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Interventions for High Body Mass Index in Children and Adolescents: An Evidence Update for the U.S. Preventive Services Task Force

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Structured Abstract

Objective: To examine the benefits and harms of weight management interventions in healthcare settings among children and adolescents with high body mass index (BMI).

Data Sources: MEDLINE via Ovid, PsycINFO via Ovid, and the Cochrane Central Registry of Controlled Trials through January 12, 2023; ongoing surveillance through August 2, 2023.

Study Selection: English-language studies of benefit or harm of weight management interventions (behavioral, liraglutide, semaglutide, orlistat, phentermine/topiramate) among children ages 2 to 18 years with high BMI (e.g., ≥85th or ≥95th percentile for age and sex) conducted in or recruited from health care settings.

Data Analysis: Outcomes with sufficient evidence for meta-analysis were pooled using random effects models, stratified by estimated intervention contact hours.

Results: 58 randomized controlled trials (RCTs) were included (N= 10,143): 50 trials of behavioral interventions (N=8,798), 3 of liraglutide (N=296), 2 of orlistat (N=579), 2 of phentermine/topiramate (N=269), and 1 of semaglutide (N=201). Behavioral weight management interventions were associated with small reductions in BMI and other weight-related outcomes after 6 to 12 months (mean difference in change between groups [MD], -0.7 kg/m^2 [95% CI, -1.0 to -0.3]; 28 RCTs [n=4,494]; I^2=86.8%**)**. Larger effects were seen in interventions with higher contact hours and that offered physical activity sessions. Reporting was sparse for other outcomes, and very few found statistically significant improvements in health outcomes (quality of life, depression, social adjustment), cardiometabolic, or behavioral outcomes. Pooled analyses showed that trials offering 26 or more hours of intervention contact, which typically included physical activity sessions, found improvements in blood pressure (e.g., MD in systolic blood pressure, -3.6 mm Hg [95% CI, (-5.7 to -1.5)]; 8 RCTs [n=773]; I^2=47.3%) and fasting plasma glucose (MD, -1.9 mg/dL [95% CI, -2.7 to -1.2]; 4 RCTs [n=367]; I^2=0%) after 6 to 12 months. Semaglutide and phentermine/topiramate had the largest effects on BMI, (e.g., MD, -6.0 kg/m^2 [95% CI, -7.3 to -4.6]; 1 RCT [n=201] for semaglutide; MD, -5.4 kg/m^2 [95% CI, -6.4 to -4.3] 1 RCT, n=227 for 15 mg/92 mg phentermine/topiramate). Effects on BMI were smaller after 12 to 13 months for liraglutide (MD, -1.6 kg/m^2 [95% CI, -2.5 to -0.7], 1 RCT, n=251) and orlistat (e.g., MD, -0.9 kg/m^2 [95% CI not reported], p<0.001, n=539). Weight outcomes were either not reported after medication discontinuation or showed immediate weight increase after discontinuation. Semaglutide was associated with improved quality of life (MD, 5.3 [95% CI, 0.2 to 8.3] on a 100-point scale), but none of the other pharmacotherapy studies found between-group differences in quality of life or depression incidence after 6 to 13 months. Semaglutide and phentermine/topiramate improved one or more lipids measures, but there was little to no improvement in other cardiometabolic outcomes with pharmacotherapy. Gastrointestinal side effects were common among patients taking liraglutide, semaglutide, and orlistat, and the most common side effects reported with phentermine/topiramate were musculoskeletal and psychiatric, when taken at doses of 15 mg/92 mg. Discontinuation due to adverse effects occurred in 10.4 percent of participants taking liraglutide, ranged from 0.9 to 15.4 percent with 15 mg/92 mg of phentermine/topiramate, but was relatively rare with semaglutide, orlistat, and 7.5 mg/46 mg of phentermine/topiramate (less than 5% in all groups). Serious

adverse effects were rare for all medications and did not differ between groups in any study. No evidence was available on adverse effects beyond 1 month after medication discontinuation, and no longer than 17 months for any medication.

Limitations: Data on behavioral interventions were extremely limited beyond 12 to 13 months. Very limited evidence showed weight rebounding after medication was discontinued, and there was no evidence on harms of medications beyond 17 months.

Conclusions: In the short term, weight management interventions led to lower weight in children and adolescents with effects that ranged in size from modest (for behavioral interventions, orlistat, and liraglutide) to substantial (for semaglutide and phentermine/topiramate), with no evidence of serious harm and small to no impact on health, behavioral, or intermediate cardiometabolic outcomes. Maintenance of weight changes beyond one year are unknown, as are longer-term impacts on psychosocial outcomes or adverse events associated with pharmacotherapy.

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Chapter 1. Introduction

Purpose

This report will be used by the United States Preventive Services Task Force (USPSTF) to update its 2017 recommendation on *Screening for Obesity in Children and Adolescents*.[1] The systematic review supporting the 2017 recommendation sought evidence on the benefits and harms of both screening as well as weight management interventions. Consistent with the parallel topic in adults,[2] the current review does not address questions related to *screening* for high weight. No evidence was found on the benefits or harms of screening in the prior review, and future studies are unlikely, since height and weight measurement is the standard of care for children and adolescents, making it difficult to create a non-screened comparison group. The current review focuses exclusively on updated evidence for the benefits and harms of weight management *interventions* (**Results Chapter**) together with important contextual information to aid in the interpretation of the evidence (**Contextual Findings Chapter**).

Terminology and Measures

Childhood and adolescent weight status is usually determined by the body mass index (BMI), which is calculated by dividing weight in kilograms by the square of height in meters. For children and adolescents in the United States, BMI is measured relative to other children of the same age and sex using the Centers for Disease Control and Prevention (CDC) 2000 Growth Charts.[3] Children and adolescents weight are categorized as having "overweight" when their BMI is between the 85th and 95th percentile, and as having "obesity" when their BMI is at or above the 95th percentile on these charts.[3] Additional stratifications for "severe obesity" have also been proposed.[4] These percentiles are calculated from CDC growth charts which were derived from US population-based survey data collected between the 1960s and 1990s, with the primary aim to monitor children's growth in the clinical setting.[5, 6] In children and adolescents, a BMI standard deviation score (BMI-SDS) or a z-score for BMI (zBMI) can also be calculated, showing the BMI in terms of as standard deviation units on a normal or z-distribution. So, a zBMI or BMI-SDS of 1.0 would indicate one standard deviation above the median BMI for age and sex. The CDC has recently published new methods for zBMI calculation to improve the performance of zBMI for children with weight above the 98th percentile for age and sex.[7]

We will use the general term "high BMI" when referring to people considered to be above "normal" or "healthy" body weight according to CDC standards, in keeping with the preferences of people with lived experience,[8] and will refer to specific BMI cut-offs whenever possible. For example, "≥95th percentile for age and sex" rather than "obese" and "85th-95th percentile for age and sex" rather than "overweight."[3] These percentile cutoffs represent statistical definitions rather than empirical risk-based criteria[6] and definitions have changed over time. For example, prior to 2007, BMI ≥95th percentile in children and adolescents was considered "overweight" where it was recommended that this screening BMI value would generate an in-depth medical assessment; BMIs in the 85th to 95th percentile were defined as "at risk for overweight."[9, 10] Alternative definitions and reference criteria have been developed and are used internationally, such as the International Obesity Task Force (IOTF) standards which use six worldwide datasets

to construct BMI percentile curves that identify cutoff values corresponding to the BMI thresholds of 25 kg/m^2 and 30 kg/m^2 used in adult populations.[11]

Being comprised only of height and weight, BMI is a crude measure that does not account for different distributions in fat or fat-free mass.[12] On the other hand, the convenience of BMI measurement makes it suitable for use in a variety of settings and BMI is the accepted clinical standard measure of excess fat in the United States[13] (see **Contextual Question 1, Contextual Findings Chapter**). While data show that the BMI is an imperfect measure of adiposity and is not an equivalent measure of adiposity across racial and ethnic groups, most children with BMI-for-age ≥95th percentile have high adiposity, few children with BMI-for-age <85th percentile have high adiposity. Misclassification as having high body fat is fairly common among those with BMI-for-age between the 85th and 95th percentile.[12-14] We found no widely accepted threshold of body fat that confers adverse impact on health, however. (See **Contextual Question 2, Contextual Findings Chapter**).

Prevalence

National Health and Nutrition Examination Survey (NHANES) data from 2017 to 2020 (pre-pandemic) show that 19.7 percent of children and adolescents in the United States have BMI ≥95th percentile for age and sex, based on the 2000 CDC growth charts.[15] There are statistically significant differences in the prevalence of BMI ≥95th percentile by age, race and ethnicity, and socioeconomic status (**Figure 1**). The prevalence of high BMI increases with age, decreases with higher income, and is the highest in Hispanic/Latino and nonHispanic Black children and adolescents. Differences in high BMI prevalence by sex are significant only for the 6- to 11-year-old age group where prevalence is higher in boys than girls (22.9% vs 18.5%). NHANES data are also available for the prevalence of BMI between the 85th and 95th percentile from the 2017-2018 survey, which was estimated to be 16.1 percent among children 2 to19 years of age.[16]

Overall, there has been an upward trend over time in the prevalence of BMI ≥95th percentile among children and adolescents in the United States, with some periodic variation in trends in particular age groups (**Figure 2**).

Data from the Youth Risk Factor Behavior Surveillance System show that 48.3 percent of US-based 9 to 12th graders were trying to lose weight in 2019, with dramatically higher rates among females (59.8%) than males (37.0%).[17] The proportion of high school students attempting to lose weight has increased since these data began being monitored in 1991. This figure is similar to the proportion of adults aged 20 and older attempting weight loss, estimated at 49.1 percent between 2013 to 2016.[18] Investigators have observed concurrent parallel increases in both measured BMI and weight loss attempts among adults.[19]

Association of Weight Loss and BMI With Health Outcomes

According to USPSTF methodology, health outcomes are symptoms, functional levels, and conditions that patients can feel or experience and are defined by measures of physical or psychological well-being, such as cardiovascular events, pain, breathing difficulties, quality of

life, and mortality.[20] There are no randomized controlled trials (RCTs) of weight loss interventions in children and adolescents with sufficient followup length to provide direct evidence about whether weight loss is potentially associated with outcomes such as cardiovascular disease (CVD) events or mortality. In the absence of evidence in children and adolescents, studies in adults may inform the evidence landscape. However, evidence about the association between weight loss and health outcomes from RCTs in adults are inconclusive and limited by short followup and low event rates.[21, 22] Given the lack of robust RCT evidence in either pediatric or adult populations, observational literature has been used to assess the relationship between BMI and health outcomes more broadly.

Overall, the literature assessing the relationship between BMI and health outcomes is difficult to interpret because of the complex etiology of adverse health outcomes, a substantial potential for confounding, and long periods of followup required for evaluation. Longitudinal data show that higher BMI in childhood is associated with early CVD mortality, early cancer mortality, diabetes, and dyslipidemia in adulthood.[23-26] However, it is generally unclear from these epidemiological data whether cardiometabolic risk factors in childhood have a direct impact on long-term health, or whether risk is elevated primarily because risk factors often track into adulthood.[23] Overall, cohort studies suggest that BMI tracking is moderate from childhood to adulthood but high for adolescence to adulthood.[27] At the same time, there is a substantial proportion of individuals for whom higher BMI emerges in adulthood.[27, 28]

Association data from cohorts of adults have even more uncertain findings with respect to the relationship between BMI and mortality. While BMIs $\geq$35 kg/m^2 are consistently associated with increased overall mortality risk, associations in intermediate BMI ranges differ in prominent analyses and are sensitive to analytic procedures.[29-31] In the adult literature, evidence suggests that lifestyle behaviors and cardiorespiratory fitness play an important role in the association between BMI and mortality.[32, 33] When these factors are taken into account, behavior appears to modify the association and vastly mitigates or eliminates the role of higher BMI in findings of higher mortality risk. Unfortunately, all of these data are from studies of associations, so cannot demonstrate that weight loss will results in similar effects. A detailed discussion of the association of BMI with health outcomes is available in **Contextual Question 2, Contextual Findings Chapter**.

Harms Associated With Diagnosing Children as Being Overweight or Having Obesity and the Harms of Weight Stigma and Weight Bias

Labeling children and adolescents as having overweight or obesity is associated with poorer psychosocial outcomes, higher rates of unhealthy weight control behaviors, and appears to have either no impact on weight or is associated with greater future weight gain, at least in the context of school and the home.[34-44] Weight labeling may undermine health-promoting behaviors associated with body satisfaction among youth with higher BMI, as under-perception of weight is associated with positive outcomes such as lower future weight gain, fewer depressive symptoms, and improved blood pressure.[44, 45] A detailed discussion of harms associated with diagnosis is available in **Contextual Question 3, Contextual Findings Chapter**.

Weight stigma is pervasive and harmful.[46] Youth with high BMI commonly experience weight-based victimization, teasing, and bullying by peers, parents, or teachers.[47] For example, in one study of treatment-seeking youth with high BMI, 73 percent reported weight-based teasing.[48] These experiences put youth at an increased risk for psychological distress, even after controlling for BMI, including low self-esteem, anxiety, depression, and suicidal ideation; substance abuse; poor social and academic outcomes; avoidance of health care services; and adverse physical health consequences including increased unhealthy behaviors (e.g., binge eating) and decreased healthy behaviors (e.g., dietary, physical activity), and weight gain.[49-51] Weight bias has been documented among healthcare clinicians, which can have deleterious effects on patients, leading to substandard care and avoidance of care.[43, 50, 52-59] A detailed discussion of harms of stigma and weight bias is available in **Contextual Question 7, Contextual Findings Chapter**.

Etiology and Risk Factors

Childhood BMI has highly complex, interacting determinants that include individual, family, school, community, societal, and structural components.[60-64] Further, genetic components contributing to high BMI are well documented.[65, 66] Within the individual, complex metabolic and hormonal systems are working to promote homeostasis. These systems appear to be sensitive to physiological adaptations, can counter the effects of weight loss, and are primed to help the body maintain or return to their previous higher weight (**Contextual Question 8, Contextual Findings**).[67]

Diet, physical activity, and screen time are the most commonly cited behavioral factors leading to high BMI in children and adolescents. There are well documented inequities in factors that support healthy eating and physical activity in children and adolescents, with financial status showing an important impact these behaviors (**Contextual Question 5, Contextual Findings**). In addition to the behavioral components of diet and physical activity, sleep habits, mental stress, and use of certain medications have also been documented to modify BMI.[13, 62, 63] Parental weight and maternal characteristics such as smoking during pregnancy,[68] prepregnancy BMI, and to a lesser degree, gestational weight gain, have been cited as additional risk factors for high BMI in childhood.[68, 69] Further, evidence suggests that adverse childhood experiences increase the risk for childhood high BMI.[70] The evidence to support many of these risk factors, however, is almost entirely observational in nature, and cannot establish causality. The role of the microbiome in high BMI is an active area of research and may have the potential to uncover some causal mechanisms.[71]

Prevalence of Potentially Weight-Related Behaviors in Children and Adolescents

Data suggest that children in the United States are generally not meeting recommendations for healthy diet and activity behaviors.

Diet

The Dietary Guidelines for Americans emphasize a healthy dietary pattern that consists of nutrient-dense forms of foods and beverages across all food groups, within calorie limits.[72] Further, added sugars should be kept to less than 10 percent of calories per day starting at age 2, saturated fat less than 10 percent of calories per day, and sodium less than 2,300 mg/day, and even less for children younger than 14 years. NHANES data suggest that overall diet quality among children and adolescents is poor.[72] Among children ages 2 to 4 years, the estimated Healthy Eating Index (HEI) score is 61 out of 100. This score progressively declines throughout childhood and adolescence, with scores for adolescents aged 14 through 18 being estimated at 51 out of 100.

Physical Activity

The Physical Activity Guidelines for Americans recommend that children and adolescents 6 to 17 years of age should get 60 or more minutes per day of moderate to vigorous physical activity.[73] Most of this physical activity should be moderate or vigorous intensity aerobic activity, but should also include muscle- and bone-strengthening activity at least 3 days per week. Survey data broadly suggest that children and adolescents in the United States. are not achieving these recommended levels. Data from the 2019 Youth Risk Factor Behavior Surveillance System show that 23.3 percent of adolescents (grades 9 to 12) achieved 60 or more minutes of moderate to vigorous physical activity daily; this represents a statistically significant gradual decline over time (28.7% of this population was achieving this level of physical activity in 2011).[74] This survey also estimated that one half of US-based 9th through 12th graders engaged in strengthening or toning exercises three or more days per week. A 2016 pooled analysis similarly estimated that 72.0 percent (95% CI, 68.8% to 75.1%) of United States adolescents aged 11 to 17 years had insufficient physical activity (60 minutes of physical activity per day).[75] This analysis further found a large difference by sex; boys were more likely to get recommended levels of physical activity (percent with insufficient physical activity: 64.0% for boys vs 80.5% for girls).

