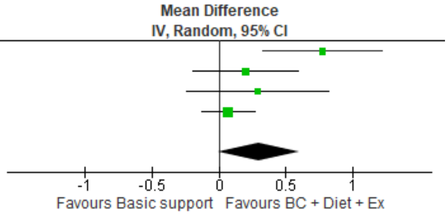


Figure 3: BC+ Diet+ Exercise vs Diet + Exercise

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Quattrin 2014	-0.45	0.055678	30	-0.25	0.05	41	100.0%	-0.20 [-0.23, -0.17]
Total (95% CI)			**30**			**41**	**100.0%**	**-0.20 [-0.23, -0.17]**

Heterogeneity: Not applicable
Test for overall effect: Z = 15.60 (P < 0.00001)

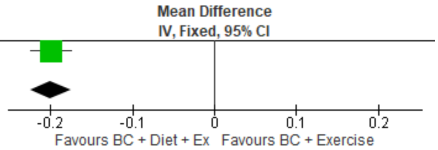


Figure 4: BC+ Diet vs Basic support

Study or Subgroup	Control Mean	Control SD	Control Total	Experimental Mean	Experimental SD	Experimental Total	Weight	Mean Difference IV, Fixed, 95% CI
Stark 2019	-0.13	0.4	47	-0.12	0.31	39	100.0%	-0.01 [-0.16, 0.14]
Total (95% CI)			**47**			**39**	**100.0%**	**-0.01 [-0.16, 0.14]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.13 (P = 0.90)

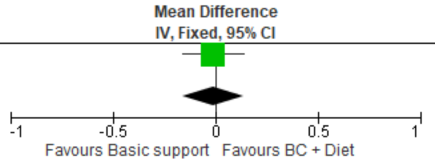
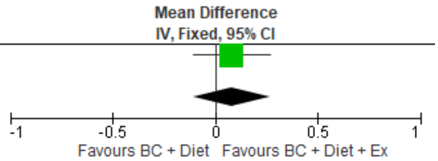


Figure 5: BC+ Diet vs BC+ Diet + Exercise

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Stark 2019	-0.12	0.31	39	-0.2	0.54	43	100.0%	0.08 [-0.11, 0.27]
Total (95% CI)			**39**			**43**	**100.0%**	**0.08 [-0.11, 0.27]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.83 (P = 0.41)



≥12 months postintervention follow up

Figure 6: Diet vs Basic Support

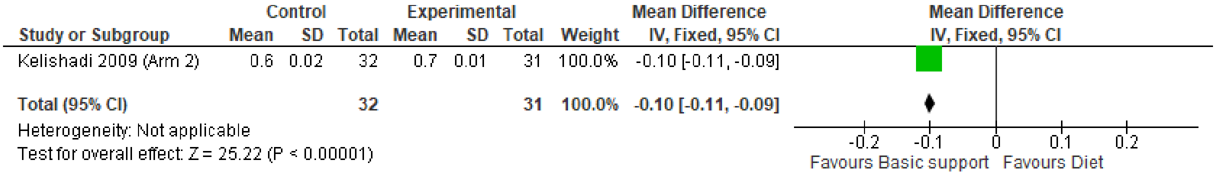


Figure 7: Basic support vs BCT + Diet + Exercise

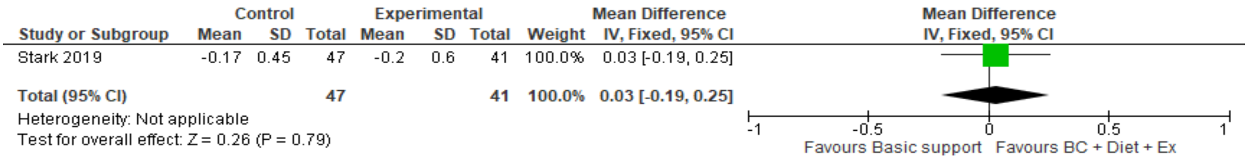


Figure 8: BC+ Diet+ Exercise vs Diet + Exercise

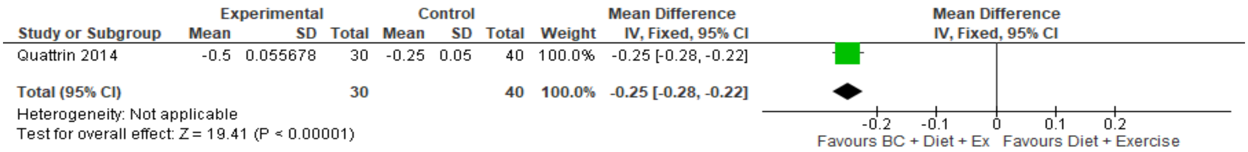


Figure 9: BC+ Diet vs Basic Support

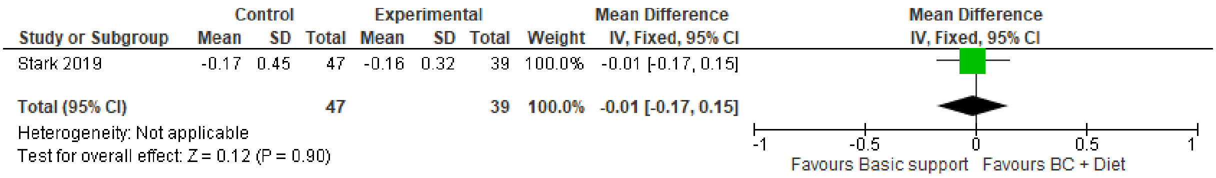
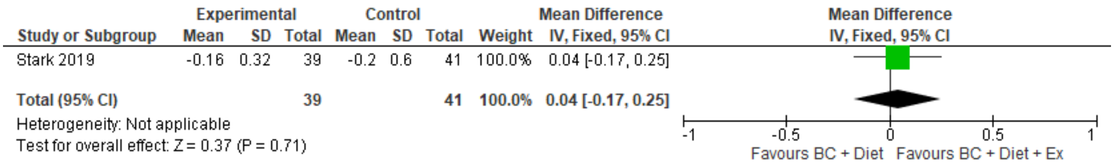


Figure 10: BC+ Diet vs BC+ Diet+ Exercise



6- 11 year olds

6-12 months postintervention follow up

Figure 11: BCT vs Basic support

	Control			Experimental				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Random, 95% CI
Estabrooks 2009 (Arm 1)	-0.06	0.03	18	-0.08	0.04	63	29.1%	0.02 [0.00, 0.04]
Estabrooks 2009 (Arm 2)	-0.06	0.03	18	-0.02	0.04	56	29.1%	-0.04 [-0.06, -0.02]
Gerards 2015	-0.08	0.27	42	0.05	0.26	44	11.7%	-0.13 [-0.24, -0.02]
Golley 2007	-0.13	0.4	31	-0.15	0.47	29	4.2%	0.02 [-0.20, 0.24]
Lochrie 2013	2.07	0.1897	40	1.97	0.1697	32	16.2%	0.10 [0.02, 0.18]
McCullum 2007	0.03	0.538424	80	-0.04	0.582752	73	6.1%	0.07 [-0.11, 0.25]
Spence 2022	-0.14	0.46	25	0	0.43	27	3.6%	-0.14 [-0.38, 0.10]
Total (95% CI)			**254**			**324**	**100.0%**	**-0.00 [-0.05, 0.04]**

Heterogeneity: Tau² = 0.00; Chi² = 36.39, df = 6 (P < 0.00001); I² = 84%
Test for overall effect: Z = 0.19 (P = 0.85)

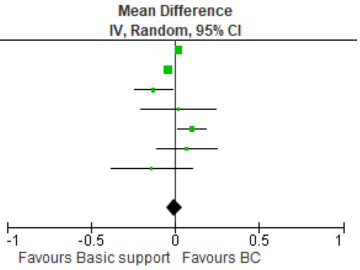


Figure 12: BCT+ Diet+ Exercise vs Basic support

	Control			Experimental				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Janicke 2008 (Arm 1)	0.022	0.17	10	-0.115	0.22	24	24.5%	0.14 [-0.00, 0.27]
Janicke 2008 (Arm 2)	0.022	0.17	11	-0.091	0.2	26	28.9%	0.11 [-0.01, 0.24]
Kirk 2012	-1.1	0.915	17	-0.7057	0.9642	35	1.6%	-0.39 [-0.93, 0.15]
Mirza 2013	-0.08	0.250599	56	-0.15	0.297153	57	45.0%	0.07 [-0.03, 0.17]
Total (95% CI)			**94**			**142**	**100.0%**	**0.09 [0.02, 0.16]**

Heterogeneity: Chi² = 3.82, df = 3 (P = 0.28); I² = 21%
Test for overall effect: Z = 2.64 (P = 0.008)

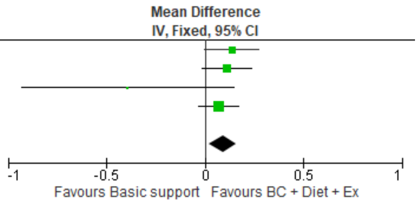


Figure13 : BCT+ Exercise vs Basic support

	Control			Experimental				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Bryant 2011	-0.03	0.2228	26	0.03	0.2022	27	52.8%	-0.06 [-0.17, 0.05]
Fedele 2013	-0.01	0.2	10	-0.12	0.24	14	22.3%	0.11 [-0.07, 0.29]
Golley 2007	-0.13	0.4	31	-0.24	0.43	29	15.7%	0.11 [-0.10, 0.32]
Robertson 2016	-0.16	0.685055	43	0.03	0.623859	45	9.2%	-0.19 [-0.46, 0.08]
Total (95% CI)			**110**			**115**	**100.0%**	**-0.01 [-0.09, 0.08]**

Heterogeneity: Chi² = 5.41, df = 3 (P = 0.14); I² = 45%
Test for overall effect: Z = 0.18 (P = 0.86)

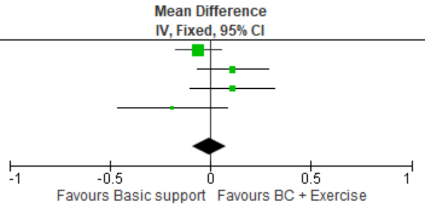


Figure 14: BCT+ Diet vs Basic support

	Control			Experimental				Mean Difference
Study or Subgroup	Mean	SD	Total	Mean	SD	Total	Weight	IV, Fixed, 95% CI
Epstein 2000 (Arm 1)	-1.3	0.8544	8	-1.3	0.9	18	23.2%	0.00 [-0.72, 0.72]
Epstein 2000 (Arm 2)	-1.3	0.8544	9	-1.1	0.953939	17	23.4%	-0.20 [-0.92, 0.52]
Gunnarsdottir 2011	0.02	0.38	6	-0.346	0.495	7	53.4%	0.37 [-0.11, 0.84]
Total (95% CI)			**23**			**42**	**100.0%**	**0.15 [-0.20, 0.50]**

Heterogeneity: Chi² = 1.86, df = 2 (P = 0.39); I² = 0%
Test for overall effect: Z = 0.84 (P = 0.40)

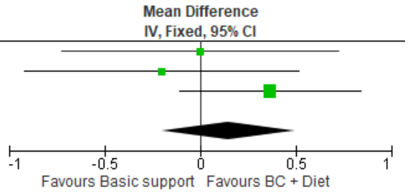


Figure 15: Diet+ Exercise vs Basic support

Study or Subgroup	Control Mean	Control SD	Control Total	Experimental Mean	Experimental SD	Experimental Total	Weight	Mean Difference IV, Fixed, 95% CI
Nowicka 2009	0.01	0.243	15	-0.02	0.243	20	100.0%	0.03 [-0.13, 0.19]
Total (95% CI)			**15**			**20**	**100.0%**	**0.03 [-0.13, 0.19]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.36 (P = 0.72)

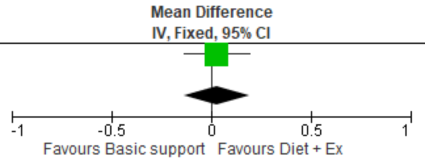


Figure 16: BCT+ Diet + Exercise vs BCT+ Exercise

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Okely/Collins 2011	-0.32	0.39	60	-0.17	0.44	63	100.0%	-0.15 [-0.30, -0.00]
Total (95% CI)			**60**			**63**	**100.0%**	**-0.15 [-0.30, -0.00]**

Heterogeneity: Not applicable
Test for overall effect: Z = 2.00 (P = 0.05)

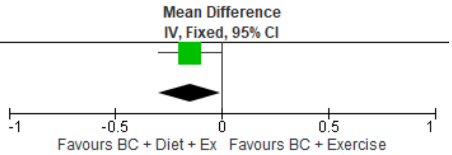


Figure 17: BCT+ Diet vs BC+ Diet + Exercise

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Okely/Collins 2011	-0.39	0.39	42	-0.32	0.39	60	100.0%	-0.07 [-0.22, 0.08]
Total (95% CI)			**42**			**60**	**100.0%**	**-0.07 [-0.22, 0.08]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.89 (P = 0.37)

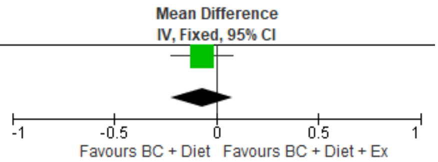


Figure 18: BCT+ Diet vs BCT+ Exercise

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Okely/Collins 2011	-0.39	0.39	42	-0.17	0.44	63	100.0%	-0.22 [-0.38, -0.06]
Total (95% CI)			**42**			**63**	**100.0%**	**-0.22 [-0.38, -0.06]**

Heterogeneity: Not applicable
Test for overall effect: Z = 2.69 (P = 0.007)

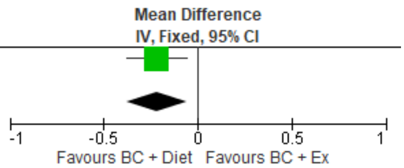


Figure 19: BCT+ Exercise vs BCT

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Golley 2007	-0.24	0.43	29	-0.15	0.47	29	100.0%	-0.09 [-0.32, 0.14]
Total (95% CI)			**29**			**29**	**100.0%**	**-0.09 [-0.32, 0.14]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.76 (P = 0.45)

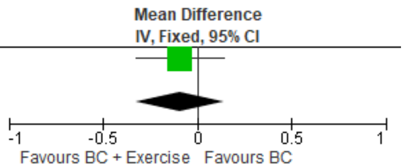


Figure 20: BCT+ Diet (parent only) vs BCT + Diet

Study or Subgroup	Experimental Mean	Experimental SD	Experimental Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Boutelle 2011	-0.2	0.6	24	-0.2	0.4	28	100.0%	0.00 [-0.28, 0.28]
Total (95% CI)			**24**			**28**	**100.0%**	**0.00 [-0.28, 0.28]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.00 (P = 1.00)

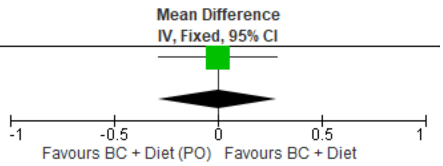
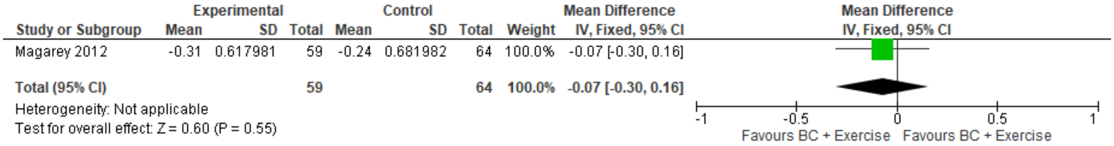


Figure 21: BCT+ Exercise vs BCT+ Exercise



≥12 months postintervention follow up

Figure 22: BCT vs Basic support

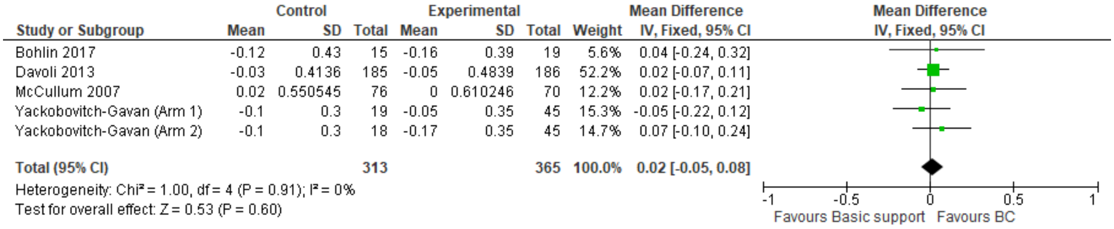


Figure 23: BCT+ Diet+ Exercise vs Basic support

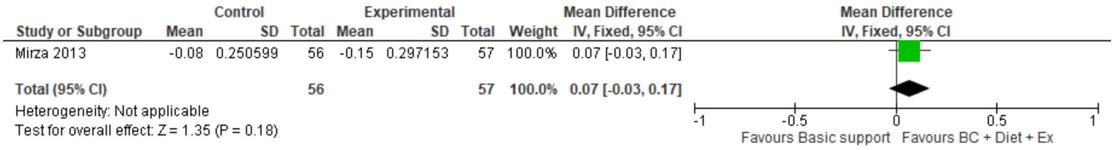


Figure 24: BCT+ Exercise vs Basic support

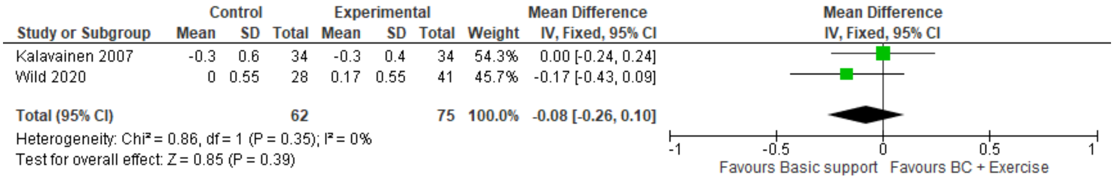


Figure 25: BCT+ Diet vs Basic support

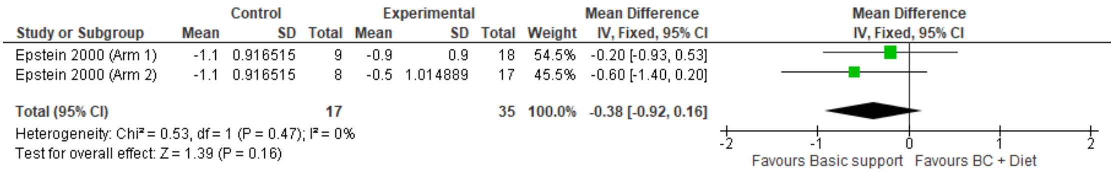


Figure 26: BCT+ Diet vs BCT+ Exercise

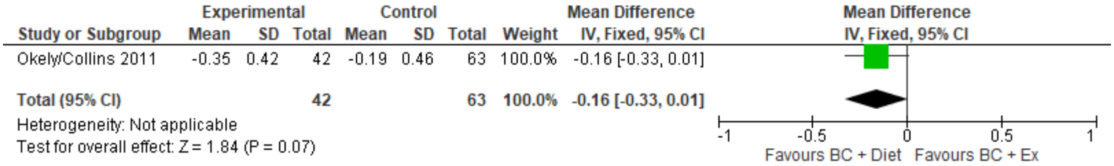


Figure 27: BCT+ Diet+ Exercise vs BCT+ Exercise

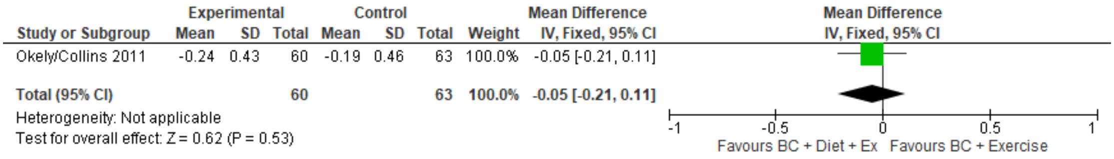


Figure 28: BCT + Diet vs BCT+ Diet + Exercise

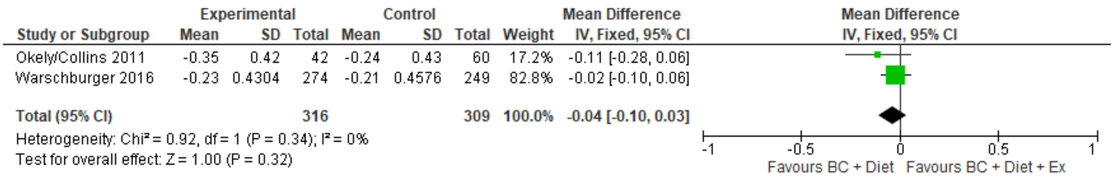


Figure 29: BCT+ Diet vs BCT

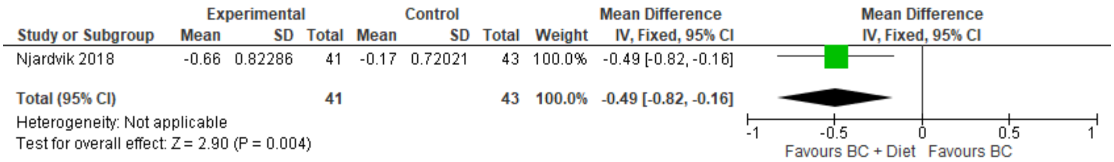


Figure 30: BCT+ Exercise vs BCT+ Exercise

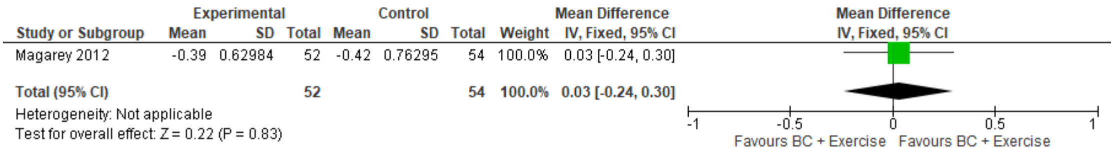
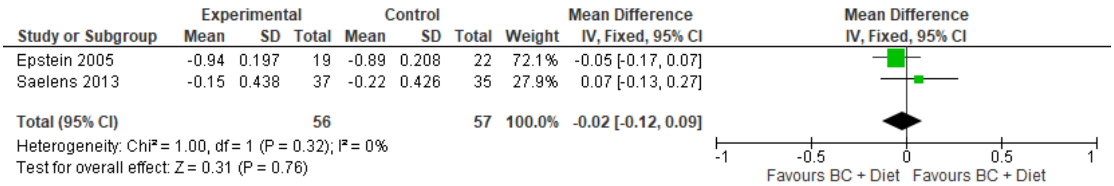


Figure 31: BCT+ Diet vs BCT+ Diet



12-18 year olds

≥12 months postintervention follow up

Figure 32: BCT+ Exercise vs Basic support

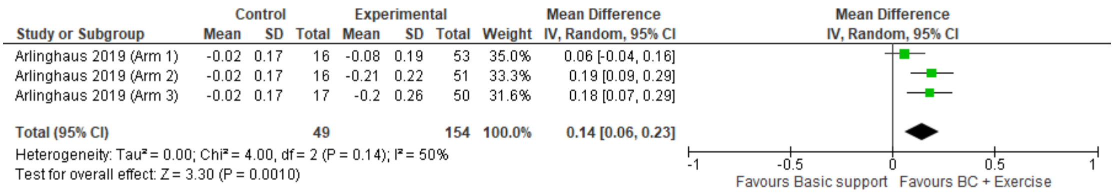


Figure 33: BCT+ Diet+ Exercise vs Basic support

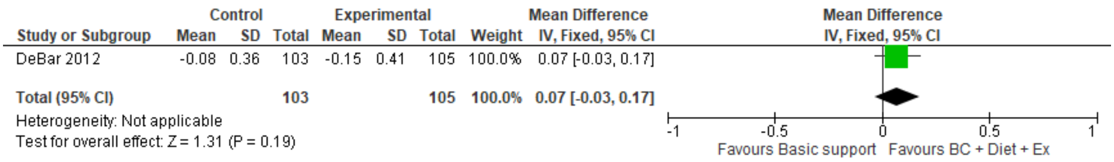


Figure 34: BCT vs Basic support

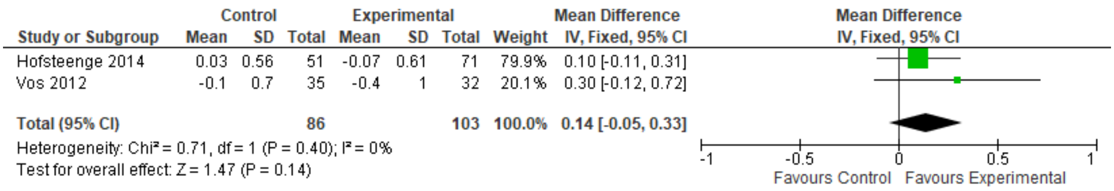
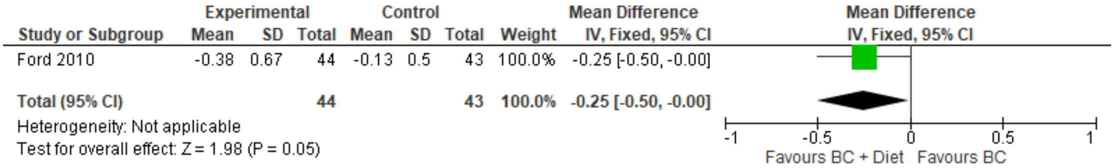


Figure 35: BCT+ Diet vs BCT



Pairwise analysis for all other outcomes

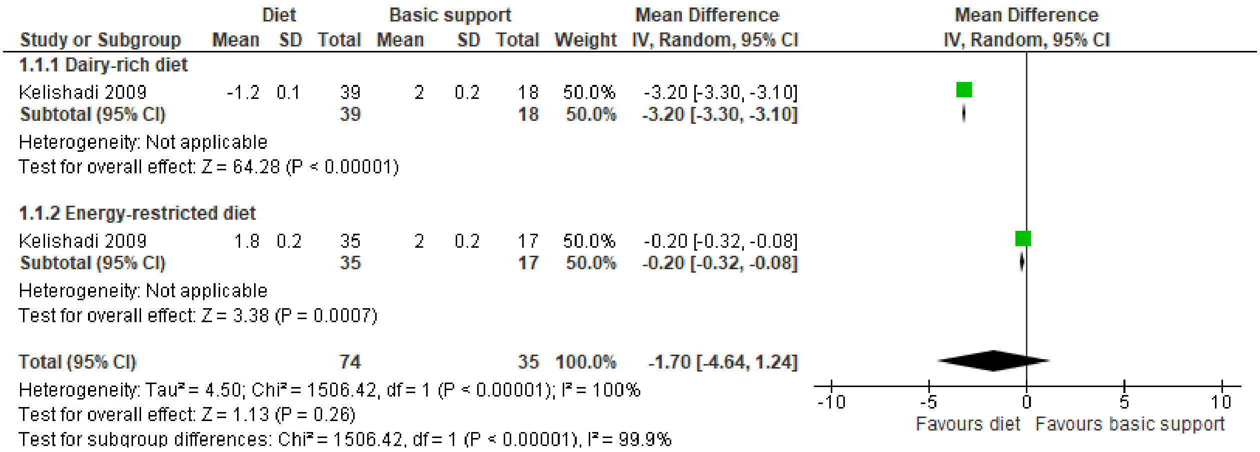
Under 6 years old

Diet modification vs basic support

6-12 months postintervention follow up

Waist circumference

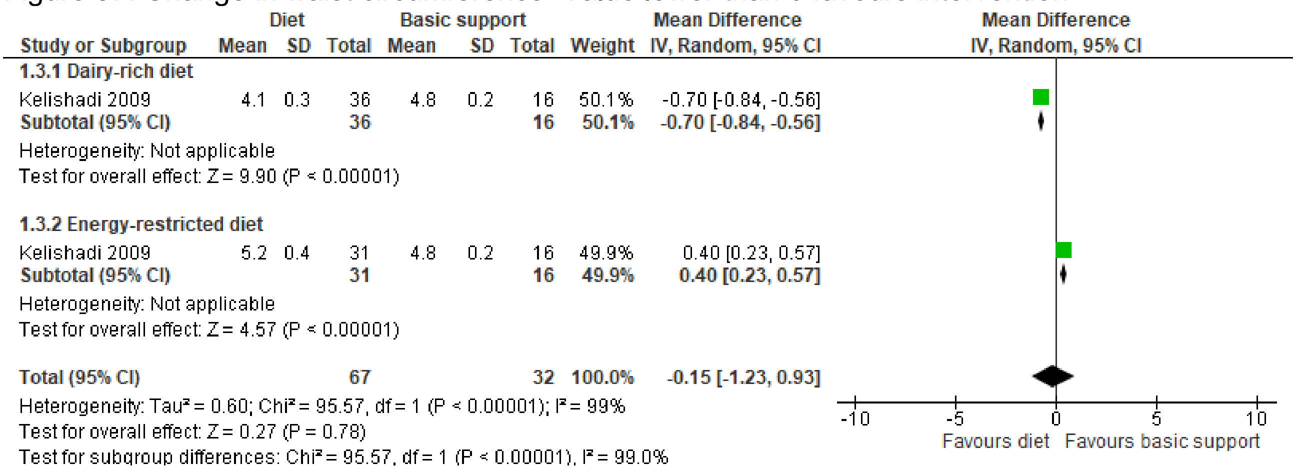
Figure 36: Change in waist circumference. Value lower than 0 favours intervention.



≥12 months postintervention follow up

Waist circumference

Figure 37: Change in waist circumference. Value lower than 0 favours intervention.

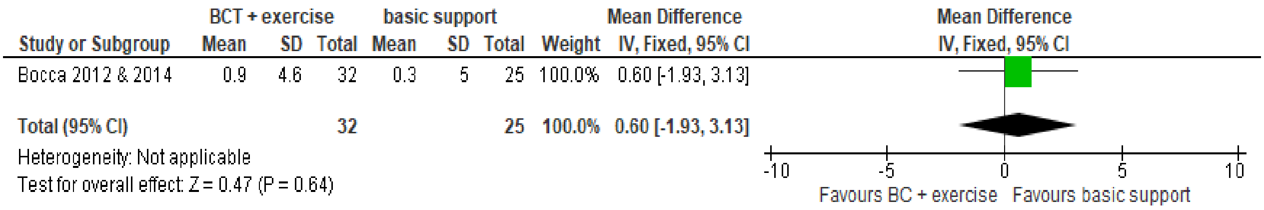


Behaviour change techniques + exercise program vs basic support

6-12 months postintervention follow up

Waist circumference

Figure 38: Change in waist circumference. Value lower than 0 favours intervention.



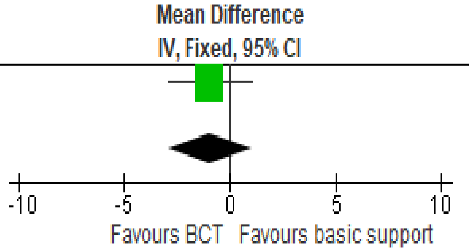
Behaviour change techniques vs basic support

6-12 months postintervention follow up

Waist circumference

Figure 39: Change in waist circumference. Value lower than 0 favours intervention.

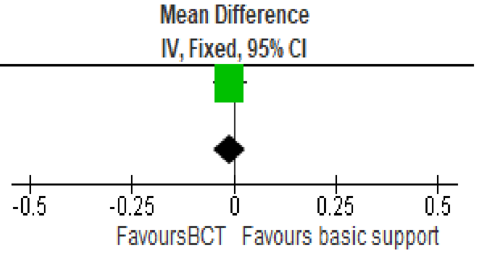
Study or Subgroup	BCT Mean	BCT SD	BCT Total	Basic support Mean	Basic support SD	Basic support Total	Weight	Mean Difference IV, Fixed, 95% CI
Small 2014	0.79	3.89	33	1.76	3.93	27	100.0%	-0.97 [-2.96, 1.02]
Total (95% CI)			**33**			**27**	**100.0%**	**-0.97 [-2.96, 1.02]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.96 (P = 0.34)								



Waist to height ratio

Figure 40: Change in waist to height ratio. Value lower than 0 favours intervention.

Study or Subgroup	BCT Mean	BCT SD	BCT Total	Basic support Mean	Basic support SD	Basic support Total	Weight	Mean Difference IV, Fixed, 95% CI
Small 2014	-0.01	0.08	33	0	0.07	27	100.0%	-0.01 [-0.05, 0.03]
Total (95% CI)			**33**			**27**	**100.0%**	**-0.01 [-0.05, 0.03]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.52 (P = 0.61)								



6-11 years

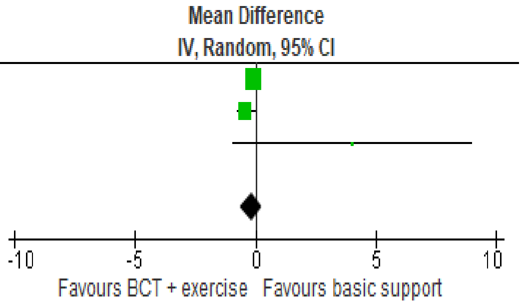
Exercise program + Behaviour change techniques vs Basic support

6-12 months postintervention follow up

Waist circumference

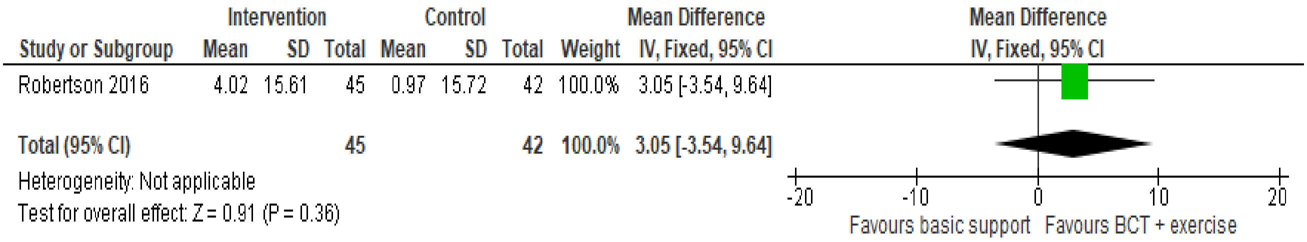
Figure 41: Change in waist circumference. Value lower than 0 favours intervention.

Study or Subgroup	BCT + exercise Mean	BCT + exercise SD	BCT + exercise Total	Basic support Mean	Basic support SD	Basic support Total	Weight	Mean Difference IV, Random, 95% CI
Bryant 2011	-0.08	0.39	27	-0.03	0.33	26	55.4%	-0.05 [-0.24, 0.14]
Golley 2007	-0.42	0.76	31	0	0.68	29	43.8%	-0.42 [-0.78, -0.06]
Robertson 2016	4.19	12.02	45	0.17	11.67	43	0.8%	4.02 [-0.93, 8.97]
Total (95% CI)			**103**			**98**	**100.0%**	**-0.18 [-0.63, 0.27]**
Heterogeneity: Tau² = 0.08; Chi² = 5.78, df = 2 (P = 0.06); I² = 65%								
Test for overall effect: Z = 0.79 (P = 0.43)								



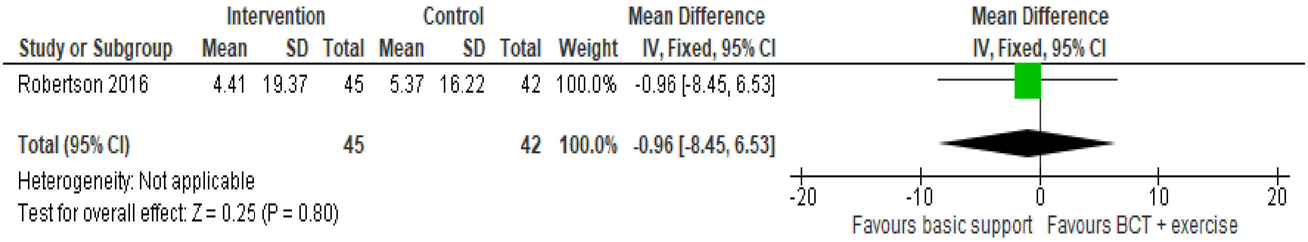
Quality of life - (PedsQL child)

Figure 42: Change in quality of life (PedsQL child). Value greater than 0 favours intervention.



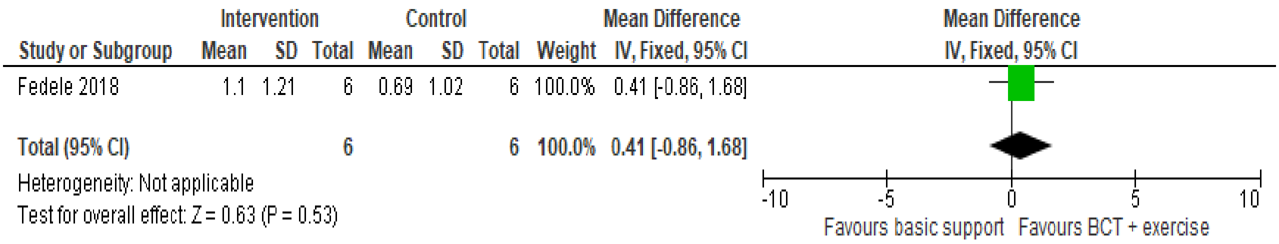
Quality of life - (PedsQL parent)

Figure 43: Change in quality of life (PedsQL parent). Value greater than 0 favours intervention.



Quality of life - (Asthma-specific QoL; PAQLQ)

Figure 44: Change in quality of life (Asthma-specific QoL; PAQLQ). Value greater than 0 favours intervention.

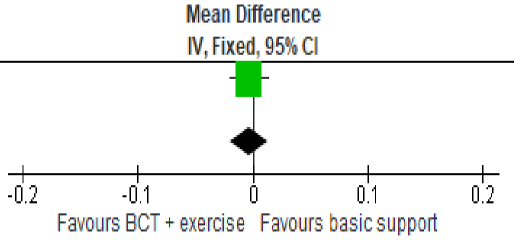


≥12 months postintervention follow up
Waist-to-height ratio

Figure 45: Change in waist-to-height ratio. Value lower than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Anderson 2021	0.005	0.05	68	0.008	0.04	53	100.0%	-0.00 [-0.02, 0.01]
Total (95% CI)			**68**			**53**	**100.0%**	**-0.00 [-0.02, 0.01]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.37 (P = 0.71)

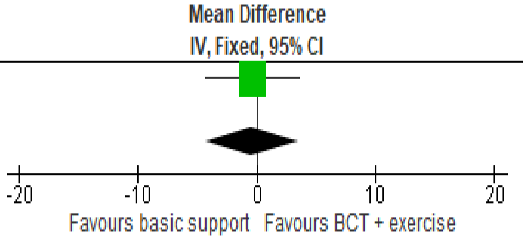


Insulin sensitivity

Figure 46: Change in insulin sensitivity (HbA1c (mmol/mol). Value greater than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Anderson 2021	0.2	10.3	68	0.6	11.3	53	100.0%	-0.40 [-4.30, 3.50]
Total (95% CI)			**68**			**53**	**100.0%**	**-0.40 [-4.30, 3.50]**

Heterogeneity: Not applicable
Test for overall effect: Z = 0.20 (P = 0.84)

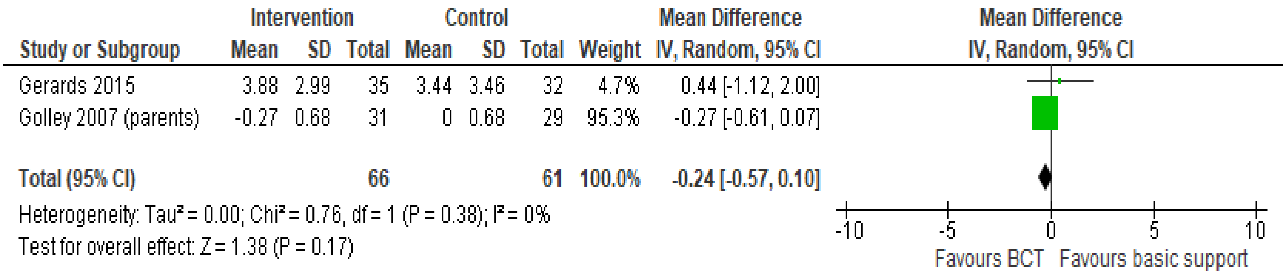


Behaviour change techniques vs Basic support

6-12 months postintervention follow up

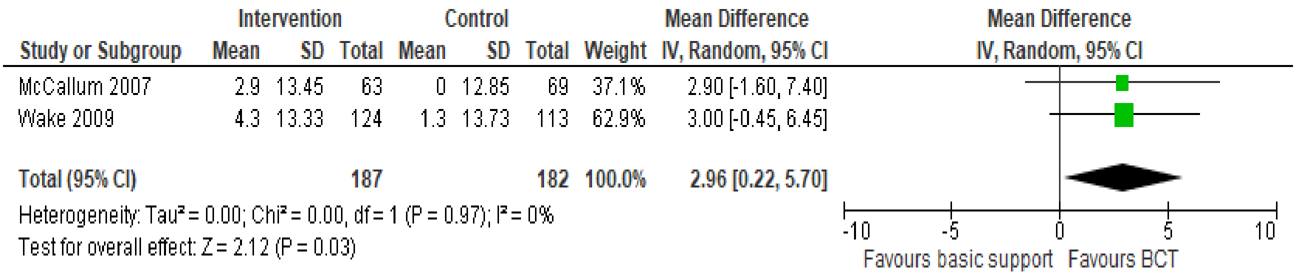
Waist circumference

Figure 47: Change in waist circumference. Value lower than 0 favours intervention.



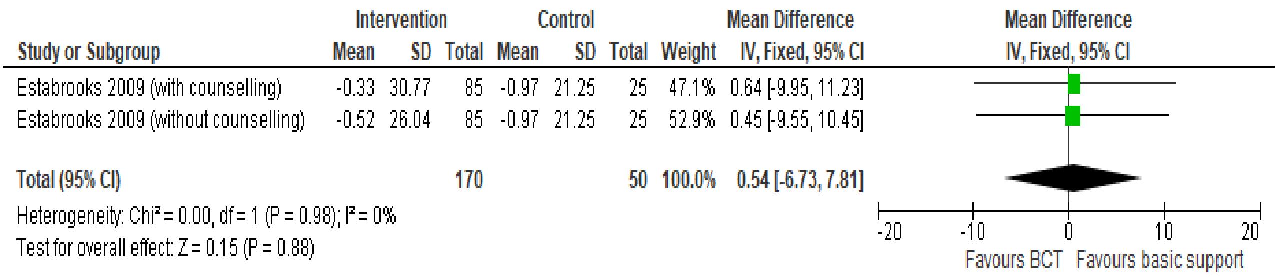
Quality of life (PedsQL parent)

Figure 48: Change in Quality of life (PedsQL parent). Value greater than 0 favours intervention.



Adverse events – Eating disorders

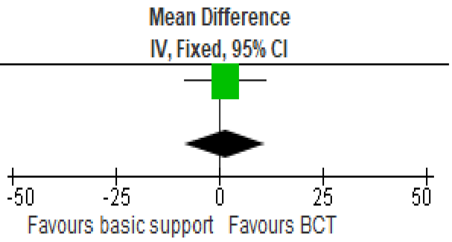
Figure 49: Adverse events – Eating disorders (KEDS child). Value lower than 0 favour intervention.



Insulin sensitivity

Figure 50: Change in insulin sensitivity (fasting insulin (pmol/L). Value greater than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Spence 2022	1	19.62	27	-0.3	16.84	25	100.0%	1.30 [-8.62, 11.22]
Total (95% CI)			**27**			**25**	**100.0%**	**1.30 [-8.62, 11.22]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.26 (P = 0.80)								

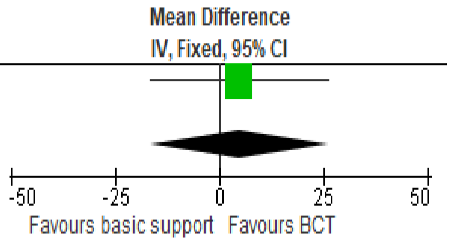


≥12 months postintervention follow up

Insulin sensitivity

Figure 51: Change in insulin sensitivity (fasting insulin (pmol/L). Value greater than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Spence 2022	8.7	38.44	27	4	40.31	25	100.0%	4.70 [-16.75, 26.15]
Total (95% CI)			**27**			**25**	**100.0%**	**4.70 [-16.75, 26.15]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.43 (P = 0.67)								



Blood pressure

Figure 52: Change in blood pressure – systolic. Value lower than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Spence 2022	-0.2	16.17	27	-3.2	19.64	25	100.0%	3.00 [-6.82, 12.82]
Total (95% CI)			**27**			**25**	**100.0%**	**3.00 [-6.82, 12.82]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.60 (P = 0.55)								

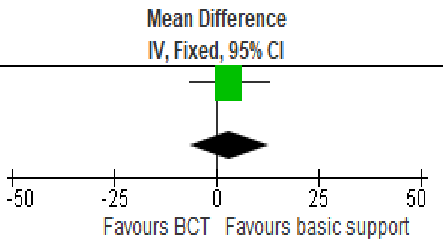
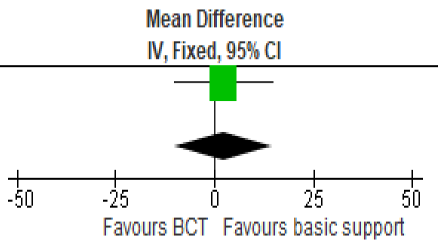


Figure 53: Change in blood pressure – diastolic. Value lower than 0 favours intervention.

Study or Subgroup	Favours intervention Mean	Favours intervention SD	Favours intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Spence 2022	3.7	20.41	27	1.4	24.87	25	100.0%	2.30 [-10.12, 14.72]
Total (95% CI)			**27**			**25**	**100.0%**	**2.30 [-10.12, 14.72]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.36 (P = 0.72)								

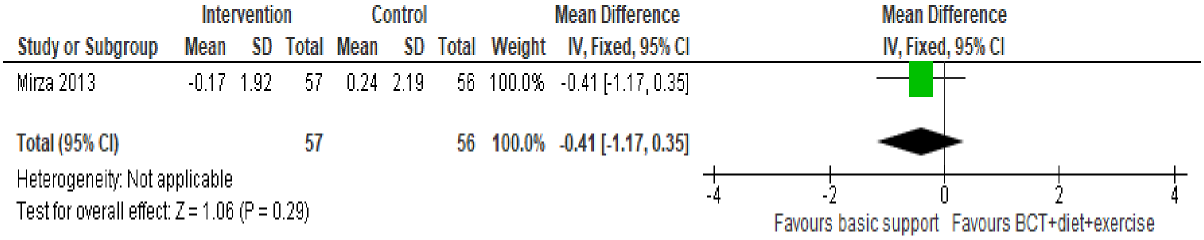


Diet modification + Exercise program + Behaviour change techniques vs Basic support

6-12 months postintervention follow up

Insulin sensitivity

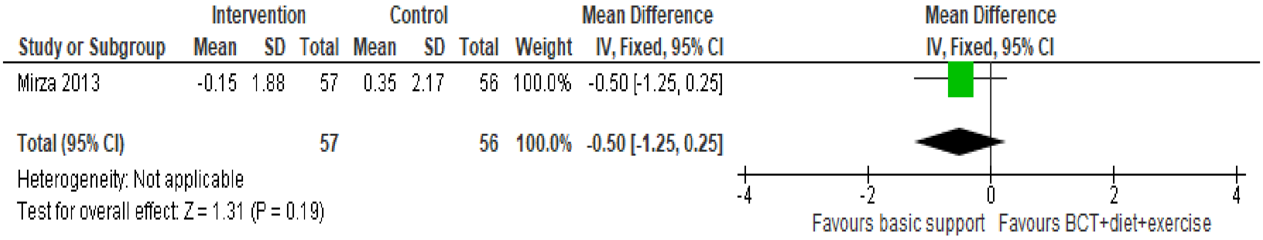
Figure 54: Change in insulin sensitivity (HOMA-IR). Value greater than 0 favours intervention.



≥12 months postintervention follow up

Insulin sensitivity

Figure 55: Change in insulin sensitivity (HOMA-IR). Value greater than 0 favours intervention.

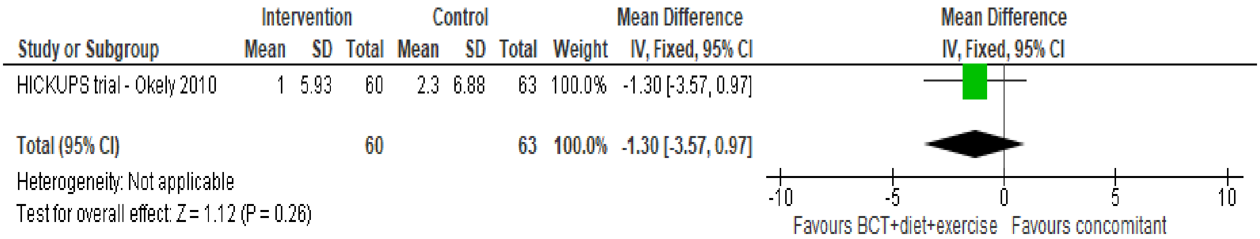


Diet modification + Exercise program + Behaviour change techniques vs Concomitant intervention

6-12 months postintervention follow up

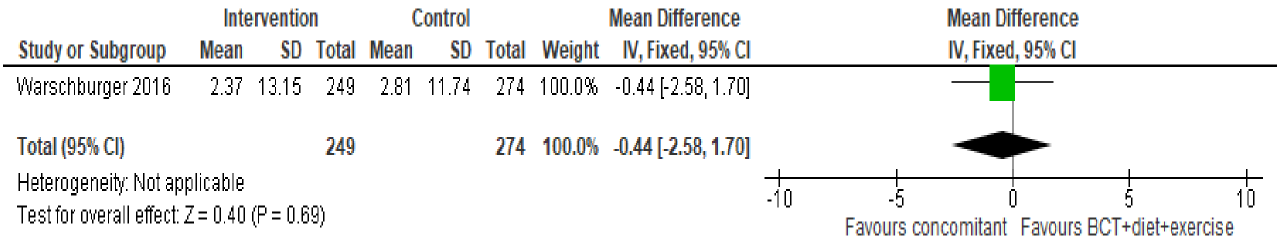
Waist circumference

Figure 56: Change in waist circumference. Value lower than 0 favours intervention.



Health-related quality of life (KID KINDL-R parent)

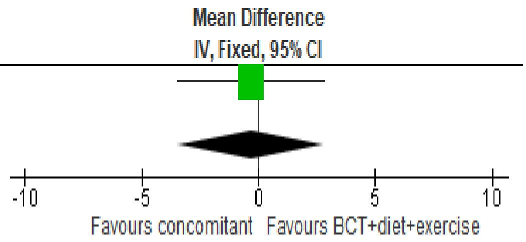
Figure 57: Change in health-related quality of life (KID KINDL-R parent). Value greater than 0 favours intervention.



Weight-related quality of life (GW-LQ-KJ parent)

Figure 58: Change in weight-related quality of life (GW-LQ-KJ parent). Value greater than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
Warschburger 2016	11.24	18.38	249	11.57	18.21	274	100.0%	-0.33 [-3.47, 2.81]
Total (95% CI)			**249**			**274**	**100.0%**	**-0.33 [-3.47, 2.81]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.21 (P = 0.84)								

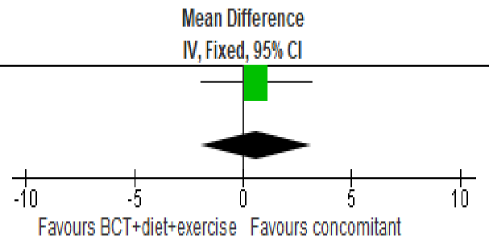


≥12 months postintervention follow up

Waist circumference

Figure 59: Change in waist circumference. Value lower than 0 favours intervention.

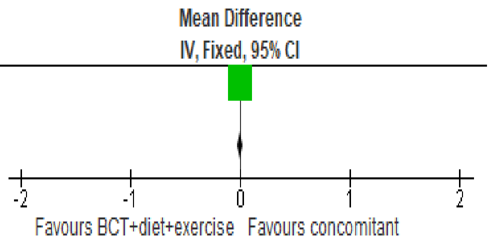
Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
HICKUPS trial - Collins 2011	5.62	6.88	60	5.04	7.53	63	100.0%	0.58 [-1.97, 3.13]
Total (95% CI)			**60**			**63**	**100.0%**	**0.58 [-1.97, 3.13]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.45 (P = 0.66)								



Waist-to-height ratio

Figure 60: Change in waist-to-height ratio. Value lower than 0 favours intervention.

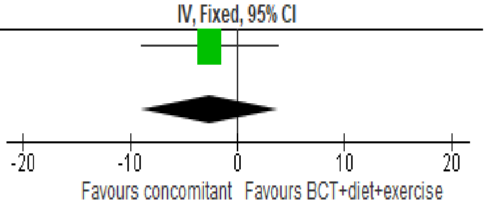
Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
HICKUPS trial - Collins 2011	-0.01	0.06	60	-0.01	0.04	63	100.0%	0.00 [-0.02, 0.02]
Total (95% CI)			**60**			**63**	**100.0%**	**0.00 [-0.02, 0.02]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.00 (P = 1.00)								



Insulin sensitivity

Figure 61: Change in insulin sensitivity (insulin (mU/mL)). Value greater than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
HICKUPS trial - Collins 2011	1.69	16.56	60	4.27	19.2	63	100.0%	-2.58 [-8.91, 3.75]
Total (95% CI)			**60**			**63**	**100.0%**	**-2.58 [-8.91, 3.75]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.80 (P = 0.42)								



Blood pressure

Figure 62: Change in blood pressure – systolic. Value lower than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
HICKUPS trial - Collins 2011	3.25	15.75	60	-1.15	17.88	63	100.0%	4.40 [-1.55, 10.35]
Total (95% CI)			**60**			**63**	**100.0%**	**4.40 [-1.55, 10.35]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.45 (P = 0.15)								

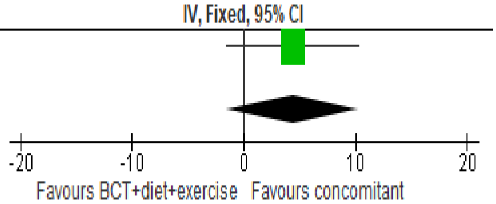
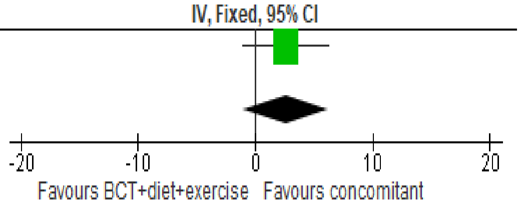


Figure 63: Change in blood pressure – diastolic Value lower than 0 favours intervention.

Study or Subgroup	Intervention Mean	Intervention SD	Intervention Total	Control Mean	Control SD	Control Total	Weight	Mean Difference IV, Fixed, 95% CI
HICKUPS trial - Collins 2011	0.45	9.66	60	-2.15	10.91	63	100.0%	2.60 [-1.04, 6.24]
Total (95% CI)			**60**			**63**	**100.0%**	**2.60 [-1.04, 6.24]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.40 (P = 0.16)								



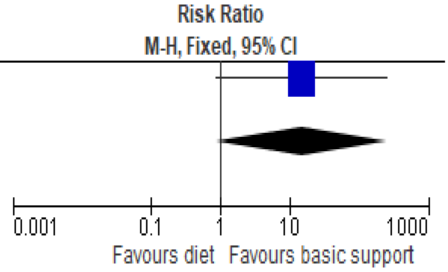
12-18 years

Diet modification vs basic support

Outcomes ≥12 months follow up (post intervention)

Figure 64: Number of serious adverse events (reported by parents); ≥12 months follow up (post intervention). Value lower than 0 favours intervention.

Study or Subgroup	Diet Events	Diet Total	Basic support Events	Basic support Total	Weight	Risk Ratio M-H, Fixed, 95% CI
Ebbeling 2012	7	105	0	104	100.0%	14.86 [0.86, 256.86]
Total (95% CI)		**105**		**104**	**100.0%**	**14.86 [0.86, 256.86]**
Total events	7		0			
Heterogeneity: Not applicable						
Test for overall effect: Z = 1.86 (P = 0.06)						

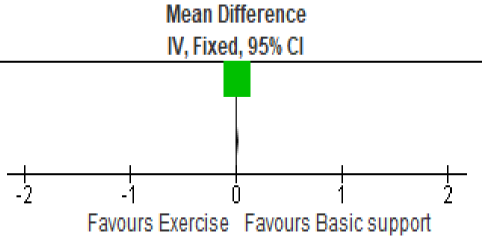


Exercise program vs basic support

Outcomes 6- 12 months follow up (post intervention)

Figure 65: Change in waist-to-height ratio; 6-12 months follow up (post intervention). Value lower than 0 favours intervention.

Study or Subgroup	Exercise Mean	Exercise SD	Exercise Total	Basic support Mean	Basic support SD	Basic support Total	Weight	Mean Difference IV, Fixed, 95% CI
Toulabi 2012	0.01	0.05	76	0	0.05	76	100.0%	0.01 [-0.01, 0.03]
Total (95% CI)			**76**			**76**	**100.0%**	**0.01 [-0.01, 0.03]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 1.23 (P = 0.22)								

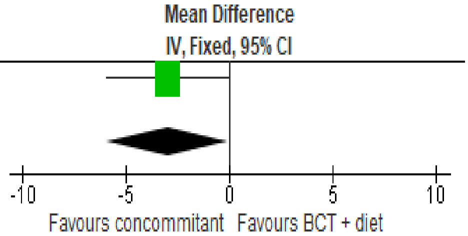


Behaviour change techniques + diet modification vs concomitant intervention

Outcomes 6- 12 months follow up (post intervention)

Figure 66: Change in insulin sensitivity (measured by HOMA); 6-12 months follow up (post intervention). Value greater than 0 favours intervention.

Study or Subgroup	BCT + diet Mean	BCT + diet SD	BCT + diet Total	Concommitant intervention Mean	Concommitant intervention SD	Concommitant intervention Total	Weight	Mean Difference IV, Fixed, 95% CI
Ebbeling 2003	-0.4	2.55	8	2.6	3.39	8	100.0%	-3.00 [-5.94, -0.06]
Total (95% CI)			**8**			**8**	**100.0%**	**-3.00 [-5.94, -0.06]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 2.00 (P = 0.05)								



Behaviour change techniques + diet modification vs basic support

Outcomes 6- 12 months follow up (post intervention)

Figure 67: Change in waist-to-height ratio; 6-12 months follow up (post intervention). Value lower than 0 favours intervention.

Study or Subgroup	BCT + diet Mean	BCT + diet SD	BCT + diet Total	Basic support Mean	Basic support SD	Basic support Total	Weight	Mean Difference IV, Fixed, 95% CI
Vos 2011 and 2012	-0.03	0.06	32	0	0.04	35	100.0%	-0.03 [-0.05, -0.01]
Total (95% CI)			**32**			**35**	**100.0%**	**-0.03 [-0.05, -0.01]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 2.39 (P = 0.02)								

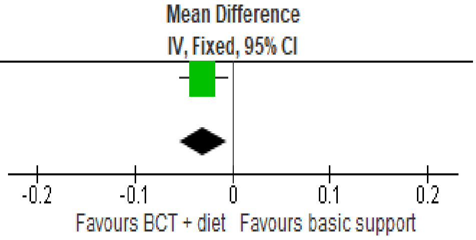


Figure 68: Change in waist circumference; 6-12 months follow up (post intervention). Value lower than 0 favours intervention.

Study or Subgroup	BCT + diet Mean	BCT + diet SD	BCT + diet Total	Basic support Mean	Basic support SD	Basic support Total	Weight	Mean Difference IV, Fixed, 95% CI
Hofsteenge 2013 and 2014	4.5	14.47	71	6.6	12.14	51	100.0%	-2.10 [-6.84, 2.64]
Total (95% CI)			**71**			**51**	**100.0%**	**-2.10 [-6.84, 2.64]**
Heterogeneity: Not applicable								
Test for overall effect: Z = 0.87 (P = 0.38)								

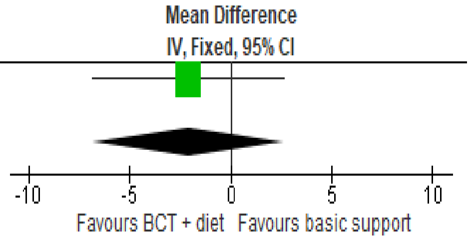


Figure 69: Change in health-related quality of life (PedsQL); 6-12 months follow up (post intervention). Value greater than 0 favours intervention.

Study or Subgroup	BCT + diet Mean	BCT + diet SD	BCT + diet Total	Basic support Mean	Basic support SD	Basic support Total	Weight	Mean Difference IV, Random, 95% CI
DeBar 2012	6.68	15.15	105	2.86	16.47	103	53.4%	3.82 [-0.48, 8.12]
Hofsteenge 2013 and 2014	6.6	12.1	57	1.5	10.6	38	46.6%	5.10 [0.49, 9.71]
Total (95% CI)			**162**			**141**	**100.0%**	**4.42 [1.27, 7.56]**
Heterogeneity: Tau² = 0.00; Chi² = 0.16, df = 1 (P = 0.69); I² = 0%								
Test for overall effect: Z = 2.75 (P = 0.006)								

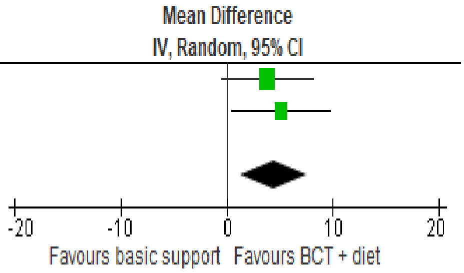
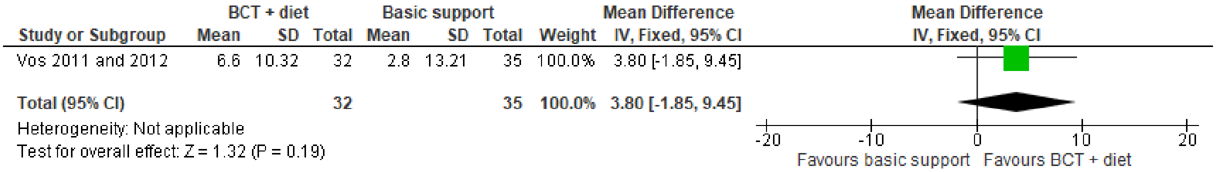


Figure 70: Change in health-related quality of life (DISABKIDS); 6-12 months follow up (post intervention). Value greater than 0 favours intervention.



Insulin sensitivity

Figure 71: Change in insulin sensitivity (measured by HOMA); 6-12 months follow up (post intervention). Value greater than 0 favours intervention.

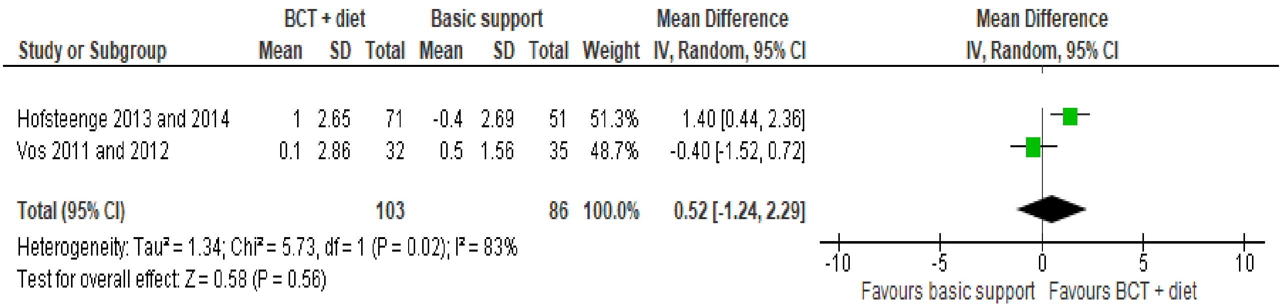
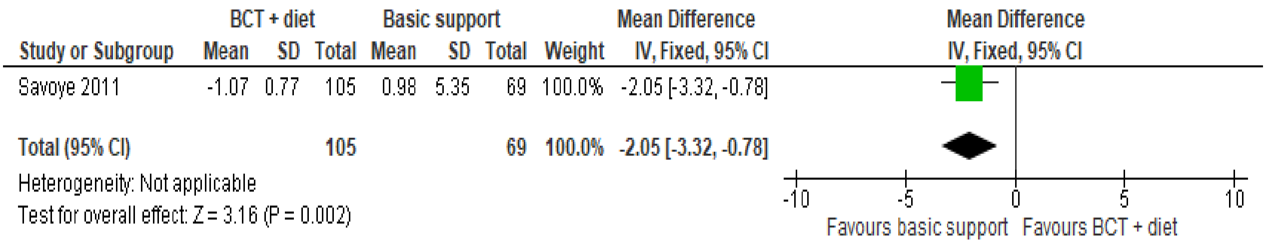


Figure 72: Change in insulin sensitivity (measured by HOMA); ≥12 months follow up (post intervention). Value greater than 0 favours intervention.



Blood pressure

Figure 73: Change in blood pressure – systolic; 6-12 months follow up (post intervention). Value lower than 0 favours intervention.

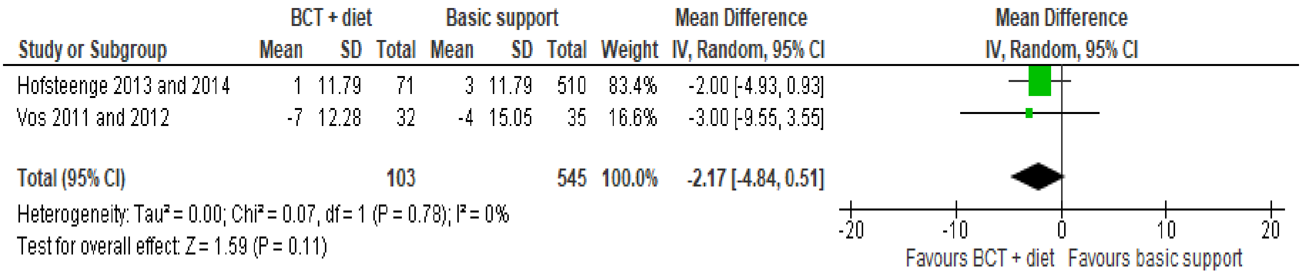


Figure 74: Change in blood pressure – dyastolic; 6-12 months follow up (post intervention). Value lower than 0 favours intervention.

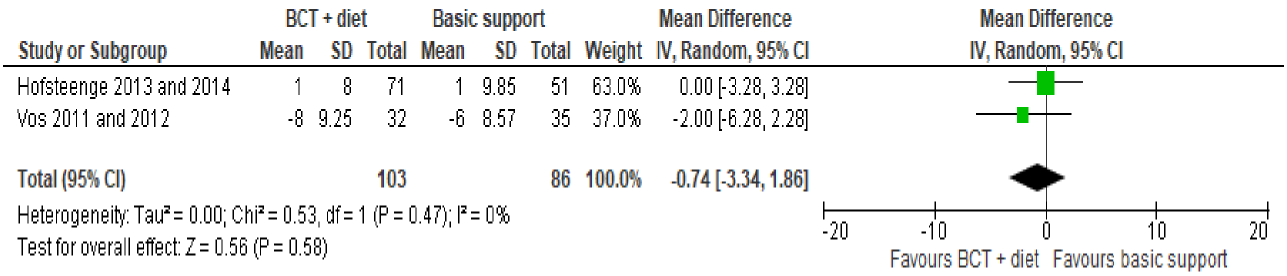


Figure 75: Change in blood pressure – systolic; 12 months follow up (post intervention). Value lower than 0 favours intervention.

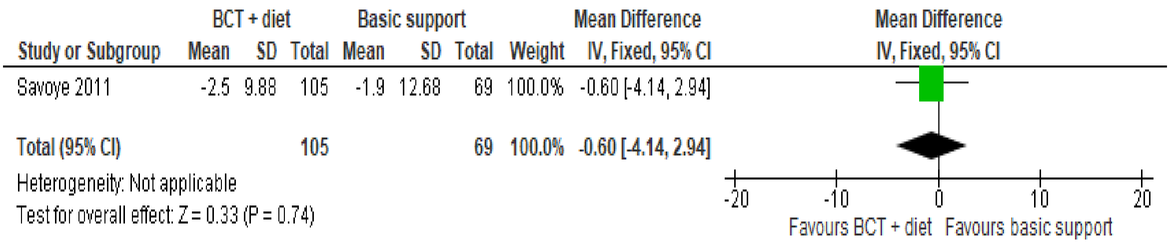
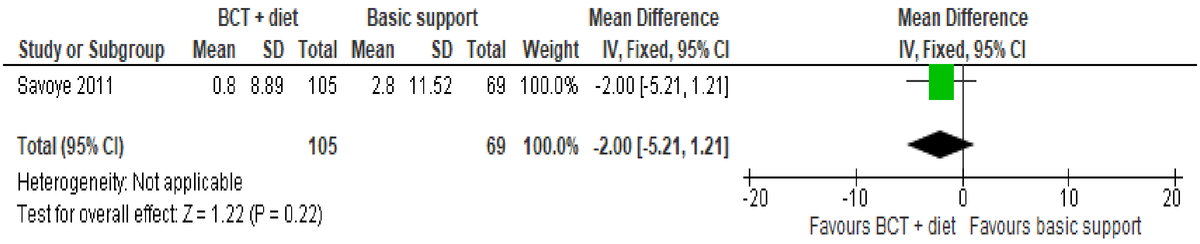


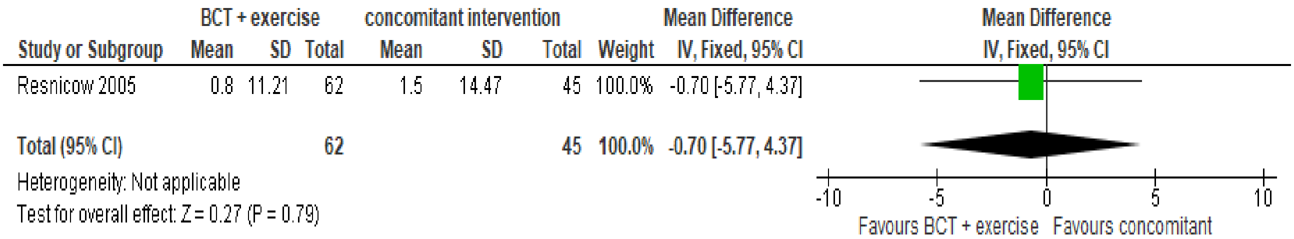
Figure 76: Change in blood pressure – dyastolic; 12 months follow up (post intervention). Value lower than 0 favours intervention.



Behaviour change techniques + exercise program vs concomitant intervention

Waist circumference

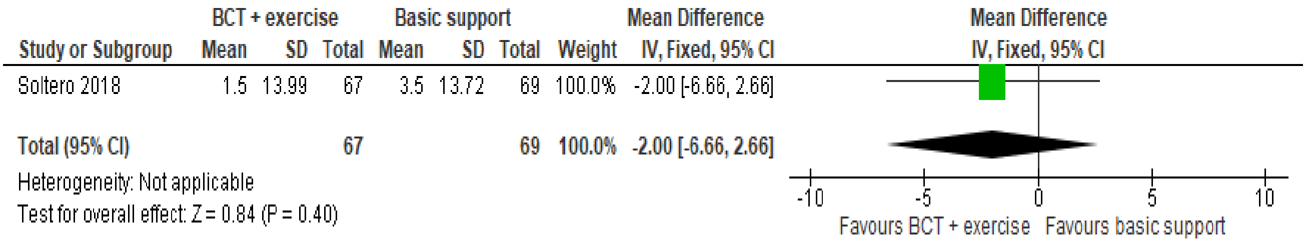
Figure 77: Change in waist circumference; 6-12 months follow up (post intervention). Value lower than 0 favours intervention.



Behaviour change techniques + exercise program vs basic support

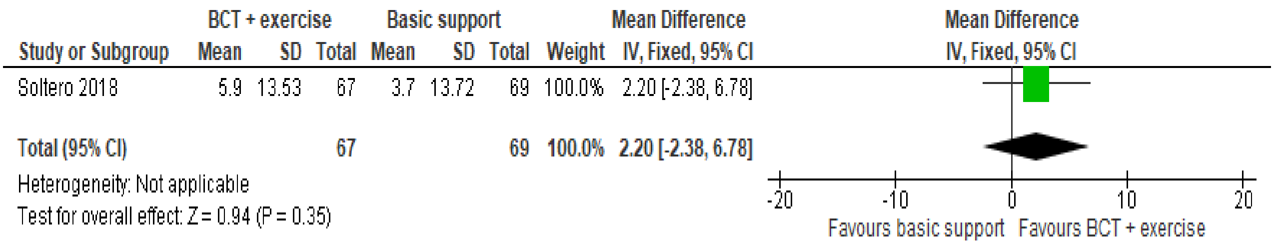
Waist circumference

Figure 78: Change in waist circumference; 6-12 months follow up (post intervention). Value lower than 0 favours intervention.



Quality of life

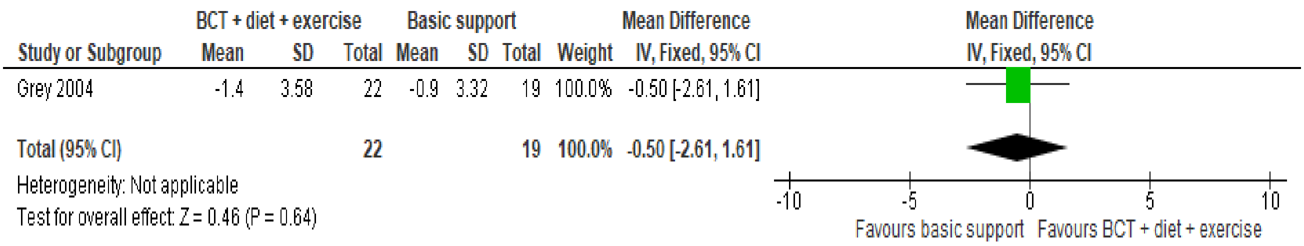
Figure 79: Change in health-related quality of life (Measured by YQOL-W); 6-12 months follow up (post intervention). Value greater than 0 favours intervention.



Behaviour change techniques + diet modification + exercise program vs basic support

Insulin sensitivity

Figure 80: Change in insulin sensitivity (measured by HOMA); 6-12 months follow up (post intervention). Value greater than 0 favours intervention.



Appendix F – GRADE and GRADE-CERQual tables

Effectiveness evidence

GRADE tables for NMA data

Change in BMI z-score

Table 29: Under 6 year olds

No. of studies	Study design	Sample size	Effect estimates	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
Under 6 years old: 6 -12 months follow up (post-intervention)								
5 studies	RCT	330	See appendix M	Serious[1]	No serious[2]	No serious[3]	Very serious[4]	Very low
Under 6 years old: ≥12 months follow up (post-intervention)								
3 studies	RCT	221	See appendix M	Serious[1]	No serious[2]	No serious[3]	Serious[5]	Low

[1] Greater than 33.3% of studies in the NMA were at moderate of high risk of bias. Downgrade 1 level for serious risk of bias.
[2] Fewer than 33.3% of studies in the NMA were partially indirect. The overall network was not downgraded.
[3] The DIC of the inconsistency model (UME model) was not 3 points lower than the DIC of the consistency model (NMA model). See Appendix M for DIC.
[4] The evidence did not identify any meaningful differences and did not demonstrate equivalence. Downgrade 2 levels for very serious imprecision.
[5] The committee were able to draw some conclusions from the evidence particularly for BCT+ Diet and BCT+ Diet+ Exercise. However, there was uncertainty in the evidence the effectiveness of the components compared to basic support as this was favoured when compared to diet alone and diet + exercise. Downgrade 1 level for serious imprecision.

Table 30: 6- 11 year olds

No. of studies	Study design	Sample size	Effect estimates	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
6-11 years old: 6 -12 months follow up (post-intervention)								
18 studies	RCT	1,371	See appendix M	Serious[1]	No serious[2]	No serious[3]	Serious[4]	Low
6-11 years old: 6 -12 months follow up (post-intervention) - Component Model: Additive sub-component								

No. of studies	Study design	Sample size	Effect estimates	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
18 studies	RCT	1,371	See appendix M	Serious[1]	No serious[2]	No serious[5]	Very serious[6]	Very low
6-11 years old: 6 -12 months follow up (post-intervention) - Component Model: Main effect with additive sub-component effects								
18 studies	RCT	1,371	See appendix M	Serious[1]	No serious[2]	No serious[5]	Very serious[6]	Very low
6-11 years old: ≥12 months follow up (post-intervention)								
14 studies	RCT	1,989	See appendix M	Serious[1]	No serious[2]	No serious[3]	Serious[4]	Low
6-11 years old: ≥12 months follow up (post-intervention)- Component Model: Additive sub-component								
14 studies	RCT	1,989	See appendix M	Serious[1]	No serious[2]	No serious[5]	Very serious[6]	Very low
6-11 years old: ≥12 months follow up (post-intervention)- Component Model: Main effect with additive sub-component effects								
14 studies	RCT	1,989	See appendix M	Serious[1]	No serious[2]	No serious[5]	Serious[7]	Low

[1] Greater than 33.3% of studies in the NMA were at moderate of high risk of bias. Downgrade 1 level for serious risk of bias.
[2] Fewer than 33.3% of studies in the NMA were partially indirect. The overall network was not downgraded.
[3] The DIC of the inconsistency model (UME model) was not 3 points lower than the DIC of the consistency model (NMA model). See Appendix M for DIC.
[4] The committee were able to draw some conclusions from the evidence particularly for BCT+ Diet. However, there was uncertainty in the evidence the effectiveness of the components compared to basic support. Downgrade 1 level for serious imprecision.
[5] The model statistics of this model was similar to the standard NMA model. See Appendix M for DIC.
[6] The evidence did not identify any meaningful differences between the sub-components and basic support. Downgrade 2 levels for very serious imprecision.
[7] The committee were able to draw some conclusions from the evidence particularly for diet sub-component, however there was uncertainty in the effectiveness of other sub-components compared to basic support. Downgrade 1 level for serious imprecision.

Table 31: 12-18 year olds

No. of studies	Study design	Sample size	Effect estimates	Risk of bias	Indirectness	Inconsistency	Imprecision	Quality
12-18 years old: 6 -12 months follow up (post-intervention)								
5 studies	RCT	687	See appendix M	Very serious[1]	No serious[2]	No serious[3]	Very serious[4]	Very low

[1] Greater than 33.3% of studies in the NMA were at high of high risk of bias. Downgrade 2 levels for serious risk of bias.
[2] Fewer than 33.3% of studies in the NMA were partially indirect. Th overall network was not downgraded.
[3] The DIC of the inconsistency model (UME model) was not 3 points lower than the DIC of the consistency model (NMA model). See Appendix M for DIC.
[4] The evidence did not identify any meaningful differences and did not demonstrate equivalence. Downgrade 2 levels for very serious imprecision.

GRADE tables for pair wise meta-analysis data

Under 6 years old

Table 32: Diet modification vs basic support

Certainty assessment							№ of patients		Effect		Certainty
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Diet	basic support	Relative (95% CI)	Absolute (95% CI)	
Change in waist circumference: 6-12 months follow up (post intervention). MID = 0.01 (Better indicated by lower values)											
1[a]	randomised trials	serious[b]	not serious[c]	very serious[d]	very serious[e]	none	74	35	-	MD **1.7 lower** (4.64 lower to 1.24 higher)	⊕◯◯◯ Very low
Change in waist circumference - Dairy-rich diet group. 6-12 months follow up (post intervention). MID = 0.01 (Better indicated by lower values)											
1[a]	randomised trials	serious[b]	not serious[c]	very serious[d]	not serious	none	39	18	-	MD **3.2 lower** (3.3 lower to 3.1 lower)	⊕◯◯◯ Very low
Change in waist circumference - Energy-restricted diet group: 6-12 months follow up (post intervention). MID = 0.01 (Better indicated by lower values)											
1[a]	randomised trials	serious[b]	not serious[c]	very serious[dCh]	serious[f]	none	35	17	-	MD **0.2 lower** (0.32 lower to 0.08 lower)	⊕◯◯◯ Very low
Change in waist circumference: ≥12 months follow up (post intervention). MID = 0.01 (Better indicated by lower values)											
1[a]	randomised trials	serious[b]	not serious[c]	very serious[d]	serious[f]	None	67	32	-	MD **0.15 lower** (1.23 lower to 0.93 higher)	⊕◯◯◯ Very low
Change in waist circumference - Dairy-rich diet group: ≥12 months follow up (post intervention). MID = 0.01 (Better indicated by lower values)											
1[a]	randomised trials	serious[b]	not serious[c]	very serious[d]	not serious	None	36	16	-	MD **0.7 lower** (0.84 lower to 0.56 lower)	⊕◯◯◯ Very low
Change in waist circumference - Energy-restricted diet: ≥12 months follow up (post intervention). MID = 0.01 (Better indicated by lower values)											
1[a]	randomised trials	serious[b]	not serious[c]	very serious[d]	not serious	none	31	16	-	MD **0.4 higher** (0.23 higher to 0.57 higher)	⊕◯◯◯ Very low

CI: confidence interval; **MD:** mean difference

a. Kelishadi 2009

b. Rated by Mead 2017

c. Single study; inconsistency not applicable
d. Downgraded twice as evidence comes from a non-OECD country (Iran)
e. Downgraded twice because confidence intervals cross two MID thresholds (0.1)
f. Downgraded once because confidence intervals cross one MID threshold (0.1)

Table 33: Behaviour change techniques + exercise program vs basic support

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT + exercise	basic support	Relative (95% CI)	Absolute (95% CI)		
Change in waist circumference: 8 months follow up (post intervention). MID = 2.5 (Better indicated by lower values)												
1[a]	randomised trials	very serious[b]	not serious[c]	serious[d]	serious[e]	none	32	25	-	MD **0.6 higher** (1.93 lower to 3.13 higher)	⨁◯◯◯ Very low	

CI: confidence interval; **MD:** mean difference
a. Bocca 2012 and 2014
b. Rated by Mead 2017
c. Single study; inconsistency not applicable
d. Downgraded once as evidence is from a non-UK country (Netherlands)
e. Downgraded once because confidence intervals cross one MID (2.5)

Table 34: Behaviour change techniques vs basic support

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT	basic support	Relative (95% CI)	Absolute (95% CI)		
Change in waist circumference: 6-12 months follow up (post intervention) MID = 1.97 (Better indicated by lower values)												

Certainty assessment							№ of patients		Effect		Certainty
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT	basic support	Relative (95% CI)	Absolute (95% CI)	
1[a]	randomised trials	serious[b]	not serious[c]	serious[d]	serious[e]	none	33	27	-	MD **0.97 lower** (2.96 lower to 1.02 higher)	⨁◯◯◯ Very low
Change in waist to height ratio: **6-12 months follow up (post intervention). MID = 0.04 (Better indicated by lower values)**											
1[a]	randomised trials	serious[b]	not serious[c]	serious[d]	serious[f]	none	33	27	-	MD **0.01 lower** (0.05 lower to 0.03 higher)	⨁◯◯◯ Very low

CI: confidence interval; **MD:** mean difference
a. Small 2014
b. Rated by Loveman 2015
c. Single study; inconsistency not applicable
d. Downgraded once as the evidence is from a non-UK country (USA)
e. Downgraded once because confidence intervals cross one MID (1.97)
f. Downgraded once because confidence intervals cross one MID (0.04)

6-11 Year olds

Table 35: Exercise program + Behaviour change techniques vs Basic support

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Exercise Program + BCTs	Basic support	Relative (95% CI)	Absolute	
Change in waist circumference; 6-12 months follow up (post intervention). MID = 6 (Better indicated by lower values)											
3[1]	randomised trials	serious[2]	serious[3]	no serious indirectness	no serious imprecision	none	103	98	-	MD 0.18 lower (0.63 lower to 0.27 higher)	⊕⊕OO LOW
Change in Quality of Life (PedsQL, child self-report); 6-12 months follow up (post intervention). MID = 7.86 (Better indicated by higher values)											
1[4]	randomised trials	no serious risk of bias	no serious inconsistency[5]	no serious indirectness	serious[6]	none	45	42	-	MD 3.05 higher (3.54 lower to 9.64 higher)	⊕⊕⊕O MODERATE

Change in Quality of life (PedsQL; parent proxy); 6-12 months follow up (post intervention). MID = 8.11 (Better indicated by higher values)											
1[4]	randomised trials	no serious risk of bias	no serious inconsistency[5]	no serious indirectness	serious[6]	none	45	42	-	MD 0.96 lower (8.45 lower to 6.53 higher)	⊕⊕⊕O MODERATE
Change in Quality of life (Asthma specific QoL; PAQLQ); 6-12 months follow up (post intervention). MID = 0.5 (Better indicated by higher values)											
1[7]	randomised trials	very serious[8]	no serious inconsistency[5]	serious[9]	very serious[10]	none	6	6	-	MD 0.41 higher (0.86 lower to 1.68 higher)	⊕OOO VERY LOW
Change in waist-to-height ratio; ≥12 months follow up (post intervention). MID = 0.02 (Better indicated by lower values)											
1[11]	randomised trials	very serious[8]	no serious inconsistency[5]	very serious	no serious imprecision	none	68	53	-	MD 0 higher (0.02 lower to 0.01 higher)	⊕OOO VERY LOW
Change in insulin sensitivity (HbA1c (mmol/mol)); ≥12 months follow up (post intervention). MID = 5.65 (Better indicated by higher values)											
1[11]	randomised trials	very serious[8]	no serious inconsistency[5]	very serious	no serious imprecision	none	68	53	-	MD 0.4 lower (4.3 lower to 3.5 higher)	⊕OOO VERY LOW

1 Bryant 2011; Golley 2007; Robertson 2016

2 Downgraded once as greater than 33.3% of the weight in the meta-analysis came from a study at moderate risk of bias

3 Downgraded once as I2 was between 33.3% and 66.7% (I2 = 61%)

4 Robertson 2016

5 Single study; inconsistency not applicable

6 Downgraded once as 95%CI crosses one calculated MID

7 Fedele 2018

8 Downgraded twice for high risk of bias due to small sample, demographically unbalanced groups, and high attrition

9 Downgraded once as study was only partially applicable - non-UK based study

10 Downgraded twice as 95%CIs crossed 2 calculated MIDs

11 Anderson 2021

Table 36: Behaviour change techniques vs Basic support

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT	Basic support	Relative (95% CI)	Absolute	
Change in waist circumference; ≥12 months follow up (post intervention). MID = 1.04 (Better indicated by lower values)											
2[1]	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	66	61	-	MD 0.24 lower (0.57 lower to 0.1 higher)	⊕⊕⊕⊕ HIGH
Change in Quality of Life (PedsQL parent proxy); 6-12 months follow up (post intervention). MID = 6.65 (Better indicated by higher values)											

2[2]	randomised trials	no serious risk of bias	no serious inconsistency	no serious indirectness	no serious imprecision	none	187	182	-	MD 2.96 higher (0.22 to 5.7 higher)	⊕⊕⊕⊕ HIGH
Adverse events - eating disorders (KEDS child self-report); ≥12 months follow up (post intervention). MID = 10.63 (Better indicated by lower values)											
1[3]	randomised trials	serious[4]	no serious inconsistency	no serious indirectness	no serious imprecision	none	170	50	-	MD 0.54 higher (6.73 lower to 7.81 higher)	⊕⊕⊕O MODERATE
Change in insulin sensitivity (fasting insulin (pmol/L); 6-12 months follow up (post intervention). MID = 8.42 (Better indicated by higher values)											
1[5]	randomised trials	serious[6]	no serious inconsistency[7]	serious[8]	very serious[9]	none	27	25	-	MD 1.3 higher (8.62 lower to 11.22 higher)	⊕OOO VERY LOW
Change in insulin sensitivity (fasting insulin (pmol/L); ≥12 months follow up (post intervention). MID = 20.15 (Better indicated by higher values)											
1[5]	randomised trials	serious[6]	no serious inconsistency[7]	serious[8]	serious[10]	none	27	25	-	MD 4.7 higher (16.75 lower to 26.15 higher)	⊕OOO VERY LOW
Change in blood pressure - systolic; ≥12 months follow up (post intervention). MID = 9.82 (Better indicated by lower values)											
1[5]	randomised trials	serious[6]	no serious inconsistency[7]	serious[8]	serious[10]	none	27	25	-	MD 3 higher (6.82 lower to 12.82 higher)	⊕OOO VERY LOW
Change in blood pressure - diastolic; ≥12 months follow up (post intervention). MID = 12.44 (Better indicated by lower values)											
1[5]	randomised trials	serious[6]	no serious inconsistency[7]	serious[8]	serious[10]	none	27	25	-	MD 2.3 higher (10.12 lower to 14.72 higher)	⊕OOO VERY LOW

1 Gerards 2015; Golley 2007 (1)

2 McCallum 2007; Wake 2009

3 Estabrooks 2009

4 Downgraded once as greater than 33.3% of the weight in the meta-analysis came from studies at moderate risk of bias

5 Spence 2022

6 Downgraded once for moderate risk of bias due to high attrition

7 Single study; inconsistency not applicable

8 Downgraded once for indirectness - non-UK study

9 Downgraded twice as 95%CI crosses 2 calculated MIDs

10 Downgraded once as 95%CI crosses 1 calculated MID

Table 37: Diet modification + Exercise program + Behaviour change techniques vs Basic support

Quality assessment							No of patients		Effect		Quality
No of studies	Design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	Diet modification + Exercise program + BCT	Basic support	Relative (95% CI)	Absolute	
Change in insulin sensitivity (HOMA-IR); 6-12 months follow up (post intervention). MID = 1.1 (Better indicated by higher values)											

1[1]	randomised trials	serious[2]	no serious inconsistency[3]	no serious indirectness	serious[4]	none	57	56	-	MD 0.41 lower (1.17 lower to 0.35 higher)	⊕⊕OO LOW	
Change in insulin sensitivity (HOMA-IR); ≥12 months follow up (post intervention). MID = 1.08 (Better indicated by higher values)												
1[1]	randomised trials	serious[2]	no serious inconsistency[3]	no serious indirectness	serious[4]	none	57	56	-	MD 0.5 lower (1.25 lower to 0.25 higher)	⊕⊕OO LOW	

[1] Mirza 2013

[2] Downgraded once for moderate risk of bias

[3] Single study; inconsistency not applicable

[4] Downgraded once as 95%CI crosses 1 calculated MID

Table 38: Diet modification + Exercise program + Behaviour change techniques vs Concomitant intervention

Quality assessment							No of patients		Effect		Quality	Importance
No of studies	**Design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Diet modification + Exercise program + BCTs**	**Concomitant intervention**	**Relative (95% CI)**	**Absolute**		
Change in waist circumference; 6-12 months follow up (post intervention). MID = 3.44 (Better indicated by lower values)												
1[1]	randomised trials	no serious risk of bias	no serious inconsistency[2]	no serious indirectness	serious[3]	none	60	63	-	MD 1.3 lower (3.57 lower to 0.97 higher)	⊕⊕⊕O MODERATE	
Change in Health Related Quality of life (KID KINDL-R parent proxy); 6-12 months follow up (post intervention). MID = 5.87 (Better indicated by higher values)												
1[4]	randomised trials	serious[5]	no serious inconsistency[2]	no serious indirectness	no serious imprecision	none	249	274	-	MD 0.44 lower (2.58 lower to 1.7 higher)	⊕⊕⊕O MODERATE	
Change in weight-related quality of life (GW-LQ-KJ parent proxy); 6-12 months follow up (post intervention). MID = 9.1 (Better indicated by higher values)												
1[4]	randomised trials	serious[5]	no serious inconsistency[2]	no serious indirectness	no serious imprecision	none	249	274	-	MD 0.33 lower (3.47 lower to 2.81 higher)	⊕⊕⊕O MODERATE	
Change in waist circumference; ≥12 months follow up (post intervention). MID = 3.77 (Better indicated by lower values)												
1[6]	randomised trials	no serious risk of bias	no serious inconsistency[2]	no serious indirectness	no serious imprecision	none	60	63	-	MD 0.58 higher (1.97 lower to 3.13 higher)	⊕⊕⊕⊕ HIGH	
Change in waist-to-height ratio; ≥12 months follow up (post intervention). MID = 0.02 (Better indicated by lower values)												
1[6]	randomised trials	no serious risk of bias	no serious inconsistency[2]	no serious indirectness	no serious imprecision	none	60	63	-	MD 0 higher (0.02 lower to 0.02 higher)	⊕⊕⊕⊕ HIGH	

Change in insulin sensitivity (insulin (mU/mL)); ≥12 months follow up (post intervention). MID = 9.6 (Better indicated by higher values)												
1[6]	randomised trials	no serious risk of bias	no serious inconsistency[2]	no serious indirectness	no serious imprecision	none	60	63	-	MD 2.58 lower (8.91 lower to 3.75 higher)	⊕⊕⊕⊕ HIGH	
Change in blood pressure - systolic; ≥12 months follow up (post intervention). MID = 8.94 (Better indicated by lower values)												
1[6]	randomised trials	no serious risk of bias	no serious inconsistency[2]	no serious indirectness	serious[3]	none	60	63	-	MD 4.4 higher (1.55 lower to 10.35 higher)	⊕⊕⊕O MODERATE	
Change in blood pressure - diastolic; ≥12 months follow up (post intervention). MID = 5.46 (Better indicated by lower values)												
1[6]	randomised trials	no serious risk of bias	no serious inconsistency[2]	no serious indirectness	serious[3]	none	60	63	-	MD 2.6 higher (1.04 lower to 6.24 higher)	⊕⊕⊕O MODERATE	

1 HICKUPS trial - Okely 2010

2 Single study; inconsistency not applicable

3 Downgraded once as 95%CI crosses 1 calculated MID

4 Warschburger 2016

5 Downgraded once for moderate risk of bias

6 HICKUPS trial - Collins 2011

12-18 year olds

Table 39: Diet modification vs basic support

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Diet**	**basic support**	**Relative (95% CI)**	**Absolute (95% CI)**		
Number of serious adverse events: ≥12 months follow up (post intervention). MID = 1.25 (Better indicated by lower values)												
1[a]	randomised trials	serious[b]	not serious[c]	very serious[d]	serious[e]	none	7/105 (6.7%)	0/104 (0.0%)	**OR 15.91** (0.90 to 282.33)	**0 fewer per 1,000** (from 0 fewer to 0 fewer)	⊕◯◯◯ Very low	

CI: confidence interval; **OR:** odds ratio

a. Ebbeling 2012

b. Rated by Al-Khudairy 2017

c. Single study; inconsistency not applicable

d. Downgraded twice because the evidence is from a non-UK country (USA) and the setting is unclear

e. Downgraded once because confidence intervals cross one MID (1.25)

Table 40: Exercise program vs basic support

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**Exercise**	**basic support**	**Relative (95% CI)**	**Absolute (95% CI)**		
Change in waist to height ratio: 6-12 months follow up (post intervention). MID = 0.025 (Better indicated by lower values)												
1[a]	randomised trials	serious[b]	not serious[c]	very serious[d]	serious[e]	none	76	76	-	MD **0.01 higher** (0.01 lower to 0.03 higher)	⊕◯◯◯ Very low	

CI: confidence interval; **MD:** mean difference
a. Toulabi 2012
b. Rated by Al-Khudairy 2017
c. Single study; inconsistency not applicable
d. Downgraded twice because the evidence is from a non-OECD country (Iran)
e. Downgraded once because confidence intervals cross one MID threshold (0.025)

Table 41: Behaviour change techniques + diet modification vs concomitant intervention

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**BCT + diet**	**concomitant intervention**	**Relative (95% CI)**	**Absolute (95% CI)**		
Change in insulin sensitivity (HOMA): 6-12 months follow up (post intervention). MID = 1.7 (Better indicated by lower values)												
1[a]	randomised trials	very serious[b]	not serious[c]	very serious[d]	serious[e]	none	8	8	-	MD **3 lower** (5.94 lower to 0.06 lower)	⊕◯◯◯ Very low	

a. Ebbeling 2003
b. Rated by Al-Khudairy 2017
c. Single study; inconsistency not applicable
d. Downgraded twice as the evidence is from a non-UK country (USA) and the setting is unclear
e. Downgraded once because confidence intervals cross one MID (1.7)

Table 42: Behaviour change techniques + diet modification vs basic support

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT + diet	basic support	Relative (95% CI)	Absolute (95% CI)		
Change in waist to height ratio: 6-12 months follow up (post intervention). MID = 0.02 (Better indicated by lower values)												
1[a]	randomised trials	serious[b]	not serious[c]	serious[d]	serious[e]	none	32	35	-	MD **0.03 lower** (0.05 lower to 0.01 lower)	⊕◯◯◯ Very low	
Change in quality of life (PedsQL): 6-12 months follow up (post intervention). MID = 6.77 (Better indicated by higher values)												
2[a,fg]	randomised trials	very serious[j]	not serious	serious[d]	serious[k]	None	162	141	-	MD **4.42 higher** (1.27 higher to 7.56 higher)	⊕◯◯◯ Very low	
Change in quality of life (DISABKIDS): 6-12 months follow up (post intervention). MID = 6.61 (Better indicated by higher values)												
1[f]	randomised trials	very serious[b]	not serious[c]	serious[d]	serious[l]	None	32	35	-	MD **3.8 higher** (1.85 lower to 9.45 higher)	⊕◯◯◯ Very low	
Change in insulin sensitivity (HOMA): 6-12 months follow up (post intervention). MID = 1.06 (Better indicated by lower values)												
2[a,g]	randomised trials	very serious[b,j]	very serious[m]	serious[d]	very serious[n]	none	103	86	-	MD **0.52 higher** (1.24 lower to 2.29 higher)	⊕◯◯◯ Very low	
Change in blood pressure (systolic mmHg): 6-12 months follow up (post intervention). MID = 6.71 (Better indicated by lower values)												
2ag	randomised trials	very serious[j]	not serious	serious[d]	not serious	none	103	86	-	MD **2.17 lower** (4.84 lower to 0.51 higher)	⊕◯◯◯ Very low	
Change in blood pressure (diastolic mmHg): 6-12 months follow up (post intervention). MID = 4.61 (Better indicated by lower values)												
2ag	randomised trials	very serious[j]	not serious	serious[d]	not serious	none	103	86	-	MD **0.74 lower** (3.34 lower to 1.86 higher)	⊕◯◯◯ Very low	

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT + diet	basic support	Relative (95% CI)	Absolute (95% CI)		
Change in waist circumference: 6-12 months follow up (post intervention). MID = 6.07 (Better indicated by lower values)												
1[g]	randomised trials	very serious[b]	not serious[c]	serious[d]	serious[o]	none	71	51	-	MD **2.1 lower** (6.84 lower to 2.64 higher)	⊕◯◯◯ Very low	
Change in insulin sensitivity (HOMA): ≥12 months follow up (post intervention). MID = 2.68 (Better indicated by lower values)												
1[p]	randomised trials	very serious[b]	not serious[c]	serious[q]	serious[r]	none	105	69	-	MD **2.05 lower** (3.32 lower to 0.78 lower)	⊕◯◯◯ Very low	
Change in blood pressure (systolic mmHg): ≥12 months follow up (post intervention). MID = 6.34 (Better indicated by lower values)												
1p	randomised trials	very serious[b]	not serious[c]	serious[q]	not serious	none	105	69	-	MD **0.6 lower** (4.14 lower to 2.94 higher)	⊕◯◯◯ Very low	
Change in blood pressure (diastolic mmHg): ≥12 months follow up (post intervention). MID = 5.76 (Better indicated by lower values)												
1p	randomised trials	very serious[b]	not serious[c]	serious[q]	not serious	none	105	69	-	MD **2 lower** (5.21 lower to 1.21 higher)	⊕◯◯◯ Very low	

CI: confidence interval; **MD:** mean difference
a. Vos 2011 and 2012
b. Rated by Al-Khudairy 2017
c. Single study; inconsistency not applicable
d. Downgraded once because the evidence is from a non-UK country (Netherlands)
e. Downgraded once because confidence intervals cross one MID (0.02)
f. DeBar 2012
g. Hofsteenge 2013 and 2014
h. Downgraded twice as 2/3 studies were rated high risk of bias
i. Downgraded once because confidence intervals cross one MID (6.71)
j. Downgraded twice as the studies are risked at high and moderate risk of bias
k. Downgraded once because confidence intervals cross one MID threshold (6.77)
l. Downgraded once because confidence intervals cross one MID threshold (6.61)
m. Downgraded twice because I2 was >66.7% (I2 = 83%)
n. Downgraded twice because confidence intervals cross two MID thresholds (1.06)
o. Downgraded once because confidence intervals cross one MID threshold (6.07)
p. Savoye 2011
q. Downgraded once because the evidence is from a non-UK country (USA)
r. Downgraded once because confidence intervals cross one MID threshold (2.68)

Table 43: Behaviour change techniques + exercise program vs concomitant intervention

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT + exercise	concomitant intervention	Relative (95% CI)	Absolute (95% CI)		
Change in waist circumference: 6-12 months follow up (post intervention). MID = 7.24 (Better indicated by lower values)												
1[a]	randomised trials	very serious[b]	not serious[c]	serious[d]	not serious	none	62	45	-	MD **0.7 lower** (5.77 lower to 4.37 higher)	⨁◯◯◯ Very low	

CI: confidence interval; **MD:** mean difference
a. Resnicow 2005
b. Rated by Al-Khudairy 2017
c. Single study; inconsistency not applicable
d. Downgraded once because evidence is from a non-UK country (USA)

Table 44: Behaviour change techniques + exercise program vs basic support

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT + exercise	basic support	Relative (95% CI)	Absolute (95% CI)		
Change in waist circumference: 6-12 months follow up (post intervention). MID = 6.86 (Better indicated by lower values)												

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT + exercise	basic support	Relative (95% CI)	Absolute (95% CI)		
1[a]	randomised trials	very serious[b]	not serious[c]	serious[d]	not serious	none	67	69	-	MD **2 lower** (6.66 lower to 2.66 higher)	⨁◯◯◯ Very low	
Change in quality of life (YQOL-W): 6-12 months follow up (post intervention). MID = 6.86 (Better indicated by higher values)												
1[a]	randomised trials	very serious[b]	not serious[c]	serious[d]	not serious[e]	none	67	69	-	MD **2.2 higher** (2.38 lower to 6.78 higher)	⨁◯◯◯ Very low	

CI: confidence interval; **MD:** mean difference
a. Soltero 2018
b. Study was rated as high risk of bias
c. Single study; inconsistency not applicable
d. Downgraded once because the evidence was from a non-UK country (USA)
e. Downgraded once because confidence intervals cross one MID threshold (6.86)

Table 45: Behaviour change techniques + diet modification + exercise program vs basic support

Certainty assessment							№ of patients		Effect		Certainty	
№ of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	BCT + diet + exercise	basic support	Relative (95% CI)	Absolute (95% CI)		
Change in insulin sensitivity (HOMA): 6-12 months follow up (post intervention). MID = 1.66 (Better indicated by lower values)												
1[a]	randomised trials	very serious[b]	not serious[c]	serious[d]	serious[e]	none	22	19	-	MD **0.5 lower** (2.61 lower to 1.61 higher)	⨁◯◯◯ Very low	

CI: confidence interval; **MD:** mean difference

a. Grey 2004

b. Rated by Al-Khudairy 2017

c. Single study; inconsistency not applicable
d. Downgraded once as evidence was from a non-UK country (USA)
e. Downgraded once because confidence intervals cross one MID threshold (1.66)

Qualitative evidence tables

Table 46: McMaster 2020: Acceptability of Hospital-Based Pediatric Weight Management Services among Patients and Families (2-18 years)

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Aspects of weight management service: Education Nutrition recommendations, that is, tangible nutrition recommendations that could be readily adopted; information about diet, exercise, and the long-term effects of obesity; healthy lifestyle messages being delivered and reinforced (caregivers' own messaging about health and wellness to their children had greater impact if reinforced by health care providers, caregivers felt supported and validated by educational content presented in sessions, combination of positive messaging and communication skills sessions helped caregivers to feel more confident in their parenting approach)	Woolford 2012; Owen 2009; Zenlea 2017	Minor concerns[1]	Moderate concerns[6]	Minor concerns[7]	No concerns	Low

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Aspects of weight management service: Strategies to facilitate behaviour change Interactive demonstrations and visual activities, parents valued home visits, adolescents valued weekly weight checks, tips/tools that helped incorporate healthy practices into routines, peer support; regular clinic contact; children/adolescents valued increased time together as a family, for example, cooking and meal planning	Woolford 2012; Owen 2009; Skelton 2016	Minor concerns[1]	Serious concerns[11]	Minor concerns[7]	No concerns	Very low
Aspects of weight management service: Weight management service staff Supportive, nonjudgmental environment that emphasized health, support from team members; clinic staff, ‘‘no nonsense’’ attitude to obesity; relationship between caregiver–health team and relationship between health team–child; supportive forum for sharing experiences related to caring for children with obesity	Woolford 2012; Owen 2009; Zenlea 2017; Garcia 2017	Minor concerns[1]	Moderate concerns[6]	Minor concerns[7]	No concerns	Low
Outcomes of attending weight management service: Health outcomes Weight outcome	Stewart 2008	Minor concerns[1]	Moderate concerns[6]	Minor concerns[7]	Serious concerns[10]	Very low
Outcomes of attending weight management service: Psychological outcomes Self-esteem (child more confident and happier); self confidence	Skelton 2016; Stewart 2008	Minor concerns[1]	Moderate concerns[6]	Minor concerns[7]	Moderate concerns[9]	Very low
Reasons for attrition: Practical barriers Physical barriers (scheduling, parking, location, time), organizational barriers (clinic environment); logistical issues (flexibility in hours and location); scheduling, transportation; difficulty adjusting schedules of consultations with activities of parents	Kitscha 2009; Sallinen Gaffka 2013; Skelton 2016; Nogueira 2013	Minor concerns[1]	Moderate concerns[6]	Minor concerns[7]	No concerns	Low

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
and patients, difficulty in scheduling a return appointment, long waiting hours						
Reasons for attrition: Content and results of program Program educational content; content and/or delivery of the intervention; unsuccessful treatment/could not lose weight, performance of new treatment at another health service	Kitscha 2009; Nogueira 2013	Minor concerns[1]	Moderate concerns[6]	Minor concerns[7]	Moderate concerns[9]	Very low
Reasons for attrition: Patient/family motivation Family readiness to change/motivation; barriers to implementation of recommendations	Kitscha 2009;	Minor concerns[1]	Minor concerns[5]	Minor concerns[7]	Serious concerns[10]	Very low
Reasons for attrition: Mismatched expectations of treatment/treatment outcomes Mismatched expectations between parents, their child, and clinic program/staff for the outcome; parents expecting greater weight loss	Skelton 2016;	Minor concerns[1]	Minor concerns[5]	Minor concerns[7]	Serious concerns[10]	Very low
Reasons for attrition: Families choosing not to return to treatment Family perceived no need for follow-up visit; most families who discontinued treatment did so on their own, without discussion of decision with member of treatment team; refusal to return to treatment by children; unforeseen circumstances	Kitscha 2009; Nogueira 2013; Sallinen Gaffka 2013	Minor concerns[1]	Moderate concerns[6]	Minor concerns[7]	No concerns	Low
Barriers to behaviour change: Perceived inadequate support from weight management service Lack of health care provider support; need for ongoing support to maintain lifestyle changes; difficulty identifying specific lifestyle changes and needed practical ideas to do so, parental anxieties	Owen 2009; Zenlea 2017; Stewart 2008	Minor concerns[1]	Minor concerns[5]	Minor concerns[7]	No concerns	Low

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Barriers to behaviour change: Perceived inadequate support from wider family Lack of support from nucleus family and/or extended family, families experienced extended family as unsupportive; more regular and practical support to deal with issues of interfering extended families; family congruence (overt and covert), continuous negotiation (parents negotiating choices such as physical activity, nutrition, homework, dinner and family chores, making school lunches with children)	Owen 2009; Stewart 2008; Fjone 2011	Minor concerns[1]	Moderate concerns[6]	Minor concerns[7]	No concerns	Low
Barriers to behaviour change: Under-recognition/underestimation of problem Parents were either aware of a weight problem (seekers/avoiders of treatment) or unaware of weight problem (deniers)	Stewart 2008	Minor concerns[1]	Minor concerns[5]	Minor concerns[7]	Serious concerns[10]	Very low
Burden and stigma: Shared burden Shared burden between parents and children; that is, burden of shame, guilt, and failure to stick to a diet or exercise plan	Fjone 2011	Minor concerns[1]	Serious concerns[11]	Minor concerns[7]	Serious concerns[10]	Very low
Burden and stigma: Guilt and blame Parents felt fear, anger, guilt, confusion around their child's weight problem; caregiver experiences of feeling blamed for causing their children's obesity (i.e., ''courtesy stigma'' in which a person is stigmatized because of close association with another person with a stigmatizing feature)	Zenlea 2017; Stewart 2008	Minor concerns[1]	Minor concerns[5]	Minor concerns[7]	Moderate concerns[9]	Very low
Service content: Program content Greater emphasis on physical activity, disease-specific information to increase children's responsibility/accountability for their health while	Zenlea 2017; Sallinen Gaffka 2013; Tremblay 2016	Minor concerns[1]	No concerns	Minor concerns[7]	No concerns	Moderate

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
providing coaching techniques for parents; general parenting and child psychology information to enable parents to redirect their children to make appropriate diet choices; nutrition education, exercise and behaviour education or support; higher frequency of medical examination; physical activity, information provision, weight and progress tracking, psychological services						
Service content: Delivery of weight management intervention Interactive elements, peer contact; family-centered approach that emphasizes family lifestyle changes rather than just child's, interactive learning environment that incorporates video games and demonstrations, appointments focused around a playgroup or a group setting to allow children to interact, develop friendships, and motivate each other, a child-friendly and inviting environment with games/ entertainment to keep the child busy, allowing the parent to focus on counselling session; breaking recommendations down into manageable goals	Tremblay 2016;	Minor concerns[1]	No concerns	Minor concerns[7]	Serious concerns[10]	Very low
Service content: Individualized treatment Development of an adolescent-specific program; individualized care; tailored treatments; diverse menu of treatment recommendations	Tremblay 2016; Zenlea 2017;	Minor concerns[1]	No concerns	Minor concerns[7]	Moderate concerns[9]	Low
Communication and therapeutic relationship Enhance family participation; motivate the child to encourage therapeutic alliance	Sallinen Gaffka 2013	Minor concerns[1]	Serious concerns[11]	Minor concerns[7]	Serious concerns[10]	Very low
Organizational: Clinic hours	Fjone 2011;	Minor concerns[1]	Serious concerns[11]	Minor concerns[7]	Serious concerns[10]	Very low

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Expanded clinic hours; staff and supporting hospital administration should consider scheduling alternative times for visits, assessing families' transportation and financial needs						
Organizational: Clinic accessibility Additional clinic locations in the community, assistance with transportation to clinic, free or reduced price parking; access to care, that is, scheduling, program location, transportation	Fjone 2011; Tremblay 2016	Minor concerns[1]	Minor concerns[5]	Minor concerns[7]	Moderate concerns[9]	Very low

[1] Downgraded once for methodological limitations as the review authors used a weak criterion to assess the quality of the studies. The authors rated all studies as equally high quality, so there were minor concerns about this rating.
[2] Downgraded twice for methodological limitations as the authors did not use any validated tool to assess the quality of the studies. The authors excluded studies with low methodological quality and thus considered all included studies to be adequate quality, so there were major concerns about this rating.
[3] Downgraded once for methodological limitations because it was identified mainly in studies rated as moderate or high risk of bias by the review author
[4] Downgraded twice for methodological limitations because it was identified mainly in studies rated as high risk of bias by the review author
[5] Downgraded once for relevance because it was identified mainly in studies that were indirectly or partially relevant.
[6] Downgraded twice for relevance because it was identified only in studies that were indirectly or partially relevant.
[7] Downgraded once for coherence because the review authors did not assess coherence in their review. It is not possible to assess coherence from reported findings, as it is necessary to compare the themes with the original data. Therefore there were minor concerns about what the coherence of these themes may be.
[8] Rating of coherence as reported by review authors, with no further assessment.
[9] Finding was downgraded twice for adequacy because of insufficient studies (fewer than 3) and the richness of detail could not be inferred.
[10] Finding was downgraded three times for adequacy because it was derived from a single study and the richness of detail could not be inferred.
[11] Downgraded three times for relevance because it was identified only in studies that were partially relevant.