Sleep

Many children and adolescents across the age span are getting less sleep than recommended,[76] with the highest prevalence of short sleep duration occurring in high school students.

- 3 to 5 year-olds (<10 hours per 24-hr period, including naps): 35%[77]
- 6 to 12 year-olds (<9 hours per 24-hr period): 38%[77]
- 13 to 14 year-olds (<8 hours per 24-hr period): 20%[77]
- High school students (<8 hours of sleep per 24-hr period): 78%[78]

Screen Time

The American Academy of Pediatrics (AAP) recommends that children ages 2 to 5 years should get one hour or less of screen time per day. For children and adolescents 5 through 18 years of

age, the AAP recommends that families develop a Family Media Use Plan for each child or teenager that specifies consistent limits on hours per day of media as well as types of media used, but does not specify a general time recommendation.[79] Further, the AAP promotes meeting physical activity and sleep recommendations. The 2019 Youth Risk Behavior Survey reports that 19.8 percent of US-based 9th through 12th graders are watching 3 or more hours of television per day on an average school day.[74] Further, 46.1 percent of this population played video or computer games or used a computer 3 or more hours per school day for activities that were not schoolwork.[74]

Recommended Interventions

Major organizations have developed guidelines for screening and interventions related to reducing high BMI in children and adolescents as well as encouraging healthy diet and physical activity behaviors more generally (**Table 1**). In January 2023, the AAP issued its first clinical practice guideline on the evaluation and treatment of children and adolescents with high BMI.[4] This guideline includes 13 "Key Action Statements" for pediatricians and other pediatric health care professionals on diagnosis and measurement, evaluation, comorbidity assessment, and treatment related to overweight and obesity. Regarding treatment, they state that "Pediatricians and other primary healthcare practitioners should treat overweight (BMI ≥ 85th percentile to <95th percentile) and obesity (BMI ≥ 95th percentile) in children and adolescents, following the principles of the medical home and the chronic care model, using a family-centered and nonstigmatizing approach that acknowledges obesity's biologic, social, and structural drivers." The guideline additionally offers implementation recommendations that are further aimed at the policy, community, and practice level that acknowledge the numerous barriers to healthy lifestyle and treatment of high BMI. The AAP guideline is a comprehensive report that addresses health equity considerations, racism, weight bias and stigma, and adverse childhood experiences as important factors in the complex and multifactorial etiology of childhood BMI. The guideline is based on technical reports addressing two overarching key questions (KQs). KQ1 was "What are effective clinically based treatments for pediatric obesity?" and KQ2 was: "What is the risk of comorbidities among children with obesity?" Harms of interventions were not directly addressed as KQs.

Recommended treatments for children and adolescents with higher BMI typically focus on behavioral interventions designed to modify dietary habits (e.g., increasing healthy grains, fruits, and vegetables and decreasing sugars, fats, and processed foods), increasing physical activity, and decreasing sedentary behaviors.[80] Interventions tend to be multi-component, behavioral or cognitive-behavioral in approach, and often involve the family in addition to the child or adolescent.[1] Behavioral components may include strategies such as goal setting, food diaries, making changes to the environment to avoid overeating, and problem-solving. Cognitive strategies may focus on identifying and reframing unhealthy thought patterns linked to overeating or poor body image. Most information on intervention approaches and outcomes are derived from RCTs of weight management interventions, and translation to clinical settings is not well understood.

Pharmacotherapy interventions are additional treatment options that may be recommended for young people when BMI is ≥95th percentile for age and sex or other higher thresholds. When

recommended, pharmacotherapy is usually offered only after lifestyle modifications have been attempted. Four medications are U.S. Food and Drug Administration (FDA)-approved for weight management as an adjunct to lifestyle modification in pediatric populations meeting various criteria for 'obesity.' Orlistat was approved in 2003 for adolescents aged 12 and older and functions by decreasing the absorption of dietary fat in the intestines.[81] Two glucagon-like peptide-1 (GLP-1) receptor agonists are approved for individuals aged 12 or older: liraglutide (approved in 2020) and semaglutide (approved in 2022). These medications function by appetite suppression and delayed gastric emptying.[82-84] In 2022, the FDA approved Qsymia (phentermine and topiramate extended-release capsules) for individuals 12 years or older; phentermine is presumed to support weight loss through appetite suppression and increase of metabolism, and topiramate may be associated with appetite suppression and enhancement of satiety.[85, 86] Metformin is prescribed off-label for weight loss in the presence of abnormal insulin or glucose metabolism, however it is not FDA-approved for weight management in either children or adults.

Bariatric surgery is another weight loss intervention available for adolescents under stringent criteria. The American Society for Metabolic and Bariatric Surgery and the American Academy of Pediatrics recommend consideration of surgical intervention in adolescents with BMI >120 percent of the 95th percentile or BMI ≥35 kg/m^2 and major comorbidity, or a BMI >140 percent of the 95th percentile or BMI ≥40 kg/m^2.[4, 87-89] Major comorbidities include but are not limited to obstructive sleep apnea, diabetes, idiopathic intracranial hypertension, nonalcoholic steatohepatitis, or selected orthopedic complications. Indications for surgery include consideration from a multidisciplinary team about long-term adherence to recommended pre- and postoperative treatments. Several professional organizations have advised against routine referral for bariatric surgery in adolescent populations; when recommended, bariatric surgery is considered for highly selected populations (**Table 1**).

Previous USPSTF Recommendation

In 2017, the USPSTF concluded with moderate certainty that screening for obesity in children and adolescents 6 years and older and offering or referring them to comprehensive, intensive behavioral interventions to promote improvements in weight status is of moderate net benefit (B recommendation).[1]

The USPSTF has also published several additional recommendations related to pediatric cardiometabolic health and eating behaviors:

- Screening for Prediabetes and Type 2 Diabetes in Children and Adolescents[90] (I statement)
- Screening for Eating Disorders in Adolescents and Adults[91] (I statement)
- Screening for High Blood Pressure in Children and Adolescents[92] (I statement)
- Screening for Lipid Disorders in Children and Adolescents[93] (I statement)

Chapter 2. Methods

Scope and Purpose

This systematic review updates a review to support the 2017 USPSTF recommendation on screening and interventions for overweight and obesity in children and adolescents.[1, 94] While most of the scope from the prior review was maintained, there are a few notable changes that were made for consistency with the USPSTF systematic reviews on obesity in adult populations and behavioral counseling in adults with cardiovascular risk factors.[21, 95] First, this update addresses weight management interventions but does not examine the evidence related to screening. Second, the medications that are in scope for the current review have changed since the previous review. Two glucagon-like peptide agonists (liraglutide and semaglutide) and combination phentermine/topiramate have been approved for use in youth aged 12 and older with obesity since the previous review and are included in this update; metformin was excluded from the current review because it is not FDA-approved for a weight loss indication in any population. Third, a selected set of behavioral physical activity and dietary outcomes were newly included for systematic review.

Key Questions and Analytic Framework

We followed USPSTF procedures and methods to define study inclusion and exclusion criteria (**Appendix A Table 1**) and developed an Analytic Framework (**Figure 3**) and four KQs to guide the literature search, data abstraction, and data synthesis.

1. Do primary care–relevant behavioral, pharmacotherapy, or combined weight management interventions for children and adolescents with higher BMI improve health outcomes?
2. Do primary care–relevant behavioral, pharmacotherapy, or combined weight management interventions for children and adolescents with higher BMI affect weight outcomes or cardiometabolic outcomes?
3. Do primary care–relevant behavioral, pharmacotherapy, or combined weight management interventions for children and adolescents with higher BMI improve behavioral outcomes?
4. Are there harms associated with weight management interventions for children and adolescents?

Data Sources and Searches

We considered all studies from the previous review on this topic for inclusion in the current review and performed a comprehensive search for new literature. We searched MEDLINE via Ovid, PsycINFO via Ovid, and the Cochrane Central Registry of Controlled Trials for relevant studies published between January 1, 2016, and January 12, 2023, building upon the most recent full search for this topic. For the MEDLINE search, we used a modified Cochrane sensitivity- and precision-maximizing RCT filter for identifying randomized trials.[96, 97] A research librarian developed and executed the search, which was peer-reviewed by a second research librarian (**Appendix A**). All searches were limited to articles published in English. Additionally, due to

updates in the eligibility criteria for control groups and study settings, we performed a targeted review of studies that were previously excluded for these reasons. Further, previously included studies were evaluated to determine whether they reported behavioral outcomes, which were a newly included outcome in this review.

In addition to these database searches, we also examined the reference lists of previously published reviews, meta-analyses, and primary studies to identify potential studies for inclusion. We supplemented our searches with news and table-of-content alerts such as those produced by the USPSTF Scientific Resource Center LitWatch activity.[20] We conducted ongoing surveillance for relevant literature through August 2, 2023. One new study was identified; however, it did not substantively change the review's interpretation of findings or conclusions and is not addressed further.[98] We managed literature search results using version X9 of Endnote® (Thomson Reuters, New York, NY), a bibliographic management software database.

Study Selection

Detailed inclusion and exclusion criteria were developed to guide study selection (**Appendix A Table 1**) Two reviewers independently reviewed the title and abstract of all identified articles using DistillerSR (Evidence Partners, Ottawa, Canada) to determine if the study met our a priori inclusion and exclusion criteria for aim, population, intervention, comparator, outcomes, setting, and study design. Two reviewers then independently evaluated the full-text article(s) of all potentially relevant studies against the complete inclusion and exclusion criteria. Disagreements about the abstract and/or full-text review were resolved by discussion. A list of included studies is available in **Appendix B** and excluded studies can be found in **Appendix C**.

Study Design, Population, and Aim

For all KQs we included RCTs, including cluster randomized trials, of weight management interventions in children aged 2 to18 years who were identified as having a higher BMI, as defined by the study. The inclusion criteria for individual studies most commonly were children with BMI at or above the 85th or 95th percentile for age and sex; however, other definitions of higher BMI were also eligible, such as those based on the percent of ideal weight, or with cut-offs other than the 85th or 95th percentiles. We did require overall cut-offs to be no lower than the 75th percentile. We also included trials of weight maintenance in youth who had previously participated in a weight management program. Studies that were limited to young people with an eating disorder, who were pregnant or postpartum, had developmental disabilities, chronic medical conditions, or who were taking medications that may affect weight were excluded. Included trials had to have a primary aim of promoting weight reduction or stabilization, or maintenance of previous weight reduction or stabilization. Thus, studies with a primary aim of preventing overweight in youth with BMI below the overweight range were excluded, as were studies designed to improve diet or physical activity without a weight management aim. Studies included for KQ1 to KQ3 had to report weight or adiposity change at least 6 months following the start of the intervention to be included. For KQ4 evaluating the potential harms of weight management interventions, we included large cohort or case-control studies examining harms of medications addition to RCTs. No minimum followup for KQ4 was required.

Interventions

We included behavioral counseling interventions, health system–level interventions (e.g., stepped care or collaborative care), pharmacotherapy approved by the FDA for long-term weight loss/management in children or adolescents (i.e., orlistat, liraglutide, semaglutide, phentermine/topiramate), and combinations of these interventions. The original research plan did not include phentermine/topiramate or semaglutide, however these medications received FDA approval during the conduct of this review and were added as an included intervention. We excluded studies with components that could not be implemented in typical primary care settings, such as changes to the built environment, and interventions providing most or all the participants' food. We excluded studies of surgical procedures, medications not approved by the FDA for long-term weight loss in children or adolescents, complementary and alternative treatments, and dietary supplements.

Settings

We included interventions that were either conducted in a primary care setting, feasible in "usual" primary care, or referrable from primary care. This was operationalized by requiring that studies were either conducted in or recruited from a health care system. Interventions that relied upon existing social networks that could not be replicated in primary care, such as schools or churches, were excluded. Moreover, for the greatest applicability to U.S.-based primary care practice, we included only studies from countries classified as "very high" on the 2019 Human Development Index.[99]

Comparators

For studies of behavioral counseling interventions, the following control groups were eligible: no intervention (e.g., wait list, usual care, assessment-only), minimal intervention (e.g., one to two sessions delivering information typically in a primary care setting, generic print materials, links to widely available website), or attention controls (e.g., similar format and contact time but different content). We excluded studies that evaluated the comparative effectiveness of two active interventions unless there was also a true control group as described above. We considered control groups with the following components too intensive to be considered usual care and these were excluded for comparative effectiveness: personalized prescription for weight loss and exercise based on standardized dietary assessment; homework, such as study-provided self-help workbooks with a weight loss focus; or more than two annual intervention contacts, unless the content was not related to weight loss. For studies of pharmacotherapy, we included both placebo-controlled studies and studies with non-medication control groups; ancillary behavioral intervention components were allowed as long as they were consistent across groups.

Outcomes

We did not abstract any outcome with less than 60 percent followup; studies where followup for all outcomes was below 60 percent were excluded for quality as described further below. A weight-related outcome reported at least 6 months following the start of the study was required to be included for KQ1 to KQ3. In addition to weight-related outcomes, we also extracted health

outcomes, cardiometabolic measures, selected diet and physical activity outcomes, and harms. Health outcomes included mortality, health effects of medical conditions that may be associated with high weight (e.g., health events related to cardiovascular disease, diabetes, or hypertension; onset or resolution of asthma, sleep apnea, or orthopedic pain), quality of life, functioning, and depression.

Intermediate outcomes included weight or adiposity, cardiometabolic measures (i.e., blood pressure, lipids, measures of glucose metabolism), measures of liver dysfunction (e.g., nonalcoholic fatty liver disease), and physical fitness. Acceptable weight-related measures included weight (kilograms or pounds), age- and sex-normative weight (BMI percentile, percent of the median BMI, percent of the 95th percentile BMI, or zBMI/BMI-SDS for age and sex), relative weight (BMI or percent overweight), total adiposity (e.g., dual-energy x-ray absorptiometry, underwater weight, or comparable), or other similar measures. The z-score for BMI was considered a secondary weight measure because of limitations of this measure above the 97th percentile.[100]

A focused set of behavioral outcomes were newly included in this updated review and included dietary pattern score, minutes per week of moderate-to-vigorous physical activity or MET-minutes per week, percent meeting physical activity goals, and sedentary behavior or screen time. We acknowledge that there are numerous individual dietary intake components that are reported in the literature (e.g., fruits and vegetables, sugar, fiber). Our selection of a dietary pattern score as the sole included dietary outcome was based on feasibility as well as the stated emphasis in the 2020 to 2025 Dietary Guidelines for Americans on the importance of a healthy dietary pattern as a whole rather than on individual nutrients or foods in isolation.[72]

Adverse events included treatment-related harms and discontinuation of medication due to adverse effects at any time point during intervention. We also included harms associated with labeling; stigma or increased body image concerns or negative mental health effects; negative impacts on provider-patient relationship (e.g., care avoidance or dissatisfaction with care); unhealthy weight management efforts (e.g., using laxatives or self-induced vomiting) or eating patterns (excessive fasting, overly restrictive eating, or binging); suppressed growth; exercise-induced injury; other serious treatment-related harms at any time after initiation of intervention (i.e., death or medical issue requiring hospitalization or urgent medical treatment) or other treatment-related harms reported in trials meeting inclusion criteria for intermediate or health outcomes. For self-esteem and body satisfaction outcomes, we acknowledge these are problematic because improvement would represent a benefit and decline would represent a harm. We captured these under KQ4 for consistency but acknowledge this complexity.

Quality Assessment and Data Abstraction

Two reviewers independently assessed the methodological quality of each study using predefined study-design specific criteria developed by the USPSTF.[20] Disagreements about quality were resolved by discussion. Each study was given a final quality rating of good, fair, or poor. Good-quality studies were those that met nearly all of the specified quality criteria (e.g., comparable groups were assembled initially and maintained throughout the study, followup was approximately ≥85%, conservative data substitution methods were used in cases of missing data,

no evidence of selective outcome or analysis reporting) (**Appendix A Table 2**). Fair-quality studies did not meet these criteria but did not have serious threats to their internal validity related to the design or execution of the study. Studies we rated as poor-quality had several important limitations, including at least one of the following risks of bias: very high attrition (generally >40%), differential attrition between intervention arms (generally >20%); lack of baseline comparability between groups without adjustment; methods for ascertainment of weight outcomes were unclear or differed between groups (e.g., self-report or objective measurement and not reported by group), or issues in trial conduct, analysis, or reporting of results (e.g., possible selective reporting, inappropriate exclusion of participants from analyses, and questionable validity of randomization and allocation concealment procedures). Studies rated as poor-quality were excluded from the review. In studies of pharmacotherapy most dropout is due to adverse events or lack of effectiveness, and not loss to followup. We allowed studies with more than 40 percent attrition to be rated as fair quality if they used adequate data substitution methods with sensitivity analyses using different methods (e.g., baseline observation carried forward, multiple imputation, estimation from a mixed effects model using all available followup data). Because this review was an update of our own work, we did not repeat critical appraisal of the original studies through full dual-quality rating; rather, we confirmed the quality rating during data abstraction. One previously included study was excluded in the update because followup for the weight-related outcome was less than 60 percent.[101]

For all included studies, one reviewer extracted key elements into standardized abstraction forms in Microsoft Access® 2010 (Microsoft, Redmond, WA). A second reviewer checked the data for accuracy. For each study, we abstracted general characteristics of the study (e.g., author, year, study design), clinical and demographic characteristics of the sample and setting (e.g., age, race/ethnicity, baseline clinical characteristics, setting, country), analytic methods, and results. For intervention characteristics, we abstracted detailed information about specific components: duration, number, and length of sessions; group or individual delivery of counseling; mode of delivery (i.e., in-person, telephone, electronic, or print); providers and provider training; setting; and adherence to the intervention. We abstracted the number of sessions and length of sessions according to what was planned (and not necessarily what was implemented).