Table 47: Jones 2019: Viewpoints of adolescents with overweight and obesity attending lifestyle obesity treatment interventions (12-18 years)

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Intervention content: Tailored intervention One factor that appears to be very important when planning and delivering an adolescent weight management programme is tailoring it to the individual, including different ethnicities, cultures, and to the specific age group. In a study that described adolescent's experiences of text message support through the maintenance period of an intervention, no consensus was found that suggested adolescents preferred a specific time to receive text messages, or how often, highlighting the need for individual tailoring. Adolescents reported that they wanted to attend an intervention that was created with their age group in mind. Often interventions were designed for wider age ranges (E.g. 8-16 years). There was a strong feeling of lack of services aimed at adolescents. One study involved home visits for adolescents and their families taking part in an intervention. This opportunity for tailored advice in the home environment received positive feedback.	Reece 2015; Morinder 2011; Holt (2005); Woolford (2012b); Banks (2014); Jogova (2013); Woolford (2012a); Smith (2014b); Staiano (2012); Woolford 2010	No concerns	No concerns	No reported concerns[8]	No concerns	High
Intervention content: Active engagement Enjoyment and fun are of large importance to adolescents when attending an obesity intervention. This sense of fun appears to be driven by hands on activities. Active engagement and fun has been highlighted in depth by Watson et al., regarding exercise and classroom-based learning of healthy eating. The importance of	Watson (2016); Woolford (2012b); Howie (2016)	Minor concerns[3]	Minor concerns[5]	No reported concerns[8]	No concerns	Moderate

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
ensuring active engagement rather than passive is an important theme to recognise in intervention content. Fun seemed an important aspect to reduce anxiety among participants attending an intervention. This sense of fun created an environment where it did not seem that learning was taking place; sessions were effortless and flowed.						
Support: Professional support valued This prominent domain of support is weighted in favour of professional support, with 15 included studies supporting this theme. Professional support appears to be valued more so than support coming from peers and family. The friendly and fun nature of this supportive relationship was particularly welcomed by adolescents who appreciated professionals encouraging attitude towards them. Adolescents appeared to value being given personal attention by professionals. The feeling of finally being given the support they have needed and having someone to talk to. This appreciation appears to be emphasised when that professional is experienced and specialises in childhood obesity. Adolescents felt comforted by this; it gave them a sense that they were not the only one who was overweight. A non-forceful approach from professionals was appreciated and adolescents valued gentle encouragement. Additionally, adolescents valued receiving support that focused on more than just weight loss, such as self-esteem and well-being. Negative	Reece (2015); Peeters (2012); Rudolf (2006); Hester (2009); Twiddy (2011); Morinder (2011); Holt (2005); Woolford (2012b); Alm (2008); Owen (2009); Li (2016); Nguyen (2014); Daley (2008); Riiser (2013); Hammar(1971)	Minor concerns[3]	No concerns	No reported concerns[8]	No concerns	High

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
comments about professional support were to do with the absence of a more personal relationship, leading to feelings of neglect and frustration, which in turn can lead to the adolescent defying all recommendations. There was a general desire from adolescents to work more closely with regular professionals, whether this be an individual professional or a team, to develop this deeper and more meaningful relationship.						
Support: Importance of family support Another avenue of support that appears to be valued highly by adolescents was their own family. Family support gave adolescents continued motivation and encouragement to continue with their weight loss attempts. Adolescents particularly found family supportive when they joined in with behaviour change efforts and valued the effect this had on bringing the family closer together. Themes from this synthesis clearly show that family support can assist in providing a positive framework for behaviour change and providing important encouragement to make healthier choices. This encouragement appears to be coming more from the mother within families, highlighting this important family figure. Although adolescents benefited from positive family support, sometimes lack of knowledge from a parent around weight management, healthy eating and behaviour change caused a barrier to weight loss for the adolescent. This lack of family support appeared more common in those adolescents reporting no	Reece (2015); Peeters (2012); Hester (2009); Watson (2016); Morinder (2011); Smith (2014a); Melnyk (2007); Woolford (2012b); Alm (2008); Howie (2016); Engström (2016); Campbell-Voytal (2018); Li (2016); Jogova (2013); Woolford (2012a)	No concerns	No concerns	No reported concerns[8]	No concerns	High

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
success. The absence of understanding and knowledge from family members can lead to frustration, despair and can create a sense of self-blaming.						
Support: Peer support valued Adolescents also valued support from their peers. Adolescents described being around their peers as a security blanket, allowing them to feel comfortable and confident. This peer support gave adolescents with obesity a sense of belonging by allowing them to talk to adolescents in a similar position to them, sharing their struggles and issues. This feeling of acceptance is something they may not have experienced outside of the intervention. Adolescents commented on their initial motivations for taking part that related to peer support and socialising. Adolescents took part to make friends outside of school and improve their social skills. Peer support was often mentioned in relation to exercise, with adolescents enjoying exercising with other adolescents and engaging in competitive activities.	Reece(2015; Peeters(2012; Hester(2009; Watson(2016; Morinder(2011; Smith(2014a; Holt(2005; Melnyk(2007; Woolford(2012b; Alm(2008; Engstrom(2016; Li(2016; Jogova (2013; Woolford (2012a; Smith (2014b; Owen (2009; Staiano (2012; Hammar 1971	No concerns	No concerns	No reported concerns[8]	No concerns	High
Barriers to attending a weight management programme and being healthy: Prior fears of attending interventions Adolescents from seven of the included studies reported prior fears of attending an intervention. Many of these worries related to the intensity of weight loss activities, type of food on offer or incorrect preconceptions. These pre-conceptions stem from the interventions not being portrayed as	Rudolf (2006); Hester (2009); Smith (2014a); Holt (2005); Woolford (2012b); Engstrom (2016); Daley (2008)	No concerns	Minor concerns[5]	No reported concerns[8]	No concerns	High

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
fun, something that has been described earlier in the theme 'active engagement' as an important element. Also, some adolescents had prior worries about being bullied, group dynamics and not being accepted. Additional worries related to previous negative experiences with health professionals and not having someone to attend with, reiterating the importance of family and/or peer support.						
Barriers to attending a weight management programme and being healthy: Obesity treatment bringing about feelings of failure, guilt and shame Adolescents commented on being fearful of being told off by a health professional for not losing weight and feeling like a failure. These feelings would lead to adolescents not continuing with the intervention, which led to feelings of guilt and shame. Attending obesity interventions also appeared to bring out a greater focus on weight, which in turn could lead to lower self-esteem. These negative feelings can also be seen after an intervention when there is a struggle with weight loss maintenance. Longer-term support that considers the mental health of adolescents is needed when planning interventions.	Morinder (2011); Alm (2008); Banks (2014); Hester (2009); Smith (2014a); Smith (2014b); Peeters (2012)	No concerns	Minor concerns[5]	No reported concerns[8]	No concerns	High
Physical activity vs. Diet: Enjoyment from learning to eat healthily Adolescents from three multi-component interventions highlighted the benefits of understanding the nutritional content of different foods and drinks as well as giving them a better	Hester (2009); Melnyk (2007); Howie (2016); Woolford (2012b); Morinder (2011);	Moderate concerns[4]	Minor concerns[5]	No reported concerns[8]	No concerns	Low

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
awareness of what foods should be eaten in moderation. Additionally, adolescents appeared to prefer healthy eating related activities that were more practical and hands-on. These visual activities seemed to engage adolescents more than tasks that involved lots of writing. The element of having more practical and interactive activities is discussed in more detail previously within the theme 'active engagement'.						
Physical activity vs. Diet: Enjoyment of sports and physical activity Most adolescents commented on their enjoyment of taking part in exercise. Again, fun was an important element. Many adolescents enjoyed being able to use a gym facility, whilst others commented on their enjoyment of sports and other activities such as cycling and basketball. Adolescents commented on how physical activity made them feel, both physically and mentally, which created that sense of accomplishment.	Peeters 2012; Hester 2009; Holt 2005; Woolford 2012b; Hemetek 2015; Alm 2008; Owen 2009; Howie 2016; Engstrom 2016; Nguyen 2014; Woolford 2012a; Daley 2008	Minor concerns[3]	Minor concerns[5]	No reported concerns[8]	No concerns	Moderate
Motivations: Weight loss as primary motivation Understanding adolescent's primary motivations for taking part in an intervention is vital to improve engagement. Adolescents from nine out of the 24 included studies commented on weight loss being their primary goal for taking part in an intervention. Although not the primary reason for motivating weight loss, some adolescents were driven to lose weight to prevent health sequelae. In some cases, being aware of preventing health sequelae was	Peeters 2012; Hester 2009; Twiddy 2011; Morinder 2011; Holt 2005; Alm 2008; Nguyen 2014; Daley 2008; Hammar 1971; Woolford	Moderate concerns[4]	No concerns	No reported concerns[8]	No concerns	Moderate

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
due to having family members with a health condition.	2012b; Woolford 2012a					
Motivations: Being a healthy weight as 'normal' and socially desirable Many adolescents viewed being a healthy weight as ‘normal’ and held this as the key to being accepted socially. Normality, from the point of view of an adolescent in these studies suggested having a boyfriend and the ability to socialise and play with friends. As well as seeing weight loss as the key to social desirability, some adolescents felt that losing weight would reduce the bullying they received, which would lead to a normal and happy life.	Reece 2015; Peeters 2012; Hester 2009; Twiddy 2011; Holt 2005; Hemetek 2015; Alm (2008); Daley 2008	Minor concerns[3]	Minor concerns[5]	No reported concerns[8]	No concerns	Moderate
Motivations: Adolescents recognising personal responsibility and personal motivation for weight loss Adolescents highlighted a strong personal drive that motivated their weight loss; this was often initiated through experiencing a ‘light bulb’ moment. Sometimes this came from reminders of past negative experiences or not wanting to be overweight like other family members. This personal drive appeared also in part due to adolescents realising their own responsibility in losing weight and following a healthy lifestyle. This is contradictory to another finding within this review where adolescents appreciated a prescriptive and regulated diet and exercise routine set by a professional. Nonetheless, more data supported the use of concise and practical messages	Reece 2015; Peeters 2012; Twiddy 2011; Morinder 2011; Hemetek 2015; Alm 2008; Owen 2009; Woolford 2012a; Hammar 1971; Smith 2014b; Daley 2008;	Minor concerns[3]	No concerns	Minor concerns reported[8]	No concerns	Moderate

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
throughout interventions. Adolescents liked gaining evidence-based knowledge, bringing the responsibility back to the individual. Adolescents spoke of a desire to lose weight to feel proud, which motivated their weight loss and personal drive.						
Maintenance: Transferring skills learnt into a home environment and routine Many adolescents commented on their struggles with adjusting to and transferring newly learnt skills and knowledge into everyday life. With many interventions taking place in a clinical or artificial setting and with professional support being more regular, the transition from an intense intervention back to a normal routine can be difficult. Adolescents also commented on the challenge of changing their eating habits for the longer term, the need for these eating habits to be engrained into normal everyday life. A sense that weight loss or weight loss maintenance was something that you must continually work at and the frustration surrounding this. Other adolescents found the transition from intervention into real life easier and felt that they had learnt and remembered valuable skills and knowledge that could be carried out in a home environment.	Reece 2015; Hester 2009; Morinder 2011; Holt 2005; Melnyk 2007; Woolford 2012b; Hemetek 2015; Alm 2008; Li 2016;	Minor concerns[3]	Minor concerns[5]	Minor concerns reported[8]	No concerns	Low
Maintenance: Longer term support Several studies included in this synthesis noted comments from adolescents suggesting that they would have benefited from more sessions as part of an intervention and post intervention. Feedback	Reece 2015; Peeters 2012; Hester 2009; Morinder 2011; Melnyk 2007;	Moderate concerns[4]	No concerns	No reported concerns[8]	No concerns	Moderate

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
from five interventions that lasted six to eight weeks all suggested that these programmes were too short. Another study that provided support after a multi-component intervention found that those participants that had been successful in losing weight through the initial programme found the additional postintervention sessions positive. However, those that were unsuccessful felt the follow-on sessions lacked physical activity opportunities and did not motivate participants. Adolescents did express their concerns and worries about maintaining their weight loss after an intervention. This may be due to their recognition of the challenge of losing weight as well as their recognition of individual responsibility. Adolescents commented on their struggles with lacking motivation after an intervention had finished and relapsing back into old habits due to the amount of focus required post-intervention. Some adolescents commented on the support they received from professionals and family members post-intervention, both positively and negatively. For some, continued support from professionals was helpful, whilst for others, over time, in terms of taking part in physical activity, was less important. Adolescents felt that physical activity was lacking in the school environment. Improving physical activity opportunities within schools will help to provide longer-term support for adolescents with overweight and obesity. The importance of family support in the maintenance period is also	Woolford 2012b; Hemetek 2015; Alm 2008; Howie 2016; Li 2016; Nguyen 2014; Daley 2008					

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
important, but this appeared to decrease over time.						
Technology: Adolescents enjoy using technology and do so with ease Seven studies contained data that related to the use of technology in an intervention. Most studies using technology suggested that adolescents enjoyed their use. Through observations and semi-structured telephone interviews, most adolescents gave the impression of using certain technologies, such as exergames, internet and taking photographs, with ease.	Jogova 2013; Nguyen 2014; Woolford 2012a; Woolford 2010; Smith 2014b; Riiser 2013; Staiano 2012	Moderate concerns[4]	Moderate concerns[6]	Moderate concerns reported[8]	No concerns	Very low

[1] Downgraded once for methodological limitations as the review authors used a weak criterion to assess the quality of the studies. The authors rated all studies as equally high quality, so there were minor concerns about this rating.
[2] Downgraded twice for methodological limitations as the authors did not use any validated tool to assess the quality of the studies. The authors excluded studies with low methodological quality and thus considered all included studies to be adequate quality, so there were major concerns about this rating.
[3] Downgraded once for methodological limitations because it was identified mainly in studies rated as moderate or high risk of bias by the review author
[4] Downgraded twice for methodological limitations because it was identified mainly in studies rated as high risk of bias by the review author
[5] Downgraded once for relevance because it was identified mainly in studies that were indirectly or partially relevant.
[6] Downgraded twice for relevance because it was identified only in studies that were indirectly or partially relevant.
[7] Downgraded once for coherence because the review authors did not assess coherence in their review. It is not possible to assess coherence from reported findings, as it is necessary to compare the themes with the original data. Therefore there were minor concerns about what the coherence of these themes may be.
[8] Rating of coherence as reported by review authors, with no further assessment.
[9] Finding was downgraded twice for adequacy because of insufficient studies (fewer than 3) and the richness of detail could not be inferred.
[10] Finding was downgraded three times for adequacy because it was derived from a single study and the richness of detail could not be inferred.
[11] Downgraded three times for relevance because it was identified only in studies that were partially relevant.

Table 48: Burchett 2018: Lifestyle weight management programmes for children: A systematic review using Qualitative Comparative Analysis to identify critical pathways to effectiveness

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Learning how to change Practical experiences that show you how to change, not only telling you what to change. Practical experiences, as opposed to didactic information giving, were valued: Practical physical activity sessions were widely and emphatically praised for giving children confidence and enabling them to experience enjoyment of being active. Practical and interactive healthy eating sessions were also highly valued such as cooking or tasting foods, and visual approaches, e.g. to illustrate portion size. Practical health behaviour change strategies such as goals, monitoring or parenting skills, were also felt to be helpful.	Watson 2012; Pittson 2013; Robertson 2009	Moderate concerns[2]	Minor concerns[5]	Minor concerns[7]	No concerns	Low
Getting all the family 'on-board' Shared understanding and a healthy home environment. One key impediment to change was felt to be other family members both within the home and in relation to extended family and friends. Engaging the wider family was felt to enable: Shared understanding across family members. Shared responsibility for making changes. The creation of a healthy home environment.	Staniford 2011; Lucas 2014; Watson 2012; Stewart 2008	Moderate concerns[2]	No concerns	Minor concerns[7]	No concerns	Low

Summary of review finding	Studies	Methodological limitations	Relevance	Coherence	Adequacy	Confidence
Social support A safe space with similar others in which to gain confidence and skills. Families were emphatic about group sessions which provided a positive contrast to experiences of prejudice and bullying. In particular group sessions were described as having a positive impact on children's confidence, which was described as fundamental to both initiation and maintenance of health behaviour changes. Skilled providers helped to create positive group experiences	Pittson 2013; Staniford 2011; Lucas 2014; Watson 2012	Moderate concerns[2]	No concerns	Minor concerns[7]	No concerns	Low

[1] Downgraded once for methodological limitations as the review authors used a weak criterion to assess the quality of the studies. The authors rated all studies as equally high quality, so there were minor concerns about this rating.
[2] Downgraded twice for methodological limitations as the authors did not use any validated tool to assess the quality of the studies. The authors excluded studies with low methodological quality and thus considered all included studies to be adequate quality, so there were major concerns about this rating.
[3] Downgraded once for methodological limitations because it was identified mainly in studies rated as moderate or high risk of bias by the review author
[4] Downgraded twice for methodological limitations because it was identified mainly in studies rated as high risk of bias by the review author
[5] Downgraded once for relevance because it was identified mainly in studies that were indirectly or partially relevant.
[6] Downgraded twice for relevance because it was identified only in studies that were indirectly or partially relevant.
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[11] Downgraded three times for relevance because it was identified only in studies that were partially relevant.

Appendix G – Economic evidence study selection

Appendix I – Economic evidence tables and checklists

Table 1: Panca at al. (2018)

Panca et al. (2018) Cost-effectiveness of a community delivered multicomponent intervention compared with enhanced standard care of obese adolescents: cost-utility analysis alongside a randomised controlled trial (the HELP trial)	
Study details	**Analysis:** Cost-utility analysis **Approach to analysis:** A cost-utility analysis based on a randomised controlled trial of the Healthy Eating Lifestyle Programme (HELP) intervention a community-delivered evidence-based multicomponent intervention focusing on enhancing motivation to change, developing self-efficacy and self-esteem for individuals with obesity compared with enhanced standard care. The base case analysis included adjustment of QALYs for age, gender and baseline utility values and adjustment of incremental costs for age and gender costs in the 6-month period prior to baseline. **Time horizon:** 1 year time period **Discounting:** The trial was conducted over 1 year therefore discounting of costs and outcomes was not conducted. **Setting:** Community settings in Greater London, United Kingdom
Interventions	**Intervention 1:** HELP - Intervention participants received 12 one-to-one sessions across 6 months, addressing lifestyle behaviours and focusing on motivation to change and self-esteem rather than weight change, delivered by trained graduate health workers in community settings. **Intervention 2:** Enhanced Standard Care - Control participants received a single 1-hour one-to-one nurse-delivered session providing didactic weight-management advice.
Population	174 young people living with obesity aged 12 – 19 years were recruited from primary care and community care settings in Greater London.
Data sources	**Baseline characteristics:** Participants in the clinical trial were well balanced in terms of age, gender and baseline BMI and EQ-5D values, although there were slightly fewer black participants and slightly greater numbers of white and Asian participants in the HELP arm. **Effectiveness:** Mean resource use, costs, utility values and QALYs were compared between groups on an intention-to-treat basis. Costs and outcomes were analysed using a linear regression model for QALYs gained and for costs a generalised linear model with gamma family and log link was used to account for the skewness in the costs data. The differences in mean costs and QALYs between the groups was calculated using regression analysis, regressing individual QALYs and costs against treatment allocation in the trial controlling for other factors. QALYs gained were adjusted for age, gender and baseline utility values. Incremental costs were adjusted for age, gender and costs in the 6-month period prior to baseline. **Resource use & costs:** Cost of the lifestyle intervention and the cost of follow-up was calculated for every participant. Cost of follow-up was calculated based on resource use data collected retrospectively in the trial via questionnaires. The cost of HELP included providers' training,

Panca et al. (2018) Cost-effectiveness of a community delivered multicomponent intervention compared with enhanced standard care of obese adolescents: cost-utility analysis alongside a randomised controlled trial (the HELP trial)

learning materials for providers and participants and time spent by providers/experienced psychologist in each follow-up session with participants.. Follow-up resource use included: general practitioner (GP) surgery consultations; GP telephone consultations; GP home consultations; contacts with the practice nurse; referrals to secondary care services (e.g. dietitian physiotherapist, osteopath, chiropractor, psychologist, counsellor, dentist, radiologist, community pharmacist); hospital inpatient admissions; hospital day cases and hospital outpatient visits.

QoL: Quality of life was measured using the generic preference-based the EQ-5D-3L. This was administered at baseline, 6 and 12-months post-randomisation. A utility profile was created for each participant assuming a straight-line relation between their utility values at each measurement point in time. QALYs for each participant from baseline to 12 months were calculated as the area under the utility profile.

Base-case result

Scenario	Intervention	Absolute		Incremental		
		Costs (£)	QALYs	Costs (£)* (95% CI)	QALYs (95% CI)	ICER (£)
Base case	Enhanced standard care	-	-	-	-	
	HELP	-	-	£1003 (£837 to £1,168)	0.008 (−0.031 to 0.046)	£120, 630

* 2013/14 UK Pounds

Sensitivity analyses

Deterministic: Three additional analyses were presented – no adjustment, complete case analysis, and complete case analysis with no adjustment The no adjustment analysis was the same as the base case analysis except the QALYs gained and incremental costs were unadjusted. The complete case analysis was the same as the base case except there was no multiple imputation of missing values. The complete case analysis with no adjustment was the same as the base case analysis except the QALYs gained and the incremental costs are unadjusted and there was no multiple imputation of missing values. The mean incremental cost for HELP versus enhanced standard care was £1003 (95% CI £837 to £1 168) and the mean QALYs gained were 0.008 (95% CI −0.031 to 0.046) (table 4). The incremental costs and QALYs gained for HELP versus enhanced standard care remained not significantly different from zero when rerunning the base case analysis without adjustment and using complete cases. The ICER of the HELP versus enhanced standard care was £120 630 per QALY gained.

Probabilistic: Bootstrapping was conducted to generate a cost-effectiveness acceptability curve. For each of the 20 imputed datasets, 1000 bootstrap replications were run. The results were combined using published equations to calculate standard errors around the mean values – accounting for uncertainty in imputed values, the skewed nature of the cost data and utility values and sampling variation. The cost-effectiveness acceptability curve shows that the probability of HELP being cost-effective is 0.002 at a threshold of £20,000 per QALY and 0.046 at a threshold of £30,000 per QALY.

Comments

Source of funding: The National Institute for Health and Care Research (NIHR) supported the research via the Programme Grants for Applied Research programme (Grant Reference Number RP-PG-0608-10035)—the Paediatric Research in Obesity Multi-model Intervention and Service Evaluation (PROMISE) programme).

Panca et al. (2018) Cost-effectiveness of a community delivered multicomponent intervention compared with enhanced standard care of obese adolescents: cost-utility analysis alongside a randomised controlled trial (the HELP trial)	
	Limitations: A key limitation of this study is the relatively high mean cost per participant of the HELP intervention due to high staff turnover during the study because there were 21 providers trained to deliver the HELP intervention. It is possible that this has inflated the mean cost and a smaller number of providers would lower the average training costs. The QALYs were generated from the EQ-5D-3L which is not ideally suited to generated utility values from children and young people.

Table 2: Robertson at al. (2017)

<table>
<tr><th colspan="2">Robertson et al. (2017). Randomised controlled trial and economic evaluation of the 'Families for Health' programme to reduce obesity in children</th></tr>
<tr><td>Study details</td><td>Analysis: Cost-utility analysis
Approach to analysis: This is a within trial economic evaluation of the Families for Health V2 (FFH) programme which is a group-based family intervention for overweight or obese children aged 6–11 years, that focused on parenting skills, relationship skills and emotional and social development. Outcome measures were collected at baseline, 3 months (or the end of the FFH programme) and 12 months post randomisation. The primary analysis was conducted on trial participants that had complete relevant data and secondary analysis was conducted where missing valued were imputed using multiple imputation. A programme-specific estimate of cost per session per child was calculated based on their attendance and QALY profiles were estimated for each child using health utilities generated from EQ-5D-Y responses from children and parents, at each time point. This was calculated as the area under the baseline-adjusted utility curve, assuming linear interpolation between utility measurements. Cost-effectiveness is reported as incremental cost-effectiveness ratios (ICERs), with outcomes as the difference in QALYs or BMI z-scores from baseline to 12 months, between the two trial arms.. Subgroup group analysis investigated population heterogeneity and covered gender and trial site.
Time horizon: 12-month
Discounting: No discounting was undertaken because the time horizon was only 12 months.
Setting: Three National Health Service Primary Care Trusts in West Midlands, England.</td></tr>
<tr><td>Interventions</td><td>Intervention 1: Usual Care; usual support for childhood obesity at each site (60 families).
<table>
<tr><th>Site</th><th>Usual Care</th></tr>
<tr><td>Site A</td><td>'One Body One Life'</td></tr>
<tr><td>Site B</td><td>One-to-one support from Change4Life advisors</td></tr>
<tr><td>Site C</td><td>1. A two-step programme: MEND and Choose It, with taster sessions for physical activity, healthy eating.
2. Weight Watchers for young people aged 10+ years.
3. Referral to the school nurse for children aged 6–9 years</td></tr>
</table>

Intervention 2: Families for Health V2 (FFH), a 10-week community-based family programme addressing parenting, lifestyle change and social and emotional development (60 families).</td></tr>
</table>

<table>
<tr><th colspan="2">Robertson et al. (2017). Randomised controlled trial and economic evaluation of the ‘Families for Health’ programme to reduce obesity in children</th></tr>
<tr><td>Population</td><td>Overweight or obese (≥91st or ≥98th centile body mass index (BMI)) children aged 6–11 years and their parents/carers, recruited March 2012–February 2014. Study was conducted in three sites with Sites A and C being more deprived.
<table>
<tr><th>Site</th><th>IMD Rank of LA district:
(1 is most deprived)</th><th>% White Ethnicity</th></tr>
<tr><td>Site A</td><td>IMD rank 55</td><td>73.8%</td></tr>
<tr><td>Site B</td><td>IMD rank 249</td><td>92.6%</td></tr>
<tr><td>Site C</td><td>IMD rank 14</td><td>67.9%</td></tr>
</table></td></tr>
<tr><td>Data sources</td><td>Baseline characteristics: Baseline characteristics such as age, sex, ethnicity and BMI z-score and socioeconomic status of the parents were collected as part of the study.
Effectiveness: Incremental cost effectiveness ratios (ICERs) were calculated as the difference in mean costs divided by the differences in mean outcomes: QALYs or change in BMI z-score at baseline and 12 months between the trial comparators. The EQ-5D-Y, which was administered at each time point to parents and children, was used to generate health utilities and estimate quality-adjusted life year (QALY) profiles for each child, assuming linear interpolation between utility measurements.
Resource use & costs: Parents completed resource use questions at each time-point which provided a profile of hospital and community health and social services received by each child and broader service utilisation such as educational support, family expenditures and lost productivity of parents attributable to the child’s health status. Unit costs were collected in 2013-2014 prices from national sources in accordance with guidelines and attached to resource use.
QoL: The children’s health-related quality of life was recorded using the Paediatric Quality-of-Life Inventory (PedsQL) V.4.0 (UK) for ages 8–12 years. The self-reported version was completed by children and parents completed the proxy version. Others survey instruments that were completed include the 14-item Warwick-Edinburgh Mental Well-Being Scale which measured Parental mental well-being. The quality of parent-child relationships was measured using the parent-completed 15-item version of the Child-Parent Relationship Scale (CPRS).</td></tr>
</table>

Robertson et al. (2017). Randomised controlled trial and economic evaluation of the 'Families for Health' programme to reduce obesity in children	
Base-case results (All children)	FFH was neither effective nor cost-effective for the management of obesity compared with UC. However, there was some evidence on the improvement in QALYs, indicating that the benefits of interventions might be related to other health and wellbeing outcomes except for weight.

Outcomes	Intervention	Mean		Mean Difference			Probability of cost-effectiveness at £20,000
		Costs (£) per child	Health Gains	Costs (£) per child	Health Gains	ICER (£)	
Complete Costs and Health Outcomes is Longitudinal change in BMI z score	Usual Care	£548	-				
	FFH	£998	-	£450 (bootstrap 95% CI £249, £650; p<0.001)	0.114 diff in BMI z-score (FFH-UC)	Dominated	Less than 1%
Complete Costs and Health Outcomes are QALYs	Usual Care	£507	-				
	FFH	£1,019	-	£512	0.0009 QALYs (FFH-UC)	£552,175 per QALY	28%

Sensitivity analyses

Subgroup analyses: The subgroup analysis focused on heterogeneity in the population:

Subgroups	Probability of cost-effectiveness at £20,000
Girls	67%
Boys	15%
Site A	61%
Site B	11%

Robertson et al. (2017). Randomised controlled trial and economic evaluation of the 'Families for Health' programme to reduce obesity in children	
	Site C | 36%

Site C	36%

Deterministic: Deterministic sensitivity analyses were undertaken where the following modifications were made to the approach to the analysis.

- **Scenario 1:** conducting a per protocol analysis where families having participated in 5 or more sessions of the 'Families for Health' programme are regarded as 'programme completers', i.e. as having complied with the protocol sufficiently.
- **Scenario 2:** multiple imputation of all missing cost and outcomes data.
- **Scenario 3:** parent-reported EQ-5D-Y values for the study child(ren) substituted for child self-reported values in the formulation for QALYs.
- **Scenario 4:** incorporation of EQ-5D values reflecting the main parent's self-reported health within calculations of overall QALYs gained.

Scenario		ICER (£)*	Probability of cost-effectiveness at £20,000
Scenario 1	Completers	£27,790	43%
	Non-completers	Dominated	17%
Scenario 2		£9,119	67%
Scenario 3		Not reported	23%
Scenario 4		Not reported	2%

Probabilistic: The uncertainty around the ICER was determined using the nonparametric bootstrapping approach by generating 10,000 estimates of incremental costs and benefits which are illustrated on a cost-effectiveness plane. The cost-effectiveness plane shows all estimates are in the north-west (greater costs and fewer health benefits) or north-east quadrant (greater costs and more health benefits). The cost-effectiveness acceptability curve showed the probability of FFH being cost effective at £20,000 is 28% and regardless of the threshold value, the probability of cost-effectiveness does not exceed 40%.

Comments	**Source of funding:** This study was funded by the National Institute for Health Research (NIHR) Health Technology Assessment (HTA) programme (project number 09/127/41) and will be published in full by the HTA. No conflict of interest was reported.

Robertson et al. (2017). Randomised controlled trial and economic evaluation of the 'Families for Health' programme to reduce obesity in children	
	Limitations: This study is directly applicable because it was conducted in the UK and analysed from an NHS perspective with appropriate interventions. However, the time horizon of 12 months does not show the long-term effects of the intervention. The estimates of baseline outcomes and intervention effects are taken directly from the study and resources used are provided by surveys completed by parents with unit costs provided by national sources. When missing data was addressed as part of a scenario analysis, the ICER changed from £552,175 to £9,119 per QALY therefore further details on the percentage of missing data and whether missingness was random or systematic and how this was addressed are needed to explain such a large change in the ICER.

Table 3: Applicability checklist

Study	1.1 Is the study population appropriate for the review question?	1.2 Are the interventions appropriate for the review question?	1.3 Is the system in which the study was conducted sufficiently similar to the current UK context?	1.4 Is the perspective for costs appropriate for the review question?	1.5 Is the perspective for outcomes appropriate for the review question?	1.6 Are all future costs and outcomes discounted appropriately?	1.7 Are QALYs, derived using NICE's preferred methods, or an appropriate social care-related equivalent used as an outcome?	1.8 Overall judgement
Panca et al. 2018	Yes	Yes	Yes (UK NHS perspective)	Yes	Yes	Yes (No discounting applied as it's a 12-month study)	Yes (EQ-5D-3L scores have been used)	Directly applicable
Robertson et al. 2017	Yes	Yes	Yes (UK based study with an NHS and PSS perspective)	Yes	Yes	Yes (No discounting applied as it's a 12-month study)	Yes (EQ-5D-Y scores have been used)	Directly applicable

Table 4: Limitations checklist

Study	2.1 Does the model structure adequately reflect the nature of the topic under evaluation?	2.2 Is the time horizon sufficiently long to reflect all important differences in costs and outcomes?	2.3 Are all important and relevant outcomes included?	2.4 Are the estimates of baseline outcomes from the best available source?	2.5 Are the estimates of relative intervention effects from the best available source?	2.6 Are all important and relevant costs included?	2.7 Are the estimates of resource use from the best available source?	2.8 Are the unit costs of resources from the best available source?	2.9 Is an appropriate incremental analysis presented or can it be calculated from the data?	2.10 Are all important parameters whose values are uncertain subjected to appropriate sensitivity analysis?	2.11 Has no potential financial conflict of interest been declared?	2.12 Overall assessment
Panca et al. 2018	Yes	Partly (results are presented over a 12-month time horizon, no long-term follow-up)	Yes	Partly (sourced from the trial)	Partly(sourced from one trial)	Yes	Yes	Yes	Yes	Yes	Yes	Minor limitations
Robertson et al. 2017	Yes	Partly (results are presented over a 12-month time horizon, no long-term follow-up)	Yes	Yes (sourced from the trial)	Yes (sourced from the trial)	Yes	Yes	Yes	Yes	Yes	Yes	Minor limitations

Appendix J – Health economic model

No economic modelling was conducted for this topic.

Appendix K – Excluded studies

Effectiveness evidence from Cochrane reviews

Study	Code [Reason]
Alberga, AS, Goldfield, GS, Kenny, GP et al. (2012) Healthy Eating, Aerobic and Resistance Training in Youth (HEARTY): study rationale, design and methods. Contemporary clinical trials 33(4): 839-47	- Exclude *Methods only, no data*
Alves, J.G.B., Gale, C.R., Souza, E. et al. (2008) Effect of physical exercise on bodyweight in overweight children: A randomized controlled trial in a Brazilian slum. Cadernos de Saude Publica 24(suppl2): 353-s359	- Full text paper not available
Anonymous. (2015) Erratum: Effects of aerobic training, resistance training, or both on percentage body fat and cardiometabolic risk markers in obese adolescents: The Healthy Eating Aerobic and Resistance Training in Youth randomized clinical trial (JAMA Pediatrics (2014) (1010)). JAMA Pediatrics 169(8): 791	- Secondary publication of an included study that does not provide any additional relevant information
Aragona, J.; Cassady, J.; Drabman, R.S. (1975) Treating overweight children through parental training and contingency contracting. Journal of applied behavior analysis 8(3): 269-278	- Follow up less than 6 months after intervention was completed
Ball, GD, Mushquash, AR, Keaschuk, RA et al. (2017) Using Intervention Mapping to develop the Parents as Agents of Change (PAC(Â©)) intervention for managing pediatric obesity. BMC research notes 10(1): 43	- Not a relevant study design
Bathrellou, E., Yannakoulia, M., Papanikolaou, K. et al. (2010) Parental involvement does not augment the effectiveness of an intense behavioral program for the treatment of childhood obesity. Hormones 9(2): 171-175	- Data not reported in an extractable format *BMI was reported as percent overweight*
Bean, M.K., Powell, P., Quinoy, A. et al. (2015) Motivational interviewing targeting diet and physical activity improves adherence to paediatric obesity treatment: Results from the MI Values randomized controlled trial. Pediatric Obesity 10(2): 118-125	- Follow up less than 6 months after intervention was completed *Follow up too short. At end of 6 month program.*
Bean, MK, Mazzeo, SE, Stern, M et al. (2011) A values-based Motivational Interviewing (MI) intervention for pediatric obesity: study design and methods for MI Values. Contemporary clinical trials 32(5): 667-74	- Secondary publication of an included study that does not provide any additional relevant information

Study	Code [Reason]
	Linked to Bean 2014. Only reports study design and methods
Bean, MK, Wilson, DB, Thornton, LM et al. (2012) Dietary intake in a randomized-controlled pilot of NOURISH: a parent intervention for overweight children. Preventive medicine 55(3): 224-7	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Mazzeo 2014, only included data on nutrient intake*
Berry, D., Savoye, M., Melkus, G. et al. (2007) An intervention for multiethnic obese parents and overweight children. Applied Nursing Research 20(2): 63-71	- Follow up less than 6 months after intervention was completed
Berry, D.C., Schwartz, T.A., McMurray, R.G. et al. (2014) The family partners for health study: A cluster randomized controlled trial for child and parent weight management. Nutrition and Diabetes 4(january): e101	- Data not reported in an extractable format *Number of children included in follow-up analysis was not reported*
Berry, DC, McMurray, R, Schwartz, TA et al. (2012) Rationale, design, methodology and sample characteristics for the family partners for health study: a cluster randomized controlled study. BMC public health 12: 250	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Berry 2014*
Bocca, G., Kuitert, M.W.B., Sauer, P.J.J. et al. (2014) A multidisciplinary intervention programme has positive effects on quality of life in overweight and obese preschool children. Acta Paediatrica, International Journal of Paediatrics 103(9): 962-967	- Secondary publication of an included study that does not provide any additional relevant information
Bocca, G., Stolk, R., Sauer, P. et al. (2011) Long lasting positive effects of a multidisciplinary intervention program to treat obesity in preschool children. Hormone Research in Paediatrics 76(suppl2): 181	- Conference abstract
Boudreau, A.D.A., Kurowski, D.S., Gonzalez, W.I. et al. (2013) Latino families, primary care, and childhood obesity: A randomized controlled trial. American Journal of Preventive Medicine 44(3suppl3): 247-s257	- Follow up less than 6 months after intervention was completed
Boutelle, K.N., Zucker, N., Peterson, C.B. et al. (2014) An intervention based on Schachter's externality theory for overweight children: the regulation of cues pilot. Journal of pediatric psychology 39(4): 405-417	- Follow up less than 6 months after intervention was completed

Study	Code [Reason]
Brennan, L., Walkley, J., Fraser, S.F. et al. (2008) Motivational interviewing and cognitive behaviour therapy in the treatment of adolescent overweight and obesity: Study design and methodology. Contemporary Clinical Trials 29(3): 359-375	- Exclude *Methods only, no data*
Brennan, L., Walkley, J., Wilks, R. et al. (2013) Physiological and behavioural outcomes of a randomised controlled trial of a cognitive behavioural lifestyle intervention for overweight and obese adolescents. Obesity Research and Clinical Practice 7(1): e23-e41	- Follow up less than 6 months after intervention was completed
Brennan, L., Wilks, R., Walkley, J. et al. (2012) Treatment acceptability and psychosocial outcomes of a randomised controlled trial of a cognitive behavioural lifestyle intervention for overweight and obese adolescents. Behaviour Change 29(1): 36-62	- Exclude *Linked to Brennan 2013, only reported data on psychopathological, psychosocial and family functioning.*
Broccoli, S, Davoli, AM, Bonvicini, L et al. (2016) Motivational Interviewing to Treat Overweight Children: 24-Month Follow-Up of a Randomized Controlled Trial. Pediatrics 137(1)	- Secondary publication of an included study that does not provide any additional relevant information
Brownell, K.D.; Kelman, J.H.; Stunkard, A.J. (1983) Treatment of obese children with and without their mothers: Changes in weight and blood pressure. Pediatrics 71(4): 515-523	- Excluded based on protocol deviation
Bseikri, M, McCann, JC, Lal, A et al. (2018) A novel nutritional intervention improves lung function in overweight/obese adolescents with poorly controlled asthma: the Supplemental Nutrition in Asthma Control (SNAC) pilot study. FASEB journal : official publication of the Federation of American Societies for Experimental Biology: fj201700338	- Follow up less than 6 months after intervention was completed
Burrows T; Janet WM; Collins CE (2011) Long-term changes in food consumption trends in overweight children in the HIKCUPS intervention. Journal of pediatric gastroenterology and nutrition 53(5): 543-547	- Exclude *No relevant outcomes*
Burrows T; Warren JM; Collins CE (2010) The impact of a child obesity treatment intervention on parent child-feeding practices. International journal of pediatric obesity : IJPO : an official journal of the International Association for the Study of Obesity 5(1): 43-50	- No relevant outcomes
Burrows, T., Warren, J.M., Baur, L.A. et al. (2008) Impact of a child obesity intervention on dietary intake	- No relevant outcomes

Study	Code [Reason]
and behaviors. International Journal of Obesity 32(10): 1481-1488	
Bäcklund, Catharina; Sundelin, Gunnevi; Larsson, Christel (2011) Effect of a 1-year lifestyle intervention on physical activity in overweight and obese children. Advances in Physiotherapy 13(3): 87-96	- Follow up less than 6 months after intervention was completed
Bäcklund, Catharina; Sundelin, Gunnevi; Larsson, Christel (2011) Effects of a 2-year lifestyle intervention on physical activity in overweight and obese children. Advances in physiotherapy 13(3): 97-109	- Follow up less than 6 months after intervention was completed
Carraway, Marissa Errickson (2014) Project MENTOR+: Mentor-led exercise with cognitive-behavioral therapy to improve perceived competence, reduce social anxiety, and increase physical activity in overweight adolescents.	- Follow up less than 6 months after intervention was completed *Follow up too short. 12 week program with 7 month from baseline assessment*
Carrel, AL, Clark, RR, Peterson, SE et al. (2005) Improvement of fitness, body composition, and insulin sensitivity in overweight children in a school-based exercise program: a randomized, controlled study. Archives of pediatrics & adolescent medicine 159(10): 963-8	- Follow up less than 6 months after intervention was completed *Outcomes reported at the end of intervention.*
Cespedes, E.M., Horan, C.M., Gillman, M.W. et al. (2014) Participant characteristics and intervention processes associated with reductions in television viewing in the High Five for Kids study. Preventive Medicine 62: 64-70	- Exclude *The main outcome was change in TV/video viewing from baseline to 1 year measured in hours/day.*
Chandra, RK (1968) Obesity in childhood--a clinical trial of low-calorie "limical". Indian journal of pediatrics 35(240): 23-6	- Study does not contain a relevant intervention
Christie, D., Hudson, L., Costa, S. et al. (2015) Effects of a motivational lifestyle intervention (the Healthy Eating and Lifestyle Programme (HELP)) on metabolic outcomes in obese adolescents: Findings from a randomized controlled trial. Pediatric Diabetes 16(suppl21): 45	- Conference abstract
Christie, D., Hudson, L., Costa, S. et al. (2015) RCT of a motivational lifestyle intervention (the healthy eating and lifestyle programme (help)) for obese young people. Archives of Disease in Childhood 100(suppl3): a2	- Conference abstract
Christie, D., Hudson, L., Mathiot, A. et al. (2011) Assessing the efficacy of the Healthy Eating and Lifestyle Programme (HELP) compared with enhanced	- Exclude *Study protocol*

Study	Code [Reason]
standard care of the obese adolescent in the community: Study protocol for a randomized controlled trial. Trials: 242	- Protocol/methods paper only
Christie, D., Hudson, L.D., Kinra, S. et al. (2015) Does a motivational lifestyle intervention (the healthy eating and lifestyle programme (HELP) work for obese young people. Journal of Adolescent Health 56(2suppl1): 19	- Conference abstract
Cliff, D.P., Okely, A.D., Morgan, P.J. et al. (2011) Movement skills and physical activity in obese children: Randomized controlled trial. Medicine and Science in Sports and Exercise 43(1): 90-100	- No relevant outcomes
Collins, CE, Morgan, PJ, Okely, AD et al. (2010) HIKCUPS (Hunter Illawarra Kids Challenge Using Parent Support) reduces BMI z-score up to 2 years: results of a multi-site randomized trial for overweight children. Obesity Reviews 11: 280	- Exclude *Abstract only*
Coppins, DF, Margetts, BM, Fa, JL et al. (2011) Effectiveness of a multi-disciplinary family-based programme for treating childhood obesity (the Family Project). European journal of clinical nutrition 65(8): 903-9	- Follow up less than 6 months after intervention was completed
Costa, Hudson, L., Christie, D. et al. (2014) Fitness may be more important for cardiovascular health than adiposity in adolescent girls. Obesity Reviews 15(suppl2): 108	- Exclude *Abstract only*
Croker, H, Viner, RM, Nicholls, D et al. (2012) Family-based behavioural treatment of childhood obesity in a UK National Health Service setting: randomized controlled trial. International journal of obesity (2005) 36(1): 16-26	- Follow up less than 6 months after intervention was completed *From Croker 2012:"All outcome measures were taken at baseline and at the end of the 6 month intervention or waiting list period."*
Daley, A.J., Copeland, R.J., Wright, N.P. et al. (2006) Exercise therapy as a treatment for psychopathologic conditions in obese and morbidly obese adolescents: A randomized, controlled trial. Pediatrics 118(5): 2126-2134	- Follow up less than 6 months after intervention was completed
Daley, A.J., Copeland, R.J., Wright, N.P. et al. (2005) Protocol for: Sheffield Obesity Trial (SHOT): A randomised controlled trial of exercise therapy and mental health outcomes in obese adolescents [ISRCNT83888112]. BMC Public Health 5: 113	- Secondary publication of an included study that does not provide any additional relevant information *Study protocol for Daley 2006* - Protocol/methods paper only

Study	Code [Reason]
Davis, A.M., Sampilo, M., Gallagher, K.S. et al. (2013) Treating rural pediatric obesity through telemedicine: outcomes from a small randomized controlled trial. Journal of pediatric psychology 38(9): 932-943	- Follow up less than 6 months after intervention was completed
Dawson, A.M., Brown, D.A., Cox, A. et al. (2014) Using motivational interviewing for weight feedback to parents of young children. Journal of Paediatrics and Child Health 50(6): 461-470	- No relevant outcomes
Dawson, A.M., Taylor, R.W., Williams, S.M. et al. (2014) Do parents recall and understand children's weight status information after BMI screening? A randomised controlled trial. BMJ Open 4(7): e004481	- No relevant outcomes
de Niet, J., Timman, R., Bauer, S. et al. (2012) Short message service reduces dropout in childhood obesity treatment: A randomized controlled trial. Health Psychology 31(6): 797-805	- Secondary publication of an included study that does not provide any additional relevant information *Linked to De Niet 2012a*
de Niet, J, Timman, R, Bauer, S et al. (2012) The effect of a short message service maintenance treatment on body mass index and psychological well-being in overweight and obese children: a randomized controlled trial. Pediatric obesity 7(3): 205-19	- Follow up less than 6 months after intervention was completed *From de Neit 2012a:"Measures were assessed at baseline, start of randomization (after 3 months of the BFC) and at 6, 9, and 12 months." The intervention was for 9 months which means the 12-month assessment was 3 months after the intervention was completed.*
Diaz, R.G., Esparza-Romero, J., Moya-Camarena, S.Y. et al. (2010) Lifestyle Intervention in Primary Care Settings Improves Obesity Parameters among Mexican Youth. Journal of the American Dietetic Association 110(2): 285-290	- Follow up less than 6 months after intervention was completed
Duffy, G and Spence, S H (1993) The effectiveness of cognitive self-management as an adjunct to a behavioural intervention for childhood obesity: a research note. Journal of child psychology and psychiatry, and allied disciplines 34(6): 1043-50	- Excluded based on protocol deviation
Duggins, M, Cherven, P, Carrithers, J et al. (2010) Impact of family YMCA membership on childhood obesity: a randomized controlled effectiveness trial. Journal of the American Board of Family Medicine : JABFM 23(3): 323-33	- Follow up less than 6 months after intervention was completed *From Duggins 2010:"Study related visits were scheduled for all participants at 2 months, 4 months, 6 months, 9 months, and 12 months after enrollment."*

Study	Code [Reason]
	Intervention lasted 1 year which means that the 12 months visit was done at completion of intervention.
Ecker-Schlipf, B. (2007) Which role does physical activity play in the prevention of obesity in preschool children?. Medizinische Monatsschrift fur Pharmazeuten 30(10): 386-387	- Full text paper not available
Eddy, Lefa, Moral, Irene, Frutos, Elisa et al. (2013) Evaluación del autoconcepto de adolescentes con sobrepeso y obesidad (Estudio Obescat). Pediatr. catalan: 107-112	- Study not reported in English
Epstein, L.H., Kuller, L.H., Wing, R.R. et al. (1989) The effect of weight control on lipid changes in obese children. American Journal of Diseases of Children 143(4): 454-457	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Epstein 1984a*
Epstein, L.H., Paluch, R.A., Saelens, B.E. et al. (2001) Changes in eating disorder symptoms with pediatric obesity treatment. Journal of Pediatrics 139(1): 58-65	- Data not reported in an extractable format
Epstein, L.H., Wing, R.R., Koeske, R. et al. (1984) Effects of diet plus exercise on weight change in parents and children. Journal of Consulting and Clinical Psychology 52(3): 429-437	- Data not reported in an extractable format *BMI was reported as percentage overweight*
Epstein, L.H., Wing, R.R., Koeske, R. et al. (1985) A comparison of lifestyle exercise, aerobic exercise, and calisthenics on weight loss in obese children. Behavior Therapy 16(4): 345-356	- Excluded based on protocol deviation
Epstein, L.H., Wing, R.R., Penner, B.C. et al. (1985) Effect of diet and controlled exercise on weight loss in obese children. Journal of Pediatrics 107(3): 358-361	- Follow up less than 6 months after intervention was completed
Epstein, Leonard H, Wing, Rena R, Woodall, Karen et al. (1985) Effects of family-based behavioral treatment on obese 5-to-8-year-old children. Behavior Therapy 16(2): 205-212	- Follow up less than 6 months after intervention was completed
Epstein, LH, Kilanowski, C, Paluch, RA et al. (2015) Reducing variety enhances effectiveness of family-based treatment for pediatric obesity. Eating behaviors 17: 140-3	- Follow up less than 6 months after intervention was completed
Epstein, LH; Paluch, RA; Raynor, HA (2001) Sex differences in obese children and siblings in family-	- Excluded based on protocol deviation

Study	Code [Reason]
based obesity treatment. Obesity research 9(12): 746-53	
Esfarjani, F, Khalafi, M, Mohammadi, F et al. (2013) FAMILY-BASED INTERVENTION FOR CHILDHOOD OBESITY: AN EXPERIENCE AMONG TEHRANIAN CHILDREN. Annals of Nutrition and Metabolism 63: 844-844	- Exclude *Abstract only*
Faude, O., Kerper, O., Multhaupt, M. et al. (2010) Football to tackle overweight in children. Scandinavian journal of medicine & science in sports 20suppl1: 103-110	- Follow up less than 6 months after intervention was completed
Finne, E, Reinehr, T, Schaefer, A et al. (2013) Changes in self-reported and parent-reported health-related quality of life in overweight children and adolescents participating in an outpatient training: findings from a 12-month follow-up study. Health and quality of life outcomes 11: 1	- Secondary publication of an included study that does not provide any additional relevant information *Recruitment data only*
Finne, E, Reinehr, T, Schaefer, A et al. (2009) Overweight children and adolescents--is there a subjective need for treatment?. International journal of public health 54(2): 112-6	- No relevant outcomes
Flodmark, C.-E., Ohlsson, T., Ryden, O. et al. (1993) Prevention of progression to severe obesity in a group of obese schoolchildren treated with family therapy. Pediatrics 91(5i): 880-884	- Excluded based on protocol deviation
Foley, L., Jiang, Y., Ni Mhurchu, C. et al. (2014) The effect of active video games by ethnicity, sex and fitness: Subgroup analysis from a randomised controlled trial. International Journal of Behavioral Nutrition and Physical Activity 11(1): 46	- Follow up less than 6 months after intervention was completed
Foley, L, Ni Mhurchu, C, Marsh, S et al. (2016) Screen Time Weight-loss Intervention Targeting Children at Home (SWITCH): process evaluation of a randomised controlled trial intervention. BMC public health 16: 439	- Follow up less than 6 months after intervention was completed
Galhardo, J., Hunt, L.P., Lightman, S.L. et al. (2012) Normalizing eating behavior reduces body weight and improves gastrointestinal hormonal secretion in obese adolescents. Journal of Clinical Endocrinology and Metabolism 97(2): e193-e201	- Follow up less than 6 months after intervention was completed
Gallagher, K.S., Davis, A.M., Malone, B. et al. (2011) Treating rural pediatric obesity through telemedicine: baseline data from a randomized controlled trial. Journal of pediatric psychology 36(6): 687-695	- Not a relevant study design

Study	Code [Reason]
Gibbons, K; McCallum, Z; Wake, M (2004) A primary care intervention for childhood obesity: Six-month results from LEAP (Live, Eat And Play), a randomised controlled trial. International Journal of Obesity 28: 194-s194	- Conference abstract
Gillis, D; Brauner, M; Granot, E (2007) A community-based behavior modification intervention for childhood obesity. Journal of pediatric endocrinology & metabolism : JPEM 20(2): 197-203	- Follow up less than 6 months after intervention was completed
Golan, M. (2006) Parents as agents of change in childhood obesity--from research to practice. International journal of pediatric obesity : IJPO : an official journal of the International Association for the Study of Obesity 1(2): 66-76	- Data not reported in an extractable format *No SD/variance reported*
Golan, M.; Kaufman, V.; Shahar, D.R. (2006) Childhood obesity treatment: Targeting parents exclusively v. parents and children. British Journal of Nutrition 95(5): 1008-1015	- Data not reported in an extractable format
Goldfield, G.S., Kenny, G.P., Alberga, A.S. et al. (2015) Effects of aerobic training, resistance training, or both on psychological health in adolescents with obesity: The HEARTY randomized controlled trial. Journal of Consulting and Clinical Psychology 83(6): 1123-1135	- Follow up less than 6 months after intervention was completed *6 month follow up from baseline not completion*
Goldschmidt, A.B., Stein, R.I., Saelens, B.E. et al. (2011) Importance of early weight change in a pediatric weight management trial. Pediatrics 128(1): e33-e39	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Wilfley 2007*
Golley RK; Magarey AM; Daniels LA (2011) Children's food and activity patterns following a six-month child weight management program. International journal of pediatric obesity : IJPO : an official journal of the International Association for the Study of Obesity 6(5-6): 409-414	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Golley 2007, only included data on food group intake, screen activity and active play*
Gourlan, M; Sarrazin, P; Trouilloud, D (2013) Motivational interviewing as a way to promote physical activity in obese adolescents: a randomised-controlled trial using self-determination theory as an explanatory framework. Psychology & health 28(11): 1265-86	- Full text paper not available
Grey, M, Jaser, SS, Holl, MG et al. (2009) A multifaceted school-based intervention to reduce risk	- Follow up less than 6 months after intervention was completed

Study	Code [Reason]
for type 2 diabetes in at-risk youth. Preventive medicine 49(23): 122-8	
Gunn, J.; McCallum, Z.; Sanci, L. (2008) What do GPs get out of participating in research? - experience of the LEAP trial. Australian family physician 37(5): 372-375	- No relevant outcomes *Qualitative data*
Hamilton-Shield, J., Goodred, J., Powell, L. et al. (2014) Changing eating behaviours to treat childhood obesity in the community using Mandolean: The Community Mandolean randomised controlled trial (ComMando) - A pilot study. Health Technology Assessment 18(47): 1-75	- Exclude *From Hamilton-Shield 2014:"...the main trial was not completed and ran for only 5 months before being terminated".*
Hamzaid, H., Talib, R.A., Azizi, N.H. et al. (2011) Quality of life of obese children in Malaysia. International Journal of Pediatric Obesity 6(56): 450-454	- Study does not contain a relevant intervention
Haszard, J.J., Williams, S.M., Dawson, A.M. et al. (2013) Factor analysis of the Comprehensive Feeding Practices Questionnaire in a large sample of children. Appetite 62: 110-118	- Study does not contain a relevant intervention
Heale, Roberta (2008) A group intervention for parents and children achieved greater weight loss in obese children than routine care. Evidence-based nursing 11(2): 43	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Kalavainen 2007*
Ho, Josephine, Pedersen, Sue D, Virtanen, Heidi et al. (2016) Family Intervention for Obese/Overweight Children Using Portion Control Strategy (FOCUS) for Weight Control: A Randomized Controlled Trial. Global pediatric health 3: 2333794x16669014	- Follow up less than 6 months after intervention was completed *The duration of the study was 6 months and measurements were at baseline, 3 months, and 6 months.*
Hofsteenge, G.H., Chinapaw, M.J., Weijs, P.J. et al. (2008) Go4it; study design of a randomised controlled trial and economic evaluation of a multidisciplinary group intervention for obese adolescents for prevention of diabetes mellitus type 2. BMC public health 8: 410	- Protocol/methods paper only - Secondary publication of an included study that does not provide any additional relevant information
Holm, K, Wyatt, H, Murphy, J et al. (2012) Parental influence on child change in physical activity during a family-based intervention for child weight gain prevention. Journal of physical activity & health 9(5): 661-9	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Rodearmel 2007*
Hughes, AR, Stewart, L, Chapple, J et al. (2008) Randomized, controlled trial of a best-practice	- Data not reported in an extractable format

Study	Code [Reason]
individualized behavioral program for treatment of childhood overweight: Scottish Childhood Overweight Treatment Trial (SCOTT). Pediatrics 121(3): e539-46	*Article reported median values only*
Janicke, D.M., Sallinen, B.J., Perri, M.G. et al. (2008) Sensible Treatment of Obesity in Rural Youth (STORY): Design and methods. Contemporary Clinical Trials 29(2): 270-280	- Exclude *Methods only no results*
Janicke, DM, Sallinen, BJ, Perri, MG et al. (2009) Comparison of program costs for parent-only and family-based interventions for pediatric obesity in medically underserved rural settings. The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association 25(3): 326-30	- Data not reported in an extractable format
Jansen, E.; Mulkens, S.; Jansen, A. (2011) Tackling childhood overweight: Treating parents exclusively is effective. International Journal of Obesity 35(4): 501-509	- Follow up less than 6 months after intervention was completed *3 month follow up posttreatment*
Jelalian, E, Jandasek, B, Wolff, JC et al. (2019) Cognitive-Behavioral Therapy Plus Healthy Lifestyle Enhancement for Depressed, Overweight/Obese Adolescents: Results of a Pilot Trial. Journal of clinical child and adolescent psychology : the official journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53 48(sup1): S24-S33	- No relevant outcomes
Jiang, J.X., Xia, X.L., Greiner, T. et al. (2005) A two year family based behaviour treatment for obese children. Archives of Disease in Childhood 90(12): 1235-1238	- Follow up less than 6 months after intervention was completed *No posttreatment follow up.*
Jones, R.A., Okely, A.D., Collins, C.E. et al. (2007) The HIKCUPS trial: A multi-site randomized controlled trial of a combined physical activity skill-development and dietary modification program in overweight and obese children. BMC Public Health 7: 15	- Exclude *Methods and design only; no results*
Kalarchian, MA, Levine, MD, Arslanian, SA et al. (2009) Family-based treatment of severe pediatric obesity: randomized, controlled trial. Pediatrics 124(4): 1060-8	- Follow up less than 6 months after intervention was completed *Blood pressure and QoL were only reported at 6 and 12 months (data was not extracted because booster sessions took place between 6 and 12 months)*
Kalarchian, MA; Levine, MD; Marcus, MD (2013) Structured Dietary Interventions in the Treatment of	- Not a relevant study design

Study	Code [Reason]
Severe Pediatric Obesity: A Pilot Study. Bariatric surgical practice and patient care 8(2): 58-60	
Kalavainen, M, Karjalainen, S, Martikainen, J et al. (2009) Cost-effectiveness of routine and group programs for treatment of obese children. Pediatrics international : official journal of the Japan Pediatric Society 51(5): 606-11	- Secondary publication of an included study that does not provide any additional relevant information
Kalavainen, M; Korppi, M; Nuutinen, O (2011) Long-term efficacy of group-based treatment for childhood obesity compared with routinely given individual counselling. International journal of obesity (2005) 35(4): 530-3	- Secondary publication of an included study that does not provide any additional relevant information
Kalavainen, M, Utriainen, P, Vanninen, E et al. (2012) Impact of childhood obesity treatment on body composition and metabolic profile. World journal of pediatrics : WJP 8(1): 31-7	- Follow up less than 6 months after intervention was completed
Kong, A.P., Choi, K.C., Chan, R.S. et al. (2014) A randomized controlled trial to investigate the impact of a low glycemic index (GI) diet on body mass index in obese adolescents. BMC public health 14: 180	- Follow up less than 6 months after intervention was completed *No posttreatment follow up*
Kong, Alberta S, Sussman, Andrew L, Yahne, Carolina et al. (2013) School-based health center intervention improves body mass index in overweight and obese adolescents. Journal of Obesity 2013	- Follow up less than 6 months after intervention was completed *No posttreatment follow up*
Kornman, K.P., Shrewsbury, V.A., Chou, A.C. et al. (2010) Electronic therapeutic contact for adolescent weight management: the Loozit study. Telemedicine journal and e-health : the official journal of the American Telemedicine Association 16(6): 678-685	- Follow up less than 6 months after intervention was completed
Kromeyer-Hauschild, K (2010) The 4th Scandinavian Pediatric Obesity Conference Poster Presentations.	- Full text paper not available
Lanigan, J.; Barber, S.; Singhal, A. (2010) Session 3 (Joint with the British Dietetic Association): Management of obesity prevention of obesity in preschool children. Proceedings of the Nutrition Society 69(2): 204-210	- Exclude *Not formal inclusion as this was a symposium paper (narrative review)*
Lanigan, Julie; Barber, Sally; Singhal, Atul (2010) Prevention of obesity in preschool children. The Proceedings of the Nutrition Society 69(2): 204-10	- Conference abstract
Lanigan, Julie, Collins, Sarah, Birbara, Toni et al. (2013) The TrimTots programme for prevention and treatment of obesity in preschool children: evidence	- Exclude *Abstract- full text not published*

Study	Code [Reason]
from two randomised controlled trials. The Lancet 382: 58	
Larsen, L.M., Hertel, N.T., Molgaard, C. et al. (2015) Early intervention for childhood overweight: A randomized trial in general practice. Scandinavian journal of primary health care 33(3): 184-190	- Follow up less than 6 months after intervention was completed
Ledoux, T, Hilmers, A, Watson, K et al. (2013) Development and feasibility of an objective measure of patient-centered communication fidelity in a pediatric obesity intervention. Journal of nutrition education and behavior 45(4): 349-54	- Protocol/methods paper only
Levine, MD, Ringham, RM, Kalarchian, MA et al. (2001) Is family-based behavioral weight control appropriate for severe pediatric obesity?. The International journal of eating disorders 30(3): 318-28	- Not a relevant study design *No comparator*
LisÃ³n, JF, Real-Montes, JM, TorrÃ³, I et al. (2012) Exercise intervention in childhood obesity: a randomized controlled trial comparing hospital-versus home-based groups. Academic pediatrics 12(4): 319-25	- Follow up less than 6 months after intervention was completed
Looney, SM and Raynor, HA (2014) Examining the effect of three low-intensity pediatric obesity interventions: a pilot randomized controlled trial. Clinical pediatrics 53(14): 1367-74	- Follow up less than 6 months after intervention was completed
Love-Osborne, K, Fortune, R, Sheeder, J et al. (2014) School-based health center-based treatment for obese adolescents: feasibility and body mass index effects. Childhood obesity (Print) 10(5): 424-31	- Follow up less than 6 months after intervention was completed *No posttreatment follow up, doesn't include the outcomes listed in protocol*
Luna-Pech, Jorge Agustin, Torres-Mendoza, Blanca Miriam, Luna-Pech, Jose Antonio et al. (2014) Normocaloric diet improves asthma-related quality of life in obese pubertal adolescents. International Archives of Allergy and Immunology 163(4): 252-258	- Follow up less than 6 months after intervention was completed *No posttreatment follow up*
Maddison, R., Foley, L., Jiang, Y. et al. (2010) Electronic games to aid motivation to exercise: A randomized controlled trial. Obesity Reviews 11(suppl1): 50	- Conference abstract
Maddison, R., Foley, L., Ni Mhurchu, C. et al. (2011) Effects of active video games on body composition: A randomized controlled trial. American Journal of Clinical Nutrition 94(1): 156-163	- Follow up less than 6 months after intervention was completed

Study	Code [Reason]
Maddison, R., Foley, L., Ni Mhurchu, C. et al. (2009) Feasibility, design and conduct of a pragmatic randomized controlled trial to reduce overweight and obesity in children: The electronic games to aid motivation to exercise (eGAME) study. BMC Public Health 9: 146	- Protocol/methods paper only
Maddison, R., Mhurchu, C.N., Jull, A. et al. (2012) Active video games: The mediating effect of aerobic fitness on body composition. International Journal of Behavioral Nutrition and Physical Activity 9: 54	- Follow up less than 6 months after intervention was completed
Maddison, R, Marsh, S, Foley, L et al. (2014) Screen-Time Weight-loss Intervention Targeting Children at Home (SWITCH): a randomized controlled trial. The international journal of behavioral nutrition and physical activity 11: 111	- Protocol/methods paper only
Maddison, R, Mhurchu, CN, Foley, L et al. (2011) Screen-time weight-loss intervention targeting children at home (SWITCH): a randomized controlled trial study protocol. BMC public health 11: 524	- Protocol/methods paper only
Markert, J, Alff, F, Zschaler, S et al. (2013) Prevention of childhood obesity: recruiting strategies via local paediatricians and study protocol for a telephone-based counselling programme. Obesity research & clinical practice 7(6): e476-86	- Protocol/methods paper only
Markert, J, Herget, S, Petroff, D et al. (2014) Telephone-based adiposity prevention for families with overweight children (T.A.F.F.-Study): one year outcome of a randomized, controlled trial. International journal of environmental research and public health 11(10): 10327-44	- Follow up less than 6 months after intervention was completed
Mazzeo, S.E., Kelly, N.R., Stern, M. et al. (2014) Parent skills training to enhance weight loss in overweight children: Evaluation of NOURISH. Eating Behaviors 15(2): 225-229	- Follow up less than 6 months after intervention was completed *No posttreatment follow up*
Mazzeo, S.E., Kelly, N.R., Stern, M. et al. (2012) Nourishing Our Understanding of Role Modeling to Improve Support and Health (NOURISH): design and methods. Contemporary clinical trials 33(3): 515-522	- Exclude *Methods only*
McCallum, Z., Wake, M., Gerner, B. et al. (2005) Can Australian general practitioners tackle childhood overweight/obesity? Methods and processes from the LEAP (Live, Eat and Play) randomized controlled trial. Journal of paediatrics and child health 41(910): 488-494	- Protocol/methods paper only

Study	Code [Reason]
McCallum, Z; Wake, M; Baur, L (2004) The Leap (live, eat and play) trial: Results of a randomized controlled trial of a primary care intervention for childhood overweight/mild obesity. Obesity Research 12: a15-a16	- Full text paper not available
McCallum, Z, Wake, M, Gerner, B et al. (2004) Six month results from the LEAP (Live, Eat and Play) trial: A randomised controlled trial of a primary care intervention for childhood overweight/mild obesity. Pediatric Research 55(4): 220a-221a	- Conference abstract
McCallum, Z, Wake, M, Waters, E et al. (2003) A primary care intervention for childhood overweight/obesity (LEAP): methodology of a randomized controlled trial. PEDIATRIC RESEARCH 53(4): 246a-246a	- Conference abstract
Moens, E. and Braet, C. (2012) Training parents of overweight children in parenting skills: a 12-month evaluation. Behavioural and cognitive psychotherapy 40(1): 1-18	- Follow up less than 6 months after intervention was completed *Only posttreatment data presented (only end of intervention)*
Munsch, S., Roth, B., Michael, T. et al. (2008) Randomized controlled comparison of two cognitive behavioral therapies for obese children: Mother versus mother-child cognitive behavioral therapy. Psychotherapy and Psychosomatics 77(4): 235-246	- Comparator in study does not match that specified in protocol *Study compared two different interventions (mother and child vs mother only) which followed different guidelines (Could not be considered concomitant therapy)*
Nemet, D, Barkan, S, Epstein, Y et al. (2005) Short- and long-term beneficial effects of a combined dietary-behavioral-physical activity intervention for the treatment of childhood obesity. Pediatrics 115(4): e443-9	- Conference abstract
Nguyen, B., Shrewsbury, V., Lau, C. et al. (2012) Adolescent and parent views of an adolescent weight management program: Lessons from the Loozit randomised controlled trial. Obesity Research and Clinical Practice 6(suppl1): 56	- Conference abstract
Nguyen, B., Shrewsbury, V.A., O'Connor, J. et al. (2015) A process evaluation of an adolescent weight management intervention: findings and recommendations. Health promotion international 30(2): 201-212	- Follow up less than 6 months after intervention was completed *No posttreatment follow up. Study only reported data at end of intervention (24 months)*
Nguyen, B, Shrewsbury, VA, O'Connor, J et al. (2013) Two-year outcomes of an adjunctive telephone	- Follow up less than 6 months after intervention was completed

Study	Code [Reason]
coaching and electronic contact intervention for adolescent weight-loss maintenance: the Loozit randomized controlled trial. International journal of obesity (2005) 37(3): 468-72	*No posttreatment follow up. Study only reported data at end of intervention (24 months)*
Nguyen, B, Shrewsbury, VA, O'Connor, J et al. (2012) Twelve-month outcomes of the loozit randomized controlled trial: a community-based healthy lifestyle program for overweight and obese adolescents. Archives of pediatrics & adolescent medicine 166(2): 170-7	- Follow up less than 6 months after intervention was completed *No posttreatment follow up. Study reported 12 month data (midway through intervention)*
Norman, G, Huang, J, Davila, EP et al. (2016) Outcomes of a 1-year randomized controlled trial to evaluate a behavioral 'stepped-down' weight loss intervention for adolescent patients with obesity. Pediatric obesity 11(1): 18-25	- Follow up less than 6 months after intervention was completed
Nova, Aurelio; Russo, Antonio; Sala, Elisabetta (2001) Long-term management of obesity in paediatric office practice: experimental evaluation of two different types of intervention. Ambulatory Child Health 7(34): 239-247	- No relevant outcomes *Only percentage overweight*
O'Connor, T.M., Hilmers, A., Watson, K. et al. (2013) Feasibility of an obesity intervention for paediatric primary care targeting parenting and children: Helping HAND. Child: care, health and development 39(1): 141-149	- Follow up less than 6 months after intervention was completed
Pakpour, A.H., Gellert, P., Dombrowski, S.U. et al. (2015) Motivational interviewing with parents for obesity: An RCT. Pediatrics 135(3): e644-e652	- Conference abstract
Patrick, K, Norman, GJ, Davila, EP et al. (2013) Outcomes of a 12-month technology-based intervention to promote weight loss in adolescents at risk for type 2 diabetes. Journal of diabetes science and technology 7(3): 759-70	- Follow up less than 6 months after intervention was completed *No posttreatment follow up*
Patsopoulou, A., Tsimtsiou, Z., Katsioulis, A. et al. (2017) Evaluating the Efficacy of the Feeding Exercise Randomized Trial in Overweight and Obese Adolescents. Childhood obesity (Print) 13(2): 128-137	- Follow up less than 6 months after intervention was completed *Study did not include a 6 month post intervention follow up.*
Patsopoulou, A., Tsimtsiou, Z., Katsioulis, A. et al. (2015) Prevalence and risk factors of overweight and obesity among adolescents and their parents in central Greece (FETA Project). International Journal of Environmental Research and Public Health 13(1): 83	- Follow up less than 6 months after intervention was completed *Study did not include a 6 month post intervention follow up. Study did not report outcomes of interest.*

Study	Code [Reason]
Pbert, Lori, Druker, Susan, Gapinski, Mary A et al. (2013) A school nurse-delivered intervention for overweight and obese adolescents. Journal of School Health 83(3): 182-193	- Follow up less than 6 months after intervention was completed *Study did not include a 6 month post intervention follow up. Study did not report outcomes of interest.*
Pimenta, AM, SÃ¡nchez-Villegas, A, Bes-Rastrollo, M et al. (2009) Relationship between body image disturbance and incidence of depression: the SUN prospective cohort. BMC public health 9: 1	- Not a relevant study design
Pitetti, KH, Rendoff, AD, Grover, T et al. (2007) The efficacy of a 9-month treadmill walking program on the exercise capacity and weight reduction for adolescents with severe autism. Journal of autism and developmental disorders 37(6): 997-1006	- Follow up less than 6 months after intervention was completed *No posttreatment follow up. Study only reported data at end of intervention.*
Raynor, HA, Osterholt, KM, Hart, CN et al. (2012) Efficacy of U.S. paediatric obesity primary care guidelines: two randomized trials. Pediatric obesity 7(1): 28-38	- No relevant outcomes
Reinehr, T, Schaefer, A, Winkel, K et al. (2010) An effective lifestyle intervention in overweight children: findings from a randomized controlled trial on "Obeldicks light". Clinical nutrition (Edinburgh, Scotland) 29(3): 331-6	- Follow up less than 6 months after intervention was completed
Resnick, E.A., Bishop, M., O'Connell, A. et al. (2009) The CHEER study to reduce BMI in Elementary School students: a school-based, parent-directed study in Framingham, Massachusetts. The Journal of school nursing : the official publication of the National Association of School Nurses 25(5): 361-372	- Follow up less than 6 months after intervention was completed *No posttreatment data presented (only end of intervention)*
Resnicow, K, McMaster, F, Bocian, A et al. (2015) Motivational interviewing and dietary counseling for obesity in primary care: an RCT. Pediatrics 135(4): 649-57	- Follow up less than 6 months after intervention was completed *2 year trial, study only reports 2 year data.*
Rodearmel, S.J., Wyatt, H.R., Stroebele, N. et al. (2007) Small changes in dietary sugar and physical activity as an approach to preventing excessive weight gain: The America on the move family study. Pediatrics 120(4): e869-e879	- Conference abstract
Roth, B; Munsch, S; Meyer, AH (2011) [Long-term evaluation of a psychological training for obese children and their parents (TAKE)]. Praxis der Kinderpsychologie und Kinderpsychiatrie 60(4): 304-21	- Study not reported in English

Study	Code [Reason]
Rudolf, M., Christie, D., McElhone, S. et al. (2006) WATCH IT: A community based programme for obese children and adolescents. Archives of Disease in Childhood 91(9): 736-739	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Bryant 2011*
Sacher, P.M., Kolotourou, M., Chadwick, P.M. et al. (2010) Randomized controlled trial of the MEND program: A family-based community intervention for childhood obesty. Obesity 18(suppl1): 62-s68	- Follow up less than 6 months after intervention was completed
Saelens, B.E., Sallis, J.F., Wilfley, D.E. et al. (2002) Behavioral weight control for overweight adolescents initiated in primary care. Obesity research 10(1): 22-32	- Follow up less than 6 months after intervention was completed *Study did not include a 6 month post intervention follow up. Study included 3 month follow up.*
Satoh, Atsuko, Menzawa, Kazuko, Lee, Sangun et al. (2007) Dietary guidance for obese children and their families using a model nutritional balance chart. Japan Journal of Nursing Science 4(2): 95-102	- Follow up less than 6 months after intervention was completed *No follow up for control group*
Savoye, M., Caprio, S., Dziura, J. et al. (2014) Reversal of early abnormalities in glucose metabolism in obese youth: Results of an intensive lifestyle randomized controlled trial. Diabetes Care 37(2): 317-324	- Follow up less than 6 months after intervention was completed - Secondary publication of an included study that does not provide any additional relevant information
Savoye, M., Shaw, M., Dziura, J. et al. (2007) Effects of a weight management program on body composition and metabolic parameters in overweight children: A randomized controlled trial. Journal of the American Medical Association 297(24): 2697-2704	- Follow up less than 6 months after intervention was completed - Secondary publication of an included study that does not provide any additional relevant information
Schaefer, A, Winkel, K, Finne, E et al. (2011) An effective lifestyle intervention in overweight children: one-year follow-up after the randomized controlled trial on "Obeldicks light". Clinical nutrition (Edinburgh, Scotland) 30(5): 629-33	- Follow up less than 6 months after intervention was completed *No follow up for control group*
Schranz, N, Tomkinson, G, Parletta, N et al. (2014) Can resistance training change the strength, body composition and self-concept of overweight and obese adolescent males? A randomised controlled trial. British journal of sports medicine 48(20): 1482-8	- No relevant outcomes
Schwingshandl, J., Sudi, K., Eibl, B. et al. (1999) Effect of an individualised training programme during weight	- Data not reported in an extractable format

Study	Code [Reason]
reduction on body composition: A randomised trial. Archives of Disease in Childhood 81(5): 426-428	*Changes in body weight reported in graph as a correlation with change in fat free mass*
Serra-Paya, N., Ensenyat, A., Real, J. et al. (2013) Evaluation of a family intervention programme for the treatment of overweight and obese children (Nereu Programme): a randomized clinical trial study protocol. BMC public health 13: 1000	- Protocol/methods paper only
Serra-Paya, N, Ensenyat, A, Castro-ViÃ±uales, I et al. (2015) Effectiveness of a Multi-Component Intervention for Overweight and Obese Children (Nereu Program): A Randomized Controlled Trial. PloS one 10(12): e0144502	- Follow up less than 6 months after intervention was completed
Sigal, R.J., Alberga, A.S., Goldfield, G.S. et al. (2014) Effects of aerobic training, resistance training, or both on percentage body fat and cardiometabolic risk markers in obese adolescents: The healthy eating aerobic and resistance training in youth randomized clinical trial. JAMA Pediatrics 168(11): 1006-1014	- Follow up less than 6 months after intervention was completed *Study did not include a 6 month post intervention follow up.*
Siwik, V., Kutob, R., Ritenbaugh, C. et al. (2013) Intervention in overweight children improves body mass index (BMI) and physical activity. Journal of the American Board of Family Medicine 26(2): 126-137	- Data not reported in an extractable format *Results reported in graphs without data. Cochrane review reports data at less than 6 months after intervention was completed (14 weeks)*
Spoor, C, Sahota, P, Wellings, C et al. (2013) Costing a pilot complex community-based childhood obesity intervention. Journal of human nutrition and dietetics : the official journal of the British Dietetic Association 26(2): 126-31	- Full text paper not available
Stewart, L., Chapple, J., Hughes, A.R. et al. (2008) Parents' journey through treatment for their child's obesity: A qualitative study. Archives of Disease in Childhood 93(1): 35-39	- Not a relevant study design *Qualitative study*
Stewart, L, Chapple, J, Hughes, AR et al. (2008) The use of behavioural change techniques in the treatment of paediatric obesity: qualitative evaluation of parental perspectives on treatment. Journal of human nutrition and dietetics : the official journal of the British Dietetic Association 21(5): 464-73	- Not a relevant study design *Qualitative study*
Stewart, L, Houghton, J, Hughes, AR et al. (2005) Dietetic management of pediatric overweight: development and description of a practical and	- Protocol/methods paper only

Study	Code [Reason]
evidence-based behavioral approach. Journal of the American Dietetic Association 105(11): 1810-5	
Taveras, E.M., Gortmaker, S.L., Hohman, K.H. et al. (2011) Randomized controlled trial to improve primary care to prevent and manage childhood obesity the high five for kids study. Archives of Pediatrics and Adolescent Medicine 165(8): 714-722	- Follow up less than 6 months after intervention was completed *The intervention duration is 2 years and includes an intensive 1-year intervention period followed by a less intensive maintenance period. This paper reports the results after the first year of intervention.*
Taveras, E.M., Marshall, R., Horan, C.M. et al. (2013) Rationale and design of the STAR randomized controlled trial to accelerate adoption of childhood obesity comparative effectiveness research. Contemporary Clinical Trials 34(1): 101-108	- Protocol/methods paper only
Taveras, EM, Marshall, R, Kleinman, KP et al. (2015) Comparative effectiveness of childhood obesity interventions in pediatric primary care: a cluster-randomized clinical trial. JAMA pediatrics 169(6): 535-42	- Follow up less than 6 months after intervention was completed
Taylor, Rachael W, Williams, Sheila M, Dawson, Anna M et al. (2013) What factors influence uptake into family-based obesity treatment after weight screening?. The Journal of pediatrics 163(6): 1657-1662	- Study does not contain a relevant intervention *Baseline and recruitment data only*
Taylor, RW, Brown, D, Dawson, AM et al. (2010) Motivational interviewing for screening and feedback and encouraging lifestyle changes to reduce relative weight in 4-8 year old children: design of the MInT study. BMC public health 10: 271	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Taylor 2015*
Taylor, RW, Cox, A, Knight, L et al. (2015) A Tailored Family-Based Obesity Intervention: A Randomized Trial. Pediatrics 136(2): 281-9	- Follow up less than 6 months after intervention was completed
Theim, K.R., Sinton, M.M., Goldschmidt, A.B. et al. (2013) Adherence to behavioral targets and treatment attendance during a pediatric weight control trial. Obesity 21(2): 394-397	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Wilfley 2007*
Tucker, SJ, Ytterberg, KL, Lenoch, LM et al. (2013) Reducing pediatric overweight: nurse-delivered motivational interviewing in primary care. Journal of pediatric nursing 28(6): 536-47	- Not a relevant study design *Quasi-experimental design*

Study	Code [Reason]
Twiddy, M., Wilson, I., Bryant, M. et al. (2012) Lessons learned from a family-focused weight management intervention for obese and overweight children. Public health nutrition 15(7): 1310-1317	- Not a relevant study design *Qualitative study*
van Egmond-Fröhlich, A, Bräuer, W, Goldschmidt, H et al. (2006) Effects of a programme for structured outpatient follow-up care after inpatient rehabilitation of obese children and adolescents--a multicentre, randomized study. Die Rehabilitation 45(1): 40-51	- Study not reported in English *Not available in English- Cochrane review did not provide enough information about the intervention or length of follow up*
van Grieken, A, Renders, CM, Veldhuis, L et al. (2014) Promotion of a healthy lifestyle among 5-year-old overweight children: health behavior outcomes of the 'Be active, eat right' study. BMC public health 14: 59	- Data not reported in an extractable format
van Grieken, A, Veldhuis, L, Renders, CM et al. (2013) Population-based childhood overweight prevention: outcomes of the 'Be active, eat right' study. PloS one 8(5): e65376	- Data not reported in an extractable format
Vann, L.H., Stanford, F.C., Durkin, M.W. et al. (2013) "Moving and losing": A pilot study incorporating physical activity to decrease obesity in the pediatric population. Journal of the South Carolina Medical Association (1975) 109(4): 116-120	- Full text paper not available
Veldhuis, L, Struijk, MK, Kroeze, W et al. (2009) "Be active, eat right', evaluation of an overweight prevention protocol among 5-year-old children: design of a cluster randomised controlled trial. BMC public health 9: 177	- Protocol/methods paper only
Vissers, Dirk, De Meulenaere, An, Vanroy, Christel et al. (2008) Effect of a multidisciplinary school-based lifestyle intervention on body weight and metabolic variables in overweight and obese youth. e-SPEN, the European e-Journal of Clinical Nutrition and Metabolism 3(5): e196-e202	- Follow up less than 6 months after intervention was completed
Vos, RC, Wit, JM, Pijl, H et al. (2011) The effect of family-based multidisciplinary cognitive behavioral treatment in children with obesity: study protocol for a randomized controlled trial. Trials 12: 110	- Secondary publication of an included study that does not provide any additional relevant information *Study protocol* - Protocol/methods paper only
Wafa, S.W., Talib, R.A., Hamzaid, N.H. et al. (2011) Randomized controlled trial of a good practice approach to treatment of childhood obesity in Malaysia: Malaysian Childhood Obesity Treatment	- Follow up less than 6 months after intervention was completed

Study	Code [Reason]
Trial (MASCOT). International Journal of Pediatric Obesity 6(22): e62-e69	
Wake, M, Lycett, K, Clifford, SA et al. (2013) Shared care obesity management in 3-10 year old children: 12 month outcomes of HopSCOTCH randomised trial. BMJ (Clinical research ed.) 346: f3092	- Follow up less than 6 months after intervention was completed
Wake, M, Lycett, K, Sabin, MA et al. (2012) A shared-care model of obesity treatment for 3-10 year old children: protocol for the HopSCOTCH randomised controlled trial. BMC pediatrics 12: 39	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Wake 2013* - Protocol/methods paper only
Waling, M. and Larsson, C. (2012) Improved dietary intake among overweight and obese children followed from 8 to 12 years of age in a randomised controlled trial. Journal of Nutritional Science 1: e16	- Follow up less than 6 months after intervention was completed
Waling, Maria, Bäcklund, Catharina, Lind, Torbjörn et al. (2012) Effects on metabolic health after a 1-year-lifestyle intervention in overweight and obese children: a randomized controlled trial. Journal of nutrition and metabolism 2012	- Follow up less than 6 months after intervention was completed
Waling, Maria, Lind, Torbjörn, Hernell, Olle et al. (2010) A one-year intervention has modest effects on energy and macronutrient intakes of overweight and obese Swedish children. The Journal of nutrition 140(10): 1793-1798	- Follow up less than 6 months after intervention was completed
Walker, Kelly (2007) Mechanisms of self-esteem change in overweight children participating in a family-based weight management program.	- Full text paper not available
Walpole, B, Dettmer, E, Morrongiello, B et al. (2011) Motivational interviewing as an intervention to increase adolescent self-efficacy and promote weight loss: methodology and design. BMC public health 11: 459	- Secondary publication of an included study that does not provide any additional relevant information *Methods only, no data*
Walpole, Beverly, Dettmer, Elizabeth, Morrongiello, Barbara A et al. (2013) Motivational interviewing to enhance self-efficacy and promote weight loss in overweight and obese adolescents: a randomized controlled trial. Journal of pediatric psychology 38(9): 944-953	- Follow up less than 6 months after intervention was completed *No posttreatment follow up*
Warschburger, P, Kroller, K, Unverzagt, S et al. (2013) What is the parents' part in long-term weight	- Conference abstract

Study	Code [Reason]
management of their obese child? Results from the EPOC study. Obesity Facts 6: 230	
Weintraub, D.L., Tirumalai, E.C., Haydel, K.F. et al. (2008) Team sports for overweight children: The Stanford Sports to Prevent Obesity Randomized Trial (SPORT). Archives of Pediatrics and Adolescent Medicine 162(3): 232-237	- Follow up less than 6 months after intervention was completed
Wengle, J.G., Hamilton, J.K., Manlhiot, C. et al. (2011) The 'Golden Keys' to health - A healthy lifestyle intervention with randomized individual mentorship for overweight and obesity in adolescents. Paediatrics and Child Health 16(8): 473-478	- Follow up less than 6 months after intervention was completed *No posttreatment follow up*
West, F, Sanders, MR, Cleghorn, GJ et al. (2010) Randomised clinical trial of a family-based lifestyle intervention for childhood obesity involving parents as the exclusive agents of change. Behaviour research and therapy 48(12): 1170-9	- Data not reported in an extractable format
Wildes, JE, Marcus, MD, Kalarchian, MA et al. (2010) Self-reported binge eating in severe pediatric obesity: impact on weight change in a randomized controlled trial of family-based treatment. International journal of obesity (2005) 34(7): 1143-8	- Secondary publication of an included study that does not provide any additional relevant information *Linked to Kalarchian 2009*
Wilfley, D.E., Stein, R.I., Saelens, B.E. et al. (2007) Efficacy of maintenance treatment approaches for childhood overweight: A randomized controlled trial. Journal of the American Medical Association 298(14): 1661-1673	- Study does not contain a relevant intervention *No control group for weight loss intervention, only for weight maintenance once a healthy weight has been reached*
Wong, J., Ebbeling, C., Robinson, L. et al. (2015) Does the recommendation to drink 8 cups of water per day promote weight loss?. FASEB Journal 29(1meetingabstracts)	- Follow up less than 6 months after intervention was completed *No posttreatment follow up*
Woo, KS, Chook, P, Yu, CW et al. (2004) Effects of diet and exercise on obesity-related vascular dysfunction in children. Circulation 109(16): 1981-6	- Follow up less than 6 months after intervention was completed
Wright, K, Giger, JN, Norris, K et al. (2013) Impact of a nurse-directed, coordinated school health program to enhance physical activity behaviors and reduce body mass index among minority children: a parallel-group, randomized control trial. International journal of nursing studies 50(6): 727-37	- Data not reported in an extractable format *Mead 2017 (Cochrane review) stated that:"... there were concerns over the 95% CIs presented which we suspected were ranges rather than CIs. We tried to contact the study author to clarify but did not receive a*

Study	Code [Reason]
	response. Therefore, we did not include this study in the meta analysis."
Wright, K, Norris, K, Newman Giger, J et al. (2012) Improving healthy dietary behaviors, nutrition knowledge, and self-efficacy among underserved school children with parent and community involvement. Childhood obesity (Print) 8(4): 347-56	- Data not reported in an extractable format *Mead 2017 (Cochrane review) stated that:"... there were concerns over the 95% CIs presented which we suspected were ranges rather than CIs. We tried to contact the study author to clarify but did not receive a response. Therefore, we did not include this study in the meta analysis."*
Wright, K and Suro, Z (2014) Using community--academic partnerships and a comprehensive school-based program to decrease health disparities in activity in school-aged children. Journal of prevention & intervention in the community 42(2): 125-39	- Data not reported in an extractable format
WW, Sharifah; AT, Ruzita; JJ, Reilly (2011) The Malaysian Childhood Obesity Treatment Trial (MASCOT). Malaysian Journal of Nutrition 17(2)	- Protocol/methods paper only

Effectiveness evidence from updated searches

Study	Code [Reason]
Abraham, AA, Chow, WC, So, HK et al. (2015) Lifestyle intervention using an internet-based curriculum with cell phone reminders for obese Chinese teens: a randomized controlled study. PloS one 10(5): e0125673	- Follow up was less than 6 months post intervention
Aguilar-Cordero, Maria Jose, Leon Rios, Ximena Alejandra, Rojas-Carvajal, Ana Maria et al. (2021) Effects of physical activity on quality of life in overweight and obese children. Nutricion hospitalaria 38(4): 736-741	- Follow up was less than 6 months post intervention
Ahmad, N., Shariff, Z.M., Mukhtar, F. et al. (2018) Family-based intervention using face-to-face sessions and social media to improve Malay primary school children's adiposity: A randomized controlled field trial of the Malaysian REDUCE programme. Nutrition Journal 17(1): 74	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Ahmadi, Alireza, Moheb-Mohammadi, Fahimeh, Navabi, Zohreh Sadat et al. (2020) The effects of aerobic training, resistance training, combined training, and healthy eating recommendations on lipid profile and body mass index in overweight and obese children and adolescents: A randomized clinical trial. ARYA atherosclerosis 16(5): 226-234	- Follow up was less than 6 months post intervention
Akgul Gundogdu, N.; Sevig, E.U.; Guler, N. (2018) The effect of the solution-focused approach on nutrition-exercise attitudes and behaviours of overweight and obese adolescents: Randomised controlled trial. Journal of clinical nursing 27(78): e1660-e1672	- Follow up was less than 6 months post intervention
Al Khudairy, L.A.-K., Loveman, E.L., Colquitt, J.C. et al. (2017) LIFESTYLE INTERVENTIONS FOR THE TREATMENT OF OVERWEIGHT/OBESE ADOLESCENTS-COCHRANE REVIEW. Journal of Epidemiology and Community Health 71(supplement1): a93	- Already captured in a separate qualitative studies search
Alberga, A.S., Farnesi, B.-C., Lafleche, A. et al. (2013) The effects of resistance exercise training on body composition and strength in obese prepubertal children. The Physician and sportsmedicine 41(3): 103-109	- Follow up was less than 6 months post intervention
Alizadeh, H. and Safarzade, A. (2019) High intensity intermittent training induces anti-inflammatory cytokine responses and improves body composition in overweight adolescent boys. Hormone Molecular Biology and Clinical Investigation 39(3): 20190004	- Follow up was less than 6 months post intervention
Alulis, S. and Grabowski, D. (2017) Theoretical frameworks informing family-based child and adolescent obesity interventions: A qualitative meta-synthesis. Obesity Research and Clinical Practice 11(6): 627-639	- Already captured in a separate qualitative studies search
Alves, A.S.R., Venancio, T.L., Honorio, S.A.A. et al. (2019) Multicomponent training with different frequencies on body composition and physical fitness in obese children. Anais da Academia Brasileira de Ciencias 91(4): e20181264	- Follow up was less than 6 months post intervention
Amini, M, Djazayery, A, Majdzadeh, R et al. (2016) A School-Based Intervention to Reduce Excess Weight in Overweight and Obese Primary School Students. Biological research for nursing 18(5): 531-540	- Follow up was less than 6 months post intervention
Amiri, P, Jalali-Farahani, S, Zarkesh, M et al. (2020) Behavioral interventions for weight management in overweight and obese adolescents: a Comparison between a Motivation-based Educational Program and Conventional Dietary Counseling. International journal of endocrinology and metabolism 18(1)	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Anderson, L.M.; Symoniak, E.D.; Epstein, L.H. (2014) A randomized pilot trial of an integrated school-worksite weight control program. Health Psychology 33(11): 1421-1425	- Target population is not overweight or obese
Anderson, Y., Wynter, L., Grant, C. et al. (2019) Two-year outcomes of Whanau Pakari: a novel home-based intervention for child and adolescent obesity. Obesity Research and Clinical Practice 13(3): 274-275	- Conference abstract
Anderson, Y., Wynter, L., O'Sullivan, N. et al. (2019) Two-year outcomes of Whanau Pakari: A novel homebased intervention for child and adolescent obesity. Hormone Research in Paediatrics 91(supplement1): 152	- Conference abstract
Anderson, Y.C., Wynter, L.E., Grant, C.C. et al. (2017) A Novel Home-Based Intervention for Child and Adolescent Obesity: The Results of the Whanau Pakari Randomized Controlled Trial. Obesity 25(11): 1965-1973	- Follow up was less than 6 months post intervention
Anderson, Y, Wynter, L, Grant, C et al. (2019) Two-year outcomes of Whānau Pakari: a novel home-based intervention for child and adolescent obesity. Obesity research & clinical practice 13(3): 274-275	- Conference abstract
Annesi, J.J., Walsh, S.M., Greenwood, B.L. et al. (2017) Effects of the Youth Fit 4 Life physical activity/nutrition protocol on body mass index, fitness and targeted social cognitive theory variables in 9- to 12-year-olds during after-school care. Journal of Paediatrics and Child Health 53(4): 365-373	- Follow up was less than 6 months post intervention
Apolzan, J.W.; Hsia, D.S.; Martin, C.K. (2016) Effects of a higher vs. lower protein diet on weight loss in teenagers: Results from a randomized controlled trial. FASEB Journal 30(meetingabstracts)	- Conference abstract
Appelhans, B.M., French, S.A., Bradley, L.E. et al. (2020) CHECK: A randomized trial evaluating the efficacy and cost-effectiveness of home visitation in pediatric weight loss treatment. Contemporary Clinical Trials 88: 105891	- Follow up was less than 6 months post intervention
Arai, L., Panca, M., Morris, S. et al. (2015) Time, monetary and other costs of participation in family-based child weight management interventions:Qualitative and systematic review evidence. PLoS ONE 10(4): e123782	- Already captured in a separate qualitative studies search
Arlinghaus, K.R., Moreno, J.P., Reesor, L. et al. (2017) Companeros: High School Students Mentor Middle School Students to Address Obesity Among Hispanic Adolescents. Preventing chronic disease 14: e92	- Comparator in study does not match that specified in protocol

Study	Code [Reason]
Armstrong, S., Mendelsohn, A., Bennett, G. et al. (2018) Texting Motivational Interviewing: A Randomized Controlled Trial of Motivational Interviewing Text Messages Designed to Augment Childhood Obesity Treatment. Childhood obesity (Print) 14(1): 4-10	- Follow up was less than 6 months post intervention
Astuti, T.; Marbun, R.; Surmita (2019) The effectiveness of nutrition education, counseling and exercise on desirable dietary pattern score and weight loss in obese teenagers. Annals of Nutrition and Metabolism 75(3): 367-368	- Conference abstract
Augustijn, Mireille J. C. M, D'Hondt, Eva, Leemans, Alexander et al. (2019) Weight loss, behavioral change, and structural neuroplasticity in children with obesity through a multidisciplinary treatment program. Human Brain Mapping 40(1): 137-150	- Follow up was less than 6 months post intervention
Backlund, C.; Sundelin, G.; Larsson, C. (2011) Evaluation of a 2-year family-based lifestyle intervention regarding physical activity among children with overweight and obesity. Physiotherapy (United Kingdom) 97(suppl1): es94-es95	- Conference abstract
Bagherniya, M., Darani, F.M., Sharma, M. et al. (2018) Assessment of the efficacy of physical activity level and lifestyle behavior interventions applying social cognitive theory for overweight and obese girl adolescents. Journal of Research in Health Sciences 18(2): e00409	- Follow up was less than 6 months post intervention
Bagherniya, Mohammad, Sharma, Manoj, Darani, Firoozeh Mostafavi et al. (2017) School-based nutrition education intervention using social cognitive theory for overweight and obese Iranian adolescent girls: A cluster randomized controlled trial. International Quarterly of Community Health Education 38(1): 37-45	- Follow up was less than 6 months post intervention
Baird, Janis, Jarman, Megan, Lawrence, Wendy et al. (2014) The effect of a behaviour change intervention on the diets and physical activity levels of women attending Sure Start Children's Centres: results from a complex public health intervention. BMJ open 4(7): e005290	- Non-RCT
Bandini, L.G., Eliasziw, M., Dittrich, G.A. et al. (2021) A family-based weight loss randomized controlled trial for youth with intellectual disabilities. Pediatric Obesity 16(11): e12816	- Comparator in study does not match that specified in protocol
Banos, R.M., Oliver, E., Navarro, J. et al. (2019) Efficacy of a cognitive and behavioral treatment for childhood obesity supported by the ETIOBE web platform. Psychology, health & medicine 24(6): 703-713	- Follow up was less than 6 months post intervention
Bean, M.K., Ingersoll, K.S., Powell, P. et al. (2018) Impact of motivational interviewing on outcomes of an adolescent obesity	- Follow up was less than 6 months post intervention

Study	Code [Reason]
treatment: results from the MI Values randomized controlled pilot trial. Clinical Obesity 8(5): 323-326	
Bean, M.K., LaRose, J.G., Raynor, H.A. et al. (2022) The role of parents in adolescent obesity treatment: Results of the TEENS+ randomized clinical pilot trial. Pediatric Obesity 17(3): e12858	- Follow up was less than 6 months post intervention
Bell, J, Spence, M, Aaron, K et al. (2016) "iRun"! An evaluation of the addition of nutrition education and a fitness log to an existing after-school fitness program. FASEB journal. Conference: experimental biology 2016, EB. San diego, CA united states. Conference start: 20160402. Conference end: 20160406. Conference publication: (var.pagings) 30(nopagination)	- Conference abstract
Benestad, B., Karlsen, T.-I., Smastuen, M.C. et al. (2019) Health-related quality of life after camp-based family obesity treatment: An RCT. BMJ Paediatrics Open 3(1): e000413	- Follow up was less than 6 months post intervention
Benestad, B., Lekhal, S., Smastuen, M.C. et al. (2017) Camp-based family treatment of childhood obesity: Randomised controlled trial. Archives of Disease in Childhood 102(4): 303-310	- Follow up was less than 6 months post intervention
Bergmann, K., Mestre, Z., Strong, D. et al. (2019) Comparison of Two Models of Family-Based Treatment for Childhood Obesity: A Pilot Study. Childhood obesity (Print) 15(2): 116-122	- Non-RCT
Berkowitz, R.I., Rukstalis, M.R., Bishop-Gilyard, C.T. et al. (2013) Treatment of adolescent obesity comparing self-guided and group lifestyle modification programs: a potential model for primary care. Journal of pediatric psychology 38(9): 978-986	- Follow up was less than 6 months post intervention
Berry, Diane C, Gonzales, Cecilia, Montano, Nilda Peragallo et al. (2019) Rationale, design, and methodology for the healthy mothers-healthy children study: a randomized controlled trial. BMC nutrition 5: 58	- No results reported
Bibiloni, MDM, Fernández-Blanco, J, Pujol-Plana, N et al. (2019) Reversion of overweight and obesity in Vilafranca del Penedès child population: ACTIVA'T Program (2012). Gaceta sanitaria 33(2): 197-202	- Follow up was less than 6 months post intervention
Boff, R.M., Dornelles, M.A., Feoli, A.M.P. et al. (2020) Transtheoretical model for change in obese adolescents: MERC randomized clinical trial. Journal of health psychology 25(1314): 2272-2285	- Follow up was less than 6 months post intervention
Bogataj, S., Trajkovic, N., Cadenas-Sanchez, C. et al. (2021) Effects of school-based exercise and nutrition intervention on body composition and physical fitness in overweight adolescent girls. Nutrients 13(1): 1-12	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Bohme, P., Legrand, K., Omorou, A.Y. et al. (2016) A proportionate intervention in school led to improve overweight prevention without aggravating the health social inequalities. Obesity Facts 9(suppl1): 34	- Conference abstract
Bonham, M.P., Dordevic, A.L., Ware, R.S. et al. (2017) Evaluation of a Commercially Delivered Weight Management Program for Adolescents. Journal of Pediatrics 185: 73-80e3	- Follow up was less than 6 months post intervention
Bonham, M.P., Dordevic, A.L., Ware, R.S. et al. (2017) Evaluation of 'JenMe', a commercially-delivered weight management program for adolescents: A randomised controlled trial. FASEB Journal 31(1supplement1)	- Conference abstract
Bouamra, M., Zouhal, H., Ratel, S. et al. (2022) Concurrent Training Promotes Greater Gains on Body Composition and Components of Physical Fitness Than Single-Mode Training (Endurance or Resistance) in Youth With Obesity. Frontiers in Physiology 13: 869063	- Follow up was less than 6 months post intervention
Bovi, A.P.D., Cesari, G.M., Rocco, M.C. et al. (2021) Healthy lifestyle management of pediatric obesity with a hybrid system of customized mobile technology: The pediafit pilot project. Nutrients 13(2): 1-15	- Non-RCT
Bowen-Jallow, K., Nunez-Lopez, O., Wright, A. et al. (2021) Wearable Activity Tracking Device Use in an Adolescent Weight Management Clinic: A Randomized Controlled Pilot Trial. Journal of Obesity 2021: 7625034	- Follow up was less than 6 months post intervention
Bridge, Gemma L, Willis, Thomas A, Evans, Charlotte E. L et al. (2019) The impact of HENRY on parenting and family lifestyle: Exploratory analysis of the mechanisms for change. Child: Care, Health and Development 45(6): 850-860	- Target population is not overweight or obese
Britto, Florian A, De Groote, Estelle, Aranda, Jaime et al. (2020) Effects of a 30-week combined training program in normoxia and in hypoxia on exercise performance and health-related parameters in obese adolescents: a pilot study. The Journal of sports medicine and physical fitness 60(4): 601-609	- Follow up was less than 6 months post intervention
Browne, S., Doyle, G., Kechadi, T. et al. (2020) Mobile health (mHealth) applications with children in treatment for obesity: A randomised feasibility study. Proceedings of the Nutrition Society 79(oce2)	- Conference abstract
Bunik, M., Shek, L., Valenzuela, M. et al. (2021) Bikes for Life: Measuring the effects of a bicycle distribution program on 6 to 12-year-old children's BMI and health behaviors. Obesity Research and Clinical Practice 15(5): 491-498	- No relevant outcomes reported

Study	Code [Reason]
Burchett, H.E.D., Sutcliffe, K., Melendez-Torres, G.J. et al. (2018) Lifestyle weight management programmes for children: A systematic review using Qualitative Comparative Analysis to identify critical pathways to effectiveness. Preventive Medicine 106: 1-12	- Already captured in a separate qualitative studies search
Butte, N.F., Hoelscher, D.M., Barlow, S.E. et al. (2017) Efficacy of a Community- Versus Primary Care-Centered Program for Childhood Obesity: TX CORD RCT. Obesity 25(9): 1584-1593	- Follow up was less than 6 months post intervention
Calleja, M., Caetano Feitoza, N., Falk, B. et al. (2020) Increased dairy product consumption as part of a diet and exercise weight management program improves body composition in adolescent females with overweight and obesity-A randomized controlled trial. Pediatric Obesity 15(12): e12690	- Follow up was less than 6 months post intervention
Canario, Catarina, Abreu-Lima, Isabel, Santos, Susana et al. (2021) Delivering group lifestyle triple p through digital practice: A case study with portuguese parents. Journal of Family Therapy: no-specified	- Follow up was less than 6 months post intervention
Carlone Baldino Garcia, Natalia, Lopes, Wendell Arthur, Locateli, Joao Carlos et al. (2019) Multidisciplinary obesity treatment program improved health-related quality of life and positively correlated with anthropometric and body composition but not with cardiorespiratory fitness parameters in adolescents. Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care & Rehabilitation 28(7): 1803-1812	- Non-RCT
Chai, L., Collins, C., May, C. et al. (2019) An online telehealth nutrition intervention to support parents in child weight management - A randomised feasibility controlled trial. Obesity Facts 12(supplement1): 111-112	- Conference abstract
Chai, Li Kheng, Collins, Clare E, May, Chris et al. (2021) Feasibility and efficacy of a web-based family telehealth nutrition intervention to improve child weight status and dietary intake: A pilot randomised controlled trial. Journal of telemedicine and telecare 27(3): 146-158	- Follow up was less than 6 months post intervention
Charlotte Bjork Ingul, C., Dias, K., Hosseini, M. et al. (2018) Sustained improvements in cardiac function and fitness one year after an exercise intervention in obese children. European Journal of Preventive Cardiology 25(2supplement1): 5	- Conference abstract
Chen, F., Huang, K., Long, Q. et al. (2022) Comparative dietary effectiveness of a modified government-recommended diet with avoidance of ultra-processed foods on weight and metabolic management in children and adolescents: An open-label, randomized study. Asia Pacific journal of clinical nutrition 31(2): 282-293	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Chen, J.-L.; Guedes, C.M.; Lung, A.E. (2019) Smartphone-based Healthy Weight Management Intervention for Chinese American Adolescents: Short-term Efficacy and Factors Associated With Decreased Weight. Journal of Adolescent Health 64(4): 443-449	- Follow up was less than 6 months post intervention
Chen, Jyu-Lin, Guedes, Claudia M, Cooper, Bruce A et al. (2017) Short-Term Efficacy of an Innovative Mobile Phone Technology-Based Intervention for Weight Management for Overweight and Obese Adolescents: Pilot Study. Interactive journal of medical research 6(2): e12	- Follow up was less than 6 months post intervention
Chen, Q, Cao, J, Zhao, L et al. (2015) Effects of different exercise modes on body composition, inflammatory factors, and exercise capacity of obese teenagers. Journal of jilin university medicine edition 41(5): 1070-1075	- Study not reported in English
Chew, C.S.E., Kelly, S.M., Rajasegaran, K. et al. (2016) Three month outcome of a family based intervention program for adolescent obesity: The LITE randomised controlled trial. Obesity Reviews 17(suppl2): 124	- Conference abstract
Chew, C.S.E., Oh, J.Y., Rajasegaran, K. et al. (2021) Evaluation of a group family-based intervention programme for adolescent obesity: The LITE randomised controlled pilot trial. Singapore Medical Journal 62(1): 39-47	- Follow up was less than 6 months post intervention
Chirita-Emandi, Adela and Puiu, Maria (2014) Outcomes of neurofeedback training in childhood obesity management: A pilot study. The Journal of Alternative and Complementary Medicine 20(11): 831-837	- Follow up was less than 6 months post intervention
Chorami, M., Amiri, S., Doost, H.T.N. et al. (2015) Comparing the effectiveness of the lifestyle training and the diet therapy on the body mass index in obese adolescents of Yasuj high schools. Research Journal of Pharmaceutical, Biological and Chemical Sciences 6(3): 231-236	- Follow up was less than 6 months post intervention
Christie, D., Hudson, L.D., Kinra, S. et al. (2017) A community-based motivational personalised lifestyle intervention to reduce BMI in obese adolescents: Results from the Healthy Eating and Lifestyle Programme (HELP) randomised controlled trial. Archives of Disease in Childhood 102(8): 695-701	- Excluded based on protocol deviation
Clayton, P., Connelly, J., Ellington, M. et al. (2021) Facilitators and barriers of children's participation in nutrition, physical activity, and obesity interventions: A systematic review. Obesity Reviews 22(12): e13335	- Already captured in a separate qualitative studies search
Cohen, T.R., Hazell, T.J., Vanstone, C.A. et al. (2017) Changes in lean mass and bone parameters in obese children	- Conference abstract