Data Synthesis and Analysis

Evidence was synthesized separately for behavioral interventions and for each medication. Tables were developed to show study, population, intervention characteristics, and outcomes for each of these interventions. We examined population characteristics to understand whether the evidence included traditionally marginalized or underrepresented groups who have a higher prevalence of higher BMI, such as Black, Latino/Hispanic, and Native American/American Indian populations, and those with low income. We also sought to understand whether interventions were effective in these populations, or if interventions tailored to these populations may have improved effectiveness.

We only conducted meta-analysis for behavioral interventions, since only one to three medication trials were included for all key questions. Among behavioral interventions, random effects meta-analysis was conducted using the restricted maximum likelihood method with the Knapp-Hartung correction for all outcomes with comparable measures and sufficient evidence

for pooling.[102, 103] Study-reported between-group effects were used in the meta-analysis if they were reported, with adjusted analyses selected over unadjusted results. Crude between-group effect estimates were calculated if they were not reported. The followup time point closest to 12 months was used in the meta-analysis if multiple time points were reported. Results that were not included in meta-analyses are presented in **Appendix D**. If a trial had more than one active intervention arm, we plotted the arm with the most comprehensive or highest contact (all denoted as Intervention Group 1 [IG1]). Results for other intervention arms are also presented in **Appendix D**. For continuous measures we preferentially analyzed between-group difference in change from baseline if available and substituted between-group post-test differences if differences in change were not available. In both cases, a negative number represents either greater weight loss or smaller weight gain in the intervention group. For dichotomous outcomes, crude risk ratios comparing post-treatment proportions were calculated if they were not reported by the studies. Egger's test was used to examine the risk of small study effects for the behavioral weight loss trials, both with and without estimated contact hours in the model to account for between-study heterogeneity due to contact hours.

The primary outcome for this review was BMI, selected because it was the most widely-reported outcome among those recommended for measuring weight outcomes in children.[100] Secondary weight- or adiposity-related outcomes are weight, BMI percentile, zBMI, proportion exceeding BMI cutoffs, waist circumference, and percent body fat. BMI was used to explore effect modification and for sensitivity analysis. A sensitivity analysis was conducted to determine whether effects would have been similar using the longest followup, rather than the followup closest to 12 months. This approach had minimal effect on the results and is not discussed further. We used meta-regression to explore whether effect size was associated with the following study or intervention characteristics:

- Publication year
- Study quality rating
- Whether the study was conducted in the United States
- Months' followup
- Months between the end of treatment and the followup assessment
- Whether the study was limited to young people with higher weight but who did not meet BMI criteria for obesity (e.g., above the 75th or 85th percentile but below the 95th percentile for age and sex)
- Contact dose (number of sessions, estimated contact hours, and duration of the intervention)
- Setting (primary care vs. other setting)
- Whether group sessions were provided
- Whether the intervention included physical activity sessions during the intervention sessions (vs. encouragement and instruction for physical activity at home)

Hours of contact were estimated based on number of planned treatment sessions and the length of each session, or average contact time if that was reported. If no information on session length was provided, we estimated only the broad category of contact hours: 0 to 5.9 hours, 6 to 25.9 hours, 26 to 51.9 hours, or 52 or more hours. If session length was provided for some parts of the intervention but not others, we used a priori–developed assumptions to estimate contact hours;

for example, assigning phone sessions described as "brief" to be 5 minutes in length, phone sessions not described as "brief" as 15 minutes, individual sessions as 30 minutes, and group sessions as 60 minutes. Concurrent parent and child sessions were counted separately, so concurrent 1-hour parent and child sessions were calculated as 2 hours of contact. Our primary analyses present studies stratified by whether the intervention involved fewer than 26 contact hours versus 26 or more contact hours. This cut-point was based both on the logic that this corresponds to weekly one-hour meetings for six months, and because the current USPSTF recommendation recommends referral to weight management interventions that include at least 26 hours of contact. Estimated hours of contact in the first 12 months only are shown on the forest plots because the primary outcome was weight change at 12 months (or closest followup available).

We used Stata 16.1 (StataCorp LLC, College Station, TX). All significance testing was 2-sided, and results were considered statistically significant if the p-value was 0.05 or less.

Grading the Strength of the Body of Evidence

We graded the strength of the overall body of evidence for each key question. We adapted the Evidence-based Practice Center approach,[104] which is based on a system developed by the Grading of Recommendations Assessment,[105] Development and Evaluation (GRADE) Working Group. Our method explicitly addresses four of the five Evidence-based Practice Center-required domains: consistency (similarity of effect direction and size), precision (degree of certainty around an estimate), reporting bias (potential for bias related to publication, selective outcome reporting, or selective analysis reporting), and study quality (i.e., study limitations). We did not address the fifth domain—directness—as it is implied in the structure of the key questions (i.e., pertains to whether the evidence links the interventions directly to a health outcome).

The domain of consistency was rated as reasonably consistent, inconsistent, or not applicable (e.g., single study). The domain of precision was rated as reasonably precise, imprecise, or not applicable (e.g., no evidence). Study quality reflects the quality ratings of the individual trials and indicates the degree to which the included studies for a given outcome have a high likelihood of adequate protection against bias. The body-of-evidence limitations field highlights important restrictions in answering the overall key question (e.g., evidence of reporting bias, lack of replication of interventions, nonreporting of outcomes important to patients).

At least two independent reviewers rated the overall strength of evidence for each intervention type. We resolved discrepancies through consensus discussion with the full review team, consulting with outside reviewers as needed. We graded the overall strength of evidence as high, moderate, low, or insufficient. "High" indicates high confidence that the evidence reflects the true effect and that further research is very unlikely to change our confidence in the estimate of effects. "Moderate" indicates moderate confidence that the evidence reflects the true effect and that further research may change our confidence in the estimate of effect and may change the estimate. "Low" indicates low confidence that the evidence reflects the true effect and that further research is likely to change our confidence in the estimate of effect and to change the estimate. A grade of "insufficient" indicates that evidence is either unavailable or does not permit an estimate of an effect.

Contextual Questions

In addition to the systematically reviewed questions (KQs 1-4), we also addressed contextual questions (CQs) to aid with the broader interpretation of the evidence. Contextual questions are important considerations that may not be readily answerable from the available RCT literature. Eight CQs were prespecified in our research plan:

1. What is the prevalence of BMI assessment in children and adolescents in primary care practice? Does the prevalence of BMI assessment vary by age?
2. How well does BMI predict adiposity and overall health? Does the predictive accuracy of BMI differ by race or ethnicity?
3. Are there harms associated with diagnosing children and adolescents as being overweight or having obesity in the healthcare setting (e.g., harms associated with labeling)? Does the risk of harm differ across racial and ethnic groups or contribute to health inequities?
4. What level of weight or relative weight decrease in children or adolescents with obesity reduces the likelihood of obesity in adulthood or health outcomes associated with obesity?
5. What are the inequities in factors that support healthy eating and physical activity in youth (e.g., food insecurity, financial security, or neighborhood-level factors)?
6. What are the inequities in access to or participation in weight management interventions?
7. What are the harms of stigma and weight bias? What is the extent of weight bias in healthcare?
8. Are there long-term harms of weight loss attempts during childhood or adolescence?

CQs are not systematically reviewed. Evidence for CQs was identified based on literature retrieved for the systematic search for KQs as well as targeted searches and scanning bibliographies of relevant articles. A best evidence approach was used to identify most recent, applicable, and robust evidence. CQs are available in the results section under "Contextual Findings."

Expert Review and Public Comment

The draft Research Plan was posted on the USPSTF website from February 10, 2022, to March 9, 2022. Most comments received by the USPSTF pertained to which outcomes should be included. Based on public comments and key informant interviews, the USPSTF removed the outcomes of self-esteem/body satisfaction (due to cultural differences in beauty and body standards that make these data difficult to interpret at the study level), BMI z-score (due to lack of sensitivity to change at the highest BMI levels; however, the USPSTF will accept this outcome if it is the only weight outcome reported by a study), and sugar-sweetened beverage consumption (to maintain the focus on overall diet pattern). The USPSTF added outcomes reflecting sedentary behavior, including both sedentary time and screen time. Other changes that were made based on public comments include: adding text to clarify that a BMI exceeding the 85th percentile for age and sex serves as an acceptable definition of higher BMI; allowing weight-neutral healthy lifestyle counseling as a control group; and including studies with 6 to 11 months of followup. A final Research Plan was posted on the USPSTF website on June 23, 2022. The draft version of this report was reviewed by invited experts and individuals at USPSTF

Federal Partner agencies. Experts were selected based on their expertise with both methodologic and content aspects of the review and were selected to obtain diverse informed perspectives.

USPSTF and AHRQ Involvement

The authors worked with USPSTF liaisons at key points throughout the review process to develop and refine the analytic framework and key questions and to resolve issues around scope for the final evidence synthesis.

AHRQ staff provided oversight for the project, coordinated the systematic review, reviewed the draft report, and assisted in an external review of the draft evidence synthesis.

Chapter 3. Results

Overview of Included Studies

We screened 6,878 abstracts and 351 full-text articles for inclusion (**Appendix A Figure 1**). After reviewing the full-text articles and performing critical appraisal, 58 RCTs (reported in 121 publications) fully met our inclusion criteria and were included (N= 10,143).[106-161] One publication reported the results of two separate studies.[130] Fifty trials examined a behavioral intervention (i.e., involved counseling and education without the use of weight-loss medication; see **Table 2**). Forty of the behavioral trials were included in the previous review and ten were newly published since the previous review.[112, 115, 120, 129, 137, 138, 141, 144, 147, 150] Eight trials examined the effects of pharmacotherapy. Three trials examined liraglutide,[155-157] one examined semaglutide,[162] two examined orlistat[158, 159] and two trials examined two dosing schemes for the combination of phentermine and topiramate (**Table 3**).[160, 161] Three of the medication trials only followed participants for 2 months or less and were therefore only included for KQ4 (harms): two liraglutide trials,[155, 157] and one trial of phentermine/topiramate.[160] Of the medication trials, only the orlistat trials were included in the previous review.[158, 159]

Description of Included Studies

Behavioral Interventions

Study Characteristics

A summary of the characteristics of the behavioral intervention trials is presented in **Table 4**. Of the 50 included trials (n=8,798), 28 (56%) were conducted in the United States and the remaining trials were conducted in Europe, Canada, Australia, New Zealand, Israel, or Turkey. Twenty-seven (54%) of the trials were conducted in primary care, and the remaining were conducted in other health care settings, such as medical research facilities or outpatient clinics covering a wide range of specialties. Twelve studies (24%) recruited patients via population-based screening, seven (14%) through clinician referral, seven (14%) recruited volunteers using various types of advertising and media announcements, and the remaining used multiple recruitment approaches, typically clinician referral plus advertising and announcements.

Populations

A summary of the population characteristics of the behavioral intervention trials is presented in **Table 5** and study-level details are provided in **Appendix D Table 1**. Specific weight criteria varied across the studies. Most trials included children who had a BMI at or above the 85th percentile or the 95th percentile for their age or sex according to CDC or country-specific norms, or meet criteria for overweight or obesity according to IOTF norms. Five of the trials specifically targeted youth who were above the 75th or 85th percentile for age and sex but below the 95th percentile, or used similar criteria based on IOTF norms.[107, 112, 137, 142, 149] In addition, 13 trials put an upper limit on weight, including: a BMI no higher than the 97th [131, 132, 143, 144] or 98th percentile[128] for age and sex; a zBMI no greater than 2.5,[121] 3.0[124] or 3.5;[114]or a BMI no more

than 100 percent[134, 139-141] or 200 percent[118] of the median. On the other hand, four trials were limited to children with BMIs in a higher range (≥97th or 98th percentile for their age and sex), conducted in the United States,[117] United Kingdom[133] and Germany.[108, 154] Baseline average BMI percentile ranged from 84.9 to 99.2 across studies, and the weighted average across all studies was 93.0. Average weighted baseline BMIs were 18.4 kg/m^2 in trials of preschool-aged children, 23.3 kg/m^2 in trials of elementary-aged children, and 31.3 kg/m^2 in trials of adolescents.

The behavioral intervention trials included children as young as 2 years[132, 139-141, 145, 147] up to age 18 or 19 years.[150] Eighteen (36%) of the trials primarily included elementary-aged children, generally from age 6 to 8 years up to age 12 years, and an additional 13 (26%) included a wider range of ages covering elementary-aged and either preschool-aged children or adolescents. Twelve trials targeted adolescents only[110, 111, 116, 119, 120, 123, 125, 129, 134, 143, 144, 150] and seven targeted preschool- to kindergarten-aged children.[107, 112, 139-141, 145, 149] Three trials were limited to girls only[111, 143, 144] (all were studies of adolescents) and the remaining trials included both boys and girls (percent female across all trials, 57.2%).

Most trials either had a predominantly White sample of participants or failed to report the race and ethnicity distribution of study participants. However, somewhat broader representation of racial and ethnic groups was seen in studies conducted in the United States, where an estimated 52.4 percent of participants were White (among 25 trials reporting on % White); 20.5 percent were Black (18 trials reporting) and 25.0 percent reported Hispanic/Latino heritage (24 trials reporting). However, there was very limited inclusion of Native American or Alaska Native participants (2.9% total among 4 studies reporting) or young people with Asian heritage (4.2% among 11 studies reporting). Seven studies included samples in which a majority of participants were Hispanic/Latino.[119, 123, 127-129, 138, 159] Black children were not as widely represented; however, in eight studies in the United States and the United Kingdom, 26 to 47 percent of participants were Black.[117, 135, 136, 142, 143, 147, 150, 157] Altogether, thirteen studies of behavioral interventions (all conducted in the United States) reported that at least 50 percent of participants were Black or Hispanic/Latino.[110, 119, 123, 127-129, 135, 136, 138, 143, 147, 157, 159]

Studies broadly reported socioeconomic status, but just four studies included a majority of participants facing socioeconomic challenges. Socioeconomic challenge was variably defined in these studies, including: explicit description by the authors that most participants were "economically disadvantaged",[108] 77 percent to 100 percent of participants being Medicaid recipients,[128, 138] or 80 percent of children living in homes with incomes less than $30,000 (published in 2014, year of data collection unknown).[136]

Interventions

The 50 included studies of behavioral interventions included 62 active intervention arms (**Table 6**, **Appendix D Tables 2 and 3**). Forty-seven of the 50 included trials provided at least dietary counseling and some information about behavior change principles. Most of these trials also provided counseling regarding physical activity or sedentary behavior. Two trials used interpersonal therapy as the primary treatment approach, linking overeating and loss-of-control eating to interpersonal functioning with apparently little to no counseling or education about eating a healthy diet and increasing physical activity.[143, 144] Another study also did not appear to provide content on healthy diet or physical activity, but instead examined a "regulation of cues"

intervention based on appetite awareness and handling cues that trigger the desire to eat other than hunger.[106] Another trial tested the impact of a calibrated dinner plate and breakfast bowl to aid in portion control.[115] Most trials focused on initial weight management, but one trial addressed longer-term weight maintenance after participation in a weight management program.[110]

Intervention contact time varied considerably among studies. The number of sessions with a live interventionist (over the phone or in-person) ranged from zero to 122 over a time period ranging from 2.25 to 24 months. The median number of sessions was 12 (interquartile range [IQR], 6 to 16), involving an estimated 16.2 hours of contact with an interventionist (IQR, 4 to 37.5 hours) over 6 months (IQR, 5 to 12 months). Only one study examined interventions that did not involve contact with an interventionist, but instead were delivered via website and print materials, with or without text messages.[129] This study had another intervention arm that did include contact with a health counselor. Many of the most intensive interventions included supervised physical activity sessions and usually included group meetings, with or without individual parent or family meetings as well **(Figure 4**). These more intensive group interventions frequently involved separate groups for parents and children, as well as joint activities. In addition to providing practical information on such topics as healthy eating, safe exercising, and reading food labels, behavioral interventions typically incorporated behavior change techniques such as goal setting, monitoring diet and activity behaviors, and problem-solving. The lower-contact interventions generally did not include group sessions. These interventions were frequently conducted in primary care settings with the involvement of the primary care provider and sometimes included motivational interviewing by the primary care provider or another healthy lifestyle counselor.