Study	Code [Reason]
participating in a familycentered lifestyle intervention: Results from a 1-year RCT. FASEB Journal 31(1supplement1)	
Cohen, T.R., Hazell, T.J., Vanstone, C.A. et al. (2016) A family-centered lifestyle intervention for obese six- to eight-year-old children: Results from a one-year randomized controlled trial conducted in Montreal, Canada. Canadian journal of public health = Revue canadienne de sante publique 107(45): e453-e460	- Data not reported in an extractable format
Cohen, T.R., Mak, I.L., Loiselle, S.-E. et al. (2022) Changes in Adiposity without Impacting Bone Health in Nine- to Twelve-Year-Old Children with Overweight and Obesity after a One-Year Family-Centered Lifestyle Behavior Intervention. Childhood obesity (Print)	- Follow up was less than 6 months post intervention
Colvin, K.M. (2022) Understanding Barriers toward Interventions for Childhood Obesity in Minority Communities: A Rapid Review. medRxiv	- Already captured in a separate qualitative studies search
Coto, J. and Graziano, P.A. (2022) Targeting Pediatric Obesity via a Healthy Lifestyle Summer Camp Intervention: How Necessary Is a Parenting Component?. Childhood obesity (Print) 18(5): 350-359	- Follow up was less than 6 months post intervention
Crespo, N.C., Talavera, G.A., Campbell, N.R. et al. (2018) A randomized controlled trial to prevent obesity among Latino paediatric patients. Pediatric Obesity 13(11): 697-704	- Follow up was less than 6 months post intervention
Croker, H.; Lucas, R.; Wardle, J. (2012) Cluster-randomised trial to evaluate the 'Change for Life' mass media/ social marketing campaign in the UK. BMC public health 12: 404	- Target population is not overweight or obese
Currie, J., Collier, D., Raedeke, T.D. et al. (2018) The effects of a low-dose physical activity intervention on physical activity and body mass index in severely obese adolescents. International Journal of Adolescent Medicine and Health 30(6): 20160121	- Follow up was less than 6 months post intervention
Cvetkovic, N., Stojanovic, E., Stojiljkovic, N. et al. (2018) Exercise training in overweight and obese children: Recreational football and high-intensity interval training provide similar benefits to physical fitness. Scandinavian journal of medicine & science in sports 28(supplement1): 18-32	- Follow up was less than 6 months post intervention
Damaso, A.R., da Silveira Campos, R.M., Caranti, D.A. et al. (2014) Aerobic plus resistance training was more effective in improving the visceral adiposity, metabolic profile and inflammatory markers than aerobic training in obese adolescents. Journal of sports sciences 32(15): 1435-1445	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Davis, A.M., Sampilo, M., Gallagher, K.S. et al. (2016) Treating rural paediatric obesity through telemedicine vs. telephone: Outcomes from a cluster randomized controlled trial. Journal of telemedicine and telecare 22(2): 86-95	- Follow up was less than 6 months post intervention
Deslippe, A.L., Bains, A., Loiselle, S.-E. et al. (2022) SMART goals of children of 6-12years enrolled in a family-centred lifestyle intervention for childhood obesity: Secondary analysis of a randomized controlled trial. Pediatric obesity: e12973	- Follow up was less than 6 months post intervention
Dhaliwal, J., Nosworthy, N.M., Holt, N.L. et al. (2014) Attrition and the management of pediatric obesity: an integrative review. Childhood obesity (Print) 10(6): 461-473	- Already captured in a separate qualitative studies search
Djaafar, T., Hadisaputro, S., Widjanarko, B. et al. (2019) The effects of physical fitness gymnastics (SKJ) 2012 towards body mass index, body fat percentage, and physical fitness inobese children. International Journal of Pharmaceutical Research 11(2): 250-254	- Full text paper not available
Dorenbos, E., Drummen, M., Adam, T. et al. (2021) Effect of a high protein/low glycaemic index diet on insulin resistance in adolescents with overweight/obesity-A PREVIEW randomized clinical trial. Pediatric Obesity 16(1): e12702	- Follow up was less than 6 months post intervention
Draper, C E, Grobler, L, Micklesfield, L K et al. (2015) Impact of social norms and social support on diet, physical activity and sedentary behaviour of adolescents: a scoping review. Child: care, health and development 41(5): 654-67	- Already captured in a separate qualitative studies search
Dreyer Gillette, M.L., Odar Stough, C., Best, C.M. et al. (2014) Comparison of a condensed 12-week version and a 24-week version of a family-based pediatric weight management program. Childhood obesity (Print) 10(5): 375-382	- Follow up was less than 6 months post intervention
Eather, N.; Morgan, P.; Lubans, D. (2015) Improving health-related fitness in adolescents: The CrossFit Teens randomized controlled trial. Journal of Science and Medicine in Sport 19(suppl1): e11	- Conference abstract
Eichen, D.M., Strong, D.R., Rhee, K.E. et al. (2019) Change in eating disorder symptoms following pediatric obesity treatment. International Journal of Eating Disorders 52(3): 299-303	- No relevant outcomes reported
Ek, A., Chamberlain, K.L., Ejderhamn, J. et al. (2015) The More and Less Study: a randomized controlled trial testing different approaches to treat obesity in preschoolers. BMC public health 15: 735	- No results reported
Ek, A., Chamberlain, K.L., Sorjonen, K. et al. (2019) A parent treatment program for preschoolers with obesity: A randomized controlled trial. Pediatrics 144(2): e20183457	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Ek, A., Delisle Nystrom, C., Chirita-Emandi, A. et al. (2019) A randomized controlled trial for overweight and obesity in preschoolers: the More and Less Europe study - an intervention within the STOP project. BMC public health 19(1): 945	- No results reported
Ek, A., Lewis Chamberlain, K., Sorjonen, K. et al. (2019) An obesity treatment in preschoolers: 12 months results from a randomized controlled trial. Obesity Facts 12(supplement1): 110	- Conference abstract
Ekambareshwar, M., Ekambareshwar, S., Mihrshahi, S. et al. (2021) Process evaluations of early childhood obesity prevention interventions delivered via telephone or text messages: a systematic review. International Journal of Behavioral Nutrition and Physical Activity 18(1): 10	- Already captured in a separate qualitative studies search
Eldridge, G., Paul, L., Bailey, S.J. et al. (2016) Effects of parent-only childhood obesity prevention programs on BMIz and body image in rural preteens. Body image 16: 143-153	- Non-RCT
Emmanouil, C.-C., Pervanidou, P., Charmandari, E. et al. (2018) The effectiveness of a health promotion and stress-management intervention program in a sample of obese children and adolescents. Hormones 17(3): 405-413	- Follow up was less than 6 months post intervention
Endevelt, Ronit, Elkayam, Orit, Cohen, Rinat et al. (2014) An intensive family intervention clinic for reducing childhood obesity. Journal of the American Board of Family Medicine : JABFM 27(3): 321-8	- Non-RCT
Fagg, J., Chadwick, P., Cole, T.J. et al. (2014) From trial to population: A study of a family-based community intervention for childhood overweight implemented at scale. International Journal of Obesity 38(10): 1343-1349	- Follow up was less than 6 months post intervention
Faith, Myles S, Cochran, William C, Diewald, Lisa et al. (2021) Group lifestyle modification vs. lifestyle newsletters for early childhood obesity: Pilot study in rural primary care. Journal of Behavioral and Cognitive Therapy 31(3): 215-228	- Follow up was less than 6 months post intervention
Falbe, J., Cadiz, A.A., Tantoco, N.K. et al. (2015) Active and Healthy Families: A Randomized Controlled Trial of a Culturally Tailored Obesity Intervention for Latino Children. Academic Pediatrics 15(4): 386-395	- Follow up was less than 6 months post intervention
Fanelli, E., Abate Daga, F., Pappaccogli, M. et al. (2022) A structured physical activity program in an adolescent population with overweight or obesity: a prospective interventional study. Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme 47(3): 253-260	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Farias, Edson Dos Santos, Goncalves, Ezequiel Moreira, Morcillo, Andre Moreno et al. (2015) Effects of programmed physical activity on body composition in post-pubertal schoolchildren. Jornal de pediatria 91(2): 122-9	- Target population is not overweight or obese
Farpour-Lambert, N.J., Martin, X.E., Bucher Della Torre, S. et al. (2019) Effectiveness of individual and group programmes to treat obesity and reduce cardiovascular disease risk factors in pre-pubertal children. Clinical Obesity 9(6): e12335	- Data not reported in an extractable format
Farrell, R., Uli, N., Macleish, S. et al. (2017) Impact of fitbits on physical activity in obese children enrolled in a weight management program. Hormone Research in Paediatrics 88(supplement1): 158	- Conference abstract
Fenner, Ashley A, Howie, Erin K, Straker, Leon M et al. (2016) Exploration of the mechanisms of change in constructs from self-determination theory and quality of life during a multidisciplinary family-based intervention for overweight adolescents. Journal of Sport & Exercise Psychology 38(1): 59-68	- Non-RCT
Fernandez-Ruiz, V.E., Sole-Agusti, M., Armero-Barranco, D. et al. (2021) Weight Loss and Improvement of Metabolic Alterations in Overweight and Obese Children Through the I2AO2 Family Program: A Randomized Controlled Clinical Trial. Biological research for nursing 23(3): 488-503	- Data not reported in an extractable format
Fiechtner, Lauren, Perkins, Meghan, Biggs, Vincent et al. (2021) Comparative Effectiveness of Clinical and Community-Based Approaches to Healthy Weight. Pediatrics 148(4)	- Follow up was less than 6 months post intervention
Fisher, Abigail, Hammersley, Megan L, Jones, Rachel A et al. (2018) Goal setting for weight-related behavior change in children: An exploratory study. Nutrition and health 24(2): 67-74	- Follow up was less than 6 months post intervention
Fleischman, A., Hourigan, S.E., Lyon, H.N. et al. (2016) Creating an integrated care model for childhood obesity: a randomized pilot study utilizing telehealth in a community primary care setting. Clinical Obesity 6(6): 380-388	- Follow up was less than 6 months post intervention
Fonseca, H., Prioste, A., Sousa, P. et al. (2016) Effectiveness analysis of an internet-based intervention for overweight adolescents: Next steps for researchers and clinicians. BMC Obesity 3(1): 15	- Follow up was less than 6 months post intervention
Forsell, C., Gronowitz, E., Larsson, Y. et al. (2019) Four-year outcome of randomly assigned lifestyle treatments in primary care of children with obesity. Acta Paediatrica, International Journal of Paediatrics 108(4): 718-724	- Comparator in study does not match that specified in protocol

Study	Code [Reason]
Foster, B.A., Weinstein, K., Padilla, T. et al. (2022) Growing Healthy Together: A Randomized Clinical Trial Using Parent Mentors for Early Childhood Obesity in Low-Income, Latino Families. Childhood obesity (Print) 18(3): 168-177	- Follow up was less than 6 months post intervention
Freira, S., Lemos, M.S., Fonseca, H. et al. (2018) Anthropometric outcomes of a motivational interviewing school-based randomized trial involving adolescents with overweight. European Journal of Pediatrics 177(7): 1121-1130	- Follow up was less than 6 months post intervention
Freira, Silvia, Fonseca, Helena, Williams, Geoffrey et al. (2019) Quality-of-life outcomes of a weight management program for adolescents based on motivational interviewing. Patient education and counseling 102(4): 718-725	- Follow up was less than 6 months post intervention
Gallardo Rodriguez, A.G., Fajardo Espinosa, F.S., Mendoza Hernandez, A.N. et al. (2021) Effects of a nutritional intervention with calcium caseinate on body composition in children with obesity. Clinical Nutrition ESPEN 46: 585	- Conference abstract
Garcia-Munoz, S, Barlinska, J, Wojtkowska, K et al. (2022) Is it possible to improve healthy food habits in schoolchildren? A cross cultural study among Spain and Poland. Food Quality and Preference 99: 1-12	- No relevant outcomes reported
George, Gretchen Lynn, Schneider, Constance, Kaiser, Lucia et al. (2016) Healthy Lifestyle Fitness Camp: A summer approach to prevent obesity in low-income youth. Journal of Nutrition Education and Behavior 48(3): 208-212	- Follow up was less than 6 months post intervention
Goldfield, G.S., Kenny, G.P., Alberga, A.A. et al. (2015) Effects of aerobic training, resistance training or both on health-related quality of life in adolescents with obesity: The HEARTY trial. Canadian Journal of Diabetes 39(suppl1): 18	- Conference abstract
Goldfield, G.S., Kenny, G.P., Alberga, A.S. et al. (2017) Effects of aerobic or resistance training or both on health-related quality of life in youth with obesity: the HEARTY Trial. Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme 42(4): 361-370	- Follow up was less than 6 months post intervention
Gorin, A.A., Wiley, J., Ohannessian, C.M. et al. (2014) Steps to Growing Up Healthy: a pediatric primary care based obesity prevention program for young children. BMC public health 14: 72	- Follow up was less than 6 months post intervention
Grao-Cruces, Alberto, Ruiz-Lopez, Rafael, Moral-Garcia, Jose-Enrique et al. (2016) Effects of a steps/day programme with evaluation in physical education on body mass index in schoolchildren 11-12 years of age. Kinesiology 48(1): 132-141	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Guo, H., Zeng, X., Zhuang, Q. et al. (2015) Intervention of childhood and adolescents obesity in Shantou city. Obesity Research and Clinical Practice 9(4): 357-364	- Follow up was less than 6 months post intervention
Hadley, W., Houck, C., Barker, D. et al. (2020) Preliminary Impact of an Adapted Emotion Regulation Intervention for Adolescents with Overweight and Obesity Attempting to Lose Weight. Journal of developmental and behavioral pediatrics : JDBP 41(9): 706-715	- Follow up was less than 6 months post intervention
Hagman, E., Johansson, L., Kollin, C. et al. (2022) Effect of an interactive mobile health support system and daily weight measurements for pediatric obesity treatment, a 1-year pragmatical clinical trial. International Journal of Obesity 46(8): 1527-1533	- Follow up was less than 6 months post intervention
Ham, Ok Kyung, Sung, Kyung Mi, Lee, Bo Gyeong et al. (2016) Transtheoretical Model Based Exercise Counseling Combined with Music Skipping Rope Exercise on Childhood Obesity. Asian nursing research 10(2): 116-22	- Follow up was less than 6 months post intervention
Hamila, A., Younes, M., Cottin, F. et al. (2018) Effects of walking exercises on body composition, heart rate variability, and perceptual responses in overweight and obese adolescents. Science and Sports 33(5): e191-e202	- Follow up was less than 6 months post intervention
Hammersley, M.L., Okely, A.D., Batterham, M.J. et al. (2019) An Internet-Based Childhood Obesity Prevention Program (Time2bHealthy) for Parents of Preschool-Aged Children: Randomized Controlled Trial. Journal of medical Internet research 21(2): e11964	- Follow up was less than 6 months post intervention
Hannon, Tamara S, Carroll, Aaron E, Palmer, Kelly N et al. (2015) Rationale and design of a comparative effectiveness trial to prevent type 2 diabetes in mothers and children: the ENCOURAGE healthy families study. Contemporary clinical trials 40: 105-11	- No results reported
Harder-Lauridsen, N.M., Birk, N.M., Ried-Larsen, M. et al. (2014) A randomized controlled trial on a multicomponent intervention for overweight school-aged children - Copenhagen, Denmark. BMC Pediatrics 14(1): 273	- Follow up was less than 6 months post intervention
Hart, C.N., Hawley, N., Egleston, B. et al. (2017) Brief behavioral intervention enhances children's sleep and improves weight status. Sleep 40(supplement1): a370	- Conference abstract
Hawkins, K.R., Apolzan, J.W., Staiano, A.E. et al. (2019) Efficacy of a Home-Based Parent Training-Focused Weight Management Intervention for Preschool Children: The DRIVE Randomized Controlled Pilot Trial. Journal of nutrition education and behavior 51(6): 740-748	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Heerman, W.J., Burgess, L.E., Escarfuller, J. et al. (2018) Competency Based Approach to Community Health (COACH): The methods of a family-centered, community-based, individually adaptive obesity randomized trial for pre-school child-parent pairs. Contemporary Clinical Trials 73: 1-7	- No results reported
Heerman, W.J., Teeters, L., Sommer, E.C. et al. (2019) Competency-Based Approaches to Community Health: A Randomized Controlled Trial to Reduce Childhood Obesity among Latino Preschool-Aged Children. Childhood obesity (Print) 15(8): 519-531	- Target population is not overweight or obese
Heldt, K., Buchter, D.J., Brogle, B. et al. (2018) Telemedicine Therapy for Overweight Adolescents: First Results of a Novel Smartphone App Intervention using a Behavioural Health Platform. Obesity Facts 11(supplement1): 214-215	- Conference abstract
Herget, S., Reichardt, S., Grimm, A. et al. (2016) High-intensity interval training for overweight adolescents: Program acceptance of a media supported intervention and changes in body composition. International Journal of Environmental Research and Public Health 13(11): 1099	- Follow up was less than 6 months post intervention
Hidayanty, H, Bardosono, S, Khusun, H et al. (2016) A social cognitive theory-based programme for eating patterns and sedentary activity among overweight adolescents in Makassar, South Sulawesi : a cluster randomised controlled trial. Asia Pacific journal of clinical nutrition 25(suppl1): S83-S92	- Follow up was less than 6 months post intervention
Hoffman, J., Frerichs, L., Story, M. et al. (2018) An integrated clinic-community partnership for child obesity treatment: A randomized pilot trial. Pediatrics 141(1): e20171444	- Follow up was less than 6 months post intervention
Jacques-Tiura, A.J., Ellis, D.A., Idalski Carcone, A. et al. (2019) African-American Adolescents' Weight Loss Skills Utilization: Effects on Weight Change in a Sequential Multiple Assignment Randomized Trial. Journal of Adolescent Health 64(3): 355-361	- Follow up was less than 6 months post intervention
Janicke, D.M., Lim, C.S., Perri, M.G. et al. (2019) Featured Article: Behavior Interventions Addressing Obesity in Rural Settings: The E-FLIP for Kids Trial. Journal of pediatric psychology 44(8): 889-901	- Full text paper not available
Jelalian, E., Evans, E.W., Rancourt, D. et al. (2020) JOIN for ME: Testing a Scalable Weight Control Intervention for Adolescents. Childhood obesity (Print) 16(3): 192-203	- Follow up was less than 6 months post intervention
Jelalian, E., Hadley, W., Sato, A. et al. (2015) Adolescent weight control: an intervention targeting parent communication and modeling compared with minimal parental involvement. Journal of pediatric psychology 40(2): 203-213	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Jelalian, E., Sato, A.F., Hart, C. et al. (2010) Two-year follow up of a behavioral adolescent weight control intervention. Obesity 18(suppl2): 104	- Conference abstract
Jensen, Chad D, Duraccio, Kara M, Barnett, Kimberly A et al. (2019) Feasibility, acceptability, and preliminary effectiveness of an adaptive text messaging intervention for adolescent weight control in primary care. Clinical Practice in Pediatric Psychology 7(1): 57-67	- Follow up was less than 6 months post intervention
Johansson, L. and Danielsson, P. (2019) A new web-based childhood obesity treatment with objective self-monitoring of weight, physical activity and continuous support from the clinic - A randomized controlled pilot study. Obesity Facts 12(supplement1): 56	- Conference abstract
Johansson, L.; Hagman, E.; Danielsson, P. (2020) A novel interactive mobile health support system for pediatric obesity treatment: A randomized controlled feasibility trial. BMC Pediatrics 20(1): 447	- Follow up was less than 6 months post intervention
Jolly, Kate, Griffin, Tania, Sidhu, Manbinder et al. (2020) A weight management programme for fathers of children aged 4-11 years: cultural adaptation and the Healthy Dads, Healthy Kids UK feasibility RCT.	- Follow up was less than 6 months post intervention
Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. et al. (2017) WHAT ARE THE VIEWS OF OVERWEIGHT AND OBESE ADOLESCENTS (12-17YRS) ATTENDING LIFESTYLE TREATMENT INTERVENTIONS: A QUALITATIVE SYSTEMATIC REVIEW. Journal of Epidemiology and Community Health 71(supplement1): a93-a94	- Already captured in a separate qualitative studies search
Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. et al. (2019) Viewpoints of adolescents with overweight and obesity attending lifestyle obesity treatment interventions: a qualitative systematic review. Obesity Reviews 20(1): 156-169	- Already captured in a separate qualitative studies search
Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. et al. (2017) Viewpoints of overweight and obese adolescents attending lifestyle obesity treatment interventions: A qualitative systematic review. The Lancet 390(speciss1): 50	- Already captured in a separate qualitative studies search
Julian, V., Thivel, D., Miguet, M. et al. (2020) Eccentric Cycling Training Improves Health-Related Quality of Life in Adolescents with Obesity. Obesity Facts 13(6): 548-559	- Follow up was less than 6 months post intervention
Jun, MK and Ha, JY (2016) Effect of Smartphone Apps Applying BodyThink Program on Obesity in Adolescent Girls. Journal of Korean Academy of Nursing 46(3): 390-399	- Full text paper not available

Study	Code [Reason]
Kahrass, H.; Strech, D.; Mertz, M. (2017) Ethical issues in obesity prevention for school children: a systematic qualitative review. International journal of public health 62(9): 981-988	- Already captured in a separate qualitative studies search
Kelleher, E., Davoren, M.P., Harrington, J.M. et al. (2016) FACTORS INFLUENCING FAMILIES' INITIAL AND CONTINUED ATTENDANCE AT COMMUNITY-BASED FAMILY-FOCUSED CHILDHOOD WEIGHT MANAGEMENT PROGRAMMES: A SYSTEMATIC REVIEW. Journal of Epidemiology and Community Health 70(supplement1): a78-a79	- Already captured in a separate qualitative studies search
Kelleher, E., Davoren, M.P., Harrington, J.M. et al. (2017) Barriers and facilitators to initial and continued attendance at community-based lifestyle programmes among families of overweight and obese children: a systematic review. Obesity Reviews 18(2): 183-194	- Already captured in a separate qualitative studies search
Kim, H.S., Park, J., Park, K.-Y. et al. (2016) Parent Involvement Intervention in Developing Weight Management Skills for both Parents and Overweight/Obese Children. Asian Nursing Research 10(1): 11-17	- Follow up was less than 6 months post intervention
Kim, J., Son, W.-M., Headid Iii, R.J. et al. (2020) The effects of a 12-week jump rope exercise program on body composition, insulin sensitivity, and academic self-efficacy in obese adolescent girls. Journal of pediatric endocrinology & metabolism : JPEM 33(1): 129-137	- Follow up was less than 6 months post intervention
Kittiya, Rattanamanee and Chintana, Wacharasin (2021) Effectiveness of a Family-Based Behavioral Counseling Program among School-aged Children with Obesity: a Quasi-Experimental Study. Pacific rim international journal of nursing research 25(3): 466-480	- Not a relevant study design *quasi-experimental*
Kokkvoll, A.S., Grimsgaard, S., Flaegstad, T. et al. (2020) No additional long-term effect of group vs individual family intervention in the treatment of childhood obesity-A randomised trial. Acta Paediatrica, International Journal of Paediatrics 109(1): 183-192	- Comparator in study does not match that specified in protocol
Kolip, P, Finne, E, Schaefer, A et al. (2015) Evaluation of the "Obeldicks Light Training" Programme for Overweight Children and Adolescents. Gesundheitswesen (Bundesverband der Arzte des Offentlichen Gesundheitsdienstes (Germany)) 77suppl1: S56-7	- Study not reported in English
Kose, S. and Yildiz, S. (2021) Motivational support programme to enhance health and well-being and promote weight loss in overweight and obese adolescents: A randomized controlled trial in Turkey. International journal of nursing practice 27(1): e12878	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Lang, S., Gibson, S., Ng, K.W. et al. (2021) Understanding children and young people's experiences pursuing weight loss maintenance using the Socio-ecological Model: A qualitative systematic literature review. Obesity Reviews 22(5): e13172	- Already captured in a separate qualitative studies search
Lanigan, J.A., Low, S.L., Lanigan-Coyte, K.M. et al. (2010) Prevention of obesity in preschool children. Obesity 18(suppl2): 104	- Non-RCT
Laroche, H., O'Shea, A., Andino, J. et al. (2020) A family obesity intervention combining motivation interviewing and resource mobilization. Obesity 28(suppl2): 42	- Conference abstract
Larsen, K.T., Huang, T., Moller, N.C. et al. (2017) Cost-effectiveness of a day-camp weight-loss intervention programme for children: Results based on a randomised controlled trial with one-year follow-up. Scandinavian journal of public health 45(6): 666-674	- Follow up was less than 6 months post intervention
Larsen, K.T., Huang, T., Ried-Larsen, M. et al. (2016) A multi-component day-camp weight-loss program is effective in reducing bmi in children after one year: A randomized controlled trial. PLoS ONE 11(6): e0157182	- Follow up was less than 6 months post intervention
Lee, J. (2021) Influences of exercise interventions on overweight and obesity in children and adolescents. Public Health Nursing 38(3): 502-516	- Systematic review references checked
Lee, J., Piao, M., Byun, A. et al. (2016) A Systematic Review and Meta-Analysis of Intervention for Pediatric Obesity Using Mobile Technology. Studies in health technology and informatics 225: 491-494	- Already captured in a separate qualitative studies search
Lee, R.L.-T., Leung, C., Chen, H. et al. (2017) The impact of a school-based weight management program involving parents via mhealth for overweight and obese children and adolescents with intellectual disability: A randomized controlled trial. International Journal of Environmental Research and Public Health 14(10): 1178	- Follow up was less than 6 months post intervention
Lee, S., Libman, I., Hughan, K. et al. (2019) Effects of Exercise Modality on Insulin Resistance and Ectopic Fat in Adolescents with Overweight and Obesity: A Randomized Clinical Trial. Journal of Pediatrics 206: 91-98e1	- Follow up was less than 6 months post intervention
Lee, So Yeong, Kim, Jieun, Oh, Seulki et al. (2020) A 24-week intervention based on nutrition care process improves diet quality, body mass index, and motivation in children and adolescents with obesity. Nutrition research (New York, N.Y.) 84: 53-62	- Non-RCT

Study	Code [Reason]
Leite, N, Pizzi, J, de Menezes Junior, FJ et al. (2022) EFFECT OF MICT AND HIIT ON CARDIOMETABOLIC RISK AND BODY COMPOSITION IN OBESE BOYS. Revista brasileira de medicina do esporte 28(4): 274-280	- Follow up was less than 6 months post intervention
Likhitweerawong, N., Boonchooduang, N., Kittisakmontri, K. et al. (2020) Short-term outcomes of tablet/smartphone-based (OBEST) application among obese Thai school-aged children and adolescents: A randomized controlled trial. Obesity Medicine 20: 100287	- Follow up was less than 6 months post intervention
Likhitweerawong, Narueporn, Boonchooduang, Nonglak, Kittisakmontri, Kulnipa et al. (2021) Effectiveness of mobile application on changing weight, healthy eating habits, and quality of life in children and adolescents with obesity: a randomized controlled trial. BMC pediatrics 21(1): 499	- Follow up was less than 6 months post intervention
Linde, S.R.F., Danielsen, Y.S., Skjakodegard, H.F. et al. (2015) Family-based behavioural treatment of obesity -The FABO-study. Acta Paediatrica, International Journal of Paediatrics 104(suppl466): 22-23	- Conference abstract
Loeb, K.L., Le Grange, D., Celio Doyle, A. et al. (2019) Adapting family-based treatment for paediatric obesity: A randomized controlled pilot trial. European Eating Disorders Review 27(5): 521-530	- Data not reported in an extractable format
Logue, C., Flynn, J., Gallagher, A. et al. (2020) Get A Move On: Using intelligent personal systems to promote behaviour change within the home setting - A process evaluation. Proceedings of the Nutrition Society 79(oce2)	- Conference abstract
Lopera, Carlos Andres, da Silva, Danilo Fernandes, Bianchini, Josiane Aparecida Alves et al. (2016) Effect of water-versus land-based exercise training as a component of a multidisciplinary intervention program for overweight and obese adolescents. Physiology & Behavior 165: 365-373	- Follow up was less than 6 months post intervention
Luca, P, Dettmer, E, Khoury, M et al. (2015) Adolescents with severe obesity: outcomes of participation in an intensive obesity management programme. Pediatric obesity 10(4): 275-82	- Non-RCT
Luque, V., Feliu, A., Escribano, J. et al. (2019) The obemat2.0 study: A clinical trial of a motivational intervention for childhood obesity treatment. Nutrients 11(2): 419	- No results reported
Lyu, J.-L., Liu, Z., Zhou, S. et al. (2022) The Effect of a Multifaceted Intervention on Dietary Quality in Schoolchildren and the Mediating Effect of Dietary Quality between Intervention and Changes in Adiposity Indicators: A Cluster Randomized Controlled Trial. Nutrients 14(16)	- Target population is not overweight or obese

Study	Code [Reason]
Mabli, J., Bleeker, M., Fox, M.K. et al. (2020) Randomized Controlled Trial of Healthy Harlem's Get Fit Program: An After-School Intervention for Childhood Overweight and Obesity in the Harlem Children's Zone. Childhood obesity (Print) 16(7): 479-487	- Follow up was less than 6 months post intervention
Makkes, S., Renders, C.M., Bosmans, J.E. et al. (2016) One-year effects of two intensive inpatient treatments for severely obese children and adolescents. BMC Pediatrics 16(1): 120	- Follow up was less than 6 months post intervention
Malley, O.G., Perry, I.J., Brinkley, A. et al. (2020) Exploring the clinical effectiveness of a mobile health intervention for adolescent weight management. Obesity Reviews 21(suppl1)	- Conference abstract
Mameli, C., Brunetti, D., Colombo, V. et al. (2018) Combined use of a wristband and a smartphone to reduce body weight in obese children: randomized controlled trial. Pediatric Obesity 13(2): 81-87	- Follow up was less than 6 months post intervention
Mancioppi, V., Solito, A., Ricotti, R. et al. (2019) Good-day: Efficacy of gamification of an educational training to mediterranean diet on weight and metabolic control in paediatric obesity. preliminary data at 6 months. High Blood Pressure and Cardiovascular Prevention 26(2): 171-172	- Conference abstract
Marandi, S., Minasian, V., Kelishadi, R. et al. (2014) Short-term effects of a physical activity intervention on obesity and cardiovascular fitness of 12-14-year-old boy students. International Journal of Preventive Medicine 5(14supplement2): 114-s119	- Follow up was less than 6 months post intervention
Martin, C., Apolzan, J., Hawkins, K. et al. (2017) Efcacy of a home-based weight management intervention for 2-6 year old children and their parents: Results of a randomized controlled pilot trial. Obesity Facts 10(supplement1): 233-234	- Conference abstract
Martinez-Vizcaino, V., Pozuelo-Carrascosa, D.P., Garcia-Prieto, J.C. et al. (2020) Effectiveness of a school-based physical activity intervention on adiposity, fitness and blood pressure: MOVI-KIDS study. British journal of sports medicine 54(5): 279-285	- Follow up was less than 6 months post intervention
Mashanskaya, AV, Pogodina, AV, Astakhova, TA et al. (2018) The modern methods for the rehabilitation of adolescents suffering obesity. Voprosy kurortologii, fizioterapii, i lechebnoi fizicheskoi kultury 95(4): 24-30	- Study not reported in English
Matthan, N.R., Wylie-Rosett, J., Xue, X. et al. (2020) Effect of a family-based intervention on nutrient biomarkers, desaturase enzyme activities, and cardiometabolic risk factors in children with overweight and obesity. Current Developments in Nutrition 4(1)	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Matthan, N.R., Xue, X., Gao, Q. et al. (2015) Effect of a family based intervention on biomarkers of diet quality/endogenous metabolism and BMI z-score. Circulation 131(suppl1)	- Conference abstract
McMaster, Caitlin M, Gow, Megan L, Neal, Renee et al. (2020) Acceptability of Hospital-Based Pediatric Weight Management Services among Patients and Families: A Narrative Synthesis. Childhood obesity (Print) 16(2): 129-140	- Already captured in a separate qualitative studies search
Md Yusop, N.B., Mohd Shariff, Z., Hwu, T.T. et al. (2018) The effectiveness of a stage-based lifestyle modification intervention for obese children. BMC public health 18(1): 299	- Follow up was less than 6 months post intervention
Md Yusop, N.B., Mohd Shariff, Z., Hwu, T.T. et al. (2019) Individualized nutrition counselling in childhood obesity management: Is it effective?. Annals of Nutrition and Metabolism 75(3): 82	- Conference abstract
Melnyk, B.M., Jacobson, D., Kelly, S.A. et al. (2015) Twelve-Month Effects of the COPE Healthy Lifestyles TEEN Program on Overweight and Depressive Symptoms in High School Adolescents. The Journal of school health 85(12): 861-870	- Target population is not overweight or obese
Mendes, M.D.S.D., De Melo, M.E., Fernandes, A.E. et al. (2017) Effects of two diet techniques and delivery mode on weight loss, metabolic profile and food intake of obese adolescents: A fixed diet plan and a calorie-counting diet. European Journal of Clinical Nutrition 71(4): 549-551	- Follow up was less than 6 months post intervention
Meng, C., Yucheng, T., Shu, L. et al. (2022) Effects of school-based high-intensity interval training on body composition, cardiorespiratory fitness and cardiometabolic markers in adolescent boys with obesity: a randomized controlled trial. BMC Pediatrics 22(1): 112	- Follow up was less than 6 months post intervention
Meyerovitch, J., Yackobovitch-Gavan, M., Wolf, D. et al. (2015) Comparison of two family-intervention (parents only vs parent and child) in the treatment of childhood obesity. Hormone Research in Paediatrics 84(suppl1): 414	- Conference abstract
Miguet, M., Fearnbach, N.S., Metz, L. et al. (2020) Effect of HIIT versus MICT on body composition and energy intake in dietary restrained and unrestrained adolescents with obesity. Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme 45(4): 437-445	- Follow up was less than 6 months post intervention
Miolanne M, Lambert C, Masurier J et al. (2022) Designing, Implementing, and Evaluating a Home-Based, Multidisciplinary, Family-Centered Pediatric Obesity Intervention: The ProxOb Program. Children (Basel, Switzerland) 9(5)	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Miri, S.F., Javadi, M., Lin, C.-Y. et al. (2019) Effectiveness of cognitive-behavioral therapy on nutrition improvement and weight of overweight and obese adolescents: A randomized controlled trial. Diabetes and Metabolic Syndrome: Clinical Research and Reviews 13(3): 2190-2197	- Follow up was less than 6 months post intervention
Mirzania, M., Eshghizadeh, M., Mousavinia, F. et al. (2018) Effects of participatory training program on the control of overweight and obesity in female adolescents. Journal of Kerman University of Medical Sciences 25(4): 365-374	- Follow up was less than 6 months post intervention
Mohammed Nawi, Azmawati and Che Jamaludin, Farrah Ilyani (2015) Effect of Internet-based Intervention on Obesity among Adolescents in Kuala Lumpur: A School-based Cluster Randomised Trial. The Malaysian journal of medical sciences : MJMS 22(4): 47-56	- Follow up was less than 6 months post intervention
Monteiro, P.A., Chen, K.Y., Lira, F.S. et al. (2015) Concurrent and aerobic exercise training promote similar benefits in body composition and metabolic profiles in obese adolescents. Lipids in Health and Disease 14(1): 153	- Follow up was less than 6 months post intervention
Moore, S.M., Borawski, E.A., Love, T.E. et al. (2019) Two family interventions to reduce BMI in low-income urban youth: A randomized trial. Pediatrics 143(6): e20182185	- Follow up was less than 6 months post intervention
Morgan, A.R.; Ali, F.E.; Sedhom, M.G. (2021) Effect of a diet program and aerobic exercise in class II and class III obese children with chronic kidney disease. Physiotherapy Quarterly 29(3): 35-39	- Follow up was less than 6 months post intervention
Morton, G; Schieder, C; Kaiser, L (2015) Anthropometric outcomes related to selfsatisfaction, parent and peer support in overweight youth participating in a fitness and nutrition themed summer camp. FASEB journal 29(1meetingabstracts)	- Conference abstract
Muhlig, Y., Scherag, A., Bickenbach, A. et al. (2017) A Structured, Manual-Based Low-Level Intervention vs. Treatment as Usual Evaluated in a Randomized Controlled Trial for Adolescents with Extreme Obesity-the STEREO Trial. Obesity Facts 10(4): 341-352	- Follow up was less than 6 months post intervention
Na Nongkhai, M.P.; Yamprasert, R.; Punsawad, C. (2021) Effects of Continuous Yoga on Body Composition in Obese Adolescents. Evidence-based Complementary and Alternative Medicine 2021: 6702767	- Follow up was less than 6 months post intervention
Naar, S., Ellis, D., Idalski Carcone, A. et al. (2019) Outcomes From a Sequential Multiple Assignment Randomized Trial of Weight Loss Strategies for African American Adolescents With Obesity. Annals of behavioral medicine : a publication of the Society of Behavioral Medicine 53(10): 928-938	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Naar-King, S., Ellis, D.A., Idalski Carcone, A. et al. (2016) Sequential Multiple Assignment Randomized Trial (SMART) to Construct Weight Loss Interventions for African American Adolescents. Journal of clinical child and adolescent psychology : the official journal for the Society of Clinical Child and Adolescent Psychology, American Psychological Association, Division 53 45(4): 428-441	- Follow up was less than 6 months post intervention
Natalina Eka, S. and Isma, R. (2019) Effect of 10,000 steps goal program on waist circumference in obese adolescences. Pakistan Journal of Medical and Health Sciences 13(4): 1259-1262	- Follow up was less than 6 months post intervention
Nayak, Baby S and Bhat, Vinod H (2016) School Based Multicomponent Intervention for Obese Children in Udupi District, South India - A Randomized Controlled Trial. Journal of clinical and diagnostic research : JCDR 10(12): c24-sc28	- Follow up was less than 6 months post intervention
NCT05225350 (2022) Family Meals on Prescription- a Randomized Controlled Trial. https://clinicaltrials.gov/show/NCT05225350	- Full text paper not available
Neelon, Sara E. Benjamin, Brouwer, Rebecca J. Namenek, Ostbye, Truls et al. (2015) A community-based intervention increases physical activity and reduces obesity in school-age children in North Carolina. Childhood Obesity 11(3): 297-303	- Target population is not overweight or obese
Nezami, B.T., Hurley, L., Power, J. et al. (2022) A pilot randomized trial of simplified versus standard calorie dietary self-monitoring in a mobile weight loss intervention. Obesity 30(3): 628-638	- Follow up was less than 6 months post intervention
Ng, CM, Kaur, S, Koo, HC et al. (2022) Experiential healthy meal preparation: a randomized-controlled trial to improve food group consumption and weight status among children. Human nutrition and metabolism 28	- Follow up was less than 6 months post intervention
Nigg, Claudio R, Ul Anwar, Md Mahabub, Braun, Kathryn et al. (2016) A Review of Promising Multicomponent Environmental Child Obesity Prevention Intervention Strategies by the Children's Healthy Living Program. Journal of environmental health 79(3): 18-26	- Already captured in a separate qualitative studies search
Nor Baizura, M.Y., Zalilah, M.S., Hwu, T.T. et al. (2018) Does Fish Oil Supplementation Improve Diet, Lipid Profile and Body Composition of Obese Children? A Randomized Controlled Trial. International Journal of Cardiology 273(supplement): 21	- Conference abstract
Nourian, M.; Kelishadi, R.; Najimi, A. (2017) Lifestyle interventions and weight control of adolescents with abdominal obesity: A randomized controlled trial based on health belief model. Iranian Red Crescent Medical Journal 19(2): e30638	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Ochoa, A, Ochoa Aviles, A, Andrade Tenesaca, DS et al. (2017) Effect of the school-based health promotion intervention activital on dietary intake and waist circumference: a cluster randomized controlled trial. Annals of nutrition & metabolism 71: 1272-1273	- Conference abstract
Onnerfalt, J., Erlandsson, L., Orban, K. et al. (2015) Loops-Lund overweight and obesity preschool study: An intervention involving parents of preschool children with obesity has a long-term effect on the weight development of targeted children. Obesity Facts 8(suppl1): 89	- Conference abstract
Oreskovic, N.M., Winickoff, J.P., Perrin, J.M. et al. (2016) A Multimodal Counseling-Based Adolescent Physical Activity Intervention. Journal of Adolescent Health 59(3): 332-337	- Follow up was less than 6 months post intervention
Pbert, L., Druker, S., Gapinski, M.A. et al. (2010) School nurse-delivered intervention for overweight and obese adolescents: Outcomes from a randomized controlled trial. Obesity 18(suppl2): 90	- Conference abstract
Pbert, Lori, Druker, Susan, Barton, Bruce et al. (2016) A School-Based Program for Overweight and Obese Adolescents: A Randomized Controlled Trial. The Journal of school health 86(10): 699-708	- Follow up was less than 6 months post intervention
Perez-Sousa, Miguel A, Olivares, Pedro R, Garcia-Hermoso, Antonio et al. (2018) Does anthropometric and fitness parameters mediate the effect of exercise on the HRQoL of overweight and obese children/adolescents?. Quality of Life Research: An International Journal of Quality of Life Aspects of Treatment, Care & Rehabilitation 27(9): 2305-2312	- Non-RCT
Ponnambalam, Sumathy, Palanisamy, Soundararajan, Singaravelu, Rajeswari et al. (2022) Effectiveness of After-School Physical Activity Intervention on Body Mass Index and Waist Circumference/Height Ratio among Overweight Adolescents in Selected Schools at Puducherry, India: A Randomized Controlled Trial. Indian journal of community medicine : official publication of Indian Association of Preventive & Social Medicine 47(1): 72-75	- Follow up was less than 6 months post intervention
Prado, G., Fernandez, A., St. George, S.M. et al. (2020) Results of a Family-Based Intervention Promoting Healthy Weight Strategies in Overweight Hispanic Adolescents and Parents: An RCT. American Journal of Preventive Medicine 59(5): 658-668	- Data not reported in an extractable format
Ptomey, L.T., Sullivan, D.K., Lee, J. et al. (2015) The use of technology for delivering a weight loss program for adolescents with intellectual and developmental disabilities. Journal of the Academy of Nutrition and Dietetics 115(1): 112-118	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Ptomey, L.T., Washburn, R.A., Goetz, J.R. et al. (2022) A randomized trial comparing diet and delivery strategies for weight management in adolescents with intellectual disabilities. Pediatric Obesity	- Follow up was less than 6 months post intervention
Ptomey, L.T., Washburn, R.A., Goetz, J.R. et al. (2021) Weight loss interventions for adolescents with intellectual disabilities: An RCT. Pediatrics 148(3): e2021050261	- Follow up was less than 6 months post intervention
Racil, Ghazi, Zouhal, Hassane, Elmontassar, Wassim et al. (2016) Plyometric exercise combined with high-intensity interval training improves metabolic abnormalities in young obese females more so than interval training alone. Applied physiology, nutrition, and metabolism = Physiologie appliquee, nutrition et metabolisme 41(1): 103-9	- Follow up was less than 6 months post intervention
Ramalho, S., Silva, D., Mansilha, H. et al. (2019) APOLO-Teens, a Web-based intervention for adolescents with overweight/obesity seeking treatment: An effectiveness study. Obesity Facts 12(supplement1): 74	- Conference abstract
Ramezani, A, Gaeini, AA, Hosseini, M et al. (2017) Effects of three methods of exercise training on cardiovascular risk factors in obese boys. Iranian journal of pediatrics 27(5)	- Follow up was less than 6 months post intervention
Redfern, J., Enright, G., Hyun, K. et al. (2019) Effectiveness of a behavioural incentive scheme linked to goal achievement in overweight children: A multicenter cluster randomized controlled trial. European Heart Journal 40(supplement1): 2534	- Conference abstract
Reinehr, T., Bucksch, J., Muller, A. et al. (2018) 7-Year follow-up of a lifestyle intervention in overweight children: Comparison to an untreated control group. Clinical Nutrition 37(5): 1558-1562	- Data not reported in an extractable format
Rhee, K.E., Herrera, L., Strong, D. et al. (2022) Guided Self-Help for Pediatric Obesity in Primary Care: A Randomized Clinical Trial. Pediatrics 150(1)	- Comparator in study does not match that specified in protocol
Rifas-Shiman, S.L., Taveras, E.M., Gortmaker, S.L. et al. (2017) Two-year follow-up of a primary care-based intervention to prevent and manage childhood obesity: the High Five for Kids study. Pediatric Obesity 12(3): e24-e27	- Follow up was less than 6 months post intervention
Rijks, J.M., Plat, J., Mensink, R.M. et al. (2015) Severe obese children benefit to the same extent as overweight and obese children from a long-term ambulatory interdisciplinary lifestyle intervention. European Journal of Epidemiology 30(8): 989	- Conference abstract
Robbins, L.B.; Wen, F.; Ling, J. (2019) Effects of an intervention on physical activity, body mass index, percent body fat, and cardiorespiratory fitness among 5th-8thgrade girls with body	- Conference abstract

Study	Code [Reason]
mass index Z-score greater than or equal to 0. Circulation 140(supplement1)	
Robertson, W., Fleming, J., Kamal, A. et al. (2017) Randomised controlled trial evaluating the effectiveness and cost-effectiveness of 'families for health', a family-based childhood obesity treatment intervention delivered in a community setting for ages 6 to 11 years. Health Technology Assessment 21(1): 1-180	- Duplicate reference
Ruotsalainen, Heidi, Kyngas, Helvi, Tammelin, Tuija et al. (2015) Effectiveness of Facebook-Delivered Lifestyle Counselling and Physical Activity Self-Monitoring on Physical Activity and Body Mass Index in Overweight and Obese Adolescents: A Randomized Controlled Trial. Nursing research and practice 2015: 159205	- Follow up was less than 6 months post intervention
Sacher, Paul M, Kolotourou, Maria, Poupakis, Stavros et al. (2019) Addressing childhood obesity in low-income, ethnically diverse families: Outcomes and peer effects of MEND 7-13 when delivered at scale in US communities. International Journal of Obesity 43(1): 91-102	- Non-RCT
Saelens, B.E., Scholz, K., Walters, K. et al. (2017) Two Pilot Randomized Trials To Examine Feasibility and Impact of Treated Parents as Peer Interventionists in Family-Based Pediatric Weight Management. Childhood obesity (Print) 13(4): 314-323	- Follow up was less than 6 months post intervention
Salahshoornezhad, S., Sohrabi, Z., Mani, A. et al. (2022) Effect of a multi-disciplinary program on anthropometric and biochemical parameters in obese and overweight elementary school girls: A randomized clinical trial. Nutrition, Metabolism and Cardiovascular Diseases 32(8): 1982-1989	- Follow up was less than 6 months post intervention
Salazar Preciado, L.L., Larrosa Haro, A., Colunga Rodriguez, C. et al. (2017) Efficacy of a cognitive behavioral treatment versus a traditional intervention to reduce adiposity within a nutritional intervention program in obese school children. Annals of Nutrition and Metabolism 71(supplement2): 631-632	- Conference abstract
Sato, A.F., Tortolani, C., Jelalian, E. et al. (2010) Impact of weight control intervention on adolescents' physical activity and sedentary behavior. Obesity 18(suppl2): 100	- Conference abstract
Schiel, R; Vahl, T; Bieber, G (2015) InterLearn - Interactive Learning and Telemedical Follow-Up for Children and Adolescents with Overweight and Obesity. Diabetologie und stoffwechsel 10(6): 314-321	- Study not reported in English
Scott, D.G. and Costello, J.M. (2015) Assessing the impact of a lifestyle modification program on body composition in overweight	- Conference abstract

Study	Code [Reason]
and obese treatment seeking children and adolescents; a hospital based program outcome review. Canadian Journal of Diabetes 39(suppl1): 51	
Sen, M., Uzuner, A., Akman, M. et al. (2018) Examination of a board game approach to children's involvement in family-based weight management vs. traditional family-based behavioral counseling in primary care. European Journal of Pediatrics 177(8): 1231-1238	- Follow up was less than 6 months post intervention
Sepulveda, A.R., Solano, S., Blanco, M. et al. (2019) Feasibility, acceptability, and effectiveness of a multidisciplinary intervention in childhood obesity from primary care: Nutrition, physical activity, emotional regulation, and family. European Eating Disorders Review	- Comparator in study does not match that specified in protocol
Shahriarzadeh, F, Kelishadi, R, Fatehizadeh, M et al. (2017) The effect of motivational interviewing and healthy diet on anthropometric indices and blood pressure in overweight and obese school children. Journal of isfahan medical school 35(426): 412-421	- Study not reported in English
Shirley Moore, S.M.M. and Borawski, E. (2019) Randomized trial of the effects of two family-based interventions on BMI in lowincome urban youth. European Journal of Preventive Cardiology 26(supplement1): 53-s54	- Conference abstract
Sigmund, E. and Sigmundova, D. (2013) Longitudinal 2-year follow-up on the effect of a non-randomised school-based physical activity intervention on reducing overweight and obesity of Czech children aged 10-12 years. International journal of environmental research and public health 10(8): 3667-3683	- Non-RCT
Skelton, J.A.; Irby, M.B.; Geiger, A.M. (2014) A systematic review of satisfaction and pediatric obesity treatment: new avenues for addressing attrition. Journal for healthcare quality : official publication of the National Association for Healthcare Quality 36(4): 5-22	- Already captured in a separate qualitative studies search
Skjakodegard, H.F., Conlon, R.P.K., Hystad, S.W. et al. (2022) Family-based treatment of children with severe obesity in a public healthcare setting: Results from a randomized controlled trial. Clinical Obesity 12(3): e12513	- Follow up was less than 6 months post intervention
Smith, L.H.; Petosa, R.L.; Laurent, D. (2020) Efficacy of "Mentoring to Be Active" on Weight Loss, Body Mass Index, and Body Fat among Obese and Extremely Obese Youth in Rural Appalachia. The Journal of rural health : official journal of the American Rural Health Association and the National Rural Health Care Association 36(1): 77-87	- Secondary analysis of an excluded study

Study	Code [Reason]
Staiano, A.E., Beyl, R.A., Guan, W. et al. (2018) Home-based exergaming among children with overweight and obesity: a randomized clinical trial. Pediatric Obesity 13(11): 724-733	- Follow up was less than 6 months post intervention
Staiano, A.E., Marker, A.M., Beyl, R.A. et al. (2017) A randomized controlled trial of dance exergaming for exercise training in overweight and obese adolescent girls. Pediatric Obesity 12(2): 120-128	- Follow up was less than 6 months post intervention
Stark, L.J., Spear Filigno, S., Bolling, C. et al. (2018) Clinic and Home-Based Behavioral Intervention for Obesity in Preschoolers: A Randomized Trial. Journal of Pediatrics 192: 115-121e1	- Follow up was less than 6 months post intervention
Stasinaki, A., Brogle, B., Buchter, D. et al. (2018) A novel digital health intervention improves physical performance in obese youth. Swiss Medical Weekly 147(supplement228): 10s	- Conference abstract
Stasinaki, A., Buchter, D., Shih, C.-H.I. et al. (2021) Effects of a novel mobile health intervention compared to a multi-component behaviour changing program on body mass index, physical capacities and stress parameters in adolescents with obesity: a randomized controlled trial. BMC Pediatrics 21(1): 308	- Follow up was less than 6 months post intervention
Stavrou, S, Nicolaides, NC, Papageorgiou, I et al. (2016) The effectiveness of a stress management intervention program in the management of overweight and obesity in childhood and adolescence. Hormone research in paediatrics 86: 316	- Follow up was less than 6 months post intervention
Stavrou, Stavroula, Nicolaides, Nicolas C, Papageorgiou, Ifigenia et al. (2016) The effectiveness of a stress-management intervention program in the management of overweight and obesity in childhood and adolescence. Journal of molecular biochemistry 5(2): 63-70	- Duplicate reference
Stovitz, Steven D, Berge, Jerica M, Wetzsteon, Rachel J et al. (2014) Stage 1 treatment of pediatric overweight and obesity: A pilot and feasibility randomized controlled trial. Childhood Obesity 10(1): 50-57	- Follow up was less than 6 months post intervention
Sutcliffe (2016) What are the critical features of successful Tier 2 lifestyle weight management programmes for children aged 0-11 years? A systematic review to identify the programme characteristics, and combinations of characteristics, that are associated with successful outcomes.	- Already captured in a separate qualitative studies search
Sze, Yan Yan, Daniel, Tinuke Oluyomi, Kilanowski, Colleen K et al. (2015) Web-Based and Mobile Delivery of an Episodic Future Thinking Intervention for Overweight and Obese Families: A Feasibility Study. JMIR mHealth and uHealth 3(4): e97	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Tabak, R.G., Morshed, A.B., Schwarz, C.D. et al. (2018) Impact of a healthy weight intervention embedded within a national home visiting program on the home food environment. Obesity Facts 11(supplement1): 264	- No relevant outcomes reported
Taveras, E.M., Marshall, R., Sharifi, M. et al. (2017) Comparative effectiveness of clinical-community childhood obesity interventions a randomized clinical trial. JAMA Pediatrics 171(8): 1325	- Follow up was less than 6 months post intervention
Thivel, D., Doucet, E., Julian, V. et al. (2017) Nutritional compensation to exercise- vs. diet-induced acute energy deficit in adolescents with obesity. Physiology and Behavior 176: 159-164	- Follow up was less than 6 months post intervention
Thivel, D., Julian, V., Miguet, M. et al. (2020) Introducing eccentric cycling during a multidisciplinary weight loss intervention might prevent adolescents with obesity from increasing their food intake: The TEXTOO study. Physiology and Behavior 214: 112744	- Follow up was less than 6 months post intervention
Topham, G.L., Washburn, I.J., Hubbs-Tait, L. et al. (2021) The families and schools for health project: A longitudinal cluster randomized controlled trial targeting children with overweight and obesity. International Journal of Environmental Research and Public Health 18(16): 8744	- Data not reported in an extractable format
Tucker, JM, DeFrang, R, Orth, J et al. (2019) Evaluation of a Primary Care Weight Management Program in Children Aged 2⁻5 years: changes in Feeding Practices, Health Behaviors, and Body Mass Index. Nutrients 11(3)	- Follow up was less than 6 months post intervention
Tufford AR, Diou C, Lucassen DA et al. (2022) Toward Systems Models for Obesity Prevention: A Big Role for Big Data. Current developments in nutrition 6(9): nzac123	- Non-RCT
Vander Wyst, K., Olson, M., Soltero, E. et al. (2020) Lifestyle intervention improves body & organ adiposity among latino youth with prediabetes & obesity. Obesity 28(suppl2): 119	- Conference abstract
Varagiannis, P., Magriplis, E., Risvas, G. et al. (2021) Effects of three different family-based interventions in overweight and obese children: The "4 your family" randomized controlled trial. Nutrients 13(2): 1-12	- Follow up was less than 6 months post intervention
Vasconcellos, F., Seabra, A., Cunha, F. et al. (2016) Health markers in obese adolescents improved by a 12-week recreational soccer program: a randomised controlled trial. Journal of sports sciences 34(6): 564-575	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Veldhorst, M.A.B., Verbruggen, S.C.A.T., van Harskamp, D. et al. (2018) Effects of a high-protein intake on metabolic targets for weight loss in children with obesity: a randomized trial. Obesity Science and Practice 4(4): 347-356	- Follow up was less than 6 months post intervention
Verduci, E., Banderali, G., Di Profio, E. et al. (2021) Effect of individual- versus collective-based nutritional-lifestyle intervention on the atherogenic index of plasma in children with obesity: a randomized trial. Nutrition and Metabolism 18(1): 11	- Follow up was less than 6 months post intervention
Verduci, E., Vizzuso, S., Ippolito, G. et al. (2019) Effectiveness of individual vs. group-based lifestyle intervention on anthropometric and metabolic profile of obese children. Journal of Pediatric Gastroenterology and Nutrition 68(supplement1): 1020	- Follow up was less than 6 months post intervention
Vermeiren, E., Naets, T., Van Eyck, A. et al. (2021) Improving Treatment Outcome in Children With Obesity by an Online Self-Control Training: A Randomized Controlled Trial. Frontiers in Pediatrics 9: 794256	- Data not reported in an extractable format
Vermeiren, E., Van Eyck, A., Naets, T. et al. (2021) Can executive function training improve short- and long-term weight control in children with obesity: A randomized controlled trial. Obesity Facts 14(suppl1): 164	- Conference abstract
Videira Silva, A.; Sardinha, L.B.; Fonseca, H. (2020) The effect of a physical activity consultation in the management of adolescents overweight (PAC-MAnO): Sixmonth results from a non-randomized controlled trial. Obesity Reviews 21(suppl1)	- Non-RCT
Videira Silva, A.; Sardinha, L.B.; Fonseca, H. (2019) Do adolescents with severe obesity benefit from a multidisciplinary weight-management program?. Obesity Facts 12(supplement1): 111	- Conference abstract
Videira-Silva, A., Hetherington-Rauth, M., Sardinha, L.B. et al. (2021) The effect of a physical activity consultation in the management of adolescent excess weight: Results from a non-randomized controlled trial. Clinical Obesity 11(6): e12484	- Non-RCT
Vizzuso, S., Amatruda, M., Banderali, G. et al. (2020) One year individual or group based lifestyle intervention in obese. Impact on metabolic profile and body composition. Obesity Reviews 21(suppl1)	- Conference abstract
Wadee, A.N.; Shafeek, M.M.; Tawfick, A.M. (2019) Influence of different exercise regimens on segmental body fat in obese primary school children. Indian Journal of Public Health Research and Development 10(11): 3380-3386	- Full text paper not available

Study	Code [Reason]
Wald, E.R., Ewing, L.J., Moyer, S.C.L. et al. (2018) An Interactive Web-Based Intervention to Achieve Healthy Weight in Young Children. Clinical Pediatrics 57(5): 547-557	- Full text paper not available
Warschburger, P., Gmeiner, M., Morawietz, M. et al. (2018) Evaluation of an approach-avoidance training intervention for children and adolescents with obesity: A randomized placebo-controlled prospective trial. European Eating Disorders Review 26(5): 472-482	- Study does not contain a relevant intervention
Warschburger, P. and Zitzmann, J. (2019) Does an age-specific treatment program augment the efficacy of a cognitive-behavioral weight loss program in adolescence and young adulthood? Results from a controlled study. Nutrients 11(9): 2053	- Non-RCT
Wen, L.M., Baur, L.A., Simpson, J.M. et al. (2015) Sustainability of effects of an early childhood obesity prevention trial over time: A further 3-year follow-up of the healthy beginnings trial. JAMA Pediatrics 169(6): 543-551	- Target population is not overweight or obese
Werk, L.N., Hossain, J., Martinez, A. et al. (2019) Extending obesity care beyond the office doors using telemedicine health coaches. A pilot test randomized trial. Pediatrics 144(2)	- Conference abstract
Wilfley, D.E., Saelens, B.E., Stein, R.I. et al. (2017) Dose, content, and mediators of family-based treatment for childhood obesity a multisite randomized clinical trial. JAMA Pediatrics 171(12): 1151-1159	- Follow up was less than 6 months post intervention
Wilson, D.K., Kitzman-Ulrich, H., Resnicow, K. et al. (2015) An overview of the Families Improving Together (FIT) for weight loss randomized controlled trial in African American families. Contemporary Clinical Trials 42: 145-157	- No results reported
Xiang, Ming-Qiang, Liao, Jing-Wen, Huang, Jun-Hao et al. (2019) Effect of a combined exercise and dietary intervention on self-control in obese adolescents. Frontiers in Psychology 10	- Follow up was less than 6 months post intervention
Yoshinaga, M., Ogata, H., Aoki, M. et al. (2016) Efficacy of walking as a lifestyle modification approach for childhood obesity. A randomized controlled trial. European Heart Journal 37(supplement1): 248	- Conference abstract
Yoshinaga, M., Seki, S., Ogata, H. et al. (2017) Treating childhood obesity by walking: A randomised controlled trial. Circulation 136(supplement1)	- Conference abstract
Yu, S., Gao, Y., Wang, A. et al. (2022) Effectiveness of an adapted physical activity intervention for weight management in adolescents with intellectual disability: A randomized controlled trial. Pediatric Obesity 17(5): e12882	- Follow up was less than 6 months post intervention

Study	Code [Reason]
Yun, L., Boles, R.E., Haemer, M.A. et al. (2015) A randomized, home-based, childhood obesity intervention delivered by patient navigators. BMC public health 15: 506	- No results reported
Zhang, Q.; O'Connor, D.B.; Hugh-Jones, S. (2022) Feasibility of a multiple-component mindfulness intervention for Chinese adolescents living with overweight: A pilot randomized trial. Applied psychology. Health and well-being	- Follow up was less than 6 months post intervention
Zoellner, J.M., You, W., Hill, J.L. et al. (2022) Comparing two different family-based childhood obesity treatment programmes in a medically underserved region: Effectiveness, engagement and implementation outcomes from a randomized controlled trial. Pediatric Obesity 17(1): e12840	- Follow up was less than 6 months post intervention

Qualitative evidence

Study	Reason
Al Khudairy, L.A.-K., Loveman, E.L., Colquitt, J.C. et al. (2017) LIFESTYLE INTERVENTIONS FOR THE TREATMENT OF OVERWEIGHT/OBESE ADOLESCENTS-COCHRANE REVIEW. Journal of Epidemiology and Community Health 71(supplement1): a93	- Conference abstract
Alulis, S. and Grabowski, D. (2017) Theoretical frameworks informing family-based child and adolescent obesity interventions: A qualitative meta-synthesis. Obesity Research and Clinical Practice 11(6): 627-639	- No relevant content *Does not contain views of participants who used WM services*
Arai, L., Panca, M., Morris, S. et al. (2015) Time, monetary and other costs of participation in family-based child weight management interventions:Qualitative and systematic review evidence. PLoS ONE 10(4): e123782	- Does not review qualitative data *Quantitative evidence review with qualitative primary research*
Clayton, P., Connelly, J., Ellington, M. et al. (2021) Facilitators and barriers of children's participation in nutrition, physical activity, and obesity interventions: A systematic review. Obesity Reviews 22(12): e13335	- Conference abstract

Study	Reason
Colvin, K.M. (2022) Understanding Barriers toward Interventions for Childhood Obesity in Minority Communities: A Rapid Review. medRxiv	- Does not review qualitative data *Searched for qualitative studies but found none*
Dhaliwal, J., Nosworthy, N.M., Holt, N.L. et al. (2014) Attrition and the management of pediatric obesity: an integrative review. Childhood obesity (Print) 10(6): 461-473	- Does not review qualitative data *Only two qualitative studies and one mixed-methods report. Review focuses on quantitative.*
Draper, C E, Grobler, L, Micklesfield, L K et al. (2015) Impact of social norms and social support on diet, physical activity and sedentary behaviour of adolescents: a scoping review. Child: care, health and development 41(5): 654-67	- No relevant content *Focus of review is WM behaviours not WM programs*
Ekambareshwar, M., Ekambareshwar, S., Mihrshahi, S. et al. (2021) Process evaluations of early childhood obesity prevention interventions delivered via telephone or text messages: a systematic review. International Journal of Behavioral Nutrition and Physical Activity 18(1): 10	- Does not review qualitative data
Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. et al. (2017) WHAT ARE THE VIEWS OF OVERWEIGHT AND OBESE ADOLESCENTS (12-17YRS) ATTENDING LIFESTYLE TREATMENT INTERVENTIONS: A QUALITATIVE SYSTEMATIC REVIEW. Journal of Epidemiology and Community Health 71(supplement1): a93-a94	- Conference abstract
Jones, H.M., Al-Khudairy, L., Melendez-Torres, G.J. et al. (2019) Viewpoints of adolescents with overweight and obesity attending lifestyle obesity treatment interventions: a qualitative systematic review. Obesity Reviews 20(1): 156-169	- Conference abstract
Kahrass, H.; Strech, D.; Mertz, M. (2017) Ethical issues in obesity prevention for school children: a systematic qualitative review. International journal of public health 62(9): 981-988	- No relevant content *Analysed the ethics of WM, not the acceptability to participants*
Kelleher, E., Davoren, M.P., Harrington, J.M. et al. (2016) FACTORS INFLUENCING FAMILIES' INITIAL AND CONTINUED ATTENDANCE AT COMMUNITY-BASED FAMILY-FOCUSED	- Conference abstract

Study	Reason
CHILDHOOD WEIGHT MANAGEMENT PROGRAMMES: A SYSTEMATIC REVIEW. Journal of Epidemiology and Community Health 70(supplement1): a78-a79	
Kelleher, E., Davoren, M.P., Harrington, J.M. et al. (2017) Barriers and facilitators to initial and continued attendance at community-based lifestyle programmes among families of overweight and obese children: a systematic review. Obesity Reviews 18(2): 183-194	- More recent systematic review included that covers the same topic *4 out of 6 included studies are duplicated in other reviews. The focus of this paper is only partially applicable to the question.*
Lang, S., Gibson, S., Ng, K.W. et al. (2021) Understanding children and young people's experiences pursuing weight loss maintenance using the Socio-ecological Model: A qualitative systematic literature review. Obesity Reviews 22(5): e13172	- No relevant content *Focus on weight maintenance, from weight loss outside of a WM program.*
Lee, J., Piao, M., Byun, A. et al. (2016) A Systematic Review and Meta-Analysis of Intervention for Pediatric Obesity Using Mobile Technology. Studies in health technology and informatics 225: 491-494	- Does not review qualitative data *Only reported quantitative*
Nigg, Claudio R, Ul Anwar, Md Mahabub, Braun, Kathryn et al. (2016) A Review of Promising Multicomponent Environmental Child Obesity Prevention Intervention Strategies by the Children's Healthy Living Program. Journal of environmental health 79(3): 18-26	- Does not review qualitative data
Skelton, J.A.; Irby, M.B.; Geiger, A.M. (2014) A systematic review of satisfaction and pediatric obesity treatment: new avenues for addressing attrition. Journal for healthcare quality : official publication of the National Association for Healthcare Quality 36(4): 5-22	- Does not review qualitative data *quasi-qualitative analysis of measures and questionnaires obtained from the authors of the quantitative studies included.*

Economic evidence

Study	Reason
Lier LM, Breuer C, Ferrari N, Friesen D, Maisonave F, Schmidt N, Graf C. Cost-effectiveness of a family-based multicomponent outpatient intervention program for children with obesity in Germany. Public Health. 2020 Sep;186:185-192. doi: 10.1016/j.puhe.2020.06.012. Epub 2020 Aug 25. PMID: 32858303.	- Non-UK study, different from the current UK context
Larsen KT, Huang T, Møller NC, Andersen LB, Sørensen J. Cost-effectiveness of a day-camp weight-loss intervention programme for children: Results based on a randomised controlled trial with one-year follow-up. Scand J Public Health. 2017 Aug;45(6):666-674. doi: 10.1177/1403494816688374. Epub 2017 Jul 30. PMID: 28758542.	- Non-UK study, different from the current UK context
Robertson W, Fleming J, Kamal A, Hamborg T, Khan KA, Griffiths F, Stewart-Brown S, Stallard N, Petrou S, Simkiss D, Harrison E, Kim SW, Thorogood M. Randomised controlled trial evaluating the effectiveness and cost-effectiveness of 'Families for Health', a family-based childhood obesity treatment intervention delivered in a community setting for ages 6 to 11 years. Health Technol Assess. 2017 Jan;21(1):1-180. doi: 10.3310/hta21010. PMID: 28059054; PMCID: PMC5292644.	- HTA report of the included study
Bandurska E, Brzeziński M, Metelska P, Zarzeczna-Baran M. Cost-Effectiveness of an Obesity Management Program for 6- to 15-Year-Old Children in Poland: Data from Over Three Thousand Participants. Obes Facts. 2020;13(5):487-498. doi: 10.1159/000509130. Epub 2020 Sep 21. PMID: 32957099; PMCID: PMC7670340.	- Non-UK study, different from the current UK context
Conesa M, Llauradó E, Aceves-Martins M, Moriña D, de Solà-Morales O, Giralt M, Tarro L, Solà R. Cost-Effectiveness of the EdAl (Educació en Alimentació) Program: A Primary School-Based Study to Prevent Childhood Obesity. J Epidemiol. 2018 Dec 5;28(12):477-481. doi: 10.2188/jea.JE20170111. Epub 2018 Jul 28. PMID: 30 058612; PMCID: PMC6242786.	- Non-UK study, different from the current UK context
Law C, Cole T, Cummins S, Fagg J, Morris S, Roberts H. A pragmatic evaluation of a family-based intervention for childhood overweight and obesity. Southampton (UK): NIHR Journals Library; 2014 Oct. PMID: 27466647.	- Not a cost-utility analysis
Mahdi S, Marr C, Buckland NJ, Chilcott J. Methods for the economic evaluation of obesity prevention dietary interventions in children: A systematic review and critical appraisal of the	- Not a cost-utility analysis

Study	Reason
evidence. Obes Rev. 2022 Sep;23(9):e13457. doi: 10.1111/obr.13457. Epub 2022 Apr 27. PMID: 35478373; PMCID: PMC9542346.	
Pearce A, Hope S, Griffiths L, et alOP28 Will government targets to increase physical activity in children reduce socio-economic inequalities in childhood overweight? a policy simulation in the uk millennium cohort study (mcs)J Epidemiol Community Health 2017;71:A15.	- Conference abstract
Spoor C, Sahota P, Wellings C, Rudolf MC. Costing a pilot complex community-based childhood obesity intervention. J Hum Nutr Diet. 2013 Apr;26(2):126-31. doi: 10.1111/j.1365-277X.2012.01273.x. Epub 2012 Jul 21. PMID: 22817273.	- Not a cost-utility analysis
Bandurska E, Brzeziński M, Metelska P, Zarzeczna-Baran M. Cost-Effectiveness of an Obesity Management Program for 6- to 15-Year-Old Children in Poland: Data from Over Three Thousand Participants. Obes Facts. 2020;13(5):487-498. doi: 10.1159/000509130. Epub 2020 Sep 21. PMID: 32957099; PMCID: PMC7670340.	- Non-UK study, different from the current UK context
Anderson YC, Leung W, Grant CC, et al. Economic evaluation of a multi-disciplinary community-based intervention programme for New Zealand children and adolescents with obesity. Obes Res Clin Pract. 2018;12(3):293-298. doi:10.1016/j.orcp.2018.04.001	- Non-UK study, different from the current UK context

Appendix L – Research recommendations – full details

Research recommendation

What is the effectiveness and cost effectiveness of behavioural overweight and obesity management interventions with long term support for children and young people?

Why this is important

Obesity is a chronic condition so there is an expectation that people will need ongoing support over the long term, however the majority of RCTs used fixed term interventions with very little support in the post intervention period. It is important to measure the effect of adding longer term support to weight management interventions to investigate whether health improvements can be maintained and changes to BMI sustained over a longer period.

Rationale for research recommendation

Importance to 'patients' or the population	Overweight and obesity is a chronic relapsing condition, so interventions that offer longer term support are important for children and young people to minimise health risks.
Relevance to NICE guidance	This guideline recommends weight management interventions with longer term support from a range of sources. Direct evidence is needed on whether this support can come from the interventions themselves.
Relevance to the NHS	Lifelong health outcomes from weight related comorbidities are a concern for the NHS, so interventions which can help to maintain health improvements and reduce these risks is valuable.
National priorities	High
Current evidence base	Minimal long-term data
Equality considerations	Children in the most deprived areas of England are more than twice as likely to be obese. By the time children in the most deprived areas reach year 6 (age 10-11) a quarter of them are obese, compared to 11.5% of children in the least deprived areas. Disparities in obesity in childhood is likely to worsen health outcomes and health inequalities in children from more deprived areas.

	Children living with obesity are more likely to become adults living with obesity and thus increase the risk of obesity for their own children later in life. Poor diet and low levels of physical activity are the primary causal factors of excess weight. Childhood obesity is also associated with psychological problems such as anxiety and depression, low self-esteem and lower self-reported quality of life and social problems such as bullying and stigma.

Modified PICO table

Population	Children and young people living with overweight or obesity
Intervention	Weight management interventions with long term support (greater than six months follow up)
Comparator	Usual care
Outcome	Change in BMI z-score, quality of life, changes in central adiposity
Study design	RCT
Timeframe	Long term interventions, greater than 6 months intervention duration
Additional information	None

Appendix M– Network meta-analysis and meta-regression

General methods

For details of the generic methods adopted for these analyses, please see Methods chapter.

Analyses undertaken

Outcome of interest

During protocol development, the committee identified changes in measured body mass index (BMI), BMI z-score and weight as critical outcomes. Amongst these measures of change, the committee highlighted that BMI z-score is the main measure used in children and young people. This is because BMI z-score is a measure of how any standard deviations a child or young person’s BMI is above or below the average BMI for their age and gender. They also highlighted that using BMI z-scores, instead of BMI, allows direct comparison of BMI (and any changes in BMI) across different ages and by gender. This term is sometimes used interchangeably with ‘BMI standard deviation score’ (BMI SDS).

Based on this discussion, the decision was made to conduct meta-analyses and meta-regression for change in BMI z-score.

Population

During protocol development, it was identified that children and young people aged 2 to up to 18 years who are living with overweight, or obesity can be stratified by weight according to the following age categories:

- 2 up to 5 years old (pre-school age, considered as up to 6 years in the analysis)
- 6 up to 11 years old (primary school age)
- 12 up to 18 years old (secondary school age)

Based on this discussion, it was agreed with the guideline committee that separate analyses would be conducted based on the different age stratifications.

Comparators

During protocol development, the committee identified no intervention, usual care and concomitant interventions as the main comparators. Further discussions were held with the committee about what would constitute usual care or standard care in weight management and what would constitute an additional intervention beyond standard care. In their view, there was rarely if ever a situation where a basic level of advice on diet and exercise would not be given, but often there would not be any further treatment given in most cases.

They further highlighted that no intervention would not, in practice, be different from usual care as the basic level of diet and exercise advice would be given in both situations. This is consistent with the descriptions of comparators found in the primary studies. There was no clear distinction between comparators described as usual care and no intervention; most contained elements of diet and exercise advice similar to that described by the committee. Therefore, these comparators were combined into a single standard care comparator termed ‘basic support’. Concomitant intervention comparators were treated as another intervention rather than a true comparator condition, so that their components could be accounted for in the network diagram.

Intervention

During protocol development, it was highlighted that the key components of behavioural overweight and obesity management interventions include diet, physical activity or exercise and behaviour change techniques. These components were further explored with the committee who identified further sub-components:

Diet components

The committee noted that in practice, diet components often comprise of diet advice, for example the eat well plate or the diet may be tailored to individual needs. As diet advice is part of standard care, the criterion for considering diet to be part of the intervention was discussed with the committee. The committee decided that if a diet was provided or prescribed by the weight management program or if advice was tailored to the individual then it would constitute a diet modification intervention. If there was only general advice given, which participants could choose how to use, then it would be considered part of standard care.

Exercise components

As exercise advice is part of standard care, the criterion for considering exercise to be part of the intervention was discussed with the committee. They decided that if exercise was done in person, as part of the weight management sessions, this would constitute an exercise intervention. If there was only general advice or encouragement to increase exercise, which participants could choose how to do so, then it would be considered part of standard care.

Behaviour change techniques components

The committee confirmed that behaviour change techniques were not used in standard care for weight management, so any use of behaviour change would constitute an intervention. For the purposes of the standard network meta-analysis, behaviour change techniques were considered a single component, to enable a connected network to be formed (see section on model selection for further information on the standard NMA approach).

The committee were also interested in the types of behaviour change techniques used in weight management, so the behaviour change technique component was also divided into sub-components, and these were explored further through the component NMAs (see section on model selection for further information on the component NMA approach).

The sub-components were determined using general behaviour change taxonomies to establish the range of behaviour change techniques possible and specifically using the CALO-RE taxonomy (Michie 2011) to narrow this down to techniques applicable to weight management.

The CALO-RE taxonomy aimed extend the scope and improve the reliability of existing taxonomies of behaviour change in order to optimize the reporting and scientific study of behaviour change interventions, specifically with regard to interventions to increase physical activity and healthy eating. Three UK study centres collaborated in applying this existing taxonomy to two systematic reviews. The taxonomy was refined in iterative steps of (1) coding intervention descriptions, and assessing inter-rater reliability, (2) identifying gaps and problems across study centres and (3) refining the labels and definitions based on consensus discussions. They produced a 40-item taxonomy, with high inter-rater reliability.

As 40 categories would be an inappropriate level of detail for this review, we modified the taxonomy by grouping similar techniques together to form more general categories. This was done using an iterative process to ensure that no details or distinctions were lost. Figure 1 shows the process of combining and grouping techniques, leading to the final set of 6 subcomponents. These 6 subcomponents could not be meaningfully combined further so were considered the minimum needed to capture the differences between behaviour change approaches to weight management.

1. Motivation: Interventions that attempted to increase the family's motivation to engage with weight management behaviours. This included motivational interviewing, as specified in the protocol.
2. Goals and planning: Interventions that involved setting behavioural or outcome goals for families to work towards and/or making a plan for how to achieve their goals. This can include problem solving.
3. Review and rewards: Interventions where feedback and/or rewards were given for progress or achievement towards weight management goals. These did not have to be goals set in the subcomponent, but often were.
4. Improving and monitoring: Interventions where families are encouraged to monitor and reflect on their own progress and the build upon it.
5. Teach strategies: Interventions that involve teaching the family how to manage weight, by developing skills or using prompts
6. Facilitating change: Interventions that involve making changes that indirectly improve weight management, by making it easier to adhere to diet and exercise changes. This encompasses both general coping skills, support, and relapse prevention.

Figure 1

Motivation	Info: Consequences	Provide information on consequences of behaviour in general
		Provide information on consequences of behaviour to the individual
	Infor: social norms	Provide information about others' approval
		Provide normative information about others' behaviour
	Resolve to change	Prompt anticipated regret
		Fear Arousal
		Motivational interviewing
GOALS and planning	Goal setting	Goal setting (behaviour)
		Goal setting (outcome)
		Stimulate anticipation of future rewards
		Agree behavioural contract
	Planning how	Set graded tasks
		Action planning
		Barrier identification/Problem solving
Review and rewards	Review	Prompt review of behavioural goals
		Prompt review of outcome goals
		Provide feedback on performance
		Facilitate social comparison
	Rewards	Prompt rewards contingent on effort or progress towards behaviour
		Provide rewards contingent on successful behaviour
		Shaping
Improving and monitoring	Building on progress	Prompting generalization of a target behaviour
		Prompt identification as role model/ position advocate
		Prompting focus on past success
	Self-monitoring	Prompt self-monitoring of behaviour
		Prompt self-monitoring of behavioural outcome
		Use of follow up prompts
Teach strategies	Explain	Provide information on where and when to perform the behaviour
		Provide instruction on how to perform the behaviour
	Show	Model/ Demonstrate the behaviour Involves
		Teach to use prompts/ cues
	Practice	Prompt practice
		Prompt Self talk
		Prompt use of imagery
Facilitating change	Reducing barriers	Environmental restructuring
		Plan social support/ social change
		Relapse prevention/ Coping planning
	Skills	General communication skills training
		Stress management/Emotional control training
		Time management

Figure 1: The stages of combining and grouping behaviour change techniques. Starting with the 40 items provided by the CALO-RE taxonomy on the right, an intermediate set of 14 combined items from the taxonomy in the centre, and the final grouped set of 6 subcomponents on the left.

Behaviour change techniques were then coded according to which subcomponents they featured. This could be any combination of the six subcomponents, interpreted by matching the descriptions of interventions in the studies to the wider set of CALO-RE items within each subcomponent group.

Intervention covariates

During the protocol development, aspects of the intervention that may moderate effectiveness were also discussed and planned to be explored through the analyses. Information on the following covariates were collected from individual studies:

- **Target** – The covariate explored if the intervention was targeted at the child or young person only, parent only, or targeted towards children, young people and their parents.
- **Delivery** – This covariate explored if the intervention was face-to face only, only delivered remotely, or included a combination of face-to-face and remote delivery.
- **Setting –** This covariate explored if the intervention was delivered only in a group setting, or only in an individual setting or included a combination of groups and individual settings.
- **Contact –** This covariate explored if participants were contacted less the weekly during the intervention, weekly or included more intensive follow up (e.g., daily contact, or contact more than once a week).

Timepoints

The protocol specified that outcome data should be at least 6 months post intervention. Most studies collected data at regular intervals counted from baseline rather than post intervention, with interventions that varied in duration. Therefore, it was not possible to select a consistent post-intervention timepoint to compare data. Instead, data was categorised into ranges of timepoints for shorter and longer follow up. Shorter follow up was between 6 months and 12 months post intervention. Longer follow up was ≥12 months post intervention. If there was more than one longer follow up, the longest was used provided there was sufficient data. The committee were satisfied that this would be the most consistent way to compare short and long term outcomes across interventions with different timelines.

Table 28: Post intervention follow up timepoints calculated from the reported follow up from baseline minus the length of the intervention.

Study	Reported follow up points from baseline	Intervention length	Between 6 and 12 month post intervention follow up	Longest follow up >=12 months post intervention
2-5 years				
Quattrin 2012; 2014	18 months and 24 months	12 months	6 months	12 months
Bocca 2012; 2014	12 months and 36 months	16 weeks	~8 months	~32 months
Stark 2011	12 months	6 months	6 months	-
Stark 2014	12 months	6 months	6 months	-
Kelishadi 2009	12 months and 36 months	6 months	6 months	30 months
Small 2014	n/a: post intervention	n/a	6 months	-
Stark 2019	18 months and 12 months	6 months	6 months	12 months
6-11 years				

Study	Reported follow up points from baseline	Intervention length	Between 6 and 12 month post intervention follow up	Longest follow up >=12 months post intervention
Bryant 2011	12 months	4 months	8 months	-
Davoli 2013	24 months	12 months	-	12 months
Epstein 2000	12 months and 24 months	6 months	6 months	18 months
Epstein 2005	24 months	6 months	-	18 months
Gunnarsdottir 2011	12 months	4 months	8 months	-
Kalavainen 2007	36 months	6 months	-	30 months
Kirk 2012	12 months	3 months	9 months	-
Lochrie 2013	12 months	6 months	6 months	-
McCallum 2007	9 months and 15 months	3 months	6 months	12 months
Mirza 2013	12 months and 24 months	3 months	9 months	21 months
Nowicka 2009	12 months	6 months	6 months	-
Saelens 2013	n/a: post intervention	n/a	-	24 months
Wake 2009	12 months	12 weeks	9 months	-
Warschburger 2016	n/a: post intervention	n/a	-	12 months
Boutelle 2011	n/a: post intervention	n/a	6 months	-
Collins 2021 and Okely 2010	12 months and 24 months	6 months	6 months	18 months
Estabrooks 2009	12 months	Unclear	~6-12 months (unclear)	-
Golley 2007	12 months	6 months	6 months	-
Magarey 2012	12 months and 24 months	6 months	6 months	18 months
Gerards 2015	12 months	4 months	8 months	-
Robertson 2016	12 months	10 weeks	~9.5 months	-
Janicke 2019	10 months	4 months	6 months	-
Anderson 2021 and Wild 2020	24 months	12 months	-	12 months
Bohlin 2017	n/a: post intervention	n/a	10 months	-
Fedele 2018	n/a: post intervention	n/a	6 months	-
Njardvik 2018	n/a: post intervention	n/a	-	24 months
Spence 2022	10 months	16 weeks	6 months	-

Study	Reported follow up points from baseline	Intervention length	Between 6 and 12 month post intervention follow up	Longest follow up >=12 months post intervention
Yackobovitch-Gavan 2017	24 months	3 months	-	21 months
12-18 years				
DeBar 2012	12 months	5 months	7 months	-
Ebbeling 2003	12 months	6 months	6 months	-
Ebbeling 2012	24 months	12 months	-	12 months
Grey 2004	12 months	16 weeks	~8 months	-
Resnicow 2005	12 months	6 months	6 months	
Toulabi 2012	n/a: post intervention	n/a	6 months	-
Savoye 2011	24 months	12 months	-	12 months
Vos 2011; 2012	12 months	6 months	6 months	-
Hofsteenge 2014; 2013	18 months	3 months + 36 weeks	6 months	-
Ford 2010	18 months	12 months	6 months	-
Arlinghaus 2019	12 months	24 weeks	~7 months	-
Soltero 2017	12 months	3 months	9 months	-

Model selection

Based on the discussions on intervention components, covariates, and comparators the following analysis plan was discussed:

1. Standard NMA Model

This was considered the first stage of the analysis, where the primary focus was to compare the key aspects of the components (diet modification, exercise programme and behaviour change technique) to basic support. It should be noted that a 'lumped' approach was utilised for the behaviour change component where all sub-components (see Figure 1) where grouped into a single behaviour change node. This model was run on datasets stratified by follow-up time (6- 12 months and ≥12 months post-intervention), for under 6 years and 6-11 years. The model was run on the 6-12 months data set for 12-18 years.

2. Component NMA: Additive sub-component effect

The additive component NMA uses network meta-regression to estimate effects of intervention sub-components. The intervention sub-components explored in this analysis were diet modification, exercise programme, and the six behaviour change technique sub-components (motivation, goals and planning, review and reward, improving and monitoring, teach strategies, and facilitating change). This model allows separate sub-component specific effects to be estimated, assuming that the effect of each component is additive. For example, the effect of an intervention with sub-components goals, teach and exercise is assumed to be equivalent to the sum of the separate effects of each sub-component. An additive component model assumes there is no interaction between the components (either synergistic or antagonistic). This model was run on datasets stratified by follow-up time (6- 12 months and ≥12 months post-intervention), for 6-11 year olds.

3. **Component NMA Model: main effect, with additive sub-component effects**

The main effect, additive sub-component NMA uses network meta-regression to estimate effects of intervention sub-components, in which a main effect for the behavioural change intervention component is estimated, plus the addition of the behaviour change techniques, diet, and exercise sub-component specific effects. The model again assumes that subcomponents are additive and that there is no interaction between subcomponents. This model was run on datasets stratified by follow-up time (6- 12 months and ≥12 months post-intervention), for 6-11 year olds.

4. **Meta-regression: Covariate analysis**

Informed by the available data and network structure, the final analysis plan was to explore effect of the covariates (target, delivery, setting and contact) where the covariate might modify the treatment effect, explaining heterogeneity within the standard NMA analysis. Covariates were not added to the component NMA.

As detailed in the ‘analyses undertaken’ section, separate analyses were planned for the different age groups: up to 6 years, 6 up to 11 years old and 12 up to 18 years old. The data was also stratified by post intervention follow up: 6- 12 months and ≥12 months. This model was run on datasets stratified by follow-up time (6- 12 months and ≥12 months post-intervention), for 6-11 year olds.

Results

Under 6 years

Overall, 5 trials were identified which reported change in BMI z-score or provided information for change in BMI z-score to be calculated. Trials were identified which reported data at multiple timepoints which were grouped into 6-12 months and ≥12 months follow up (post intervention). Studies included in the analyses are highlighted in Table 29 and 30.

These trials also utilised a number of different behaviour change techniques which are highlighted in Table 31. It should be noted that Kelishadi 2009 is a three arm trial which compared basic support to a dairy-rich diet and energy restricted diet. During committee discussions, it was highlighted that a dairy-rich diet would not be a treatment option used in a UK setting as this paper specifically tested this type of diet because the intake of calcium was seen to be low in the Iranian population.

Therefore, only data from the energy restricted diet and basic support arm were used in this analysis.

Further information on the covariates is also presented in Table 32.

Table 29: Studies included in up to 6 years, 6–12 months post intervention follow-up analysis.

Study	Arm 1	Arm 2	Arm 3
Quattrin 2014	BCT + Diet + Exercise	Diet + Exercise	NA
Bocca 2014	Basic support	BCT + Exercise	NA
Stark 2011	Basic support	BCT + Diet + Exercise	NA
Stark 2014	Basic support	BCT + Diet + Exercise	BCT + Diet+ Exercise
Stark 2019	Basic support	BCT + Diet + Exercise	BCT + Diet

See Appendix E for pairwise meta-analysis.
Intervention abbreviations used: Diet = diet modification; exercise = exercise programme; BCT = behaviour change techniques

Table 30: Studies included in up to 6 years, ≥12 months follow-up analysis

Study	Arm 1	Arm 2	Arm 3
Quattrin 2014	BCT + Diet + Exercise	Diet + Exercise	NA
Kelishadi 2009	Basic support	Diet	NA
Stark 2019	Basic support	BCT + Diet + Exercise	BCT + Diet

See Appendix E for pairwise meta-analysis.
Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

Table 31: Behavioural components of included studies for up to 6 years

Study	Intervention[1]	Motivation[2]	GOALS and planning[2]	Review and rewards[2]	Improving and monitoring[2]	Teach strategies[2]	Facilitating change[2]
Quattrin 2014	BCT + Diet + Exercise		✓	✓	✓	✓	✓
Bocca 2014	BCT + Exercise	✓	✓	✓	✓	✓	✓
Stark 2011	BCT + Diet + Exercise		✓	✓	✓	✓	✓
Stark 2014	BCT + Diet + Exercise		✓	✓	✓	✓	✓
	BCT + Diet + Exercise		✓			✓	✓
Stark 2019	BCT + Diet + Exercise		✓	✓	✓	✓	✓
	BCT + Diet	✓	✓	✓			

1 Intervention abbreviations used: Diet = diet modification; exercise = exercise programme; BCT = behaviour change techniques
2 Further descriptions of the behaviour change techniques are provided in section: Interventions.

Table 32: Other variables of included studies for up to 6 years

Study	Intervention[1]	Target		Delivery		Setting		Contact		
		Parent is target	Child is target	Group	Individual	Face-to-face	Remote	Less than weekly	Weekly	Intensive
Quattrin 2014	BCT + Diet + Exercise	✓	✓	✓		✓	✓	✓		
	Diet + Exercise	✓	✓	✓		✓	✓	✓		
Bocca 2014	BCT + Exercise	✓	✓	✓	✓	✓			✓	
Stark 2011	BCT + Diet + Exercise	✓	✓	✓	✓	✓		✓		
Stark 2014	BCT + Diet + Exercise	✓	✓	✓	✓	✓		✓		

Study	Intervention[1]	Target		Delivery		Setting		Contact		
		Parent is target	Child is target	Group	Individual	Face-to-face	Remote	Less than weekly	Weekly	Intensive
	BCT + Diet + Exercise	✓	✓	✓		✓		✓		
Kelishadi 2009	Diet	✓	✓	✓				✓		
Stark 2019	BCT + Diet + Exercise	✓	✓	✓	✓	✓		✓		
	BCT + Diet	✓			✓	✓	✓	✓		
1 Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques										

Model selection

6- 12 months follow up (post intervention)

Standard NMA model

Table 33: Model fit statistics for under 6 years old (6-12 months follow up (post intervention))

	Residual Deviance [a]	DIC [b]	Posterior median of between-study standard deviation	LCrI [c]	UCrI [d]	Convergence	Chains
Fixed NMA	17.13	-15.77	-	-	-	10000	2
Random NMA	12.19	-18.03	0.37	0.05	2.06	10000	2
Unrelated mean effects (UME) (Random)	12.39	-17.78	0.35	0.034	1.92	10000	2

[a] Residual deviance - Total residual deviance compared to 12 data points.
[b] Deviance information criteria (DIC) – lower values preferred
[c] LCrl- Lower credible interval
[d] UCrl- Upper credible interval

Both fixed effects and random effects models were explored, with final model selection for each network based on the methods described in the Methods Chapter.

Goodness-of-fit measures for the candidate models are presented in Table 33. The following observations can be made:

- For 6–12 months follow-up (post-intervention), the DIC in the random effects model was lower than the fixed effects model, however this was not 3 points lower as highlighted in the Methods Chapter. However, the random effects model showed a closer fit to the data (with total residual deviance closer to the number of data points) than the fixed effects model and the between-study SD was estimated to be moderately high, suggesting that the random effects models would be the more appropriate model.

Inconsistency checks were performed using the random effects model fit statistics of both the NMA and UME models are presented in Table 33. Deviance contributions for the random effect NMA and UME models were plotted to identify studies contributing to inconsistency (See Figure 2). The were no meaningful differences of at least 3 or 5 points between the DIC and total residual deviance in the NMA and UME models. Additionally, there was no meaningful difference in the between- study SDs in the NMA and UME models.

Furthermore, points where the deviance was greater than 2 in the NMA and reduced in the UME model were investigated for their contribution to inconsistency. There were no points notably below the line of equality in the deviance contribution plot 6–12 months follow up (post intervention).

Component NMA: Additive sub-component effect and main effect, with additive sub-component effects

Due to the limited number of studies in this population, component NMA models for additive sub-component effect and main effect with additive sub-component effects were not conducted, and results were limited to the standard NMA model.

Meta-regression: Covariate analysis

Due to the limited number of studies in this population, covariate analysis not conducted, and results were limited to the standard NMA model.

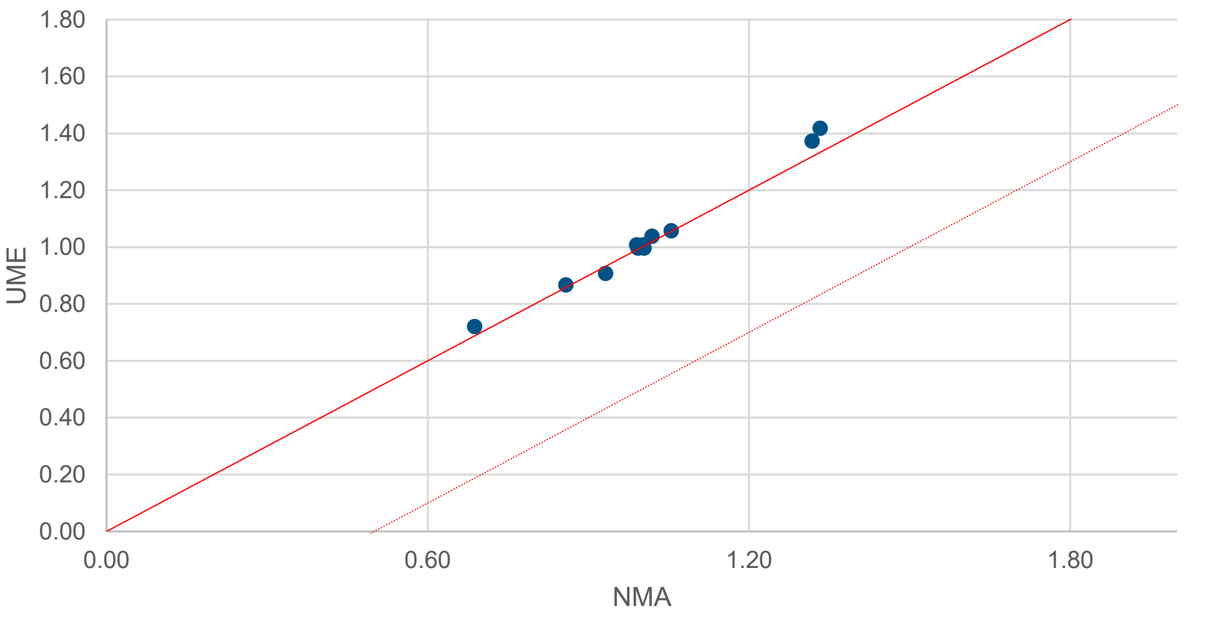


Figure 2: Deviance contributions for the random effect NMA and UME model for up to 6 years, 6–12 months follow-up (post intervention).

Results

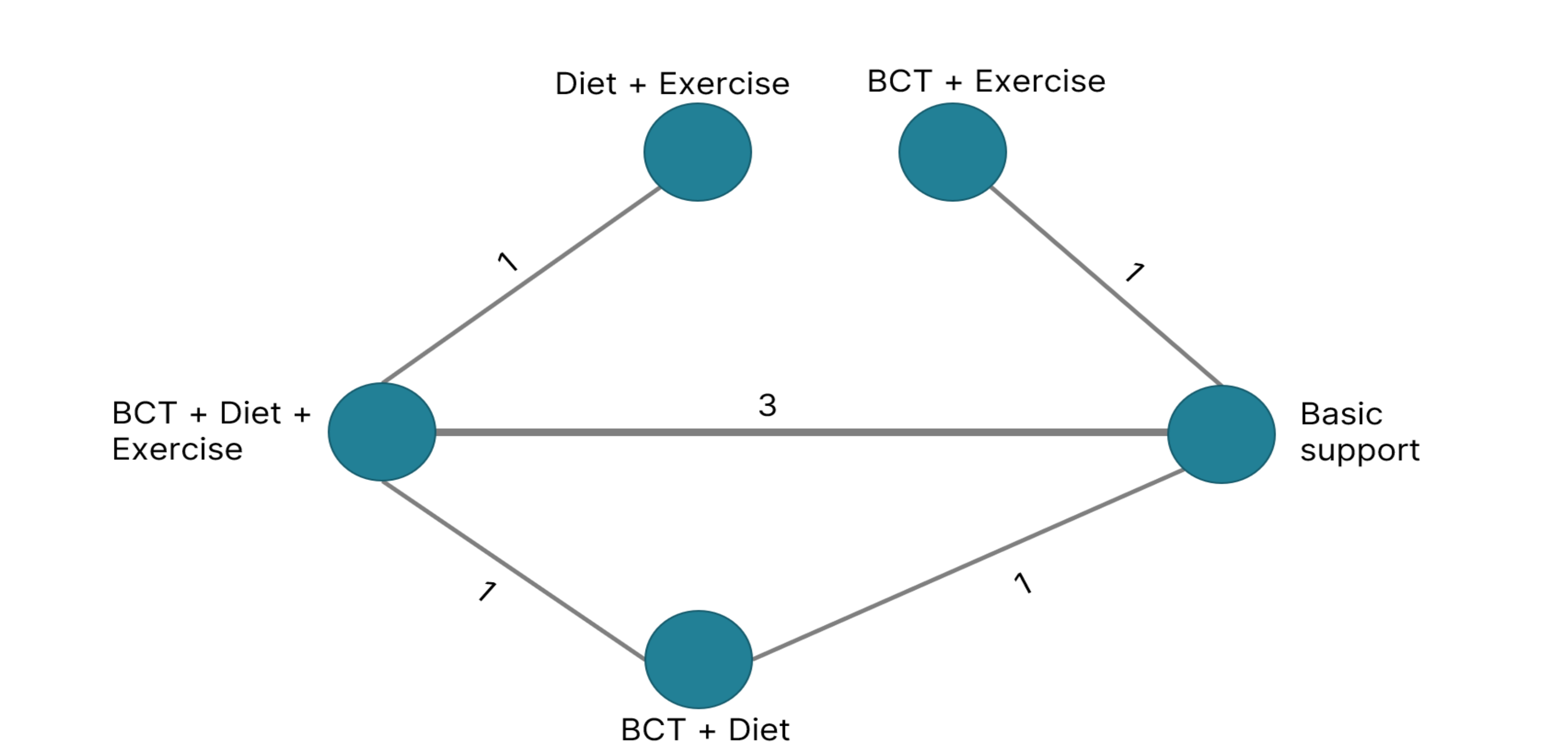


Figure 3: Network diagram of studies underlying NMA for up to 6 years, 6–12 months follow-up. Thickness of line indicates number of studies included.

Intervention abbreviations used: ***Diet*** *= diet modification;* ***exercise*** *= exercise program;* ***BCT*** *= behaviour change techniques*

Table 34: Relative effectiveness of pairwise comparisons for up to 6 years, 6–12 months follow-up

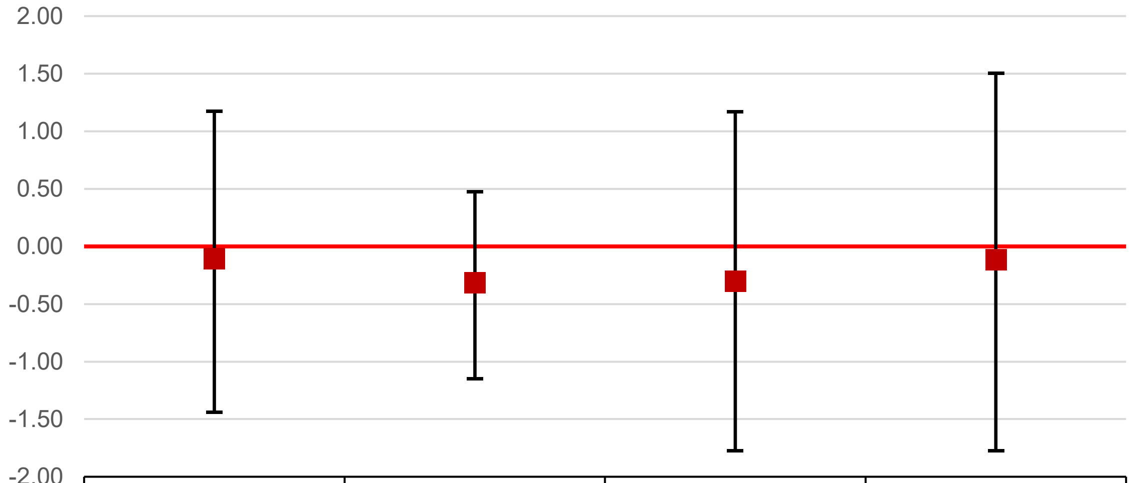
		Pairwise analysis				
NMA		**Basic Support**	**BCT+ Diet**	**BCT + Diet + Exercise**	**BCT + Exercise**	**Diet + Exercise**
	Basic Support		-0.01 (-0.16, 0.14)	0.30 (-0.01, 0.60)	**0.30 (0.04, 0.58)**	
	BCT+ Diet	-0.11 (-1.44, 1.18)			0.08 (-0.11, 0.27)	
	BCT + Diet + Exercise	-0.31(-1.15, 0.47)	-0.21 (-1.51, 1.11)			**-0.20 (-0.23, -0.17)**
	BCT + Exercise	0.30 (-1.77, 1.17)	-0.20 (2.15, 1.79)	0.01 (-1.63, 1.73)		
	Diet + Exercise	0.11 (-1.77, 1.51)	-0.01 (-1.96, 1.90)	0210 (-1.24, 1.64)	0.19 (-2.05, 2.37)	

The lower diagonal segment of the chart is derived from the network meta-analysis (NMA), reflecting direct and indirect evidence of treatment effects. The point estimate reflects the median of the posterior distribution, and numbers in parentheses are 95% credible intervals. Mean difference (MD) of less than 0 favours row defining treatment and indicates a beneficial effect of the intervention.

The upper diagonal segment of the chart gives pooled direct evidence (fixed-effect and randoms pairwise meta-analysis), where available. Numbers in parentheses are 95% confidence intervals. Mean difference (MD) of less than 0 favours row defining treatment. See Appendix E for the pair-wise meta-analysis forest plots.

Statistically significant results are in bold.

*Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise program; **BCT** = behaviour change techniques*



	BCT+ Diet	BCT+ Diet+ Exercise	BCT+ Exercise	Diet+ Exercise
MD	-0.11	-0.31	-0.30	-0.11
LCrI	-1.44	-1.15	-1.77	-1.77
UcrI	1.18	0.47	1.17	1.51

Figure 4: Caterpillar plot of relative effectiveness of all treatment options versus basic support for up to 6 years, 6–12 months follow-up (post-intervention). Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

*Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise program; **BCT** = behaviour change techniques*

≥ 12 months follow up (post intervention)

Standard NMA model

Table 35: Model fit statistics for under 6 years old (≥12 months follow up (post intervention))

	Residual Deviance [a]	DIC [b]	Posterior median of between-study standard deviation	LCrI [c]	UCrI [d]	Convergence	Chains
Fixed NMA	7.03	-32.00	-	-	-	10000	2
Random NMA	6.97	-32.12	2.48	0.12	4.87	10000	2
Unrelated mean effects (UME) (Fixed)	7.01	-32.04	-	-	-	10000	2

[a] Residual deviance - Total residual deviance compared to 7 data points.
[b] Deviance information criteria (DIC) – lower values preferred
[c] LCrI- Lower credible interval
[d] UCrI- Upper credible interval

Both fixed effects and random effects models were explored, with final model selection for each network based on the methods described in the Methods Chapter.

Goodness-of-fit measures for the candidate models are presented in Table 35. The following observations can be made:

- For ≥ 12 months follow up (post intervention), the DIC in the random effects model was lower than the fixed effects model, however this was not 3 points lower as highlighted in the Methods Chapter. However, the fixed effects model showed a closer fit to the data (with the total residual deviance closer to the number of data points) than the random effects model. However, as the model statistics between the fixed and random effects demonstrate slight differences and because the edges of the network were not informed by multiple studies (See figure 6), the simple fixed effects model was selected.

Inconsistency checks performed using the fixed effects model and the model fit statistics for both NMA and UME models are presented in table 25. Deviance contributions for the fixed effect NMA and UME models were plotted to identify studies contributing to inconsistency (See Figure 5). The were no meaningful differences of at least 3 or 5 points between the DIC and total residual deviance in the NMA and UME models.

***Component NMA:* Additive sub-component effect and main effect, with additive sub-component effects**

Due to the limited number of studies in this population, component NMA models for additive sub-component effect and main effect with additive sub-component effects were not conducted, and results were limited to the standard NMA model.

Meta-regression: Covariate analysis

Due to the limited number of studies in this population, covariate analysis not conducted, and results were limited to the standard NMA model.

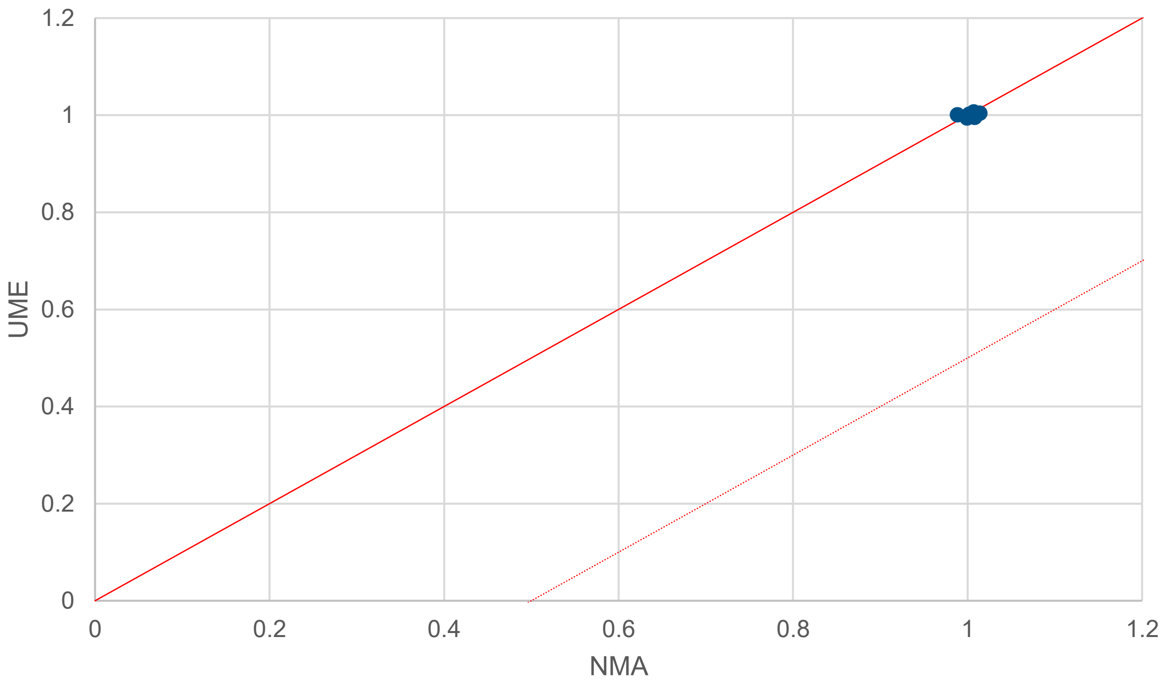


Figure 5: Deviance contributions for the fixed effect NMA and UME model for up to 6 years, ≥12 months follow-up (post intervention).