Most trials reported some measure of participation in the intervention. Studies most commonly reported a measure related to the percent of sessions attended, or the percent who attended at least some threshold number of sessions. Where reported, the average percent of sessions completed generally ranged from the mid-60s to low 80s. The percentage of participants who attended all planned sessions ranged from 31 to 93 in nine trials that reported this outcome.[110, 119, 132, 138, 140, 149-152]

Quality Assessment

Nine studies were rated as "good" quality[107, 111, 124, 145-148, 152, 153] and the rest were rated as "fair" quality. Among the fair-quality trials, three reported generally good methods but were downgraded to fair because attrition was greater than 15 percent.[113, 114, 136] More typically, there was more than one concern if studies received a fair rating. Aside from attrition, common concerns included unblinded outcomes assessment, or failure to report one or more of: allocation concealment, randomization methods, outcomes assessment blinding, information about intervention fidelity, or patient adherence or attendance. Many trials had small sample sizes; the median sample size was 108 (IQR, 70 to 206), equating to approximately 50 participants per study group. In addition, eight studies were rated as "poor" quality and excluded from the review. Among the studies excluded for poor quality, the most common issues were high attrition (>40%) or differential attrition (>20 percentage-point difference between groups).

Pharmacotherapy

Three trials examined the impact of liraglutide (n=296),[155-157] one examined semaglutide (n=201),[162] two examined orlistat (n=579)[158, 159] and two trials examined two dosing schemes for the combination of phentermine and topiramate (n=269)[160, 161] (**Table 3**). Three of these trials only followed participants for 2 months or less and were therefore only included for KQ4 (harms): two liraglutide trials[155, 157] and one trial of phentermine/topiramate.[160] Only one included trial, examining liraglutide, reported weight loss maintenance more than one month after treatment had ended.[156] Of the pharmacotherapy trials, only the orlistat trials were included in the previous review.[158, 159] Seven of the eight trials were either conducted entirely in the United States or had study sites in the United States, and the remaining trial was conducted in Germany.[155] One trial examining harms of short-term (8-week) use of liraglutide included children age 7 to 11 years,[157] and the remaining included adolescents age 12 and older or 14 and older (**Appendix D Table 4**). Mean baseline BMIs were higher in trials of pharmacotherapy, ranging from 35.6 to 40.4 among trials of adolescents. The mean baseline zBMI for the study in younger children was 3.9. There was representation of Hispanic/Latino adolescents in trials of liraglutide (22% to 38% of participants), orlistat (62.5% in one small study), and phentermine/topiramate (32.3%). Only one short-term trial of liraglutide included substantial representation of Black children (42.0%). Daily dosing was 3 mg given by injection for liraglutide, three 120 mg tablets taken daily for orlistat, and combination tablets of either 15 mg phentermine/92 mg topiramate or 7.5 mg phentermine/46 mg topiramate (**Appendix D Table 5**) Semaglutide was administered by a weekly injection of 2.4 mg. Five of the studies of pharmacotherapy included behavioral counseling components along with the medication or placebo.[156, 158, 159, 161, 162] Those that did not appear to include behavioral counseling were the short-term trials focused on establishing the safety of the medications that were only included for KQ5 (harms).[155, 157, 160]

KQ1. Do Primary Care–Relevant Behavioral, Pharmacotherapy, or Combined Weight Management Interventions for Children and Adolescents With BMI Improve Health Outcomes?

Summary of Results

Health outcomes were rarely reported. Among the fourteen trials of behavioral interventions reporting a health outcome (n= 2,558), very few found any statistically significant improvements in quality of life at any followup timepoint (**Appendix D Table 6**). However, pooled analyses indicated small increases in total and physical quality of life after 6 to 12 months, reported in only a very small subset of the included trials (Total: mean difference in change [MD], 1.9 [95% CI, 0.2 to 3.5]; 11 RCTs [n=1,922]; I^2=48.4%; Physical: MD, 1.7 [95% CI, 0.1 to 3.4]; 4 RCTs [n=1,216]; I^2=0% for studies with <26 hours estimated contact; **Table 7, Figure 5 and Appendix E Figure 1;** most scales range from 0 to 100). Evidence from only one to four trials suggested that behavioral interventions had no impact on psychosocial quality of life, depression, or social adjustment. Among the four pharmacotherapy studies that included a health outcome

semaglutide was associated with a 5.3-point greater improvement in weight-related quality of life (MD, 5.3 [95% CI, 0.2 to 8.3]) but the remaining three found no between-group differences in change in quality of life or depression incidence compared with placebo after 6 to 13 months.[156, 158, 159]

Detailed Results by Intervention Type and Outcome

Behavioral Interventions

Fourteen of the behavioral intervention trials reported health outcomes (N= 2,674).[111, 116, 117, 120, 124, 129, 139, 144, 147, 148, 150-153] Detailed results for all health outcomes are shown in **Appendix D Table 6**. Six of these trials were conducted in the United States.[111, 117, 129, 139, 144, 147] Two included a majority of participants who were Black or Hispanic/Latino (conducted in the United States),[147] or Black or Asian (conducted in the United Kingdom).[150] None of these studies focused specifically on families facing financial or other social challenges.

Quality of Life

Thirteen of the 14 trials reporting a health outcome reported quality of life, measured by the Pediatric Quality of Life Inventory (PedsQL),[111, 116, 120, 124, 129, 139, 144, 147, 148, 152, 153] the Child Health Questionnaire (CHQ),[116, 117] the DISAKIDS questionnaire (DISAKIDS)[151] or the Impact of Weight on Quality of Life--Kids (IWQOL).[150] Only three trials found statistically significant group differences at any time point, on any measure of quality of life.[116, 119, 139] Eleven of these trials reported a total or global score, completed by either the child or the parent. Among those with sufficient data to include in meta-analysis, the intervention groups increased by 1.9 points more than the control groups, typically on 100-point scales (MD, 1.9 [95% CI, 0.2 to 3.5]; 11 RCTs [n=1,922]; I^2=48.4%, **Figure 5 and Appendix E Figure 2**). Effect sizes were similar between interventions with higher (≥26 hours) and lower (<26 hours) estimated contact time. Physical quality of life scores also showed a very small impact when pooled in four lower-contact trials (MD, 1.7 [95% CI, 0.1 to 3.4]; 4 RCTs [n=1,216]; I^2=0%, **Appendix E Figure 1**), but one very small study (n=16) of young children reported a large improvement (MD, 16.5 [95% CI, 9.5 to 23.5]) after 12 months.[139] The same four lower-contact trials showed no benefit on psychosocial quality of life (MD, 0.7 [95% CI, -0.6 to 1.9]; 4 RCTs [n=1,216]; I^2=0%, **Appendix E Figure 3**). Effects sizes in studies with higher representation of Black, Hispanic, and Asian children were similar to those in other studies.[129, 147, 150]

Depression

Three studies of adolescents reported depression.[111, 129, 144] None of these studies found group differences at any time point. For example, the best quality study[111] reported no group differences in the percent with depression according to the Mood module of the Adolescent version of the Patient Health Questionnaire (PHQ) at either 6 months (relative risk [RR], 0.81 [95% CI, 0.24 to 2.74]; 5.9% in the control group vs. 4.8% in the intervention group) or 12 months (RR, 1.37 [95% CI, 0.37 to 5.04]; 5.3% in the control group vs. 7.1% in the intervention group).

Social Adjustment

One study found no group difference on the Social Adjustment Scale-Self-Report at 6- or 12-month followup (MD, 6-mo: -0.3 [95% CI, -0.6 to 0]; 12-mo: -0.1 [95% CI, -0.4 to 0.2]).[144]

Glucagon-Like Peptide 1 Agonists

One study each of liraglutide[156] (n=251) and semaglutide[162] (n=201) reported health outcomes(**Table 8**). Weight-related Quality of life scores did not differ at the end of treatment with liraglutide; after 13 months scores increased by 7.9 (standard deviation [SD], 11.6) with liraglutide and 6.6 (SD, 11.9) with placebo (MD, 1.3 [95% CI, -1.6 to 4.2]) on a 100-point scale. Weight-related Quality of life showed greater improvement with semaglutide than placebo at the end of the 16-month treatment period; scores increased by 5.3 points with semaglutide, compared to 1.0 with placebo, on a 100-point scale (MD, 5.3 [95% CI, 0.2 to 8.3]). Four percent (5/125) of participants taking liraglutide developed depression, compared with 2.4 percent (3/126) with placebo (RR, 1.7 [95% CI, 0.4 to 7.3]). This study also conducted an analysis among people who endorsed at least moderate level depression symptomatology on the PHQ-9. When categorized into moderate, moderate-to-high, and high symptom severity, participants receiving liraglutide were more likely to endorse severe levels of symptoms and less likely to endorse moderate levels of symptoms than those receiving placebo injections.

Orlistat

One study each reported on quality of life (n=40)[159] and depression incidence (n=539)[158] (**Table 9**). There were no differences in either quality of life after 6 months (detailed data not provided), or depression incidence after 1 year (0.6% [2/352] with orlistat, 0% [0/181] with placebo, RR, 2.6 [95% CI, 0.1 to 54.2]).

Phentermine/Topiramate

One study (n=227) reported quality of life and depression and found no between-group differences in either outcome (**Table 10**).[156] Quality of life scores increased by 3.1 (SD, 12.8) to 4.3 (SD, 12.5) points with phentermine/topiramate and 2.9 (SD, 14.1) with placebo (MD, 0.2 [95% CI, -4.2 to 4.6]). Four percent (5/113) of participants taking the higher dose of phentermine/topiramate developed depression, compared with 2 percent (1/54) taking the lower dose and none (0/56) taking the placebo (RR of high dose vs placebo: 5.7 [95% CI, 0.3 to 105.4]; low dose vs placebo: 3.2 [95% CI, 0.1 to 79.5]). No group differences were found between phentermine/topiramate and placebo on heart rate (beats per minute).

KQ2. Do Primary Care–Relevant Behavioral, Pharmacotherapy, or Combined Weight Management Interventions for Children and Adolescents With Higher BMI Affect Weight Outcomes or Cardiometabolic Outcomes?

Summary of Results

Behavioral weight management interventions were associated with small reductions in BMI and other weight-related outcomes after 6 to 12 months (MD, -0.7 kg/m^2 [95% CI, -1.0 to -0.3]; 28 RCTs [n=4,494]; I^2=86.8%, **Figure 6, Table 11**). Larger effects were seen in interventions with higher contact hours and that offered physical activity sessions as part of the intervention, rather than simply encouraging increased physical activity at home. We could not clearly disentangle the impact of contact hours from the impact of physical activity sessions, because many of the higher contact interventions included physical activity sessions. The clinical significance of the effect size is unclear, and evidence was sparse beyond 12 months. Lipids, blood pressure, and fasting plasma glucose were reported by a fairly small subset of trials. Pooled effects indicated no impact on measures of cholesterol but suggested small improvements in blood pressure and fasting plasma glucose in trials offering 26 or more hours of contact, again, most of which also offered physical activity sessions (**Table 12**). One study found that physical fitness was better maintained among participants of an intervention that included physical activity sessions compared with control participants.[151]

Intermediate outcomes were reported by two studies of orlistat[158, 159] and one study each of phentermine/topiramate,[161] liraglutide,[156] and semaglutide[162] (**Tables 13–18**). Pharmacotherapy was associated with larger mean BMI reductions than placebo in all the studies except one small (n=40) study of orlistat.[159] Liraglutide was associated with 1.6 kg/m^2 greater reduction in BMI than placebo (MD, -1.6 kg/m^2 [95% CI, -2.5 to -0.7] after 13 months),[156] semaglutide with a 6.0 kg/m^2 greater reduction BMI, (MD, -6.0 kg/m^2 [95% CI, -7.3 to -4.6] after 16 months), orlistat with a 0.9 kg/m^2 greater reduction (MD, -0.9 kg/m^2 [95% CI not reported [NR], p=0.001], after 12 months),[158] and phentermine/topiramate with 3.7 to 5.4 kg/m^2 greater reductions (15/92 mg dose MD, -5.4 kg/m^2 [95% CI, -6.4 to -4.3]; 7.4/46 mg dose MD, -3.7 kg/m^2 [95% CI, -5.0 to -2.5] after 13 months).[161] Group differences were not maintained in the liraglutide study after 6 months without treatment and longer-term maintenance after medication withdrawal was not reported for any of the other medications. All medications showed increases in the likelihood of losing both 5 percent and 10 percent of baseline weight or BMI. The only medication that showed a clear benefit for blood pressure was phentermine/topiramate, and only at the higher dose level (MD, -4.0 [95% CI, -7.7 to -0.5]). Semaglutide use improved LDL (MD in % change, -7.1 [95% CI, -11.9 to -1.8]), and phentermine/topiramate improved HDL (e.g., 15/92 mg/day dose: MD in % change, 8.8 [95% CI, 2.2 to 15.4]) but other medications had minimal to no impact on lipids. None of the trials found improvements in glucose-related parameters.

Detailed Results by Outcome

Behavioral Interventions

All 50 behavioral intervention trials reported a weight outcome, as specified in our inclusion criteria (N= 8,798). Sixteen studies also reported blood pressure, one or more lipid measures, an insulin-related measure, or a measure of physical fitness (N=1,700).[110, 114-120, 127, 131, 133, 135, 136, 150, 151, 154] Detailed results for intermediate outcomes are shown in **Appendix D Tables 7 and 8**.

Weight

BMI was the primary outcome for this review, reported by 30 studies. Young people participating in behavioral interventions demonstrated a 0.7 kg/m^2 greater reduction (or smaller increase) in BMI than those in control groups after 6 to 12 months (MD, -0.7 [95% CI, -1.0 to -0.3]; 28 RCTs [n=4,494]; I^2=86.8%, **Figure 6, Table 11**). The effect was larger in trials with 26 or more hours of estimated contact (MD, -1.4 [95% CI, -2.2 to -0.6]; 11 RCTs [n=1,087]; I^2=87.8%) than trials with fewer than 26 hours of contact (MD, -0.3 [95% CI, -0.5 to -0.1]; 17 RCTs [n=3,407]; I^2=62.1%; p=0.004 for difference between contact time levels). Meta-analysis results of other measures of weight generally showed similar patterns of results (**Table 11, Appendix E Figures 4 and 5**). The change in weight was 2.1 kilograms greater weight loss (or less weight gain) in the intervention groups than the control groups, (MD, -2.1 [95% CI, -3.0 to -1.2]; 18 RCTs [N=1,625], but the effect on weight change did not differ between higher and lower contact interventions. While zBMI is not recommended as a measure of change,[100] it is included in the table because it was the most widely reported outcome and was the primary outcome in the previous USPSTF report.[94] Forest plots showing BMI and zBMI by four levels of estimated contact time are included in the appendix, for comparison with findings of the previous review (**Appendix E Figures 6 and 7**).

Stratified analyses and meta-regression indicated that, in addition to contact time, a higher number of sessions (p<0.001) and the inclusion of physical activity sessions (p<0.001) during the intervention sessions were both associated with larger reductions in BMI (**Figure 7**, **Appendix D Table 9**). All of these measures are highly correlated, making it impossible to determine with certainty which features are driving the association. However, exploratory analyses suggested that the presence of physical activity sessions may have the strongest predictive utility. First, physical activity sessions were the only statistically significant predictor in a meta-regression that included both contact hours and an indicator for the presence of physical activity sessions. Second, a separate analysis found no association between effect size and contact hours among interventions that did not include physical activity sessions. On the other hand, the small number calories burned during in-session activities seems unlikely to have direct impact on weight.

Effect modification was not detected by any of the other characteristics we examined, including:

- age category (preschool, elementary, adolescent, wide range)
- months to followup
- whether weight was measured immediately post-treatment vs. delayed by one month or more

- months' gap between treatment completion and followup assessment
- study quality rating (good vs. fair)
- publication year
- whether the study was conducted in the United States
- whether the study was implemented in a primary care setting
- whether the study was limited to young people with BMI ≥95th percentile for age and sex (or similar criteria)
- whether the study was limited to young people with higher BMI but below the 95th percentile for age and sex (or similar criteria)
- whether at least 50% of the study sample were comprised of Black or Hispanic/Latino young people.