Results

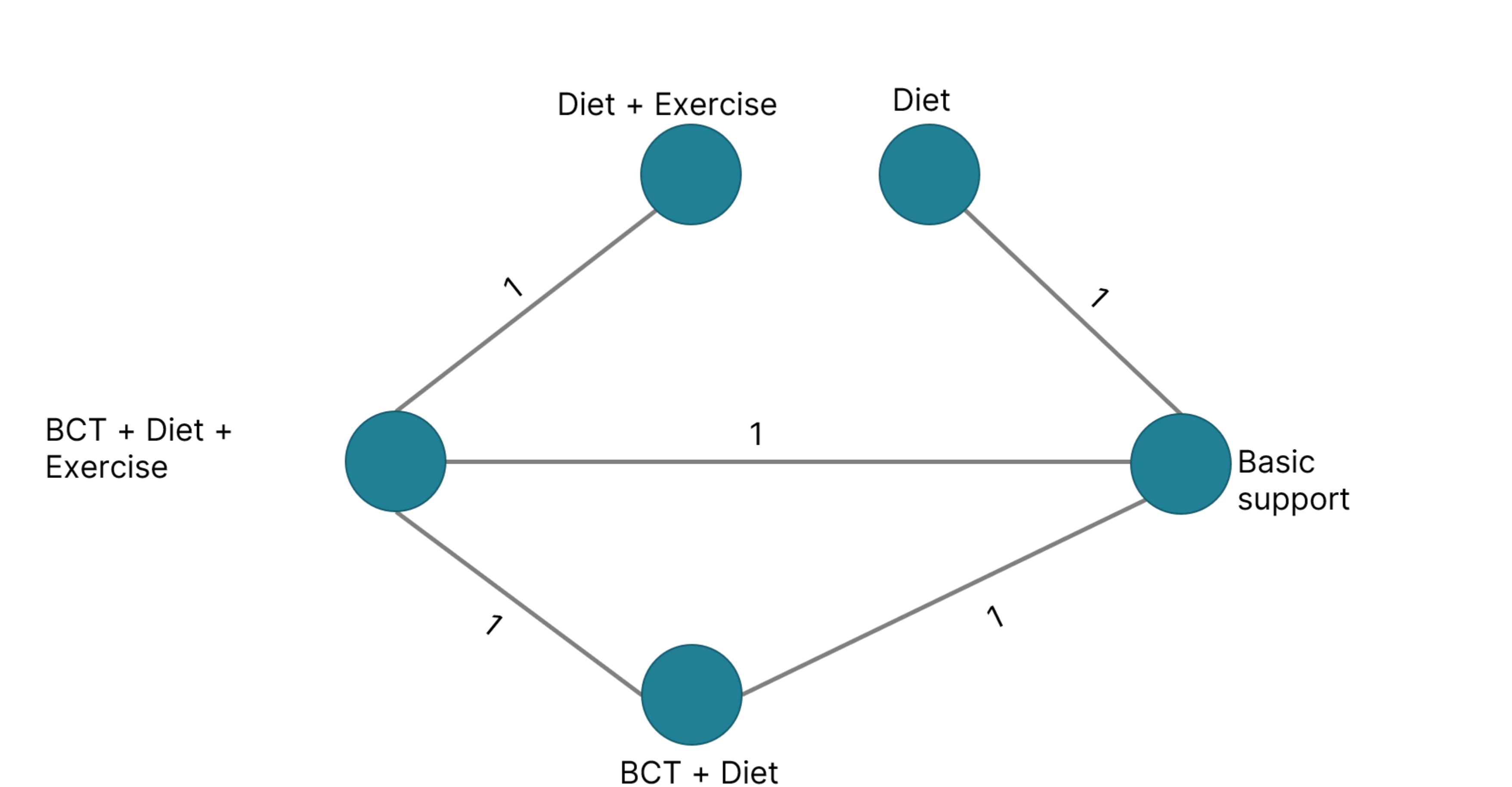


Figure 6: Network diagram of studies underlying NMA for up to 6 years, ≥12 months follow-up. Thickness of line indicates number of studies included.

Intervention abbreviations used: ***Diet*** *= diet modification;* ***exercise*** *= exercise program;* ***BCT*** *= behaviour change techniques*

Table 36: Relative effectiveness of pairwise comparisons for up to 6 years, ≥ 12 months follow-up

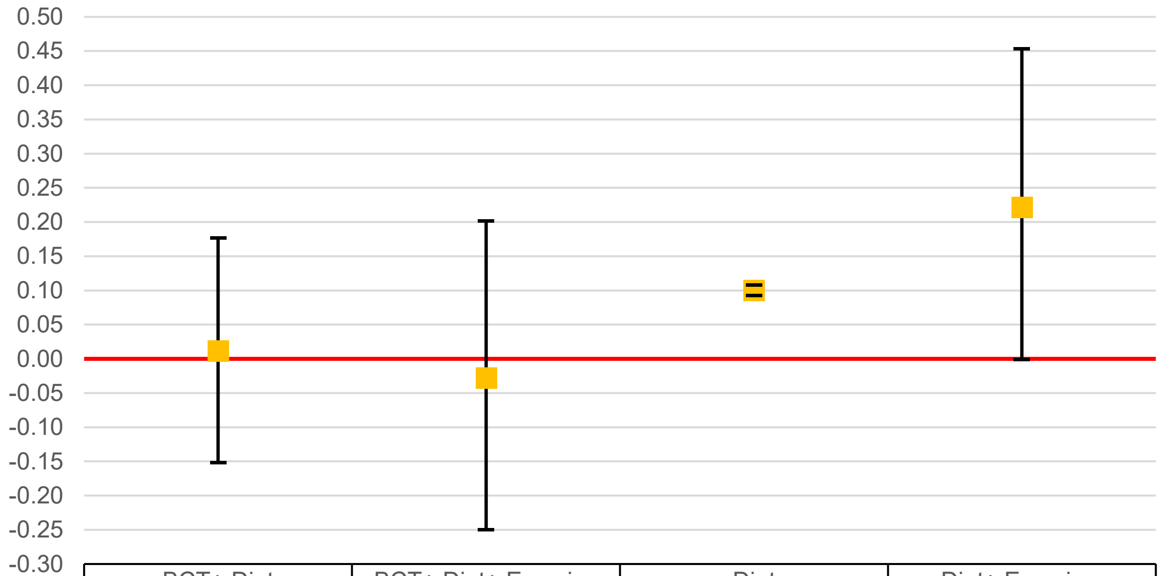
		Pairwise analysis				
NMA		**Basic Support**	**BCT+ Diet**	**BCT + Diet + Exercise**	**Diet**	**Diet + Exercise**
	Basic Support		-0.01 (-0.17, 0.15)	0.03 (-0.19, 0.25)	**-0.10 (-0.11, -0.09)**	
	BCT+ Diet	-0.01 (-0.15, 0.18)		0.04 (-0.17, 0.25)		
	BCT + Diet + Exercise	-0.03(-0.25, 0.20)	-0.04 (-0.25, 0.17)			**-0.25 (-0.28, -0.22)**
	Diet	**0.10 (0.09, 0.11)**	0.09 (-0.08, 0.25)	0.13 (-0.10, 0.35)		
	Diet + Exercise	**0.22 (0.00, 0.45)**	**0.21 (0.00, 0.42)**	**0.25 (0.22, 0.28)**	0.12 (-0.10, 0.35)	

The lower diagonal segment of the chart is derived from the network meta-analysis (NMA), reflecting direct and indirect evidence of treatment effects. The point estimate reflects the median of the posterior distribution, and numbers in parentheses are 95% credible intervals. Mean difference (MD) of less than 0 favours row defining treatment and indicates a beneficial effect of the intervention.

The upper diagonal segment of the chart gives pooled direct evidence (fixed-effect and randoms pairwise meta-analysis), where available. Numbers in parentheses are 95% confidence intervals. Mean difference (MD) of less than 0 favours row defining treatment. See appendix E for the pair-wise meta-analysis forest plots.

Significant results are in bold.

Intervention abbreviations used: ***Diet*** *= diet modification;* ***exercise*** *= exercise program;* ***BCT*** *= behaviour change techniques*



	BCT+ Diet	BCT+ Diet+ Exercise	Diet	Diet+ Exercise
MD	0.01	-0.03	0.10	0.22
LCrI	-0.15	-0.25	0.09	0.00
UcrI	0.18	0.20	0.11	0.45

Figure 7: Caterpillar plot of relative effectiveness of all treatment options versus basic support for up to 6 years, ≥12 months follow-up (post-intervention). Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

*Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise program; **BCT** = behaviour change techniques*

6-11 year olds

Overall, 27 trials were identified which reported change in BMI z-score or provided information for change in BMI z-score to be calculated. Trials were identified which reported data at multiple timepoints which were grouped into 6-12 months and ≥12 months follow up (post intervention). Studies included in the analyses are highlighted in Table 37 and 38.

These trials also utilised a number of different behaviour change techniques which are highlighted in Table 39. Further information on the covariates is also presented in Table 40.

Table 37: Studies included in up to 6–11 years, 6–12 months post intervention follow-up analysis.

Study	Arm 1	Arm 2	Arm 3
Bryant 2011	Basic support	BCT + Exercise	NA
McCallum 2007	Basic support	BCT	NA
Epstein 2000	Basic support	BCT + Diet	BCT + Diet
Kirk 2012	Basic support	BCT + Diet + Exercise	NA
Mirza 2013	Basic support	BCT + Diet + Exercise	NA
Lochrie 2013	Basic support	BCT	NA
Nowicka 2009	Basic support	Diet + Exercise	NA
Gunnarsdottir 2011	Basic support	BCT + Diet	NA
Boutelle 2011	BCT + Diet	BCT + Diet	NA
Golley 2007	Basic support	BCT	BCT + Exercise
Estabrooks 2009	Basic support	BCT	BCT
Okely/Collins 2011	BCT + Diet	BCT + Exercise	BCT + Diet + Exercise
Janicke 2008	Basic support	BCT + Diet + Exercise	BCT + Diet + Exercise
Magarey 2012	BCT + Exercise	BCT + Exercise	NA
Fedele 2013	Basic support	BCT + Exercise	NA
Gerards 2015	Basic support	BCT	NA
Robertson 2016	Basic support	BCT + Exercise	NA
Spence 2022	Basic support	BCT	NA

See Appendix E for pairwise meta-analysis.
Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

Table 38: Studies included in up to 6–11 years, ≥12 months post intervention follow-up analysis

Study	Arm 1	Arm 2	Arm 3
McCallum 2007	Basic support	BCT	NA
Epstein 2000	Basic support	BCT + Diet	BCT + Diet
Davoli 2013	Basic support	BCT	NA
Epstein 2005	BCT + Diet	BCT + Diet	NA
Kalavainen 2007	Basic support	BCT + Exercise	NA
Mirza 2013	Basic support	BCT + Diet + Exercise	NA
Saelens 2013	BCT + Diet	BCT + Diet	NA
Warschburger 2016	BCT + Diet	BCT + Diet + Exercise	NA
Okely/Collins 2011	BCT + Diet	BCT + Exercise	BCT + Diet + Exercise
Magarey 2012	BCT + Exercise	BCT + Exercise	NA
Wild 2020	Basic support	BCT + Exercise	NA
Bohlin 2017	Basic support	BCT	NA
Njardvik 2018	BCT + Diet	BCT	NA
Yackobovitch-Gavan 2017	Basic support	BCT	BCT

See Appendix E for pairwise meta-analysis.
Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

Table 39: Behavioural components of included studies for 6–11 years

Study	Intervention[1]	Motivation	GOALS and planning	Review and rewards	Improving and monitoring	Teach strategies	Facilitating change
Bryant 2011	BCT + Exercise	✓	✓				✓
McCallum 2007	BCT		✓			✓	
Epstein 2000	BCT + Diet		✓	✓	✓		✓
	BCT + Diet		✓	✓	✓	✓	✓
Davoli 2013	BCT	✓	✓	✓			
Epstein 2005	BCT + Diet		✓	✓	✓		✓
	BCT + Diet		✓	✓	✓	✓	✓
Kalavainen 2007	BCT + Exercise		✓			✓	
Kirk 2012	BCT + Diet + Exercise		✓	✓	✓	✓	
Mirza 2013	BCT + Diet + Exercise		✓	✓	✓	✓	✓
Saelens 2013	BCT + Diet		✓	✓	✓	✓	✓
	BCT + Diet	✓	✓		✓	✓	✓
Warschburger 2016	BCT + Diet + Exercise		✓	✓	✓	✓	✓
	BCT + Diet		✓	✓		✓	
Lochrie 2013	BCT		✓		✓	✓	✓
Gunnarsdottir 2011	BCT + Diet		✓	✓	✓		✓
Boutelle 2011	BCT + Diet		✓	✓	✓		✓
	BCT + Diet		✓	✓	✓		
Golley 2007	BCT + Exercise				✓		✓
	BCT				✓		✓
Estabrooks 2009	BCT		✓		✓		✓
	BCT		✓	✓	✓		✓

Study	Intervention[1]	Motivation	GOALS and planning	Review and rewards	Improving and monitoring	Teach strategies	Facilitating change
Okely/Collins 2011	BCT + Diet + Exercise		✓	✓	✓		
	BCT + Exercise		✓	✓			
	BCT + Diet		✓	✓	✓		
Janicke 2008	BCT + Diet + Exercise		✓	✓	✓	✓	
	BCT + Diet + Exercise		✓		✓	✓	
Magarey 2012	BCT + Exercise				✓	✓	✓
	BCT + Exercise				✓		✓
Wild 2021	BCT + Exercise					✓	✓
Bohlin 2017	BCT		✓		✓	✓	✓
Fedele 2013	BCT + Exercise	✓	✓	✓	✓	✓	✓
Gerards 2015	BCT		✓		✓	✓	
Njardvik 2018	BCT + Diet		✓	✓	✓	✓	✓
	BCT		✓	✓	✓		✓
Robertson 2016	BCT + Exercise					✓	✓
Spence 2022	BCT	✓	✓		✓	✓	✓
Yackobovitch-Gavan 2017	BCT	✓	✓		✓	✓	✓
	BCT	✓	✓		✓	✓	✓
1 Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques							

Table 40: Other variables of included studies for 6–11 years

Study	Intervention[1]	Target		Delivery		Setting		Contact		
		Parent is target	Child is target	Group	Individual	Face-to-face	Remote	Less than weekly	Weekly	Intensive
Bryant 2011	BCT + Exercise	✓	✓	✓	✓	✓			✓	
McCallum 2007	BCT	✓	✓		✓	✓		✓		
Epstein 2000	BCT + Diet	✓	✓	✓	✓	✓		✓		
	BCT + Diet	✓	✓	✓	✓	✓		✓		
Davoli 2013	BCT	✓	✓		✓	✓		✓		
Epstein 2005	BCT + Diet	✓	✓		✓	✓		✓		
	BCT + Diet	✓	✓		✓	✓		✓		
Kalavainen 2007	BCT + Exercise	✓	✓	✓	✓	✓		✓		
Kirk 2012	BCT + Diet + Exercise		✓	✓	✓	✓			✓	
Mirza 2013	BCT + Diet + Exercise	✓	✓	✓	✓	✓			✓	
Saelens 2013	BCT + Diet	✓	✓	✓	✓	✓			✓	
	BCT + Diet	✓	✓	✓	✓	✓			✓	
Warschburger 2016	BCT + Diet + Exercise	✓	✓	✓		✓				✓
	BCT + Diet		✓	✓		✓				✓
Lochrie 2013	BCT		✓	✓		✓		✓		
Nowicka 2009	Diet + Exercise		✓	✓		✓				✓
Gunnarsdottir 2011	BCT + Diet	✓	✓	✓	✓	✓			✓	
Boutelle 2011	BCT + Diet	✓		✓		✓			✓	
	BCT + Diet	✓	✓	✓		✓			✓	
Golley 2007	BCT + Exercise	✓		✓	✓	✓	✓	✓		
	BCT	✓	✓	✓	✓	✓	✓	✓		

Study	Intervention[1]	Target		Delivery		Setting		Contact		
		Parent is target	Child is target	Group	Individual	Face-to-face	Remote	Less than weekly	Weekly	Intensive
Estabrooks 2009	BCT	✓		✓		✓			✓	
	BCT	✓		✓	✓	✓	✓		✓	
Okely/Collins 2011	BCT + Diet + Exercise	✓		✓		✓	✓	✓		
	BCT + Exercise		✓	✓		✓	✓	✓		
	BCT + Diet	✓	✓	✓		✓	✓	✓		
Janicke 2008	BCT + Diet + Exercise	✓	✓	✓		✓		✓		
	BCT + Diet + Exercise	✓		✓		✓		✓		
Magarey 2012	BCT + Exercise	✓		✓	✓	✓	✓	✓		
	BCT + Exercise	✓		✓	✓	✓	✓	✓		
Wild 2021	BCT + Exercise	✓	✓	✓		✓			✓	
Bohlin 2017	BCT	✓			✓		✓	✓		
Fedele 2013	BCT + Exercise	✓	✓	✓	✓	✓			✓	
Gerards 2015	BCT	✓		✓	✓	✓	✓		✓	
Njardvik 2018	BCT + Diet	✓	✓	✓		✓			✓	
	BCT	✓	✓	✓		✓			✓	
Robertson 2016	BCT + Exercise	✓	✓	✓		✓			✓	
Spence 2022	BCT	✓		✓		✓			✓	
Yackobovitch-Gavan 2017	BCT	✓		✓		✓			✓	
	BCT	✓	✓	✓		✓			✓	

[1] Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

Model selection

6- 12 months follow up (post intervention)

Standard NMA model

Both fixed effects and random effects models were explored, with final model selection for each network based on the methods described in the Methods Chapter.

Goodness-of-fit measures for the candidate models are presented in Table 41. The following observations can be made:

- For 6–12 months follow-up (post intervention), the random effects model was more than 5 points lower than the fixed effects model. The random effects model also showed a closer fit to the data (with total residual deviance closer to the number of data points) than the fixed effects model. The between-study SD was to be moderately high, suggesting that the random effects models would be the more appropriate model.

- Additionally, the total residual deviance showed a better fit with the random effects model, as it was closer to the total number of datapoints than the fixed effects model.

Inconsistency checks were performed using the random effects model fit statistics of both the NMA and UME models are presented in Table 41. Deviance contributions for the random effect NMA and UME models were plotted to identify studies contributing to inconsistency (See Figure 8). The were no meaningful differences of at least 3 or 5 points between the DIC and total residual deviance in the NMA and UME models. Additionally, there was no meaningful difference in the between- study SDs in the NMA and UME models.

Furthermore, points where the deviance was greater than 2 in the NMA and reduced in the UME model were investigated for their contribution to inconsistency. There were no points notably below the line of equality in the deviance contribution plot for the 6–12 months follow up (post intervention).

Component NMA: Additive sub-component effect and main effect with additive sub-component effects

Random-effect component NMA models examining additive sub-component effect and main effect with sub-component effects, were explored. The model statistics for these models are presented in Table 41. Both models demonstrated similar fit to the standard NMA model.

Meta-regression: Covariate analysis

Covariate analysis was explored using a random-effect NMA approach. However, these models did not show better fit compared to the standard or component models. Based on this finding, it was deemed inappropriate to conduct covariate analysis. The model fit statistics are presented Table 41.

Table 41: Model fit statistics for 6- 11 years old (6-12 months follow up (post intervention))

	Residual Deviance [a]	DIC [b]	Posterior median of between-study standard deviation	LCrI [c]	UCrI [d]	Convergence	Chains
Fixed NMA	114.80	-18.12	-	-	-	20000	2
Random NMA	40.65	-85.25	0.07	0.03	0.13	20000	2
Unrelated mean effects (UME) (Random)	42.18	-82.45	0.06	0.02	0.13	20000	2
Random NMA - Component Model: Additive sub-component	41.98	-81.55	0.07	0.02	0.15	20000	2
Random NMA- Component Model: Main effect with additive sub-component effects	42.31	-80.31	0.07	0.02	0.17	20000	2
Random NMA - Covariate: Target	41.31	-83.45	0.06	0.03	0.14	20000	2
Random NMA - Covariate: Setting	40.83	-83.46	0.07	0.03	0.15	20000	2
Random NMA - Covariate: Delivery	40.89	-84.29	0.07	0.02	0.14	20000	2
Random NMA- Covariate: Frequency	40.89	-84.29	0.07	0.02	0.14	20000	2

[a] Residual deviance - Total residual deviance compared to 41 data points.
[b] Deviance information criteria (DIC) – lower values preferred
[c] LCrI- Lower credible interval
[d] UCrI- Upper credible interval

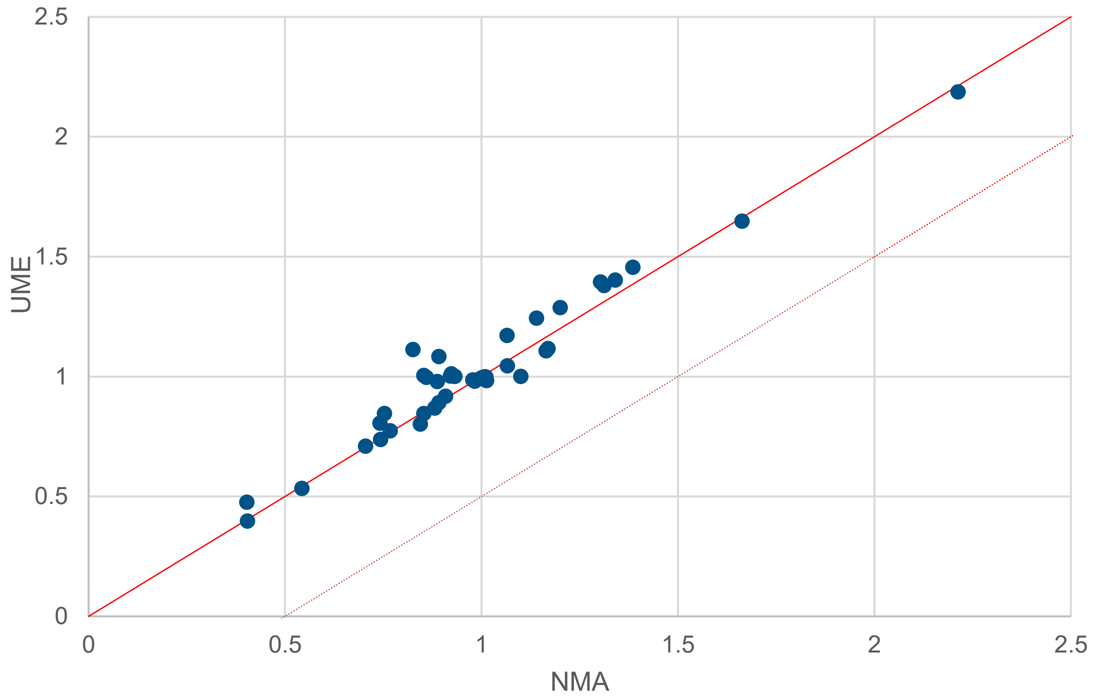


Figure 8: Deviance contributions for the random effect NMA and UME model for 6–11 years, 6–12 months follow-up (post-intervention).

Results

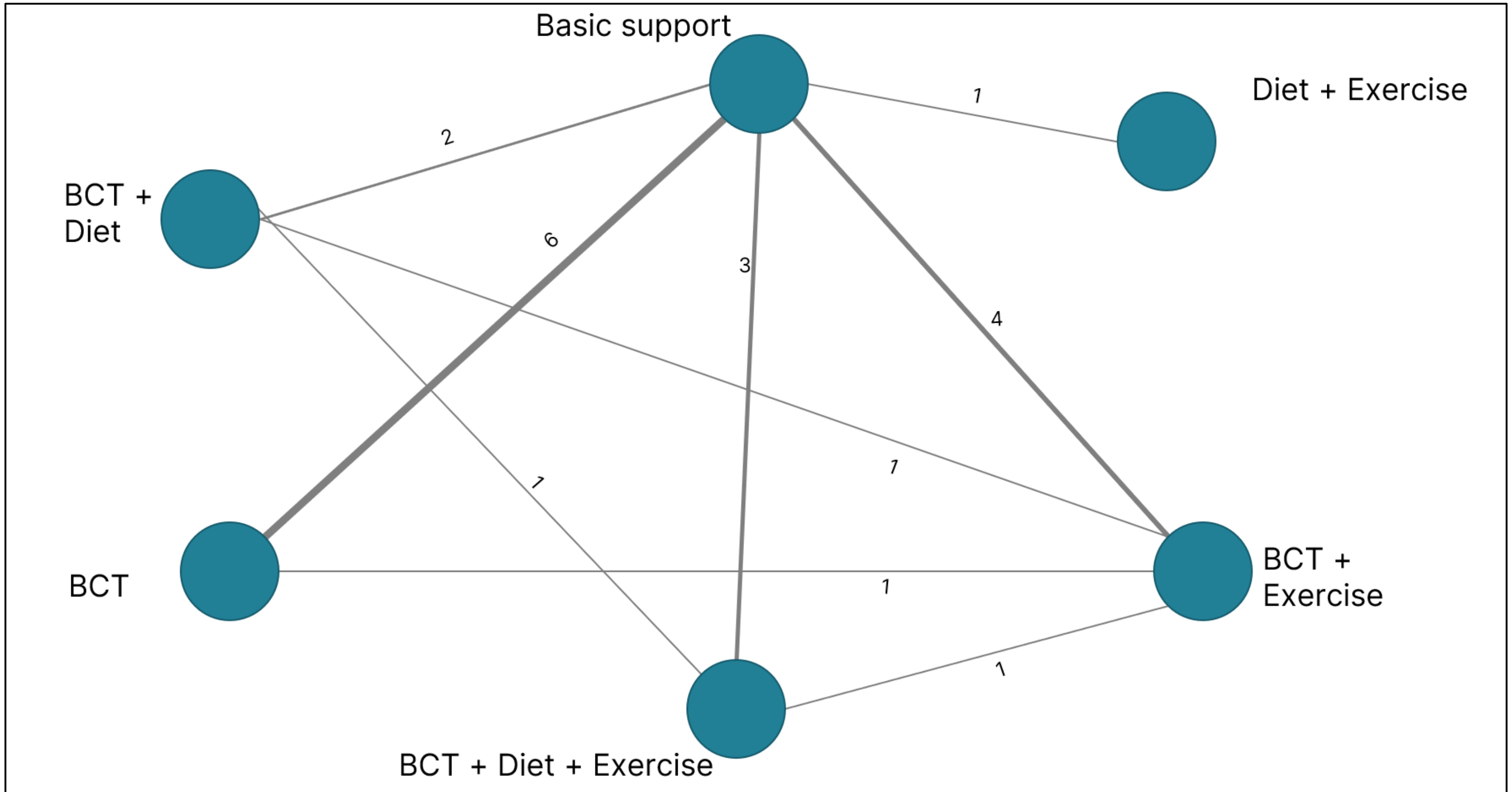


Figure 9: Network diagram of studies underlying NMA for 6–11 years, 6–12 months follow-up. Thickness of line indicates number of studies included.

*Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise programme; **BCT** = behaviour change techniques*

Table 42: Relative effectiveness of pairwise comparisons for 6–11 years, 6–12 months follow-up

		Pairwise analysis					
NMA		**Basic Support**	**BCT+ Diet**	**BCT + Diet + Exercise**	**BCT + Exercise**	**BCT**	**Diet + Exercise**
	Basic Support		0.15 (-0.20, 0.50)	**0.09 (0.02, 0.16)**	-0.01 (-0.09,0.08)	-0.00 (-0.05, 0.04)	0.03 (-0.13, 0.19)
	BCT+ Diet	**-0.17 (-0.35, 0.00)**		-0.07 (-0.22, 0.08)	**-0.22 (-0.38, -0.06)**		
	BCT + Diet + Exercise	-0.09 (-0.19, 0.01)	0.08 (-0.09, 0.26)		**-0.15 (-0.30, -0.00)**		
	BCT + Exercise	0.01 (-0.09, 0.11)	0.19 (0.01, 0.36)	0.11 (-0.02, 0.23)		-0.09 (-0.32, 0.14)	
	BCT	0.01 (-0.06, 0.08)	**0.18 (0.00, 0.37)**	0.10 (-0.02, 0.22)	0.00 (-0.12, 0.12)		
	Diet + Exercise	-0.03 (-0.24, 0.18)	0.15 (-0.13, 0.42)	0.06 (-0.17, 0.29)	-0.04 (-0.28, 0.19)	-0.04 (-0.27, 0.18)	

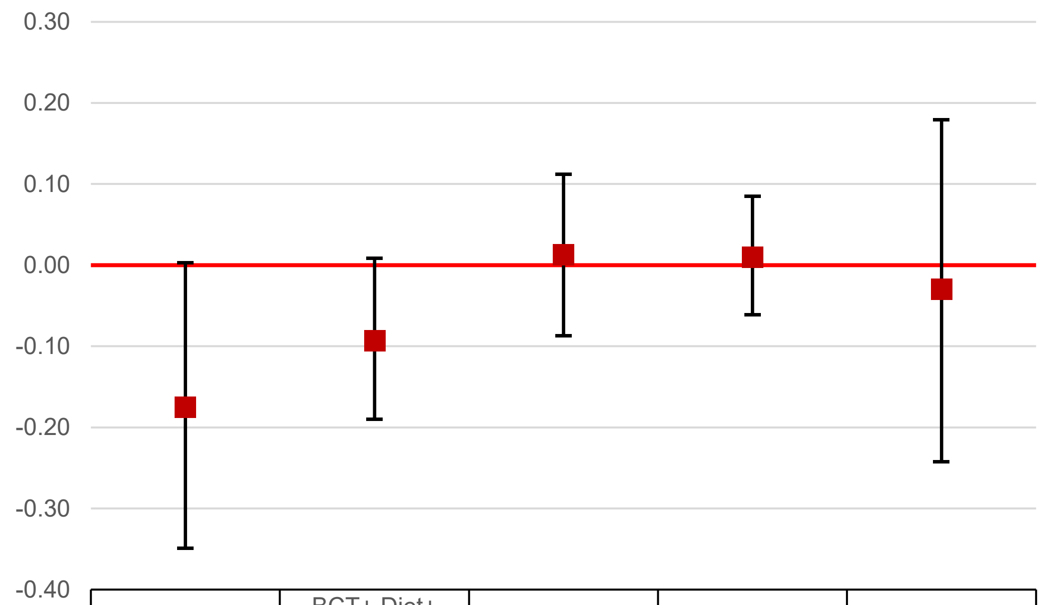
The lower diagonal segment of the chart is derived from the network meta-analysis (NMA), reflecting direct and indirect evidence of treatment effects. The selected model for computing treatment effect estimates was the random-effects standard NMA model. The point estimate reflects the median of the posterior distribution, and numbers in parentheses are 95% credible intervals. Mean difference (MD) of less than 0 favours row defining treatment and indicates a beneficial effect of the intervention.

The upper diagonal segment of the chart gives pooled direct evidence (fixed-effect and randoms pairwise meta-analysis), where available. Numbers in parentheses are 95% confidence intervals. Mean difference (MD) of less than 0 favours row defining treatment. See appendix E for the pair-wise meta-analysis forest plots.

Significant results are in bold.

Some studies compared the utilised the same component in both arms but used different approaches (for example, used different combinations of behaviour change techniques). As these studies examined the same comparison, these studies could not be displayed on the network diagram (figure 9) or be included in the upper diagonal segment of this chart. The mean differences from these studies are detailed below (See Appendix E for forest plots):

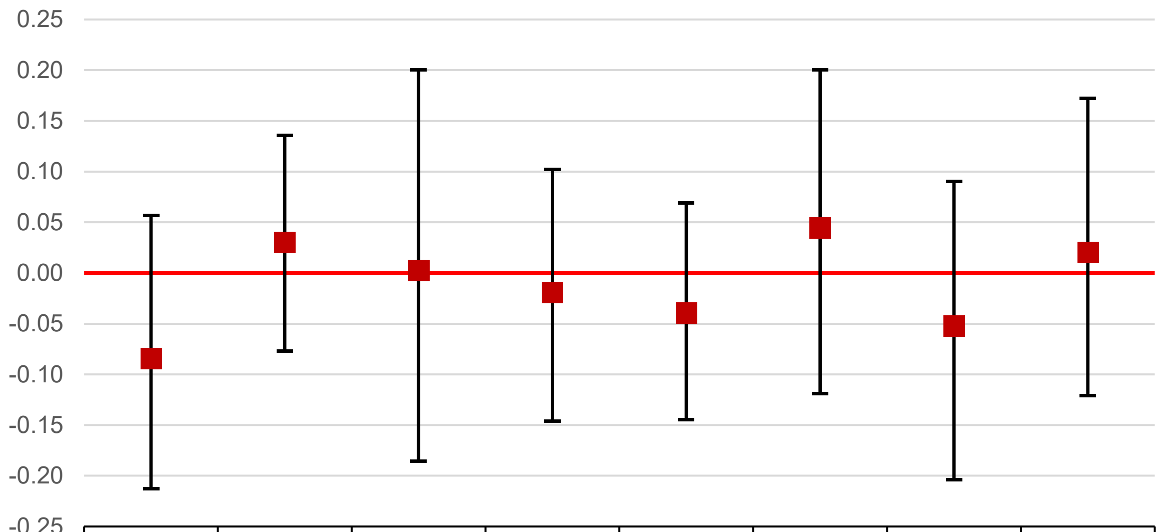
***Boutelle 2011; BCT + Diet vs BCT + Diet:** 0.00 (-0.28, 0.28)*
***Magarey 2012; BCT + Exercise vs BCT + Exercise:** -0.07 (-0.30, 0.16)*
*Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise program; **BCT** = behaviour change techniques*



	BCT+ Diet	BCT+ Diet+ Exercise	BC+ Exercise	BCT	Diet+ Exercise
Intervention MD	-0.17	-0.09	0.01	0.01	-0.03
Intervention LCrl	-0.35	-0.19	-0.09	-0.06	-0.24
Intervention Ucrl	0.00	0.01	0.11	0.08	0.18

Figure 10: Standard NMA Model - Caterpillar plot of relative effectiveness of all treatment options versus basic support for 6–11 years, 6–12 months follow-up. Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

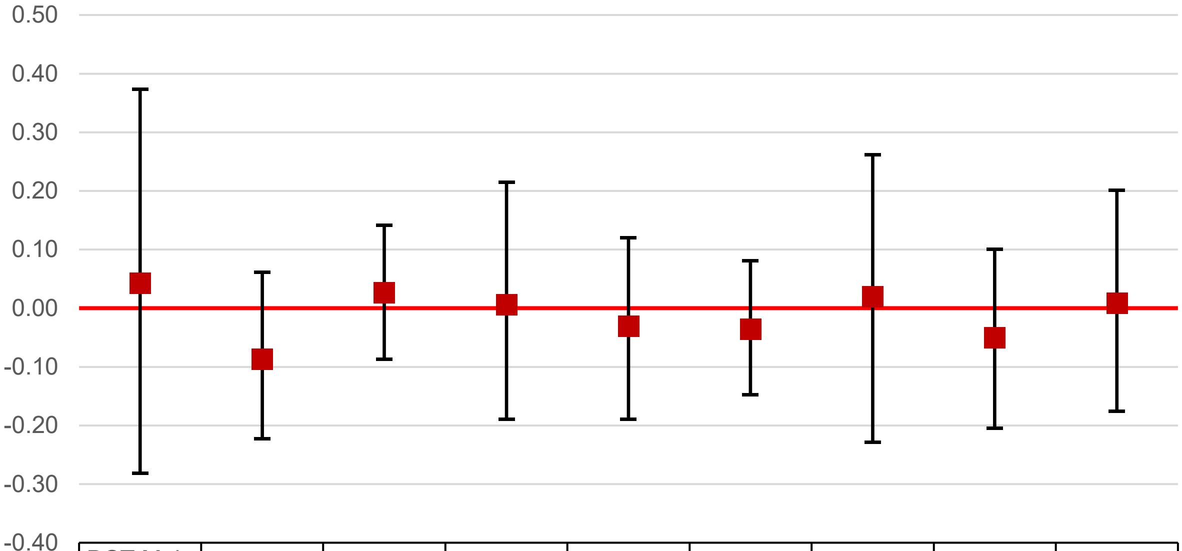
*Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise programme; **BCT** = behaviour change technique, **LCrI=** lower credible interval, **UCrI**= Upper credible interval*



	Diet	Exercise	Motiv.	Facilit.	Reward	Goals	Monitor	Teach
MD	-0.08	0.03	0.00	-0.02	-0.04	0.04	-0.05	0.02
LCrl	-0.21	-0.08	-0.19	-0.15	-0.14	-0.12	-0.20	-0.12
Ucrl	0.06	0.14	0.20	0.10	0.07	0.20	0.09	0.17

Figure 11: Component NMA: Additive sub-component effect- Caterpillar plot of relative effectiveness of all treatment options versus basic support for 6–11 years, 6–12 months follow-up (post-intervention). Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

Diet *= diet modification;* ***exercise*** *= exercise programme,* ***LCrI=*** *lower credible interval,* ***UCrI****= Upper credible interval*



	BCT Main Effect	Diet	Exercise	Motiv.	Facilit.	Reward	Goals	Monitor	Teach
MD	0.04	-0.09	0.03	0.01	-0.03	-0.04	0.02	-0.05	0.01
LCrl	-0.28	-0.22	-0.09	-0.19	-0.19	-0.15	-0.23	-0.21	-0.18
Ucrl	0.37	0.06	0.14	0.21	0.12	0.08	0.26	0.10	0.20

Figure 12: Component NMA: main effect, with additive sub-component effects - Caterpillar plot of relative effectiveness of all treatment options versus basic support for 6–11 years, 6–12 months follow-up. Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

***Diet** = diet modification; **exercise** = exercise programme; **BCT** = behaviour change techniques, **LCrI=** lower credible interval, **UCrI**= Upper credible interval*

≥12 months follow up (post intervention)

Standard NMA model

Both fixed effects and random effects models were explored, with final model selection for each network based on the methods described in the Methods Chapter.

Goodness-of-fit measures for the candidate models are presented in Table 43. The following observations can be made:

- For ≥12 months follow up (post intervention), the DIC in the fixed effects model was lower than the random effects model, however this was not 3 points lower as highlighted in the Methods Chapter.

- The random effects model also showed a closer fit to the data (with total residual deviance closer to the number of data points) than the fixed effects model. However, there was not enough evidence to estimate the between-study heterogeneity. It was assumed that the level of heterogeneity between the 6-12 months data and the ≥12 months data would be similar. Based on this assumption the between-study SD from the 6-12 months data was used to inform the between-study SD for 12 months data. This is presented in Table 43. The random effects model utilising informative priors demonstrated better fit compared to the fixed effects model. Furthermore, the between-study SD was to be moderately high, suggesting that the random effects models utilising the informative prior would be the more appropriate model.

Inconsistency checks were performed using the random effects (informative prior) model fit statistics of both the NMA and UME models are presented in Table 43. Additionally, deviance contributions for the random effect NMA and UME models were plotted to identify studies contributing to inconsistency. Points where the deviance was greater than 2 in the NMA and reduced in the UME model were investigated for their contribution to inconsistency.

For change in BMI z-score at ≥12 months follow-up, the DIC and residual deviance for the random effect UME model were lower than that of the NMA model. Figure 13 also showed that points [2,1], [2,3], [13,1] and [13,2] demonstrated a deviance greater than 1. The first two points corresponded to the study Epstein 2000, with the latter two corresponding to Njardvik 2018.

Epstein 2000 was a 3 arm trial that compared the two interventions, both containing dietary and behavioural components, to basic support. In one intervention, the behavioural component (problem solving) was delivered to both parents and children, whereas the second intervention only delivered the behavioural component to children. The arm that delivered to both parents and children was significantly less effective at reducing BMI z-score than the other intervention and basic support. The authors suggested that by increasing the program requirements beyond the standard treatment may cause families to reallocate time they would have used for learning new eating and exercise habits to problem solving.

Njardvik 2018 was a 2 arm trial that compared a diet modification and behavioural change intervention to a concomitant behavioural change intervention. The behavioural change intervention was significantly less effective than the diet modification and behavioural change intervention. The behavioural component of both interventions was based on the Traffic Light Diet, which has previously featured in multiple publications by Epstein et al., including Epstein 2000. As stated above, Epstein 2000 includes two interventions containing dietary and behavioural components.

Furthermore, the remaining studies within the network that compared behavioural change interventions to basic support (Davoli 2013, Bohlin 2017, McCullum 2007 and Yackobovitch-Gavan 2017) were not based on the Traffic Light Diet. Davoli 2013 used paediatrician-led motivational interviews; Bohlin 2017 used telephone coaching; McCullum 2007 used the Live, Eat and Play (LEAP) intervention; Yackobovitch-Gavan 2017 cognitive behavioural changes in the family lifestyle.

Table 43: Model fit statistics for 6- 11 years old ≥12 months follow up (post intervention)

	Residual Deviance [a]	DIC [b]	Posterior median of between-study standard deviation	LCrI [c]	UCrI [d]	Convergence	Chains
Fixed NMA	33.93	-56.45	-	-	-	20000	2
Random NMA (vague prior)	32.95	-54.84	0.0	0.00	0.13	20000	2
Random NMA (Informative prior)	32.56	-54.64	0.05	0.03	0.09	20000	2
Unrelated effects (Random: Informative prior)	27.40	-57.30	0.05	0.03	0.09	20000	2
Random NMA - Component Model: Additive sub-component	34.03	-49.98	0.06	0.03	0.11	20000	2
Random NMA- Component Model: Main effect with additive sub-component effects	33.57	-49.77	0.06	0.03	0.11	20000	2
Random NMA - Covariate: Target	32.41	-54.13	0.03	0.00	0.13	20000	2
Random NMA - Covariate: Setting	32.90	-52.67	0.05	0.03	0.10	20000	2
Random NMA - Covariate: Delivery	33.14	-53.25	0.05	0.03	0.10	20000	2
Random NMA- Covariate: Frequency	33.12	-53.29	0.05	0.03	0.10	20000	2

[a] *Residual deviance - Total residual deviance compared to 31 data points.*
[b] *Deviance information criteria (DIC) – lower values preferred*
[c] *LCrI- Lower credible interval*
[d] *UCrI- Upper credible interval*

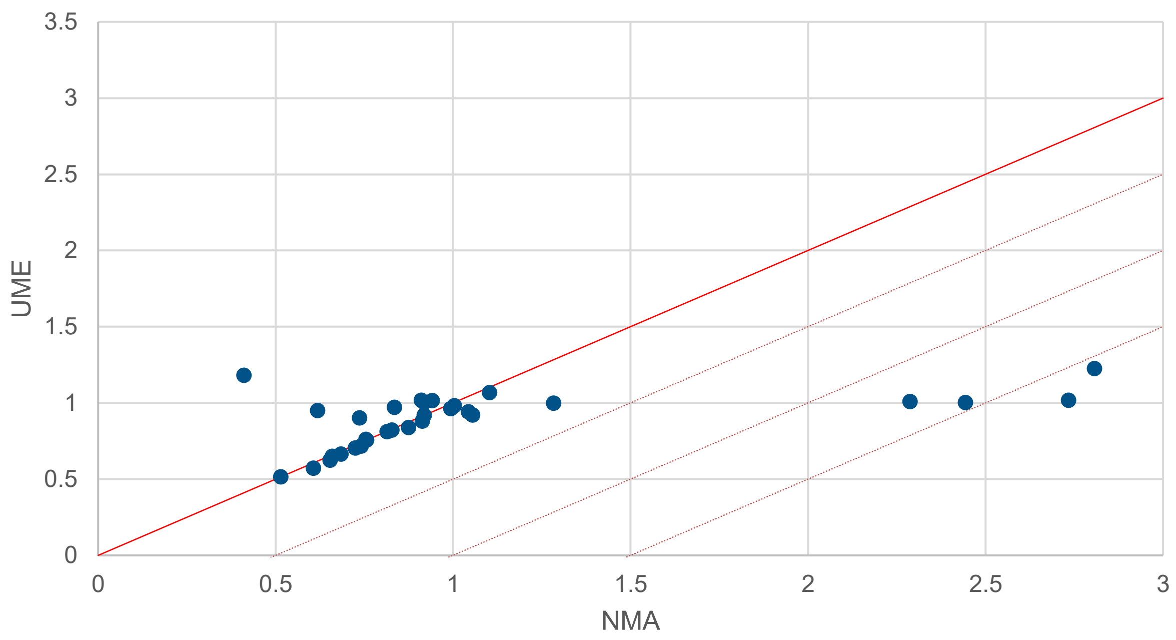


Figure 13: Deviance contributions for the random effect NMA and UME model for 6–11 years, ≥12 months follow-up (post-intervention). Four points can be seen in the lower right-hand side of the plot, demonstrating inconsistency. These points corresponded to the following studies:

- *Epstein 2000 – 3 arm trial*
- *Njardvik 2018 – 2 arm trial*

Inconsistency demonstrated by these studies has been explored.

Results

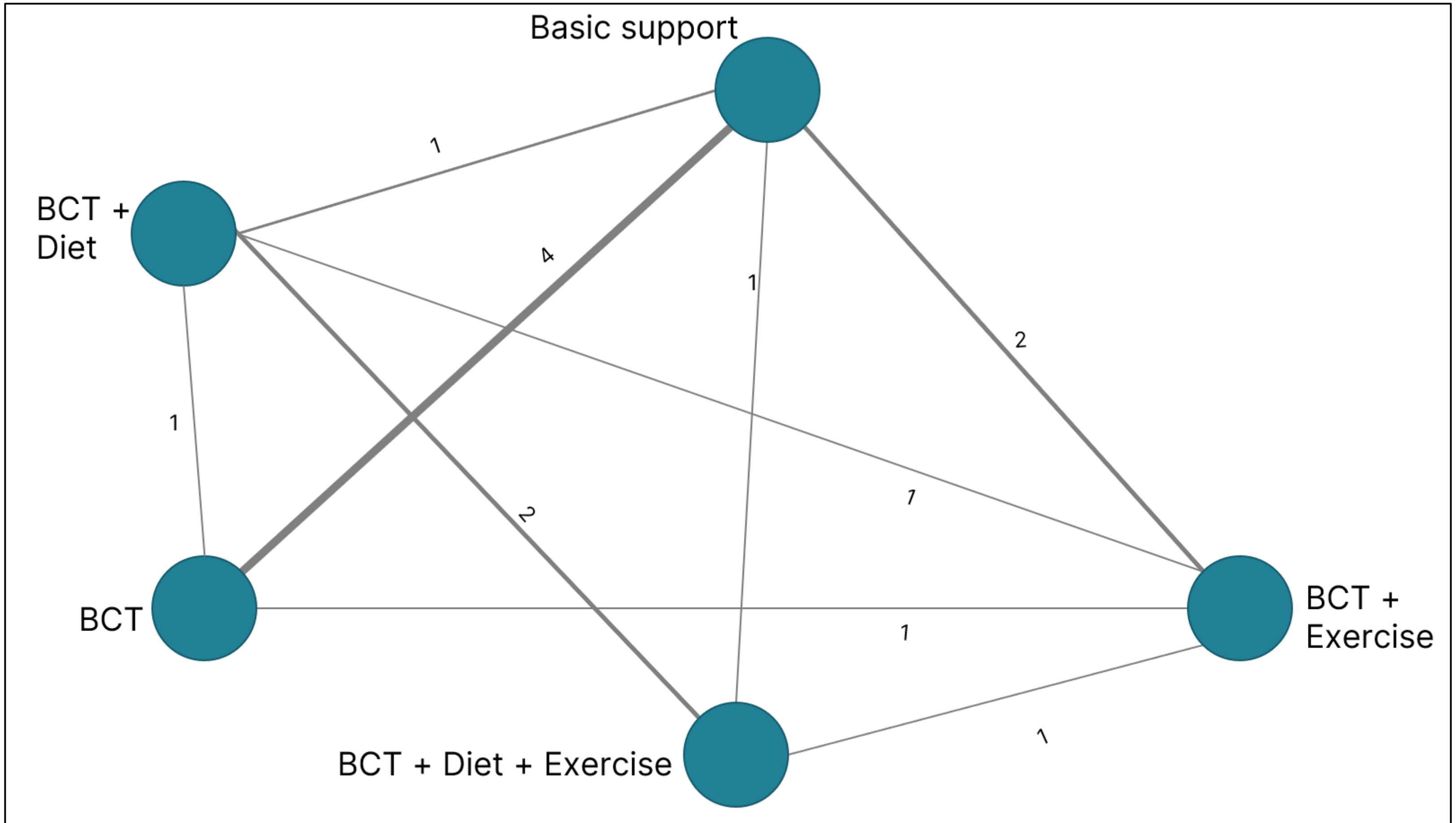


Figure 14: Network diagram of studies underlying NMA for 6–11 years, ≥12 months follow-up. Thickness of line indicates number of studies included.

Intervention abbreviations used: ***Diet*** *= diet modification;* ***exercise*** *= exercise program;* ***BCT*** *= behaviour change techniques*

Table 44: Relative effectiveness of pairwise comparisons for 6–11 years, ≥12 months follow-up

	Pairwise analysis					
NMA		**Basic Support**	**BCT+ Diet**	**BCT + Diet + Exercise**	**BC + Exercise**	**BCT**
	Basic Support		-0.38 (-0.92, 0.16)	0.07 (-0.03, 0.17)	-0.08 (-0.26, 0.10)	0.02 (-0.05, 0.08)
	BCT+ Diet	-0.13 (-0.27, 0.02)		-0.04 (-0.10, 0.03)	-0.16 (-0.33, 0.01)	**-0.49 (-0.82, -0.16)**
	BCT + Diet + Exercise	-0.07 (-0.19, 0.05)	0.05 (-0.05, 0.16)		-0.05 (-0.21, 0.11)	
	BCT + Exercise	0.04 (-0.11, 0.18)	**0.16 (0.01, 0.32)**	0.11 (-0.04, 0.25)		
	BCT	0.00 (-0.08, 0.09)	0.13 (-0.03, 0.29)	0.08 (-0.07, 0.22)	-0.03 (-0.20, 0.14)	

The lower diagonal segment of the chart is derived from the network meta-analysis (NMA), reflecting direct and indirect evidence of treatment effects. The selected model for computing treatment effect estimates was the random-effects standard NMA model. The point estimate reflects the median of the posterior distribution, and numbers in parentheses are 95% credible intervals. Mean difference (MD) of less than 0 favours row defining treatment and indicates a beneficial effect of the intervention.

The upper diagonal segment of the chart gives pooled direct evidence (fixed-effect and randoms pairwise meta-analysis), where available. Numbers in parentheses are 95% confidence intervals. Mean difference (MD) of less than 0 favours row defining treatment. See appendix E for the pair-wise meta-analysis forest plots.

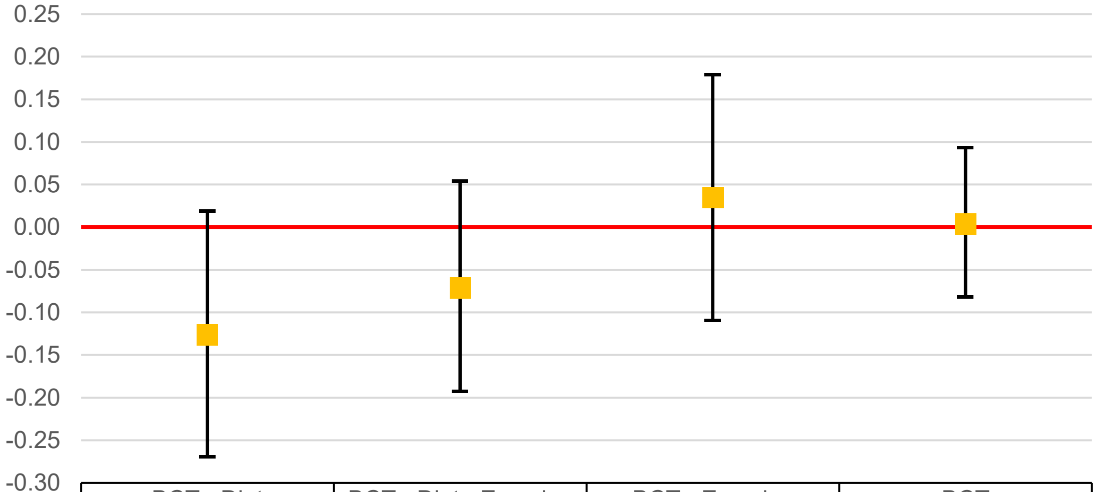
Significant results are in bold.