None of the alternative interventions with little to no counseling to change diet and physical activities levels showed an impact on weight. These included two trials examining interpersonal therapy as the treatment modality,[143, 144] specially calibrated plates and bowls for portion control,[115] and a regulation of cues intervention.[106]

Seven studies reported subgroup analyses examining whether effect sizes for weight outcomes differed by socioeconomic indicators,[107, 112, 145] gender,[112, 114, 127, 136, 145] age,[107, 145] baseline BMI category,[123] and race and ethnicity[145] (**Appendix D Table 7**). Although none of them directly tested the interaction term, several found statistically significant effects in some subgroups but not their counterparts. All three studies that examined socioeconomic indicators found larger effects among participants with higher socioeconomic status, including those with higher maternal education levels,[107] families categorized as having high socioeconomic status,[112] and those with family income ≤$50,000 (published in 2011).[145] The findings of effect sizes differences by gender were mixed, with some favoring girls[112, 145] and some favoring boys.[114, 127, 136] The one trial that examined race and ethnicity found that effects were smaller among Hispanic/Latino youth than among those who were Black, White, or "Other".[145] No other analyses indicated effect modification.

We were unable to draw any conclusions about whether efforts to address social determinants of health improved the likelihood of improved weight outcomes. The approaches to addressing social determinants were highly heterogenous and interventions to address social determinants were confounded by effects of intervention dose. Ten trials (all behavioral intervention trials) reported an effort to mitigate one or more barriers to participation or social risk factors, such as difficulty with transportation, language barriers, help with accessing social services to address housing, financial strain, or food insecurity (**Table 19**).[111, 123, 125, 132, 133, 136, 138-140, 147] Four of these trials included a majority of participants who were Black, Hispanic/Latino, South Asian, or Native American.[123, 133, 136, 138]

The efforts to address social determinants of health ranged from relatively minor accommodations such as flexibility with location or in-person vs. phone sessions,[111, 132] to providing free food samples or access to exercise facilities,[123, 133, 139, 140] bilingual instructors,[136] or providing referrals to partner agencies to help address employment, food and housing insecurity, and insurance coverage.[138] One trial did not provide material help, but described efforts to make the intervention materials inclusive and relevant to a wide range of families by

integrating ethnic, cultural, and economic differences into the intervention content, including using a broad range of family types in the materials and examples.[125] The pattern of effects in this subset of studies was similar to the overall findings: trials testing higher-contact interventions were likely to find greater relative reductions in weight-related outcomes while lower-contact interventions were not. One trial that countered this pattern was a higher-contact trial that showed no group differences in weight, despite the fact that the intervention addressed social needs by providing families in need with referral to existing resources for help with employment, food and housing insecurity, and insurance coverage.[138] Despite this trial's results, we were not able to discern any pattern of effect modification with the integration of intervention components to address barriers to participation or social risk factors, and a meta-regression testing for effect modification was not statistically significant (p=0.61).

Data on the long-term effects of behavioral weight management interventions were extremely limited. Only ten of the 50 trials reported results beyond 12 months after the baseline assessment (**Appendix D Table 7**).[107, 117, 118, 124, 132, 137, 141, 145, 148, 149] Only two trials found greater improvements in any weight outcome beyond 12 months, and both of these tested 24-month interventions and measured outcomes immediately after the intervention was completed.[132, 148] One of these two trials reported a 3.1-point greater reduction in BMI percentile, (MD, -3.1 [95% CI, -6.3 to 0.1]; study-reported p=0.02). The other found larger reductions for both BMI (MD, -0.3 kg/m^2 [95% CI, -0.6 to -0.0]) and waist circumference (MD, -1.5 cm [95% CI, -2.5 to -0.5]) after 24 months.[148] Evidence was similarly very limited on how the trajectory of BMI over time is affected by weight management interventions, among studies providing multiple followup assessments. **Figure 8** shows all studies reporting more than one post-baseline followup and illustrates both how limited the evidence is on longer-term trajectories, and how group differences tend to attenuate over time, among trials with group differences at any timepoint.

Smaller subsets of trials reported waist circumference or percent body fat, which are more direct measures of adiposity. Similar to the other weight outcomes, these outcomes also showed larger effects in trials with higher contact hours, most of which included physical activity sessions (**Table 11, Appendix E Figures 8 and 9)**. For both waist circumference and percent body fat, effects were statistically significant among trials offering 26 or more hours of contact and not significant among lower-contact trials. These results are limited by the small number of trials reporting these outcomes.

Blood Pressure

13 studies reported either systolic (SBP) or diastolic (DBP) blood pressure.[114-118, 127, 131, 133, 135, 136, 150, 151, 154] Only four studies found greater improvement in either SBP or DBP at any timepoint;[117, 131, 136, 154] all of these included more than 26 hours of contact, and three included physical activity sessions.[131, 136, 154]

Pooled analyses showed that weight management interventions were associated with improvements in DBP and that only higher contact trials were associated with improvements in SBP after 6 to 12 months (SBP, ≥ 26 hours: MD, -3.6 mm Hg [95% CI, (-5.7 to -1.5)]; 8 RCTs [n=773]; I^2=47.3%; DBP, all studies: MD, -2.2 mm Hg [95% CI, (-3.8 to -0.7)]; 12 RCTs [n=1,190]; I^2=35.2%, **Appendix E Figures 10 and 11, Table 12**). All but one of the higher-contact trials included in the meta-analyses utilized physical activity sessions during the

intervention sessions. No trials reported the percent of participants meeting criteria for hypertension. These results are limited by the small number of trials reporting these outcomes.

Lipids

14 studies reported either total cholesterol, HDL, LDL, or triglyceride levels.[110, 114-116, 118-120, 123, 127, 135, 136, 150, 151, 154] Only three studies reported any positive findings for any lipid outcome at any followup timepoint, finding larger improvements in total cholesterol,[135] triglycerides,[136] and LDL only among female participants.[127] All of these trials offered more than 26 hours of contact, two of them offered physical activity sessions, and none found group differences in other lipids.

None of the overall pooled analyses showed greater improvement in lipid outcomes for participants in weight management interventions than for those in control conditions after 6 to 12 months (**Appendix E Figures 12–15, Table 12**). For example, the overall effect for LDL showed no group differences in change (MD, -3.2 mg/dL [95% CI, -9.0 to 2.6]; 7 RCTs [n=648]; I^2=56.9%), and effect sizes were very similar for higher and lower contact trials (≥26 hours: MD, -2.4 mg/dL [95% CI, -9.7 to 4.8]; 3 RCTs [n=301]; I^2=0%; <26 hours: MD, -3.9 mg/dL [95% CI, -17.4 to 9.5]; 4 RCTs [n=347]; I^2=74.6%, **Appendix E Figure 12**). The only lipid outcome that showed improvement in any pooled analysis was triglycerides, which only showed improvement among participants of higher contact trials (**Table 12**). One additional trial reported on the percent of participants meeting criteria for dyslipidemia at the end of an 8-month intervention, finding no difference between groups (1.2% of participants in each group met criteria).[123] Lipid results are limited by the small number of trials reporting these outcomes.

Glucose Metabolism

Twelve studies reported an outcome related to glucose metabolism after 6 to 12 months.[110, 114-116, 118-120, 123, 127, 135, 136, 150, 151] Four trials found group differences in improvement in outcomes related to glucose metabolism at any time point, including fasting plasma glucose,[119, 136] or insulin levels.[135, 136, 151] Diabetes incidence was reported in only two studies but there were too few cases to draw conclusions (2 cases combined in both studies).[123, 136] In the pooled analysis, higher (but not lower) contact interventions were associated with a small decline in fasting plasma glucose (≥26 hours: MD, -1.9 mg/dL [95% CI, -2.7 to -1.2]; 4 RCTs [n=367]; I^2=0%; <26 hours: MD, 1.0 mg/dL [95% CI, -1.4 to 3.4]; 5 RCTs [n=383]; I^2=5.0%, p=0.016 for difference between groups, **Figure 9**). All four interventions with 26 or more hours of contact also included physical activity sessions. These results are limited by the small number of trials reporting these outcomes.

Physical Fitness

One study found that children participating in a multidisciplinary weight management intervention that included physical activity sessions maintained physical fitness after 12 months of participation in the intervention while fitness (measured by peak value of oxygen uptake, standardized for age and gender) declined in those in the control group (MD, 0.7 [95% CI, 0.3 to 1.1], mean (SD) change from baseline: 0.0 (2.1) in the intervention group, -1.1 (2.0) in the control group.[151]

Glucagon-Like Peptide 1 Agonists

One study each reported intermediate outcomes for semaglutide (n=201)[162] and liraglutide (n=251).[156]

Weight

After 13 months of daily injections of 3.0 mg of liraglutide, BMI was reduced by 1.6 kg/m^2 more than those taking placebo (MD, -1.6 [95% CI, -2.5 to -0.7], **Table 13**, **Appendix D Table 10**). This effect was no longer statistically significant 6 months later, in the absence of treatment (MD, -1.0 [95% CI, -2.0 to 0.01]). This amounted to a 4.5 kg greater reduction in weight than the placebo group after 13 months (MD, -4.5 [95% CI, -7.2 to -1.8]) and a statistically nonsignificant reduction of 2.7 more kilograms 6 months later (MD, -2.7 [95% CI, -5.6 to 0.2]). At the 13-month followup, participants taking liraglutide were more likely to have lost 5 percent of their baseline BMI (RR, 3.5 [95% CI, 1.8 to 6.2) and 10 percent of their baseline BMI (RR, 4.4 [95% CI, 1.8 to 8.8]). Percent of BMI loss was not reported at the 19-month followup, 6 months after treatment had ended.

After 16 months of weekly injections of 2.4 mg of semaglutide, there was a 16.7 percentage point greater reduction in baseline BMI compared to those receiving placebo injections (MD, -16.7 [95% CI, -20.3 to -13.2] (**Table 13**, **Appendix D Table 10**).[162] Participants taking semaglutide lost a mean 15.3 kilograms compared to a mean 2.4 kg increase with placebo injections (MD, -17.7 [95% CI, -21.8 to -13.7]). In the one month after semaglutide was discontinued, those who had been taking semaglutide regained 3.1 percent of their original weight. After 16 months of treatment, those taking semaglutide showed a marked increased likelihood of 5 percent and 10 percent weight loss (5%: RR, 12.2 [95% CI, 6.3 to 31.0]; 10%: RR, 18.5 [95% CI, 8.3 to 63.7]). And 25.4 percent of participants had a BMI below 25 after 16 months, compared with 1.7 percent receiving placebo injections (RR, 19.4 [95% CI, 2.6 to 146.5]). In this study, change in body weight did not differ by sex, age, or baseline body weight.

Blood Pressure

There were no group differences in either SBP or DBP for either medication at the end of the treatment period, with differences of 2.0 mm Hg or less in all cases (**Table 16**, **Appendix D Table 11**).

Lipids

Liraglutide was associated with 1.0 mg/dL greater increases in all lipids measures after 13 months (e.g., LDL MD, 1.0 [95% CI, 0.9 to 1.0]; HDL MD, 1.0 [95% CI, 1.0 to 1.1]; **Table 16, Appendix D Table 11**). Semaglutide was associated with greater percent reductions in LDL, total cholesterol, and triglycerides from baseline levels (e.g., LDL MD, -7.0% [95% CI, -11.9 to -1.8]) and a statistically nonsignificant increase in HDL (MD, 4.7% [95% CI, (-1 to 10.7).

Glucose Metabolism

Liraglutide was not associated with a greater improvement in fasting plasma glucose (MD, -1.8 [95% CI, -4.1 to 0.5]) or HbA1c (MD, - 0.16 [95% CI, -0.1 to 0.0]) after 13 months (**Table 16,**

Appendix D Table 11). Semaglutide also found no differences between groups in HbA1c (MD, -0.3 [95 % CI NR]).

Orlistat

Weight Outcomes

In the larger study of orlistat (n= 539),[158] BMI of participants treated with orlistat had decreased from baseline by 0.6 kg/m^2 and increased by 0.3 kg/m^2 in the placebo group after 12 months (p=0.001, **Table 14, Appendix D Table 12**). The difference in BMI change was slightly smaller and not statistically significant in the smaller study (n=40) after 6 months (MD, -0.5 kg/m^2 [95% CI, -7.9 to 6.9]).[159] After 12 months, participants taking orlistat in the larger study were more likely to have lost at least 5 percent of their baseline BMI (RR, 1.9 [95% CI, 1.2 to 3.0]) and at least 10 percent of their baseline BMI (RR, 3.2 [95 % CI, 1.5 to 7.0]).[158]

Blood Pressure

Blood pressure was only reported by the larger study, which found a small reduction in DBP with orlistat compared to placebo after 12 months, but no group differences in SBP (SBP: MD, -0.2 [95% CI not reported], p=0.84; DBP: MD, -1.8 [95% CI not reported], p=0.04; **Table 17, Appendix D Table 13**).

Lipids

Neither study of orlistat found group differences in change in any lipid measures (**Table 17, Appendix D Table 13**).

Glucose Metabolism

Neither study of orlistat found group differences in change in any glucose-related measures (**Table 17, Appendix D Table 13**).

Phentermine/Topiramate

One study reported intermediate outcomes for phentermine/topiramate (n=227).[161]

Weight

After 13 months of treatment, participants taking the higher dose (15/92 mg) had reduced their BMI by 5.4 kg/m^2 more than those taking placebo (MD, -5.4 [95% CI, -6.4 to -4.3]) and those taking the lower dose (7.5/46 mg) had reduced their BMI by 3.7 kg/m^2 more than placebo (MD, -3.7 [95% CI, -5.0 to -2.5], **Table 15**). This amounted to a 15.8 kg greater reduction in weight than the placebo group after 13 months in the higher-dose group (MD, -15.8 [95% CI, -18.8 to -12.8]) and a 12.1 kg reduction in the lower-dose group (MD, -12.1 [95% CI, -15.6 to 8.6]). At the 13-month followup, participants taking either dose of phentermine/topiramate were more likely to have lost 5 percent of their baseline BMI (RR, higher dose: 5.6 [95% CI, 2.2 to 14.4]; lower dose: 4.6 [95% CI, 1.7 to 21.7]) and 10 percent of their baseline BMI (RR, higher dose: 12.2 [95% CI, 3.1 to 48.3]; lower dose: 9.3 [95% CI, 2.3 to 38.0]).

Blood Pressure

There were no group differences for SBP after 13 months of treatment in either group, however the lower dose group (but not the higher dose group) did show a statistically significant reduction in DBP (MD, -4.0 mm Hg [95% CI, -7.5 to -0.4], **Table 18**).

Lipids

The phentermine/topiramate study reported only percent change in HDL (**Table 18**).

Glucose Metabolism

Phentermine/topiramate was not associated with a greater improvement in insulin level (e.g., MD with the higher dose, 0.8 [95% CI, -0.6 to 2.2]) after 13 months (**Table 18**).

KQ3. Do Primary Care–Relevant Behavioral, Pharmacotherapy, or Combined Weight Management Interventions for Children and Adolescents With Higher BMI Improve Behavioral Outcomes?

Summary of Results

Twenty-three of the 50 behavioral intervention trials reported an eligible behavioral outcome (n= 3,459).[107, 111, 113, 114, 119, 122, 124, 126, 128-131, 133, 134, 137-141, 145, 148, 152, 153] Although some individual trial findings were statistically significant, most evidence and the meta-analyses indicated no effect on minutes per day of physical activity or sedentary behavior (physical activity; MD, 5.2 [95% CI, -2.0 to 12.4]; 10 RCTs [n=1,533]; I^2=85.5%, **Figure 10, Table 20**; sedentary behavior: MD, -13.3 [95% CI, -26.9 to 0.4]; 11 RCTs [n=1,366]; I^2=41.4%, **Figure 11, Table 20**). Only five trials reported overall dietary patten scores and findings were mixed (**Figure 12**). None of the pharmacotherapy studies reported relevant behavioral outcomes.

Detailed Results by Outcome

Behavioral Interventions

Twenty-three behavioral intervention trials reported an eligible behavioral outcome (n= 3,459).[107, 111, 113, 114, 119, 122, 124, 126, 128-131, 133, 134, 137-141, 145, 148, 152, 153] Detailed results for all behavioral outcomes are shown in **Appendix D Table 14**. Thirteen of these trials were conducted in the United States.[111, 119, 122, 128-130, 134, 137-141, 145] Four included a majority of participants who were Hispanic/Latino,[119, 128, 129, 138] and most or all participating families had low income levels in two of these trials, based on Medicaid or CHIP enrollment.[128, 138]

Physical Activity

Seventeen trials reported a measure of moderate, moderate-to-vigorous, or overall physical activity (including metabolic-equivalent [MET] unit measures).[111, 113, 114, 119, 122, 128-130, 133, 137, 139-141, 145, 148, 152, 153] Physical activity was most commonly measured by accelerometer, but some trials used 24-hour or 7-day self-reported recall measures. Only one trial reported a statistically significant increase in physical activity at followup compared to the control group.[133] Ten trials reported a measure of minutes per day (or one that could be converted to minutes/day) and provided sufficient data to be included in the meta-analysis. Change in minutes per day of physical activity did not differ between participants in weight management interventions and those in control conditions (MD, 5.2 [95% CI, -2.0 to 12.4]; 10 RCTs [n=1,533]; I^2=85.5%, **Figure 10, Table 20**). Effects were statistically non-significant for both higher- and lower-contact interventions.