Some studies compared the utilised the same component in both arms but used different approaches (for example, used different combinations of behaviour change techniques). As these studies examined the same comparison, these studies could not be displayed on the network diagram (figure 14) or be included in the upper diagonal segment of this chart. The mean difference from these studies are detailed below (See Appendix E for forest plots):

***Magarey 2012**; BCT + Exercise vs BCT + Exercise: 0.03 (-0.24, 0.30)*

***Epstein 2005+ Saelens 2013**; BCT + Diet vs BCT + Diet: -0.02 (-0.12, 0.09)*

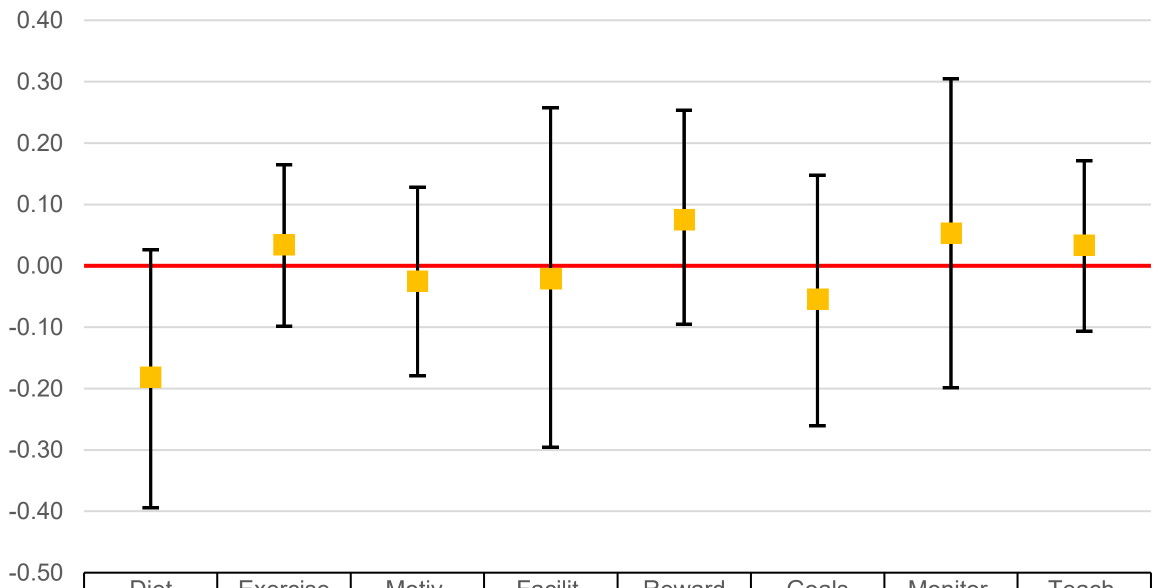
*Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise programme; **BCT** = behaviour change techniques*



	BCT+ Diet	BCT+ Diet+ Exercise	BCT+ Exercise	BCT
MD	-0.13	-0.07	0.04	0.00
LCrl	-0.27	-0.19	-0.11	-0.08
Ucrl	0.02	0.05	0.18	0.09

Figure 15: Standard NMA- Caterpillar plot of relative effectiveness of all treatment options versus basic support for 6–11 years, ≥12 months follow-up. Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

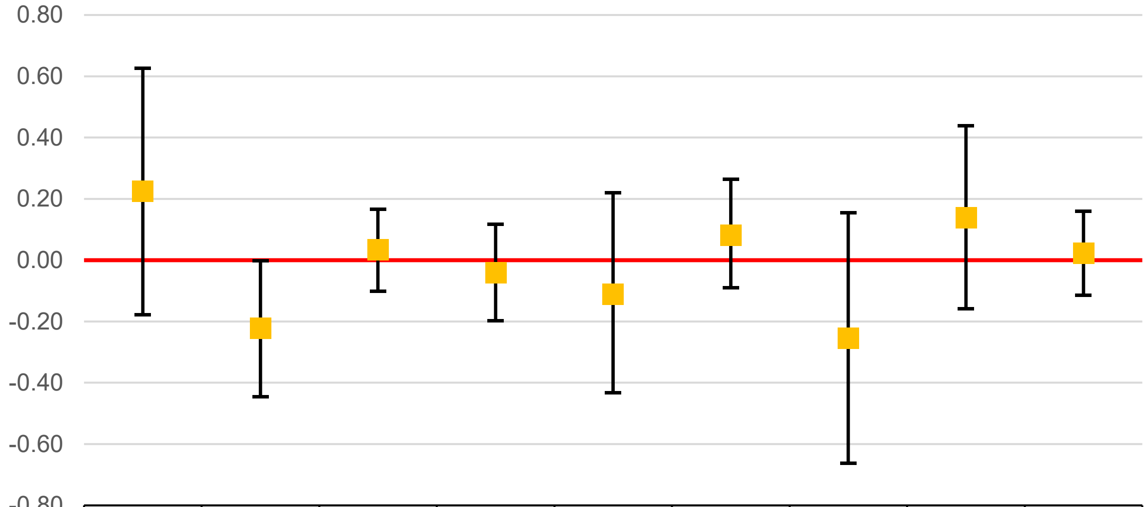
Intervention abbreviations used: Diet = diet modification; exercise = exercise programme; BCT = behaviour change techniques, ***LCrl=*** *lower credible interval,* ***UCrl****= Upper credible interval*



	Diet	Exercise	Motiv.	Facilit.	Reward	Goals	Monitor	Teach
MD	-0.18	0.03	-0.03	-0.02	0.08	-0.05	0.05	0.03
LCrI	-0.39	-0.10	-0.18	-0.30	-0.10	-0.26	-0.20	-0.11
UcrI	0.03	0.16	0.13	0.26	0.25	0.15	0.30	0.17

Figure 16: Component NMA: Additive sub-component effect- - Caterpillar plot of relative effectiveness of all treatment options versus basic support for 6–11 years, ≥12 months follow-up. Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

***Diet** = diet modification; **exercise** = exercise programme, **LCrI=** lower credible interval, **UCrI**= Upper credible interval*



	BCT Main Effect	Diet	Exercise	Motiv.	Facilit.	Reward	Goals	Monitor	Teach
MD	0.23	-0.22	0.03	-0.04	-0.11	0.08	-0.25	0.14	0.02
LCrI	-0.18	-0.45	-0.10	-0.20	-0.43	-0.09	-0.66	-0.16	-0.11
Ucrl	0.63	0.00	0.17	0.12	0.22	0.26	0.15	0.44	0.16

Figure 17: Component NMA: main effect, with additive sub-component effects - Caterpillar plot of relative effectiveness of all treatment options versus basic support for 6–11 years, ≥12 months follow-up. Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

Diet *= diet modification;* ***exercise*** *= exercise programme;* ***BCT*** *= behaviour change techniques,* ***LCrI=*** *lower credible interval,* ***UCrI****= Upper credible interval*

12-18 year olds

Overall, 5 trials were identified which reported change in BMI z-score or provided information for change in BMI z-score to be calculated. Trials were identified which reported data at multiple timepoints which were grouped into 6-12 months follow up (post intervention). Only one study (Savoye 2011) included outcome data at ≥12 months follow up (post intervention). Therefore, an NMA could not be conducted for ≥12 months follow up (post intervention).

Studies included in the analyses are highlighted in Table 45.

These trials also utilised a number of different behaviour change techniques which are highlighted in Table 46. Further information on the covariates is also presented in Table 47. These tables include information on Savoye 2011, but this study was not included in the standard NMA .

Table 45: Studies included in up to 12–18 years, 6–12 months follow-up analysis

Study	Arm 1	Arm 2	Arm 3	Arm 4
DeBar 2012	Basic support	BCT + Diet + Exercise	NA	NA
Vos 2011	Basic support	BCT	NA	NA
Hofsteenge 2014	Basic support	BCT	NA	NA
Ford 2010	BCT	BCT + Diet	NA	NA
Arlinghaus2019	Basic support	BCT + Exercise	BCT + Exercise	BCT + Exercise
Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise programme; **BCT** = behaviour change techniques				

Table 46: Behavioural components of included studies for 12–18 year olds

Study	Intervention[1]	Motivation	GOALS and planning	Review and rewards	Improving and monitoring	Teach strategies	Facilitating change
DeBar 2012	BCT + Diet + Exercise	✓	✓	✓	✓	✓	✓
Vos 2011	BCT + Diet	✓				✓	✓
Hofsteenge 2014	BCT	✓	✓			✓	✓
Ford 2010	BCT + Diet				✓	✓	
	BCT	✓	✓				
Arlinghaus 2019	BCT + Exercise		✓	✓	✓		
	BCT + Exercise		✓	✓	✓		
	BCT + Exercise		✓	✓	✓		
Savoye 2011[2]	BCT + Exercise		✓		✓	✓	✓

[1] Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise programme; **BCT** = behaviour change techniques

[2] Study included to show the full evidence base for this age group. This study was not included in the NMA model as it was the only study reporting outcome at ≥ 12 months post intervention.

Table 47: Other variables of included studies for 12–18 year olds

Study	Intervention[1]	Target		Delivery		Setting		Contact		
		Parent is target	Child is target	Group	Individual	Face-to-face	Remote	Less than weekly	Weekly	Intensive
DeBar 2012	BCT + Diet + Exercise	✓	✓	✓	✓	✓		✓		
Vos 2011	BCT + Diet	✓	✓	✓		✓		✓		
Hofsteenge 2014	BCT	✓	✓	✓		✓		✓		
Ford 2010	BCT + Diet		✓		✓	✓	✓	✓		
	BCT	✓	✓		✓	✓		✓		
Arlinghaus 2019	BCT + Exercise	✓	✓	✓		✓			✓	
	BCT + Exercise	✓	✓	✓		✓				✓
	BCT + Exercise	✓	✓	✓		✓				✓
Savoye 2011[2]	BCT + Exercise	✓	✓	✓		✓			✓	

[1] Intervention abbreviations used: Diet = diet modification; exercise = exercise program; BCT = behaviour change techniques

[2] Study included to show the full evidence base for this age group. This study was not included in the NMA model as it was the only study reporting outcome at ≥ 12 months post intervention.

Model selection

6- 12 months follow up (post intervention)

Standard NMA model

Table 48: Model fit statistics for under 12-18 years old (6-12 months follow up (post intervention))

	Residual Deviance [a]	DIC [b]	Posterior median of between-study standard deviation	LCrI [c]	UCrI [d]	Convergence	Chains
Fixed NMA	22.52	-15.67	-	-	-	10000	2
Random NMA	11.83	-23.87	0.15	0.04	0.89	10000	2
Unrelated mean effects (Random)	11.85	-23.88	0.11	0.03	0.77	10000	2

[a] *Residual deviance - Total residual deviance compared to 12 data points.*
[b] *Deviance information criteria (DIC) – lower values preferred*
[c] *LCrI- Lower credible interval*
[d] *UCrI- Upper credible interval*

Both fixed effects and random effects models were explored, with final model selection for each network based on the methods described in the Methods Chapter.

Goodness-of-fit measures for the candidate models are presented in Table 48. The following observations can be made:

- For 6–12 months follow-up, the DIC in the random effects model was more than 5 points lower than the fixed effects model. Additionally, the total residual deviance showed a better fit with the random effects model, as it was closer to the total number of datapoints than the fixed effects model.

Inconsistency checks were performed using the random effects model the model fit statistics of both the consistency and inconsistency models are presented in Table 48. Additionally, deviance contributions for the random effect consistency and inconsistency models were plotted to identify studies contributing to inconsistency. Points on either model with a deviance of greater than 1 were considered as contributing to inconsistency. The were no meaningful differences of at least 3 or 5 points between the DIC and total residual deviance in the consistency and inconsistency models. Furthermore, there were no points notably below the line of equality in the deviance contribution plots for 6–12 months follow-up.

Component NMA: Additive sub-component effect and main effect with additive sub-component effects

Due to the limited number of studies in this population, component NMA models for additive sub-component effect and main effect with additive sub-component effects were not conducted, and results were limited to the standard NMA model.

Meta-regression: Covariate analysis

Due to the limited number of studies in this population, covariate analysis not conducted, and results were limited to the standard NMA model.

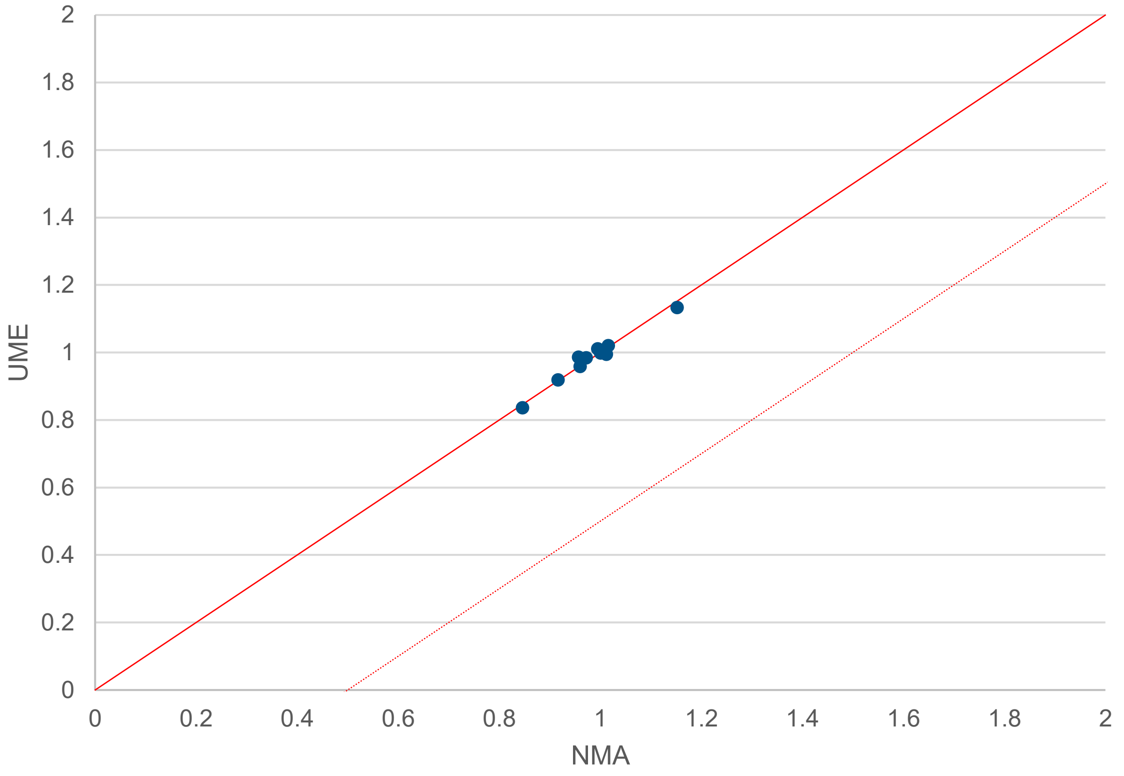


Figure 18: Deviance contributions for the random effect NMA and UME model for 12–18 years, 6–12 months follow-up (post-intervention).

Results

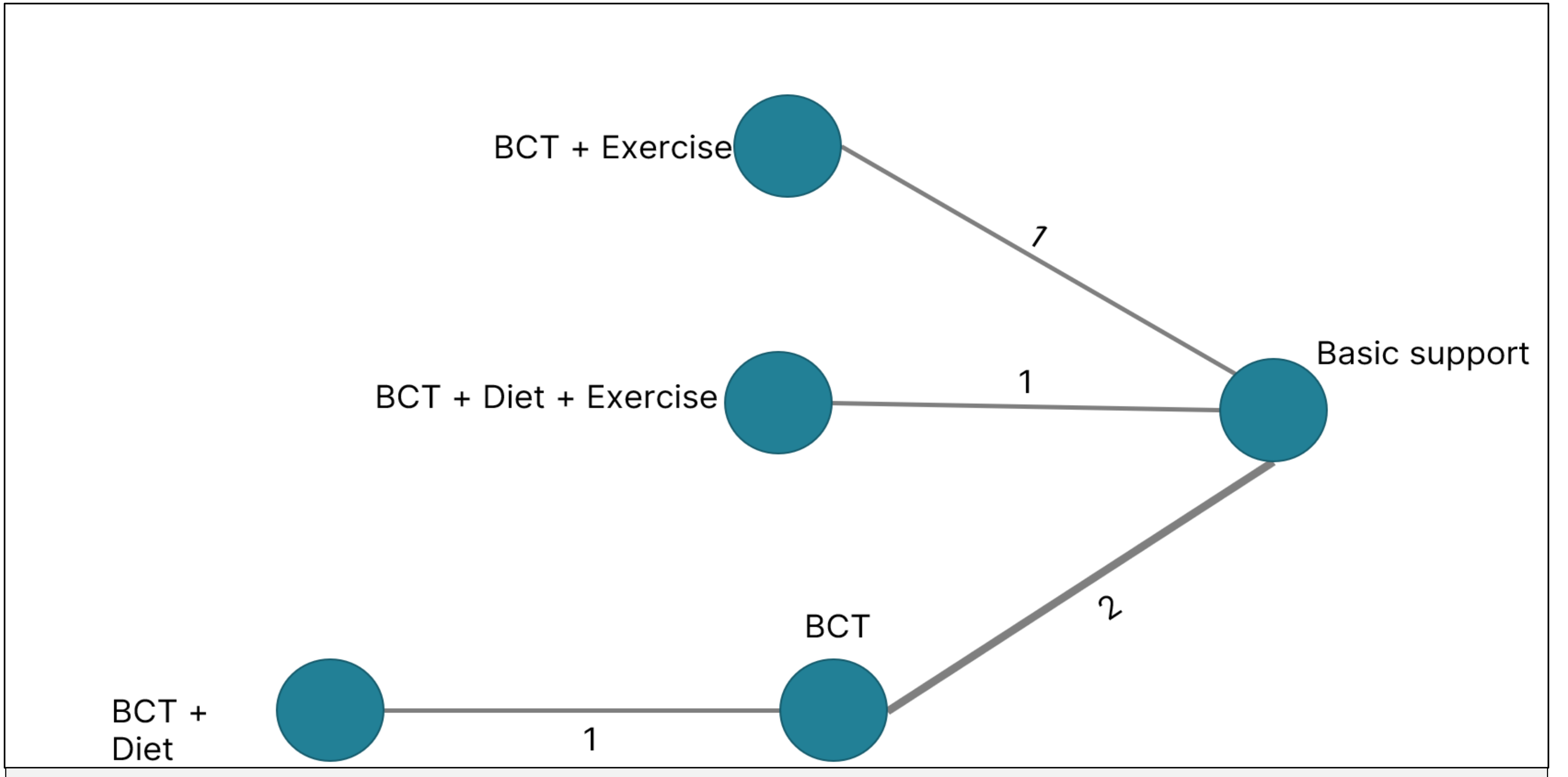


Figure 19: Network diagram of studies underlying NMA for 12–18 years, 6–12 months follow-up. Thickness of line indicates number of studies included. Intervention abbreviations used: ***Diet*** *= diet modification;* ***exercise*** *= exercise programme;* ***BCT*** *= behaviour change techniques.*

Table 49: Relative effectiveness of pairwise comparisons for 12–18 years, 6–12 months follow-up

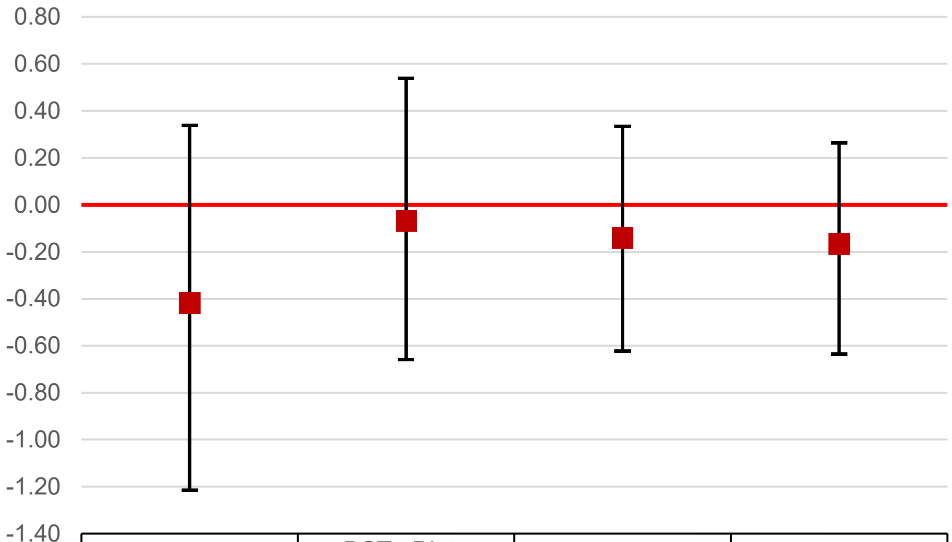
	Pairwise analysis					
NMA		**Basic Support**	**BCT+ Diet**	**BCT + Diet + Exercise**	**BCT + Exercise**	**BCT**
	Basic Support			0.07 (-0.03, 0.17)	**0.14 (0.06, 0.23)**	0.14 (-0.05, 0.33)
	BCT+ Diet	-0.42 (-1.22, 0.34)				**0.25 (-0.50, -0.00)**
	BCT + Diet + Exercise	-0.07 (-0.66, 0.54)	0.35 (-0.59, 1.35)			
	BCT + Exercise	-0.14 (-0.62, 0.33)	0.27 (-0.61, 1.20)	-0.07 (-0.84,0.69)		
	BCT	-0.17 (-0.64, 0.26)	0.25 (-0.38, 0.87)	-0.10 (-0.88, 0.62)	-0.22 (-0.71, 0.62)	

The lower diagonal segment of the chart is derived from the network meta-analysis (NMA), reflecting direct and indirect evidence of treatment effects. The point estimate reflects the median of the posterior distribution, and numbers in parentheses are 95% credible intervals. Mean difference (MD) of less than 0 favours row defining treatment and indicates a beneficial effect of the intervention.

The upper diagonal segment of the chart gives pooled direct evidence (fixed-effect and randoms pairwise meta-analysis), where available. Numbers in parentheses are 95% confidence intervals. Mean difference (MD) of less than 0 favours row defining treatment. See appendix E for the pair-wise meta-analysis forest plots.

Significant results are in bold.

*Intervention abbreviations used: **Diet** = diet modification; **exercise** = exercise program; **BCT** = behaviour change techniques*



	BCT+ Diet	BCT+ Diet+ Exercise	BC+ Exercise	BCT
Intervention MD	-0.42	-0.07	-0.14	-0.17
Intervention LCrI	-1.22	-0.66	-0.62	-0.64
Intervention UcrI	0.34	0.54	0.33	0.26

Figure 20: Caterpillar plot of relative effectiveness of all treatment options versus basic support for 12–18 years, 6–12 months follow-up. Values less than 0 indicate a beneficial effect of the intervention compared to basic support.

Intervention abbreviations used: ***Diet*** *= diet modification;* ***exercise*** *= exercise programme;* ***BCT*** *= behaviour change techniques,* ***LCrI=*** *lower credible interval,* ***UCrI****= Upper credible interval*

Winbugs code

Under 6 years old – 6-12 months follow up (post intervention)

Fixed effects model

```
#PROGRAM STARTS
model{
	for(i in 1:ns){
	mu[i] ~ dnorm(0,.0001) # vague priors for all trial baselines

# LOOP THROUGH ARMS
	for (k in 1:na[i]) {
	var[i,k] <- pow(se[i,k],2) # calculate variances
	prec[i,k] <- 1/var[i,k] # set precisions
y[i,k] ~ dnorm(theta[i,k],prec[i,k]) # normal likelihood
theta[i,k] <- mu[i] + d[t[i,k]] - d[t[i,1]] # model for linear predictor
dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k] #Deviance contribution
}

# summed residual deviance contribution for this trial
resdev[i] <- sum(dev[i,1:na[i]])
}

totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment
for (k in 2:nt){ d[k] ~ dnorm(0,.0001) } # vague priors for treatment effects



# all MDs for each comparison
for (c in 1:(nt-1)) {
```

```
        for (k in (c+1):nt) {
                smd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {           mymd[c,c] <- 0 }
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}

} # *** PROGRAM ENDS
```

Random effects model

```
model{
for(i in 1:ns){
 w[i,1] <- 0
 delta[i,1] <- 0
 mu[i] ~ dnorm(0,.0001)

 for (k in 1:na[i]) {
 var[i,k] <- pow(se[i,k],2)
 prec[i,k] <- 1/var[i,k]
 y[i,k] ~ dnorm(theta[i,k],prec[i,k])
 theta[i,k] <- mu[i] + delta[i,k]
 dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]
 }
```

```
resdev[i] <- sum(dev[i,1:na[i]])

for (k in 2:na[i]) {
 delta[i,k] ~ dnorm(md[i,k],taud[i,k])
 md[i,k] <- d[t[i,k]] - d[t[i,1]] + sw[i,k]
 taud[i,k] <- tau *2*(k-1)/k
 w[i,k] <- (delta[i,k] - d[t[i,k]] + d[t[i,1]])
 sw[i,k] <- sum(w[i,1:k-1])/(k-1)
 }
 }

totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment

for (k in 2:nt){
d[k] ~ dnorm(0,.0001)  # vague priors for treatment effects
}

sd ~ dunif(0,5) # vague prior for between-trial SD.
tau <- pow(sd,-2) # between-trial precision = (1/between-trial variance)
#}

# all MDs for each comparison
#for (c in 1:(nt-1)) {
#for (k in (c+1):nt) {
#mymd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {           mymd[c,c] <- 0 }
```

```
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}

}   # *** PROGRAM ENDS
```

Under 6 years old – ≥12 months follow up (post intervention)

Fixed effects model

```
# PROGRAM STARTS
model{
        for(i in 1:ns){
        mu[i] ~ dnorm(0,.0001) # vague priors for all trial baselines

# LOOP THROUGH ARMS
        for (k in 1:na[i]) {
        var[i,k] <- pow(se[i,k],2) # calculate variances
        prec[i,k] <- 1/var[i,k] # set precisions
y[i,k] ~ dnorm(theta[i,k],prec[i,k]) # normal likelihood
theta[i,k] <- mu[i] + d[t[i,k]] - d[t[i,1]] # model for linear predictor
dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k] #Deviance contribution
}

# summed residual deviance contribution for this trial
resdev[i] <- sum(dev[i,1:na[i]])
}
```

```
totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment
for (k in 2:nt){ d[k] ~ dnorm(0,.0001) } # vague priors for treatment effects


# all MDs for each comparison
for (c in 1:(nt-1)) {
        for (k in (c+1):nt) {
                smd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {          mymd[c,c] <- 0 }
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}

} # *** PROGRAM ENDS
```

Random effects model

```
model{
for(i in 1:ns){
 w[i,1] <- 0
 delta[i,1] <- 0
 mu[i] ~ dnorm(0,.0001)
```

```
 for (k in 1:na[i]) {
 var[i,k] <- pow(se[i,k],2)
 prec[i,k] <- 1/var[i,k]
 y[i,k] ~ dnorm(theta[i,k],prec[i,k])
 theta[i,k] <- mu[i] + delta[i,k]
 dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]
 }

resdev[i] <- sum(dev[i,1:na[i]])

for (k in 2:na[i]) {
 delta[i,k] ~ dnorm(md[i,k],taud[i,k])
 md[i,k] <- d[t[i,k]] - d[t[i,1]] + sw[i,k]
 taud[i,k] <- tau *2*(k-1)/k
 w[i,k] <- (delta[i,k] - d[t[i,k]] + d[t[i,1]])
 sw[i,k] <- sum(w[i,1:k-1])/(k-1)
 }
 }

totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment

for (k in 2:nt){
d[k] ~ dnorm(0,.0001)  # vague priors for treatment effects
}

sd ~ dunif(0,5) # vague prior for between-trial SD.
tau <- pow(sd,-2) # between-trial precision = (1/between-trial variance)
```

```
#}

# all MDs for each comparison
#for (c in 1:(nt-1)) {
#for (k in (c+1):nt) {
#mymd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {           mymd[c,c] <- 0 }
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}

}   # *** PROGRAM ENDS
```

Under 6 – 11 years old – 6-12 months follow up (post intervention)

Fixed effects model

```
# PROGRAM STARTS
model{
        for(i in 1:ns){
        mu[i] ~ dnorm(0,.0001) # vague priors for all trial baselines

# LOOP THROUGH ARMS
        for (k in 1:na[i]) {
        var[i,k] <- pow(se[i,k],2) # calculate variances
        prec[i,k] <- 1/var[i,k] # set precisions
```

```
y[i,k] ~ dnorm(theta[i,k],prec[i,k]) # normal likelihood
theta[i,k] <- mu[i] + d[t[i,k]] - d[t[i,1]] # model for linear predictor
dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k] #Deviance contribution
}

# summed residual deviance contribution for this trial
resdev[i] <- sum(dev[i,1:na[i]])
}

totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment
for (k in 2:nt){ d[k] ~ dnorm(0,.0001) } # vague priors for treatment effects



# all MDs for each comparison
for (c in 1:(nt-1)) {
        for (k in (c+1):nt) {
                smd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {          mymd[c,c] <- 0 }
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}
```

```
} # *** PROGRAM ENDS
```

Random effects model

```
model{
for(i in 1:ns){
 w[i,1] <- 0
 delta[i,1] <- 0
 mu[i] ~ dnorm(0,.0001)

 for (k in 1:na[i]) {
 var[i,k] <- pow(se[i,k],2)
 prec[i,k] <- 1/var[i,k]
 y[i,k] ~ dnorm(theta[i,k],prec[i,k])
 theta[i,k] <- mu[i] + delta[i,k]
 dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]
 }

resdev[i] <- sum(dev[i,1:na[i]])

for (k in 2:na[i]) {
 delta[i,k] ~ dnorm(md[i,k],taud[i,k])
 md[i,k] <- d[t[i,k]] - d[t[i,1]] + sw[i,k]
 taud[i,k] <- tau *2*(k-1)/k
 w[i,k] <- (delta[i,k] - d[t[i,k]] + d[t[i,1]])
 sw[i,k] <- sum(w[i,1:k-1])/(k-1)
 }
 }

totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment
```

```
for (k in 2:nt){
d[k] ~ dnorm(0,.0001)  # vague priors for treatment effects
}

sd ~ dunif(0,5) # vague prior for between-trial SD.
tau <- pow(sd,-2) # between-trial precision = (1/between-trial variance)
#}

# all MDs for each comparison
#for (c in 1:(nt-1)) {
#for (k in (c+1):nt) {
#mymd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {          mymd[c,c] <- 0 }
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}

}   # *** PROGRAM ENDS
```

Component NMA: Additive sub-component effect (Random-effects model)

```
model{
        for(i in 1:ns){                         # LOOP THROUGH STUDIES
                w[i,1] <- 0                                     # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                 # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)          # vague priors for all trial baselines
```

```
            for(k in 1:na[i]){                                          # LOOP THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)           # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])              # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                  # model for linear predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

#Intervention component model
      dInt[i,k]<- d[1]*equals(t[i,k],1) +  d[2]*diet[i,k] + d[3]*ex[i,k] + d[4]*motiv[i,k] + d[5]*facilit[i,k] +
d[6]*reward[i,k] + d[7]*goals[i,k] + d[8]*monitor[i,k] + d[9]*teach[i,k]

                        }

# summed residual deviance contribution for this trial
            resdev[i] <- sum(dev[i,1:na[i]])

            for(k in 2:na[i]){                                          # LOOP THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- dInt[i,k] - dInt[i,1]  + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  (dInt[i,k] - dInt[i,1])

# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
      }
      }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
      for(k in 2:nt){
            d[k] ~ dnorm(0,.0001)
      }

# vague prior for between-trial SD
sd ~ dunif(0,5)

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)


#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
```

```
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]


}                    ## MODEL ENDS
```

Component NMA: Main effect with additive sub-component effect (Random-effects model)

```
model{
        for(i in 1:ns){                         # LOOP THROUGH STUDIES
                w[i,1] <- 0                                     # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                       # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)                # vague priors for all trial baselines

                for(k in 1:na[i]){                                                          # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)                # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])                 # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                             # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

#Intervention component model
        dInt[i,k]<- d[1]*equals(t[i,k],1) +  d[2]*(1-equals(t[i,k],1))*(1-equals(t[i,k],6)) + d[3]*diet[i,k] + d[4]*ex[i,k] +
d[5]*motiv[i,k] + d[6]*facilit[i,k] + d[7]*reward[i,k] + d[8]*goals[i,k] + d[9]*monitor[i,k] + d[10]*teach[i,k]

                        }

# summed residual deviance contribution for this trial
                resdev[i] <- sum(dev[i,1:na[i]])

                for(k in 2:na[i]){                                                          # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- dInt[i,k] - dInt[i,1]  + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  (dInt[i,k] - dInt[i,1])
```

```
# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
        }
        }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
        for(k in 2:nt){
                d[k] ~ dnorm(0,.0001)
        }

# vague prior for between-trial SD
sd ~ dunif(0,5)

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)


#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]


}                ## MODEL ENDS
```

Network meta-regression Model- Covariate: Target (Random effects model)

```
model{
        for(i in 1:ns){                         # LOOP THROUGH STUDIES
                w[i,1] <- 0                             # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                 # treatment effect is zero for control arm
```

```
                mu[i] ~ dnorm(0,.0001)              # vague priors for all trial baselines

                for(k in 1:na[i]){                                                        # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)                # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])                  # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                              # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

#Form covariate for target of intervention. p_only = 1 (parent only), c_only = 1 (child only).
#Reference is both i.e. p_only=c_only=0
                        p_only[i,k]<- equals(parent[i,k],1)*(1-equals(child[i,k],1))
                        c_only[i,k]<- (1 - equals(parent[i,k],1))*equals(child[i,k],1)
                        }

# summed residual deviance contribution for this trial
                resdev[i] <- sum(dev[i,1:na[i]])
                for(k in 2:na[i]){                                                        # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- d[t[i,k]] - d[t[i,1]]  + beta[1]*(p_only[i,k] - p_only[i,1]*(1-equals(t[i,k],1))) +
beta[2]*(c_only[i,k]-c_only[i,1]*(1-equals(t[i,k],1))) + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  ( d[t[i,k]] - d[t[i,1]] + beta[1]*(p_only[i,k] - p_only[i,1]*(1-
equals(t[i,k],1))) + beta[2]*(c_only[i,k]-c_only[i,1]*(1-equals(t[i,k],1)))  )

# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
        }
        }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
        for(k in 2:nt){
                d[k] ~ dnorm(0,.0001)
        }

# vague prior for between-trial SD
sd ~ dunif(0,5)

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)

#Priors for covariate effects
for (i in 1:2){
        beta[i]~dnorm(0,.0001)
```

```
}

#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]
}                    ## MODEL ENDS
```

Network meta-regression Model- Covariate: Setting (Random effects model)

```
model{
        for(i in 1:ns){                         # LOOP THROUGH STUDIES
                w[i,1] <- 0                                 # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                     # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)              # vague priors for all trial baselines

                for(k in 1:na[i]){                                                          # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)               # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])                # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                            # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

#Form covariate for setting of intervention. g_only = 1 (group only), i_only = 1 (inidvidual only).
#Reference is both i.e. g_only=i_only=0
                        g_only[i,k]<- equals(group[i,k],1)*(1-equals(individual[i,k],1))
                        i_only[i,k]<- (1 - equals(group[i,k],1))*equals(individual[i,k],1)
                        }

# summed residual deviance contribution for this trial
                resdev[i] <- sum(dev[i,1:na[i]])
                for(k in 2:na[i]){                                                          # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- d[t[i,k]] - d[t[i,1]]  + beta[1]*(g_only[i,k] - g_only[i,1]*(1-equals(t[i,k],1))) +
beta[2]*(i_only[i,k]-i_only[i,1]*(1-equals(t[i,k],1))) + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
```

```
                        w[i,k] <- delta[i,k] -  ( d[t[i,k]] - d[t[i,1]] + beta[1]*(g_only[i,k] - g_only[i,1]*(1-
equals(t[i,k],1))) + beta[2]*(i_only[i,k]-i_only[i,1]*(1-equals(t[i,k],1)))  )

# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
        }
        }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
        for(k in 2:nt){
                d[k] ~ dnorm(0,.0001)
        }

# vague prior for between-trial SD
sd ~ dunif(0,5)

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)

#Priors for covariate effects
for (i in 1:2){
        beta[i]~dnorm(0,.0001)
}

#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}               ## MODEL ENDS
```

Network meta-regression Model- Covariate: Delivery (Random effects model)

```
model{
        for(i in 1:ns){                 # LOOP THROUGH STUDIES
                w[i,1] <- 0                             # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                 # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)          # vague priors for all trial baselines
```

```
            for(k in 1:na[i]){                                                  # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)               # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])                  # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                             # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

                        }

# summed residual deviance contribution for this trial
            resdev[i] <- sum(dev[i,1:na[i]])
            for(k in 2:na[i]){                                                  # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- d[t[i,k]] - d[t[i,1]]  + beta*(remote[i,k] - remote[i,1]*(1-equals(t[i,1],1))) + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  ( d[t[i,k]] - d[t[i,1]] + beta*(remote[i,k] - remote[i,1]*(1-
equals(t[i,1],1))) )

# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
      }
      }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
      for(k in 2:nt){
            d[k] ~ dnorm(0,.0001)
      }

# vague prior for between-trial SD
sd ~ dunif(0,5)

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)

#Priors for covariate effects
      beta~dnorm(0,.0001)


#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
```

```
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}                    ## MODEL ENDS
```

Network meta-regression Model- Covariate: Frequency (Random effects model)

```
model{
        for(i in 1:ns){                          # LOOP THROUGH STUDIES
                w[i,1] <- 0                                      # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                          # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)                   # vague priors for all trial baselines

                for(k in 1:na[i]){                                                               # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)                    # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])                     # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                                 # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

                        }

# summed residual deviance contribution for this trial
                resdev[i] <- sum(dev[i,1:na[i]])
                for(k in 2:na[i]){                                                               # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- d[t[i,k]] - d[t[i,1]]  + beta*(weekly[i,k] - weekly[i,1]*(1-equals(t[i,1],1))) + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  ( d[t[i,k]] - d[t[i,1]] + beta*(weekly[i,k] - weekly[i,1]*(1-
equals(t[i,1],1))) )

# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
        }
        }

# total residual deviance
```

```
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
        for(k in 2:nt){
                d[k] ~ dnorm(0,.0001)
        }

# vague prior for between-trial SD
sd ~ dunif(0,5)

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)

#Priors for covariate effects
        beta~dnorm(0,.0001)


#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}                       ## MODEL ENDS
```

Under 6 – 11 years old – ≥12 months follow up (post intervention)

Fixed effects model

```
model{
	for(i in 1:ns){
	mu[i] ~ dnorm(0,.0001) # vague priors for all trial baselines

# LOOP THROUGH ARMS
	for (k in 1:na[i]) {
	var[i,k] <- pow(se[i,k],2) # calculate variances
	prec[i,k] <- 1/var[i,k] # set precisions
y[i,k] ~ dnorm(theta[i,k],prec[i,k]) # normal likelihood
theta[i,k] <- mu[i] + d[t[i,k]] - d[t[i,1]] # model for linear predictor
dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k] #Deviance contribution
}

# summed residual deviance contribution for this trial
resdev[i] <- sum(dev[i,1:na[i]])
```

```
}

totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment
for (k in 2:nt){ d[k] ~ dnorm(0,.0001) } # vague priors for treatment effects


# all MDs for each comparison
for (c in 1:(nt-1)) {
        for (k in (c+1):nt) {
                smd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {          mymd[c,c] <- 0 }
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}

} # *** PROGRAM ENDS
```

Random effects model

```
model{
for(i in 1:ns){
 w[i,1] <- 0
 delta[i,1] <- 0
```

```
 mu[i] ~ dnorm(0,.0001)

 for (k in 1:na[i]) {
 var[i,k] <- pow(se[i,k],2)
 prec[i,k] <- 1/var[i,k]
 y[i,k] ~ dnorm(theta[i,k],prec[i,k])
 theta[i,k] <- mu[i] + delta[i,k]
 dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]
 }

resdev[i] <- sum(dev[i,1:na[i]])

for (k in 2:na[i]) {
 delta[i,k] ~ dnorm(md[i,k],taud[i,k])
 md[i,k] <- d[t[i,k]] - d[t[i,1]] + sw[i,k]
 taud[i,k] <- tau *2*(k-1)/k
 w[i,k] <- (delta[i,k] - d[t[i,k]] + d[t[i,1]])
 sw[i,k] <- sum(w[i,1:k-1])/(k-1)
 }
 }

totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment

for (k in 2:nt){
d[k] ~ dnorm(0,.0001)  # vague priors for treatment effects
}

#sd ~ dunif(0,5) # vague prior for between-trial SD.
```

```
sd.prec <- pow(0.3728487988637566, -2)    #precision of informative distribution
sd ~ dlnorm(-2.795824123316176, sd.prec)   # prior on between-trial variance

tau <- pow(sd,-2) # between-trial precision = (1/between-trial variance)
#}

# all MDs for each comparison
#for (c in 1:(nt-1)) {
#for (k in (c+1):nt) {
#mymd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {           mymd[c,c] <- 0 }
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}

}   # *** PROGRAM ENDS
```

Component NMA: Additive sub-component effect (Random-effects model)

```
model{
        for(i in 1:ns){                         # LOOP THROUGH STUDIES
                w[i,1] <- 0                                     # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                 # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)          # vague priors for all trial baselines

                for(k in 1:na[i]){                                                              # LOOP
THROUGH ARMS
```

```
                    prec[i,k] <- pow(se[i,k], -2)                # set precision
                    y[i,k] ~ dnorm(theta[i,k],prec[i,k])                # normal likelihood
                    theta[i,k] <- mu[i] + delta[i,k]                # model for linear
predictor

# deviance contribution
                    dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

#Intervention component model
        dInt[i,k]<- d[1]*equals(t[i,k],1) +  d[2]*diet[i,k] + d[3]*ex[i,k] + d[4]*motiv[i,k] + d[5]*facilit[i,k] +
d[6]*reward[i,k] + d[7]*goals[i,k] + d[8]*monitor[i,k] + d[9]*teach[i,k]

                    }

# summed residual deviance contribution for this trial
                resdev[i] <- sum(dev[i,1:na[i]])

                for(k in 2:na[i]){                                # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                    delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                    md[i,k] <- dInt[i,k] - dInt[i,1]  + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                    taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                    w[i,k] <- delta[i,k] -  (dInt[i,k] - dInt[i,1])

# cumulative adjustment for multi-arm trials
                    sw[i,k] <- sum(w[i,1:k-1])/(k-1)
        }
        }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
        for(k in 2:nt){
                d[k] ~ dnorm(0,.0001)
        }

# vague prior for between-trial SD
#sd ~ dunif(0,5)

sd.prec <- pow(0.3728487988637566, -2)    #precision of informative distribution
sd ~ dlnorm(-2.795824123316176, sd.prec)   # prior on between-trial variance

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)


#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
```

```
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}                    ## MODEL ENDS
```

Component NMA: Main effect with additive sub-component effect (Random-effects model)

```
model{
        for(i in 1:ns){                              # LOOP THROUGH STUDIES
                w[i,1] <- 0                                   # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                      # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)               # vague priors for all trial baselines

                for(k in 1:na[i]){                                                          # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)                # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])                 # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                             # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

#Intervention component model
        dInt[i,k]<- d[1]*equals(t[i,k],1) +  d[2]*(1-equals(t[i,k],1))*(1-equals(t[i,k],6)) + d[3]*diet[i,k] + d[4]*ex[i,k] +
d[5]*motiv[i,k] + d[6]*facilit[i,k] + d[7]*reward[i,k] + d[8]*goals[i,k] + d[9]*monitor[i,k] + d[10]*teach[i,k]

                        }

# summed residual deviance contribution for this trial
                resdev[i] <- sum(dev[i,1:na[i]])

                for(k in 2:na[i]){                                                          # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- dInt[i,k] - dInt[i,1]  + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  (dInt[i,k] - dInt[i,1])
```

```
# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
        }
        }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
        for(k in 2:nt){
                d[k] ~ dnorm(0,.0001)
        }

# vague prior for between-trial SD
#sd ~ dunif(0,5)
sd.prec <- pow(0.3728487988637566, -2)    #precision of informative distribution
sd ~ dlnorm(-2.795824123316176, sd.prec)   # prior on between-trial variance


# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)


#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}               ## MODEL ENDS
```

Network meta-regression Model- Covariate: Target (Random effects model)

```
model{
        for(i in 1:ns){                 # LOOP THROUGH STUDIES
                w[i,1] <- 0                             # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                 # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)          # vague priors for all trial baselines

                for(k in 1:na[i]){                                              # LOOP
THROUGH ARMS
```

```
                              prec[i,k] <- pow(se[i,k], -2)                    # set precision
                              y[i,k] ~ dnorm(theta[i,k],prec[i,k])                       # normal likelihood
                              theta[i,k] <- mu[i] + delta[i,k]                                    # model for linear
predictor

# deviance contribution
                              dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

#Form covariate for target of intervention. p_only = 1 (parent only), c_only = 1 (child only).
#Reference is both i.e. p_only=c_only=0
                              p_only[i,k]<- equals(parent[i,k],1)*(1-equals(child[i,k],1))
                              c_only[i,k]<- (1 - equals(parent[i,k],1))*equals(child[i,k],1)
                              }

# summed residual deviance contribution for this trial
                    resdev[i] <- sum(dev[i,1:na[i]])
                    for(k in 2:na[i]){                                                            # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                              delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                              md[i,k] <- d[t[i,k]] - d[t[i,1]]  + beta[1]*(p_only[i,k] - p_only[i,1]*(1-equals(t[i,k],1))) +
beta[2]*(c_only[i,k]-c_only[i,1]*(1-equals(t[i,k],1))) + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                              taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                              w[i,k] <- delta[i,k] -  ( d[t[i,k]] - d[t[i,1]] + beta[1]*(p_only[i,k] - p_only[i,1]*(1-
equals(t[i,k],1))) + beta[2]*(c_only[i,k]-c_only[i,1]*(1-equals(t[i,k],1)))  )

# cumulative adjustment for multi-arm trials
                              sw[i,k] <- sum(w[i,1:k-1])/(k-1)
          }
          }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
          for(k in 2:nt){
                    d[k] ~ dnorm(0,.0001)
          }

# vague prior for between-trial SD
sd ~ dunif(0,5)

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)

#Priors for covariate effects
for (i in 1:2){
          beta[i]~dnorm(0,.0001)
}

#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
```

```
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}                    ## MODEL ENDS
```

Network meta-regression Model- Covariate: Setting (Random effects model)

```
model{
        for(i in 1:ns){                          # LOOP THROUGH STUDIES
                w[i,1] <- 0                                  # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                    # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)             # vague priors for all trial baselines

                for(k in 1:na[i]){                                                  # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)              # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])               # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                           # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

#Form covariate for setting of intervention. g_only = 1 (group only), i_only = 1 (inidvidual only).
#Reference is both i.e. g_only=i_only=0
                        g_only[i,k]<- equals(group[i,k],1)*(1-equals(individual[i,k],1))
                        i_only[i,k]<- (1 - equals(group[i,k],1))*equals(individual[i,k],1)
                        }

# summed residual deviance contribution for this trial
                resdev[i] <- sum(dev[i,1:na[i]])
                for(k in 2:na[i]){                                                  # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- d[t[i,k]] - d[t[i,1]]  + beta[1]*(g_only[i,k] - g_only[i,1]*(1-equals(t[i,k],1))) +
beta[2]*(i_only[i,k]-i_only[i,1]*(1-equals(t[i,k],1))) + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  ( d[t[i,k]] - d[t[i,1]] + beta[1]*(g_only[i,k] - g_only[i,1]*(1-
equals(t[i,k],1))) + beta[2]*(i_only[i,k]-i_only[i,1]*(1-equals(t[i,k],1)))  )
```

```
# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
        }
        }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
        for(k in 2:nt){
                d[k] ~ dnorm(0,.0001)
        }

# vague prior for between-trial SD
#sd ~ dunif(0,5)

sd.prec <- pow(0.3728487988637566, -2)   #precision of informative distribution
sd ~ dlnorm(-2.795824123316176, sd.prec)   # prior on between-trial variance

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)

#Priors for covariate effects
for (i in 1:2){
        beta[i]~dnorm(0,.0001)
}

#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}                ## MODEL ENDS
```

Network meta-regression Model- Covariate: Delivery (Random effects model)

```
model{
        for(i in 1:ns){                # LOOP THROUGH STUDIES
                w[i,1] <- 0                        # adjustment for multi-arm trials is zero for control
arm
```

```
            delta[i,1] <- 0                      # treatment effect is zero for control arm
            mu[i] ~ dnorm(0,.0001)               # vague priors for all trial baselines

            for(k in 1:na[i]){                                                          # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)          # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])            # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                        # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

                        }

# summed residual deviance contribution for this trial
            resdev[i] <- sum(dev[i,1:na[i]])
            for(k in 2:na[i]){                                                          # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- d[t[i,k]] - d[t[i,1]]  + beta*(remote[i,k] - remote[i,1]*(1-equals(t[i,1],1))) + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  ( d[t[i,k]] - d[t[i,1]] + beta*(remote[i,k] - remote[i,1]*(1-
equals(t[i,1],1))) )

# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
      }
      }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
      for(k in 2:nt){
            d[k] ~ dnorm(0,.0001)
      }

# vague prior for between-trial SD
#sd ~ dunif(0,5)

sd.prec <- pow(0.3728487988637566, -2)    #precision of informative distribution
sd ~ dlnorm(-2.795824123316176, sd.prec)   # prior on between-trial variance

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)

#Priors for covariate effects
      beta~dnorm(0,.0001)


#Dummy variables for unused covariates in data
```

```
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}                    ## MODEL ENDS
```

Network meta-regression Model- Covariate: Frequency (Random effects model)

```
model{
        for(i in 1:ns){                         # LOOP THROUGH STUDIES
                w[i,1] <- 0                                     # adjustment for multi-arm trials is zero for control
arm
                delta[i,1] <- 0                         # treatment effect is zero for control arm
                mu[i] ~ dnorm(0,.0001)                  # vague priors for all trial baselines

                for(k in 1:na[i]){                                                              # LOOP
THROUGH ARMS
                        prec[i,k] <- pow(se[i,k], -2)                   # set precision
                        y[i,k] ~ dnorm(theta[i,k],prec[i,k])                    # normal likelihood
                        theta[i,k] <- mu[i] + delta[i,k]                                # model for linear
predictor

# deviance contribution
                        dev[i,k]<-(y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]

                        }

# summed residual deviance contribution for this trial
                resdev[i] <- sum(dev[i,1:na[i]])
                for(k in 2:na[i]){                                                              # LOOP
THROUGH ARMS >1
# trial-specific effect distributions
                        delta[i,k] ~ dnorm(md[i,k],taud[i,k])

# mean of effect distributions, with multi-arm correction
                        md[i,k] <- d[t[i,k]] - d[t[i,1]]  + beta*(weekly[i,k] - weekly[i,1]*(1-equals(t[i,1],1))) + sw[i,k]

# precision of effect distributions (with multi-arm correction)
                        taud[i,k] <- tau*2*(k-1)/k
# adjustment for multi-arm trials
                        w[i,k] <- delta[i,k] -  ( d[t[i,k]] - d[t[i,1]] + beta*(weekly[i,k] - weekly[i,1]*(1-
equals(t[i,1],1))) )

# cumulative adjustment for multi-arm trials
                        sw[i,k] <- sum(w[i,1:k-1])/(k-1)
        }
```

```
        }

# total residual deviance
totresdev <- sum(resdev[])

# effect is zero for reference
d[1]<-0

# vague priors for d
        for(k in 2:nt){
                d[k] ~ dnorm(0,.0001)
        }

# vague prior for between-trial SD
#sd ~ dunif(0,5)

sd.prec <- pow(0.3728487988637566, -2)   #precision of informative distribution
sd ~ dlnorm(-2.795824123316176, sd.prec)   # prior on between-trial variance

# between-trial precision = (1/between-trial variance)
tau <- pow(sd, -2)

#Priors for covariate effects
        beta~dnorm(0,.0001)


#Dummy variables for unused covariates in data
dummy[1]<-motiv[1,1]
dummy[2]<-goals[1,1]
dummy[3]<-reward[1,1]
dummy[4]<-monitor[1,1]
dummy[5]<-teach[1,1]
dummy[6]<-facilit[1,1]
dummy[7]<-diet[1,1]
dummy[8]<-ex[1,1]
dummy[9]<-parent[1,1]
dummy[10]<-child[1,1]
dummy[11]<-f2f[1,1]
dummy[12]<-remote[1,1]
dummy[13]<-group[1,1]
dummy[14]<-individual[1,1]
dummy[15]<-less[1,1]
dummy[16]<-weekly[1,1]
dummy[17]<-intensive[1,1]

}                ## MODEL ENDS
```

Under 12-18 years old – 6-12 months follow up (post intervention)

Fixed effects model

```
# PROGRAM STARTS
model{
        for(i in 1:ns){
        mu[i] ~ dnorm(0,.0001) # vague priors for all trial baselines

# LOOP THROUGH ARMS
        for (k in 1:na[i]) {
        var[i,k] <- pow(se[i,k],2) # calculate variances
        prec[i,k] <- 1/var[i,k] # set precisions
y[i,k] ~ dnorm(theta[i,k],prec[i,k]) # normal likelihood
theta[i,k] <- mu[i] + d[t[i,k]] - d[t[i,1]] # model for linear predictor
dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k] #Deviance contribution
}

# summed residual deviance contribution for this trial
resdev[i] <- sum(dev[i,1:na[i]])
```

```
}

totresdev <- sum(resdev[]) #Total Residual Deviance
d[1]<-0 # treatment effect is zero for reference treatment
for (k in 2:nt){ d[k] ~ dnorm(0,.0001) } # vague priors for treatment effects


# all MDs for each comparison
for (c in 1:(nt-1)) {
        for (k in (c+1):nt) {
                smd[c,k] <- (d[k]-d[c])  } }

# treatment effect is zero for control arm
for (c in 1:nt) {          mymd[c,c] <- 0 }
# vague priors for treatment effects
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
for (k in (c+1):nt)  {
mymd[c,k] <- d[k] - d[c]
mymd[k,c] <- -mymd[c,k]
}
}

} # *** PROGRAM ENDS
```

Random effects model

```
#This code is part of
#Dias, S., Welton, N.J., Sutton, A.J. & Ades, A.E. NICE DSU Technical Support Document 2: A Generalised Linear Modelling Framework for #Pairwise and Network Meta-Analysis of
```

Randomised Controlled Trials. 2011; last updated September 2016 (available from #http://www.nicedsu.org.uk).

#This work should be cited whenever the code is used whether in its standard form or adapted.

```
# Normal likelihood, identity link
# Random effects model for multi-arm trials
model{                          # *** PROGRAM STARTS
for(i in 1:ns){                 #   LOOP THROUGH STUDIES
    delta[i,1] <- 0             # treatment effect is zero for control arm
    mu[i] ~ dnorm(0,.0001)           # vague priors for all trial baselines
    for (k in 1:na[i]) {            #  LOOP THROUGH ARMS
        var[i,k] <- pow(se[i,k],2)   # calculate variances
        prec[i,k] <- 1/var[i,k]      # set precisions
        y[i,k] ~ dnorm(theta[i,k],prec[i,k]) # binomial likelihood
        theta[i,k] <- mu[i] + delta[i,k]  # model for linear predictor
#Deviance contribution
        dev[i,k] <- (y[i,k]-theta[i,k])*(y[i,k]-theta[i,k])*prec[i,k]
      }
#  summed residual deviance contribution for this trial
    resdev[i] <- sum(dev[i,1:na[i]])
    for (k in 2:na[i]) {            # LOOP THROUGH ARMS
# trial-specific LOR distributions
        delta[i,k] ~ dnorm(d[t[i,1],t[i,k]] ,tau)
      }
  }
totresdev <- sum(resdev[])          #Total Residual Deviance
# treatment effect is zero for control arm
for (c in 1:nt) {           d[c,c] <- 0 }
# vague priors for treatment effects
```

```
for (c in 1:(nt-1)) {  # priors for all mean treatment effects
   for (k in (c+1):nt)  {
                        d[c,k] ~ dnorm(0,.001)
                        d[k,c] <- -d[c,k]
                        }
  }
sd ~ dunif(0,5)     # vague prior for between-trial SD
tau <- pow(sd,-2)   # between-trial precision = (1/between-trial variance)
}
}
}
```