Sedentary Behavior

Eighteen trials reported a measure of sedentary behavior, screen time, or computer time, typically measured by self-report.[107, 111, 113, 114, 119, 122, 124, 126, 128-131, 133, 134, 137, 145, 148, 153] Five trials found a greater improvement in the intervention participants than the control participants at some timepoint, but in all cases, multiple timepoints, intervention groups, or specific outcomes were reported and differences were statistically significant for only one group, timepoint, or outcome.[119, 128, 129, 133, 145] Eleven trials reported a measure of minutes per day (or one that could be converted to minutes/day) and provided sufficient data to include in the meta-analysis. Change in minutes per day of sedentary activity did not differ between participants in weight management interventions and those in control conditions (MD, -13.3 [95% CI, -26.9 to 0.4]; 11 RCTs [n=1,366]; I^2=41.4%, **Figure 11, Table 20**). Effects were statistically non-significant for both higher- and lower-contact interventions.

Dietary Pattern

Only five trials reported an overall dietary pattern outcome (N=820).[124, 138, 141, 152, 153] All available data are shown in **Figure 12**. Three of the trials reported in improvement in dietary pattern,[124, 138, 141] one only for the higher contact intervention arm.[141] One of these trials reported a 2.1 (95% CI, 1.3 to 2.9) greater increase in dietary pattern score, measured on a 28-point scale, six months after treatment had ended, and a slightly smaller but still statistically significant effect 6 months later.[124] The other trial found an 8.7-point difference (95% CI, 3.8 to 13.6), measured on a 100-point scale, for their higher-contact group, but no improvement over the control group for the lower contact group (estimated contact hours were 38 and 7.5, respectively). The third study there was a decline in the control group's mean dietary pattern score but no change for the intervention group (MD, 0.2 [95% CI, -0.06 to 0.4], study-reported p=.008).[138]

Pharmacotherapy

None of the included studies reported eligible behavioral outcomes.

KQ4. Are There Harms Associated With Weight Management Interventions for Children and Adolescents?

Summary of Results

None of the 18 trials (N=2,539) reporting potential harms of behavioral weight management interventions found an increase in the risk of any adverse event or serious adverse events, or decreases in self-esteem, body satisfaction, or disordered eating after 6 to 12 months (**Table 21**). Two trials of interpersonal therapy with limited counseling to change diet and physical activity found *reductions* in disordered eating,[143, 144] suggesting a benefit rather than a harm of behavioral interventions. No information was available on the risk of harm beyond 12 months.

Gastrointestinal side effects were common among patients taking glucagon-like peptide-1 agonists and orlistat (**Figure 13**). Discontinuation due to adverse effects occurred in 10.4 percent in the larger trial of liraglutide compared with none in the group receiving placebo injections.[156] Discontinuation due to adverse effects was relatively rare with semaglutide, orlistat, and phentermine/topiramate, less than 5 percent in all groups. Serious adverse effects were rare for all medications and did not differ between groups in any study, although five participants taking semaglutide (3.8%) developed gallstones, compared to none taking placebo (calculated RR, 5.8 [95% CI, 0.3 to 106.1]). The most common non-serious adverse events reported with phentermine/topiramate were musculoskeletal and psychiatric, when taken at doses of 15 mg/92 mg. No evidence was available beyond 13 to 17 months of medication administration.

Detailed Results by Outcome

Behavioral Interventions

Eighteen of the behavioral intervention trials reported a potential harm (N= 2,539).[109, 111, 112, 115, 116, 124, 129-131, 133, 134, 141, 143, 144, 150, 152, 153] None of the trials measured potential harms beyond 12 months post-baseline. Detailed results can be found in **Appendix D Table 15.**

Any or Any Serious Adverse Events

Three trials reported that no participants experienced either any adverse events[115, 131] or any adverse events related to treatment.[133] One trial each reported an adverse event judged to be probably related to treatment.[133, 141] In these studies, one person bumped their head during an intervention activity[141] and in the other one person in the control group reduced their BMI by 4.2 kg/m^2, which the authors viewed as a possible harm.[109] One other trial reported that no participants in either group were underweight at followup.[112] Four trials reported no serious adverse events among the study participants.[130, 141, 150]

Disordered Eating

Five trials reported an outcome related to disordered eating.[111, 134, 143, 144, 150] All of these trials were limited to youth age 12 and older, and three were limited to girls.[111, 143, 144] Two of these

trials (both limited to girls) examined interpersonal therapy, and focused on overeating and loss-of control eating and their links to interpersonal functioning, rather than the more typical approach of encouraging changes in diet and physical activity.[143, 144] Both of these trials reported larger improvements with interpersonal therapy compared to a brief health education control. One found a reduction in the percent of girls with any binge eating (odds ratio [OR], 0.14 [95% CI, 0.03 to 0.64]) and fewer binge eating episodes during the year post-baseline among youth in the interpersonal therapy group (the control group had 0.28 [95% CI, 0.03 to 0.53] more episodes than those in the interpersonal therapy group).[144] The other trial of interpersonal therapy also found a greater reduction in the number of disordered eating episodes with interpersonal therapy (MD in change, -0.32 episodes, 95% CI not reported, p=0.04). Another study in adolescent girls found no difference between groups in the percent of participants with disordered eating, with very few events but trending in the direction of benefit (e.g., 2/104 [1.9%] in the intervention group vs. 5/102 [4.9%] in the control group; RR, 0.38 [95% CI, 0.07 to 2.01] after 6 months).[111] Groups did not differ on continuous measures based on questionnaires assessing eating attitude,[134, 150] dieting,[150] loss-of-control eating,[144] eating restraint,[134] or eating disinhibition.[134]

Self Esteem

Seven trials reported an outcome related to self-esteem.[111, 124, 129, 133, 150, 152, 153] None found group differences at any timepoint on any measure. Effect sizes for rating scales ranged from 0 to 1.8-point differences in change between groups, on 30- to 36-point scales.

Body Satisfaction

Five trials reported an outcome related to body satisfaction.[111, 116, 124, 152, 153] One study of adolescent girls found that Body Satisfaction Scores improved by 0.23 points after 12 months (MD, 0.23 [95% CI, 0.02 to 0.44]; range of the scale NR). The remaining studies found no group differences on the 7-point Collins Body Figure Perception scale, with differences in change between groups ranging from -0.3 to 0.2, or no differences on the weight satisfaction subscale of a body esteem scale (MD, 0.0 [95% CI, -0.2 to 0.2]), range of the scale NR).

Glucagon-Like Peptide 1 Agonists

One RCT (n=201) of semaglutide[162] and three RCTs of liraglutide were included for examination of harms.[155-157] Two of the liraglutide studies were small trials (n=21 and n=24) with only one to two months in duration, so did not meet the 6-month minimum followup criteria for health outcomes, weight, and other intermediate outcomes.[155, 157] The other study evaluating liraglutide included 251 participants.[163]

Discontinuation Due to Adverse Effects and Serious Adverse Effects

In the largest trial of liraglutide, 10.4 percent of participants discontinued treatment due to adverse effects, compared with none receiving placebo injections (RR, 30.36 [95% CI, 1.78 to 516.57], **Figure 13, Table 21, Appendix D Table 16**). The rate of serious adverse effects in the largest trial did not differ between groups (2.4% with liraglutide, 4% with placebo, RR, 0.60 [95% CI, 0.14 to 2.55) and no serious adverse events occurred in either of the smaller trials. The smaller trials reported that 14.3[155] percent and 31.3[157] percent of participants taking liraglutide experienced an adverse event of any level of severity that was probably related to the treatment.

For semaglutide, groups showed similar proportions who discontinued the medication due to adverse effects (4% in each group), who had serious adverse effects (11% with semaglutide, 9% with placebo), and any adverse effects (79% with semaglutide, 82% with placebo). Although the difference between groups was not statistically significant, 5 individuals taking semaglutide developed gallstones (3.8%), compared to none taking placebo (calculated RR, 5.8 [95% CI, 0.3 to 106.1]).

Side Effects

Gastrointestinal complaints were the most common class of side effects (**Appendix D Table 16**). For example, in the largest trial gastrointestinal complaints occurred in 65 percent of those receiving liraglutide and 36 percent of those receiving placebo injections over the course of treatment, and difference was statistically significant (RR, 3.20 [95% CI, 1.91 to 5.36]). Similarly, 61.7 percent of those receiving semaglutide and 41.8 percent receiving placebo injections reported gastrointestinal complaints. No other side effects differed between groups for either medication.

Orlistat

The same two RCTs of orlistat included for other key questions also reported harms outcomes; one was substantially larger (n=537)[158] than the other (n=40).[159]

Discontinuation Due to Adverse Effects and Serious Adverse Effects

Both orlistat studies reported discontinuation due to adverse effects. Combined, 14/372 (4.0%) of participants taking orlistat discontinued due to adverse effects, compared with 3/201 (1.5%) taking placebo (**Figure 13, Table 21, Appendix D Table 17**). In the larger orlistat trial, there were 11 serious adverse events in the orlistat group and five in the placebo group.[158] In the orlistat group, only one serious adverse event was thought to be possibly study-related—asymptomatic cholelithiasis leading to cholecystectomy in a 15-year-old female who had lost 15.8 kg by the time of the event. In the smaller trial, one suicide occurred in the orlistat group; this patient was under a psychiatrist's care.[159] No deaths occurred in the placebo group.

Side Effects

Side effects were primarily gastrointestinal and were fairly common among patients taking orlistat (**Appendix D Table 17**). Abdominal pain was higher with orlistat (22%) than placebo (11%) in the larger study.[158] In the smaller study, cramping was not statistically higher during the final month of treatment, (orlistat, 13% vs. placebo, 22%), however cramping was higher with orlistat during the first months of treatment (e.g., 65% with orlistat vs. 26% with placebo in month 1).[159] Across both studies, flatus with discharge was reported by 20 to 25 percent of those taking orlistat and 0 to 3 percent of those taking placebo (RR, 8.74 [95% CI, 3.46 to 22.07] in the larger study). Fecal incontinence was reported in 6 to 9 percent of orlistat participants and 0 to 1 percent of placebo participants (RR, 17.38 [95 % CI, 2.35 to 128.4] in the larger study). The smaller trial reported adverse effects over time.[159] The prevalence of some but not all adverse effects decreased over time among those taking orlistat.

Vitamin Levels

Both orlistat trials measured vitamin A, D, and E levels and reported no differences between groups.[158, 159] Both trials, however, provided multivitamin supplementation for all participants.

Phentermine/Topiramate

In addition to the trial examined for efficacy of phentermine/topiramate,[161] an additional small RCT (n=42) reported on harms of two dosing regimens (15 mg/92 mg and 7.5 mg/46 mg) after two months of use.[160] This trial was not included for evaluation of health outcomes, weight, or other intermediate outcomes due to the short duration of followup.

Discontinuation Due to Adverse Effects and Serious Adverse Effects

Across all treatment arms in both studies, 3 of 126 persons taking phentermine/topiramate discontinued treatment (2.4%, all receiving the higher dose) and 2 of 70 persons taking placebo discontinued (2.8%, **Figure 13, Table 21, Appendix D Table 18**). Three serious adverse events among two individuals were reported across both trials among those assigned to the higher dose of topiramate/phentermine: a bile duct stone, depression, and suicidal ideation. Most types of side effects were experienced at comparable rates between groups.

Side Effects

In the larger study, the side effects that were slightly more common with higher-dose phentermine/topiramate were musculoskeletal (experienced by 10 persons [8.8%] with phentermine/topiramate vs 1 [1.8%] with placebo) and psychiatric (10 persons [8.8%] with phentermine/topiramate vs 1 [1.8%] with placebo), although group differences were not statistically significant (**Appendix D Table 18**).[161] Side effects that were more common in the smaller trial included those related to the nervous system (7 persons [54%] taking the 15 mg/92 mg combination, 2 persons [13%] taking the 7.5 mg/46 mg combination, and 4 [29%] taking the placebo) and gastrointestinal system (1 persons taking the 15 mg/92 mg combination, 3 person taking the 7.5 mg/46 mg combination, and 0 taking the placebo).[160]

Contextual Findings

CQ1. What Is the Prevalence of BMI Assessment in Children and Adolescents in Primary Care Practice? Does the Prevalence of BMI Assessment Vary by Age?

Summary: *Data regarding the contemporary assessment of BMI in children and adolescents in the United States shows a mixed picture. Overall, clinical practice appears to have changed dramatically over the past one to two decades. Survey data of pediatricians indicate that the assessment of BMI is very common and the standard of practice, however, the prevalence of BMI percentile documentation is smaller in other datasets. Further, the extent to which BMI results are discussed with patients or used for referral for weight management is much more uncertain. Much of the literature is over a decade old and may no longer be applicable.*[164]

A 2017 survey of AAP members assessing BMI-related practices found that 96 percent of pediatricians reported calculating BMI at each well-child visit.[165] This proportion represents a dramatic increase over time, rising from 37 percent in 2006. An analysis of NHANES data found that in 2014, just over one-third (34%) of children aged 2 to 18 years with a BMI ≥85th percentile were notified by their health care provider about 'unhealthy weight.'[166] This represented an increase over time, where 22 percent were notified in 1999. This analysis found that older children and teens were more likely to be notified of unhealthy weight than younger children, as were girls, Black and Hispanic/Latino children, and those with BMI ≥95th percentile (compared to ≥85th percentile).

Another data source suggests that BMI measurement is less common. The current Healthcare Effectiveness Data and Information Set (HEDIS) measures include a metric for "Weight Assessment and Counseling for Nutrition and Physical Activity for Children/Adolescents."[167, 168] This measure assesses the percentage of health plan members 3 to 17 years of age who had an outpatient visit with a primary care clinician or OB/GYN and who had evidence of BMI percentile documentation during the measurement year. In 2021, 72 percent of Commercial Health Maintenance Organization (HMO) members, 61 percent of Commercial preferred provider organization (PPO) members, and 76 percent of Medicaid HMO members had documentation of BMI percentile. These figures represent dramatic increases over 2009 data, where 35, 17, and 30 percent, respectively, had BMI percentile documentation. For both survey data and HEDIS measures, no data are available for BMI assessment by age.[168]

In addition to measuring BMI at well-child visits, pediatrician surveys also suggest that providers are discussing healthy behaviors with families. The 2017 survey of AAP members reported that 93 percent are discussing eating a variety of fruits and vegetables, 91 percent are discussing being physically active, and 89 percent are discussing screen time.[165] Again, results from HEDIS measures are more conservative.[168] 2020 HEDIS measures showed that counseling for nutrition occurred in 60 percent of Commercial HMO members, 53 percent of Commercial PPO members, and 67 percent of Medicaid HMO members. For physical activity counseling, these numbers were 56 percent, 49 percent, and 63 percent, respectively for 2020.

Some data suggest that an increasing proportion of pediatricians are referring children and adolescents to community-based weight management programs. Comparing 2017 to 2006 survey data, more pediatricians reported referring children with "overweight" (14.6% vs. 20.4%), "obesity" without complications (44% vs. 52.3%), and "obesity" with complications (60.1% vs. 68.2%) to community-based weight management programs.[165] These estimates, however, are higher than those cited in other sources. For example, a 2018 US-based quality improvement study found that at baseline, 22.3 percent of visits with children and adolescents with BMI ≥95th percentile documented referral to a weight management program.[169]

While physicians responding to the 2017 AAP survey overwhelmingly felt that pediatricians should address obesity at well-child visits (98%) and that pediatricians can help prevent childhood obesity (88%), far fewer felt that there are effective means of treating pediatric obesity (56%).[165] A similar proportion agreed that their counseling on obesity management was somewhat or very effective (55%).

CQ2. How Well Does BMI Predict Adiposity and Overall Health? Does the Predictive Accuracy of BMI Differ by Race or Ethnicity?

Summary: *The BMI is an imperfect measure of adiposity and is not an equivalent measure of adiposity across racial and ethnic groups. At BMIs at or above the 95th percentile, however, most young people have relatively high levels of adiposity (e.g., at or above the 75th percentile in normative samples). Despite limitations in this measure, it is important to understand how the BMI correlates with health outcomes given that its measurement is standard of practice.*

Overall, the literature assessing the relationship between BMI and overall health is difficult to interpret because of complex etiology, a substantial potential for confounding, and long periods of followup required for evaluation. Longitudinal data show that higher BMI in childhood is associated with early cardiovascular disease (CVD) (mortality, early cancer mortality, diabetes, and dyslipidemia in adulthood). The degree of BMI tracking between childhood and adulthood may influence perspectives on when and how aggressively to attempt treatment in children with higher BMI. Overall, cohort studies suggest that BMI tracking is moderate from childhood to adulthood but high for adolescence to adulthood. At the same time, there is a substantial proportion of individuals for whom higher BMI emerges in adulthood. Association data from cohorts of adults have more uncertain findings with respect to the relationship between BMI and mortality. While BMIs ≥35 kg/m^2 are consistently associated with increased overall mortality risk, associations in intermediate BMI ranges differ in prominent analyses and are sensitive to analytic procedures. In the adult literature, evidence suggests that lifestyle behaviors and cardiorespiratory fitness play an important role in the association between BMI and mortality. When these factors are taken into account, behavior appears to modify the association and vastly mitigates or eliminates the role of higher BMI in findings of higher mortality risk. Unfortunately, all of these data are from studies of associations. Trial data evaluating the effect of intentional weight loss on subsequent mortality are sparse and inconclusive.

Strong evidence that weight loss in children and adolescents at higher BMI is associated with health outcomes would support intervention to reduce higher BMI at younger ages. Evidence to connect BMI in childhood to health outcomes is difficult to obtain because of long followup periods between measurement in childhood and older ages at which health events and mortality would occur. In the absence of robust evidence between child BMI and adult health outcomes, an indirect evidence pathway can be assessed by the degree to which childhood BMI persists into adulthood, and how adult BMI is subsequently associated with adult health outcomes (**Figure 14**). Evaluation of these associations at all ages is complicated by a complex ecosystem of factors which are related to both BMI and health outcomes, including other cardiometabolic measures as well as behavioral, social, psychological, and environmental factors.

Accuracy of the BMI

Obesity is presumed to have an impact on health through accumulation of adipose tissue, particularly subcutaneous adipose tissue, which may affect health by increasing inflammation, among other possible pathways.[170] Although there is not an established cutoff for defining excess body fat that is associated with poor health,[171] one study showed many young people with BMI percentile in the 85th to 95th percentile do not have high body fat, as measured using normative

data for DEXA measures of body fat (i.e., at or above the 75th percentile body fat).[12] For example, 43 percent of youth with BMI percentile between 85th and 95th percentile were above the 75th percentile for body fat, meaning 57 percent were below this threshold for high body fat. Misclassification declined as children's BMI percentile increased; 81 percent of boys and 87 percent of girls with BMI at or above the 95th percentile had high levels of body fat. Other investigators have evaluated the accuracy of the BMI to classify adults as cardiometabolically healthy or unhealthy using intermediate outcomes such as blood pressure, lipids, and glucose-related measures.[172] An analysis using a sample of 40,020 adults in the United States showed that 47 percent of adults with BMI 25 to <30 kg/m^2, 29 percent of adults with BMI 30 to <35 kg/m^2, and 16 percent of adults with BMI ≥35 kg/m^2 were metabolically healthy; 69 percent of adults with BMI 18.5 to <25 kg/m^2 were metabolically healthy.

Evidence further shows that BMI is not an equivalent measure of adiposity in different racial and ethnic groups. Overall, analyses suggest that at the same BMI, Black children and adolescents tend to have lower body fat compared to White children and adolescents, and Hispanic/Latino children and adolescents tend to have a higher body fat percent.[14, 173, 174] Several analyses have suggested that these differences are more prominent in boys than girls.[14, 174] Others investigators have reported differences in body composition and stature across the lifespan between Black, Hispanic/Latino, and White adults that could give rise to differences in the BMI-adiposity relationship.[175] The above analyses did not include Asian children and adolescents. A recent NHANES analysis using 2011-2018 data including Asian children and adolescents found that age-adjusted mean body fat percentage was similar for Asian and White boys, which were higher than Black boys, and lower than Latinos.[174] For girls, body fat percentage was similar in Asian, White, and Black girls but higher in Latinas. This analysis further demonstrated that differences by race and ethnicity were not consistent by BMI category, with fewer significant differences at BMIs at or above the 95th percentile. Older studies have shown more consistently that at the same BMI, Asian populations have a higher body fat percentage than White populations, with some variation by sex and BMI-for-age.[176] However, because of heterogeneity in body fatness within regions of Asia, findings for the broad population categorization of 'Asian' should be interpreted with caution.[177, 178]

Some analyses in adults have translated racial and ethnic differences in the BMI-adiposity relationship into specific BMI values. For example, a meta-analysis of 32 studies (N=11,924 adults) showed that at the same body fat percent, age, and gender, Black Americans had a 1.3 kg/m^2 higher predicted BMI than White populations, meaning that Black adults had lower body fat for the same BMI as White adults.[179] This analysis also included a small sample of 128 individuals in Polynesia, and found an even larger discrepancy compared to White adults; among adults at the same body fat, age, and gender, Polynesian individuals had a 4.5 kg/m^2 higher predicted BMI than White populations at a given body fat percent.

Racial and ethnic differences are also present in the relationship between BMI and the incidence of type 2 diabetes in adults. Evidence from NHANES data (n= 19 335) suggests that Black, Hispanic/Latino, and Asian adults all have increased risk for diabetes at lower BMI thresholds than White adults.[180] This study found that, among adults in the United States aged 35 years or older, offering diabetes screening to Black Americans and Hispanic/Latino Americans at BMI ≥18.5 kg/m^2 and ≥20 kg/m^2 for Asian Americans would be equivalent to screening White

Americans with BMI ≥25 kg/m^2.[180]. The American Diabetes Association's 2020 guidelines recommend a lower screening threshold in Asian Americans (≥23 kg/m^2) compared to a ≥25 kg/m^2 threshold in other groups, and further consider African Americans, Hispanic/Latino individuals, Native Americans and Pacific Islanders to have a "high risk race/ethnicity."[181] On the other hand, a separate study based on NHANES data (N= 45,514) seems to contradict these findings, showing that the relationship between BMI and diabetes onset is weaker for Black adults (OR for the interaction term relative to White adults, 0.97 [95% CI, 0.95 to 0.98]).[182] Taken together, these findings suggest some complexity to the association between BMI and diabetes.

Line a. BMI Prediction of Adiposity and Overall Health, Direct Evidence as Measured in Childhood

Robust assessment of the relationship between childhood BMI and overall health requires very long followup periods to observe health outcomes, overcoming difficulties of participant retention over a substantial time horizon, and the ability to control for confounders. Large, pooled analyses from the International Childhood Cardiovascular Cohort (i3c) Consortium represent 30- to 40-year prospective longitudinal followup for seven international cohorts, which offer adjudicated outcomes collected from registries that overcome some of these difficulties. Evidence from this robust dataset shows that higher BMI in childhood is consistently associated with early CVD mortality, early cancer mortality, diabetes, and dyslipidemia in adulthood[23-26] (**Appendix D Table 19**). For example, for each unit of childhood zBMI, the hazard ratio for CVD mortality was 1.44 (95% CI, 1.33 to 1.57) when adjusted for sex, Black race, cohort, mean age, and parental education.[23] Several features of these data, however, limit the certainty of conclusions for the independent predictive value of childhood BMI. These estimates were not adjusted for other cardiometabolic risk factors, physical activity, diet or other behaviors, adult BMI alone, and other potential confounders. When an adult CVD risk score combining several risk factors was added to an analysis of combined childhood CVD risk, the risk for fatal CVD events associated with childhood combined CVD risk was reduced and was no longer statistically significant, underscoring the prognostic importance of risk factors in adulthood. Cohort enrollment occurred 30 to 50 years ago and so may not be representative of contemporary populations. For example, advances in CVD treatment and changes in diet, physical activity, and sleep patterns, environmental contaminants, and myriad other environmental and lifestyle factors may affect these associations. Further, the mean age at death in this analysis was 47 years; thus, it reflects associations with premature CVD death, which may reflect a different risk profile than later death. Additionally, when analyses were conducted for categorical BMI, the reference category of "low-normal" is <50th percentile, which is a low and unconventional cut-point for BMI. I3c analyses specifically for cancer mortality offer several analytic advantages such as control for additional cardiometabolic risk factors and adult BMI; the more comprehensively adjusted HR for cancer mortality was 1.35 (95% CI, 1.12 to 1.63).[24] The mean age of cancer death was 45 years.

In these analyses, the proportions of Black participants ranged from 13 to 29 percent and the proportion of participants who were Hispanic/Latino, Asian, or Native American was not reported but is presumably very low.[23-26] In analyses for CVD and cancer mortality, there were no statistically significant interactions with Black race.[23, 24] In analyses for diabetes and dyslipidemia,[25, 26] associations with BMI were larger in White participants than Black

participants, but only statistically significant in selected analyses for dyslipidemia (association of dyslipidemia with adult BMI in females; White: 2.01 [1.83 to 2.22], Black: 1.61 [1.41 to 1.83], p=0.003).

Other investigators have used alternate measures of predictive value. A systematic review by Llewellyn and colleagues[183] estimated the accuracy of various BMI cut-points in childhood to predict adult outcomes in terms of sensitivity, finding that the use of the BMI to predict adult morbidities is poor. At a childhood BMI cut-point of ≥85th percentile, the pooled sensitivities for adult coronary heart disease (CHD) and stroke were 22 percent (95% CI, 19% to 26%) and 16 percent (95% CI, 16% to 17%) when BMI was measured between ages 12 and 18 years, with similar estimates for ages 7 to 11 years. Estimates were lower at a childhood BMI cut-point of ≥95th percentile. For BMI measured between ages 12 and 18 years, sensitivities for adult CHD and stroke were 8 percent (95% CI, 7% to 10%) and 5 percent (95% CI, 5.36% to 5.84%). At each cut-point, sensitivities for hypertension and diabetes outcomes were higher. The highest sensitivity was ≥85th percentile to predict diabetes, at 31 percent. This review included 37 total cohort studies; however, analyses for any one outcome for a specific age group and cut-point included no more than four cohorts each, and were limited to one cohort for stroke outcomes predicted from ages 12 to 18.

Line b. BMI Tracking From Childhood to Adulthood

In concert with evidence for direct associations between BMI at a particular age and mortality, evidence on the degree of BMI tracking throughout the lifespan may influence perspectives on when and how aggressively to attempt treatment in children with higher BMI. Overall, cohort studies suggest that BMI tracking is moderate from childhood to adulthood but high for adolescence to adulthood. At the same time, there is a substantial proportion of individuals for whom higher BMI emerges in adulthood. It is rare for BMI trajectory to improve over the lifespan, and factors associated with higher risk for increasing BMI over time are female sex and Black race.

A 2016 systematic review and meta-analysis of 15 prospective cohort studies (N=200,777) showed that while the persistence of BMI in the ≥95th percentile from childhood to adolescence was moderate (55%), the persistence of BMI in the ≥95th percentile from adolescence to adulthood was quite strong (80%).[27] Taken together, children and adolescents with BMI in the ≥95th percentile were five times more likely to have this BMI percentile in adulthood (RR 5.21 [95% CI, 4.50 to 6.02]) than children and adolescents below this threshold. However, 70 percent of adults with BMI ≥95th percentile did not have a BMI ≥95th percentile in childhood or adolescence, suggesting that BMIs at this threshold emerge principally in adulthood.

This finding parallels an analysis from the i3c Consortium (N=12,142) focusing on the higher BMI threshold of ≥35 kg/m^2 in adulthood.[28] Adult BMIs of ≥35 kg/m^2 occurred in 6 percent of children with 'normal weight'; 29 percent of children with 'overweight'; 56 percent of children with 'obesity'; and 80 percent of children with 'severe obesity'. On the other hand, 38 percent of the 1440 adults with BMI ≥35 kg/m^2 were 'normal weight' as children. Another i3C analysis shows that less than 5 percent of individuals in included cohorts had decreasing BMI trajectories.[184] Nearly half (47%) demonstrated increasing BMI trajectories. Factors associated

with a higher risk of increasing BMI trajectory were female gender, lower parental education level, and Black race.

Line C. BMI Prediction of Adiposity and Overall Health, Evidence From BMI Measured in Adulthood

Although the applicability to children of evidence among adults is not well understood, given the limited information among children, it may nevertheless be informative to explore the evidence among adults for potential extrapolation. Very large meta-analyses and individual-patient-data meta-analyses of observational studies have evaluated the association between BMI and all-cause mortality in adult populations.[29-31] These studies have consistently shown that BMIs ≥35 kg/m^2 are positively associated with all-cause mortality, however, there are mixed findings for BMI in the range of 25 to 35 kg/m^2 . One prominent analysis shows that BMIs 25 to <30 kg/m^2 are statistically significantly protective for all-cause mortality[30] and another analysis shows that this BMI category is associated with statistically significant excess risk.[29] For example, an IPD meta-analysis by the Global BMI Collaboration reported a hazard ratio of 1.11 (95% CI, 1.10, 1.11) for the association of BMIs in the 25 to <30 kg/m^2 range with all-cause mortality in their primary analysis.[29] In contrast, a systematic review and meta-analysis by Flegal and colleagues found a hazard ratio of 0.94 (95% CI, 0.91 to 0.96) for this same comparison.[30] These analyses have several analytic differences such as varied sample size constraints as well as differential methods for handling smoking and pre-existing disease. Further, these analyses identified data using different procedures, a study-level meta-analysis based on systematic review in one case and an individual patient-data analysis with opportunity for selection bias in the other.[185] Other investigators have empirically studied the potential for uncontrolled confounding in both analyses, suggesting caution in the interpretation of protective or detrimental effects of overweight on all-cause mortality.[186]

Cardiorespiratory fitness is rarely reported in the studies underlying the above meta-analyses and may have a meaningful joint association with BMI in examining the risk of mortality. A systematic review of prospective studies (k=10, N=92,986) examined the joint association of cardiorespiratory fitness and BMI and found that unfit adults have roughly twice the all-cause mortality risk as fit adults, regardless of BMI, and that fit "overweight and obese" adults had similar mortality risk to fit adults at "normal weight" (**Figure 15**).[32] These findings, however, are from a subset of the literature, as few studies report objectively measured cardiorespiratory fitness. This analysis should be confirmed with additional research incorporating new studies.

Studies including a broader array of healthy behaviors when investigating the association of BMI with mortality have similarly found important joint associations between these factors. An analysis of 11,761 adults from NHANES evaluated mortality by BMI category and the number of healthy behaviors: eating ≥5 fruits or vegetables per day, regular exercise >12 times per month, moderate alcohol use (up to 1 drink per day for women and 2 per day for men) and not smoking.[33] Mortality risks were similar among adults with all four healthy behaviors, regardless of BMI category. Further, mortality was similar between adults with BMI ≥30 kg/m^2 with all 4 healthy behaviors and adults with BMI 18.5 to <25 kg/m^2 with none of these healthy behaviors. Such evidence challenges a common perception that BMI is synonymous with health (**Figure 16**).

The above studies address the association between BMI at the baseline period of observational studies and subsequent mortality after prospective followup. More relevant to this review, however, may be the association of intentional weight *loss* with subsequent mortality and other health outcomes. Mortality has been traditionally hard to assess because of the limited followup periods in RCTs of weight loss trials and low event rates. A meta-analysis of 32 studies and 19,463 participants showed that weight loss interventions were associated with a lower but nonsignificant risk of all-cause mortality (OR 0.86 [95% CI, 0.73 to 1.02]).[22] The average followup in this analysis was 9.2 years; 593 deaths occurred which is equivalent to an annual mortality rate of 0.3 percent. A 2018 systematic review by LeBlanc and colleagues that focused more directly on general population samples (e.g., without diabetes) identified only four RCTs of intentional weight loss in adults that reported all-cause mortality. Results were too sparse to be quantitatively pooled; none of the four trials found significant differences in weight loss versus control groups over 2 to 16 years followup.[21] This review also reported that only two studies reported on cardiovascular outcomes, and neither found a reduction in cardiovascular events.[21] This review also reported that weight management interventions were associated with reduction in type 2 diabetes incidence, with an estimated absolute risk reduction of approximately 14.5 percent over 3 to 9 years.[21] Similarly, the Look AHEAD trial, which was limited to adults with type 2 diabetes age 45-75, found no group differences CVD events after 9 years' followup (HR for the primary composite outcome, 0.95 [95% CI, 0.83 to 1.09]), despite the mean 3.5 percent reduction in weight at the end of the intervention and sustained improvements in glycated hemoglobin level and systolic blood pressure.[187-190]

CQ3. Are There Harms Associated With Diagnosing Children and Adolescents as Being Overweight or Having Obesity in the Healthcare Setting (e.g., Harms Associated With Labeling)? Does the Risk of Harm Differ Across Racial and Ethnic Groups or Contribute to Health Inequities?

Summary: *Labeling children and adolescents as having overweight or obesity is associated with poorer psychosocial outcomes, higher rates of unhealthy weight control behaviors, and appears to have either no impact on weight or is associated with greater future weight gain. Weight labeling may undermine health-promoting behaviors associated with body satisfaction among youth with higher BMI, and children who misperceive their weight as being lower than it is may experience less future weight gain, fewer depressive symptoms, and improved blood pressure.*

Accurate weight perception has historically been a focus of public health efforts to reduce obesity, founded on the belief that motivation to engage in healthy behaviors requires individuals to acknowledge that they have elevated BMI.[44] However, this belief is not based on empirical findings and some observational studies have reported the opposite effect. Specifically, research has shown that under-perception of one's weight may be associated with lower future weight gain and improved blood pressure.[44] For example, the NHLBI Growth and Health Study reported that youth with overweight or obesity who under-perceived their weight had lower blood pressure in adulthood than those who perceived themselves to be overweight.[45] In a 2020 editorial, Tracy Richmond, MD of Boston Children's Hospital stated, "because body satisfaction is protective against so many adverse health outcomes, the continued push to correct weight misperception ignores these protective effects and may actually cause harm by inadvertently

promoting weight stigma and weight discrimination."[44] The harms of stigma and weight bias are discussed in more depth in **Contextual Question 7**.

Association of Labeling With Future Weight

Prior studies have demonstrated that labeling of children as "overweight" or "obese" is associated with either no change in BMI or increased BMI in both the short- and long-term. For example, Madsen and colleagues (2021) reported on the impact of school-based BMI reporting on weight status and adverse outcomes among a diverse student population. Children in 79 California schools were cluster randomized to annual BMI screening and reporting results to parents, BMI screening only, or control (no screening or reporting).[34] They found that BMI reporting had no effect on BMI z score change at 1- or 2- years' followup. Furthermore, they found increased weight dissatisfaction among students having BMI screened at school compared to control participants. Likewise, the longitudinal National Heart, Lung, and Blood Institute (NHLBI) Growth and Health Study (2018) followed 2379 girls aged 10–19 years to evaluate the effect of being labeled "too fat" by a family member, friend, or teacher on future obesity.[35, 36] At baseline, 58 percent of girls reported being labeled and Black girls reported more weight labeling than white girls. The results indicated that girls who experienced weight-based labeling at age 10 years were more likely to experience obesity at age 19 years, adjusting for baseline BMI, household income, parental education, race, and age at menarche. This effect was not modulated by race. Relatedly, the National Longitudinal Study of Adolescent Health (N = 6,523; mean age at baseline = 16 years; 58% female) found that adolescents who misperceived themselves as being overweight had greater odds of developing obesity over the 12-year followup period than adolescents who perceived their weight accurately (odds ratio = 1.41, 95% confidence interval = [1.22, 1.64]).[191] Taken together, these findings suggest that labeling may be associated with no changes in weight in the short term and possibly increased weight longer term, at least in the context of the school and home. We did not find information on the impact of labeling in the medical context, but these findings suggest the need to discuss children's weight in a sensitive manner. Further, clinicians may have a valuable role to play in helping parents avoid harmful labeling of their children.

Association of Labeling With Unhealthy Weight Control Behaviors

Increasing child BMI over time is correlated strongly with parental concerns about their child's weight and perceived overweight or obesity.[192] Parental concern about child overweight or obesity is associated with an increased likelihood of restricting children's food intake.[193] In turn, parental feeding restriction has been linked to increased child food intake and higher child body weight.[194]

Weight-labeling has been consistently linked to disordered eating and unhealthy weight control behaviors in adolescence. The National Heart, Lung, and Blood Institute (NHLBI) Growth and Health Study (2018) found that girls who were told they were "too fat" by family member, friends, or teachers at age 14 demonstrated an increase in unhealthy weight control behaviors over the subsequent five years, including not eating for a day or more, vomiting, taking diet pills, and using laxatives.[37] These effects were independent of baseline levels of disordered eating, BMI, and demographic factors such as race, parental income, and education levels. Neumark-Sztainer and colleagues (2011) published 5- and 10-year results of a longitudinal study

examining the prevalence and patterns of unhealthy dieting and weight control behaviors, including binge eating, from adolescents to young adulthood.[38, 195] They found that weight concerns, importance of weight and shape, and parent weight concerns predicted the onset of unhealthy weight loss behaviors, among other factors (e.g., peer dieting, depression, reading articles about weight loss).[195] Further, disordered eating behaviors that began during adolescence often continued into young adulthood. They concluded that there is a need for both early prevention efforts before the onset of harmful behavioral patterns as well as ongoing prevention and treatment interventions to address the high prevalence of disordered eating throughout adolescence and young adulthood.[38]

Solmi and colleagues (2020) examined consequences of the focus on obesity in a study of teenagers from three U.K.-based birth cohorts spanning three decades.[39] They reported that the percentage of youths reporting intentions to lose weight increased substantially from 2005 to 2015 and they also reported an increase in the perception of excess weight across the actual weight spectrum from 1986 to 2015, as well as an increase in percentage of youths who reported using diet or exercise to lose weight over the same time period. Evidence suggests similar trends in the United States; it has been estimated that at least two-thirds of adolescents restrict their food intake with the intent of losing weight, and the use of diet and exercise behaviors to lose weight has increased over time.[44, 196] Such weight loss behaviors (whether unhealthy or not) are likely to be counterproductive, as evidence suggests that adolescents who diet (i.e., changed the way they eat to lose weight) tend to have higher BMI five years later, compared with adolescents who do not diet.[40] We discuss potential harms of weight loss attempts in childhood and adolescence in more depth in **Contextual Question 8**.

Association of Labeling With Psychosocial Well-Being

Prior research has suggested that the use of weight-based labels or terminology is associated with children's physical self-perception and emotional wellbeing. For example, children labeled as having overweight or obesity may feel less smart, less physically capable, and less positive about themselves in general.[41, 42] Children report that weight-based labels contribute to feelings of embarrassment and sadness, and youth who perceive themselves to be overweight are more likely to experience depressive symptoms than children who do not perceive themselves to be overweight, even when controlling for actual BMI.[43, 44] Internalization of thin-body ideal and body dissatisfaction are both associated with an increased risk of onset of binge- and purge-spectrum eating disorders.[197]

A systematic review by Gillison and colleagues[198] examined the association of parent-child weight-talk and child wellbeing. Weight-talk was categorized into four communication types: encouragement to lose weight; encouragement to exercise/eat a healthy diet without reference to weight; weight criticism (including teasing); and impersonal weight comment/discussion. They found that encouraging children to lose weight and criticizing weight were associated with poorer physical self-perceptions and greater dieting and dysfunctional eating (effect sizes: 0.20 to 0.47). However, parental encouragement of healthy lifestyles without explicit reference to weight was associated with better wellbeing, but this was only measured in two studies. They found no effect of child age on the strength of associations, but they did report differences by gender. Specifically, dysfunctional eating was more strongly associated with parent communication for girls than boys. They were unable to draw conclusions about impersonal

weight comments due to limited and heterogeneous evidence. The findings suggest that certain types of parent-child weight-talk may be linked with poorer child wellbeing, however, encouraging healthy behaviors without reference to weight may help offset such effects.

Limited research has evaluated the impact of race and ethnicity on the psychological correlates of weight labeling in children and adolescents; however, studies in adult populations may be relevant. One such study used data from the National Health Measurement Study (NHMS), a national sample of English-speaking adults.[199] Those findings suggest that the effect of weight-based discrimination on mental health is highly dependent upon social status. Specifically, the psychological consequences of discrimination on Hispanic women and women in the lowest household income group were significantly greater relative to White women and women with higher household income, controlling for obesity status and self-rated health. These results indicate that higher social status may have a protective effect on mental health with regard to weight related stigma.

CQ4. What Level of Weight or Relative Weight Decrease in Children or Adolescents With Obesity Reduces the Likelihood of Obesity in Adulthood or Health Outcomes Associated With Obesity?

Summary: *Empiric evidence to support any particular cutoff of weight loss that confers health benefit is limited in both pediatric and adult populations. The most robust evidence in pediatric populations is from a meta-regression study which suggested zBMI reductions of at least 0.7 are needed to confer benefit for cardiometabolic measures. Mean reductions in zBMI found in the behavioral intervention trials included in our review were far smaller, generally ranging from 0.2 to 0.4 with higher-contact interventions, 0 to 0.2 in lower contact interventions. Semaglutide was associated with a zBMI reduction of 1.1, however, which is consistent with the range needed to expect an impact on cardiometabolic parameters. Conclusions about clinically important differences in weight change are difficult to draw because most evidence does not attempt to disentangle potential benefits from improved diet and physical activity from potential benefits of weight loss alone.*

The clinical importance of small reductions in BMI or BMI percentile in children or adolescents, such as those found in our review, is difficult to understand and disentangle from potential benefits associated with behavioral change alone. All evidence we identified exploring thresholds for clinically important weight change in young people examined change in zBMI. This outcome has important limitations as a measure of weight change among young people with zBMI above the 97th percentile for age and sex.[100] Nevertheless, it is used because it may be applied across the age spectrum of growing children, in whom the goal may be slowing the trajectory of weight growth rather than weight reduction.

A 2020 meta-regression of 71 studies reported various cardiovascular measurements associated with mean change in BMI standard deviation scores (BMI-SDS, equivalent to zBMI) in children and adolescents.[200] They concluded that BMI-SDS reductions of 1, 1.2, and 0.7 were associated with consistent mean reductions in SBP, LDL, and TG, respectively. These values are substantially higher than the mean improvements in zBMI with the behavioral interventions in our review, where zBMI change generally ranged from mean reductions 0.2 to 0.4 with higher-contact interventions and 0 to 0.2 in lower contact interventions. In contrast, mean changes in the

control groups generally ranged from -0.1 to +0.1 (**Appendix E Figure 5**). Baseline zBMI scores were heterogeneous across studies, however, and the importance in zBMI change magnitude may vary by baseline zBMI. This level of weight reduction was seen in the included study of semaglutide, however. This study also found greater improvement in LDL, triglycerides, waist circumference, and blood pressure among participants taking semaglutide who achieved 2 category BMI reduction vs less than 2 category BMI reduction.

Several prospective studies of children with weight categorized as "obese" have reported larger improvements in cardiometabolic measures among those who reduced their zBMI over time compared to those who did not reduce their zBMI.[201-205] These studies typically found a greater likelihood of statistically detectable change in cardiometabolic risk factors, with zBMI reductions of 0.125 to 0.500.[201-205] Statistical significance was the determinant of benefit in all of these studies, however, which is partially a function of sample size and may not reflect clinically meaningful change. However, in many trials, children in the control groups were more likely to show a continued trajectory of increasing levels of high weight, on average, so simply arresting the gain in excess weight may constitute a clinically important benefit for many of these interventions, assuming the changes in weight trajectory are maintained in the long term.

Given limited evidence in children, it may be helpful to explore what is known about the clinical significance of weight loss in adults, for potential extrapolation. In the literature focusing on adult populations, weight loss amounts of both 5 and 10 percent or more of baseline weight are commonly cited as thresholds of clinical significance to confer cardiovascular benefit.[206] These thresholds appear to be based largely on evidence that adults participating in lifestyle-based weight management interventions have shown reductions of 0.6 percent to 1.0 percent in HbA1c and a reduced need for diabetes medications among adults with type 2 diabetes; approximately 3 and 2 mm Hg for SBP and DBP, respectively, among adults with elevated CVD risk (e.g., diabetes or hypertension); and longitudinal studies showing a dose-response relationship between weight loss and lipids. However, a systematic review of long-term (≥2 years) dietary-focused interventions for weight loss found that weight loss of at least 5 percent was not consistently associated with significant improvements in cardiovascular risk factors in an unselected adult population with overweight or obesity.[207] Instead, substantial changes in risk factors occurred principally among those at increased cardiovascular risk, such as participants with impaired glucose tolerance. The FDA set efficacy benchmarks of mean weight loss of 5 percent or more to guide industry about developing products for weight management, subsequently citing the Diabetes Prevention Program (DPP) and a narrative review of obesity epidemiology.[94, 208-211]

However, the association between particular cutoffs of weight loss and reduction in CVD events is less clear. The Look AHEAD trial, a large weight loss trial conducted in adults with type 2 diabetes, was stopped for futility after a mean 9.6 years of followup.[187] This trial found that their primary composite cardiovascular event outcome occurred in 403 patients in the intervention group and in 418 in the control group (1.83 and 1.92 events per 100 person-years, respectively; HR 0.95 [95% CI, 0.83 to 1.09]). The results were very similar for their broader secondary CVD outcome. This finding of no difference in cardiovascular events was despite greater weight loss in the intervention group (8.6% vs. 0.7% at 1 year; 6.0% vs. 3.5% at study end) as well as greater improvements in measures of several CVD risk factors and cardiorespiratory fitness.

We found limited direct evidence to justify any specific threshold for percent weight reduction or percent BMI reduction for children or adolescents. In the pediatric literature, we found one study

showing a statistically greater increase in insulin sensitivity with an 8 percent reduction in BMI, however they did not provide compelling data showing this level of BMI change to be an important threshold (e.g., compared with 6% or 10%), nor whether the amount of improvement in insulin sensitivity reported was clinically significant.[212]

A limitation of the literature showing the association between weight loss and cardiometabolic risk factors is the potential confounding by accompanying behavioral changes such as improved fitness, eating habits, and engagement with the health care system; few studies have adjusted for these factors (see **Contextual Question 2**). Interestingly, the Look AHEAD study did attempt to disentangle the effects of weight loss from the effects of improved fitness among adults with type 2 diabetes.[188] While results were not conclusive, they suggested that fitness may have a comparable or possibly stronger association with improved CVD events, particularly with smaller changes in fitness or weight (**Figure 17**). At all levels of fitness improvement (small, medium, or large gain), the risk of CVD events trended in the direction of benefits (13% to 22% relative reduction in the risk of a CVD event), but a comparable effect size was only seen at the highest level of weight loss (≥10%).[187-190] Weight loss of less than 10% was associated with statistically non-significant relative increases in CVD events of 8 percent to 16 percent. However, the degree to which the findings apply to children and adolescents is unknown.

CQ5. What Are the Inequities in Factors That Support Healthy Eating and Physical Activity in Youth (e.g., Food Insecurity, Financial Security, or Neighborhood-Level Factors)?

Summary: *Diet and physical activity are heavily influenced by the local community environment and by family-level economics, which are also shaped by larger structural forces that have systematically disadvantaged communities that have experienced discrimination, such Black, Hispanic/Latino, and Native American communities.[213, 214,215] For example, neighborhood environment has an impact on physical activity.[213] Further, financial insecurity is an important driver of dietary behaviors; families with limited financial resources must spend a higher proportion of their household income on food, and insufficient food budgets can drive families to prioritize cost-effectiveness over healthfulness in order to help reduce financial strain.[214] Additionally, stress, uncertainty, and long work hours for parents constrain their ability to prepare and serve healthy foods, and are associated with haphazard meal planning, emotional eating, and snacking on sweets among adults with higher BMI.[213]*

Encouraging families with higher-weight children to change their diet and physical activity forms the foundation of most weight management interventions. However, diet and physical activity are heavily influenced by the local community environment and by family-level economics, which are also shaped by larger structural forces.[213, 214] In the United States, numerous local and national-level policies have systematically disadvantaged communities that have historically experienced substantial discrimination.[215] Not surprisingly, such policies have contributed to higher proportions of Black, Hispanic/Latino, and Native American families living below the poverty line than White families.[213] In the United States, rates of children meeting BMI criteria for obesity are also highest in the Black, Hispanic/Latino, and Native American communities, (**Figure 1**)[216] and also higher for people with limited financial resources. Food insecurity is associated with higher zBMI as young as age two.[217] Cross-sectional economic

evidence is strengthened by studies looking at changes over time, associated with larger economic trends. There is also evidence that economic recession has a larger deleterious effect on BMI in young children among families living at or below the federal poverty level; a study conducted in Los Angeles County found that average BMI increased more in these children after the 2008 recession than in children in families with higher income levels.[218]

Sawyer and colleagues published an umbrella review of 43 different reviews examining systems that influence consumption of healthier versus unhealthier diets. They identified geographic accessibility, household finances and resources, social and cultural influences, and individual influences as all being important determinants of food consumption.[214] With regard to geographic accessibility, these authors note that healthy food is generally less accessible in low-income neighborhoods. Residents then must take the time to seek healthy food in other areas, but many residents in low-income neighborhoods also have limited access to private vehicles, which makes acquisition of healthy foods more costly and unreliable than simply shopping in local stores. These time and travel barriers are heightened if childcare is limited or unaffordable and young children must accompany parents on shopping expeditions. These barriers also may affect food selection, such as through discouraging purchase of perishable (e.g., fresh fruits and vegetables) and heavy items (e.g., grains) that are more difficult to transport via public transportation.

A review by Soltero and colleagues highlights the impact of the immigration policies on the Hispanic/Latino community, and notes that immigration policies may limit employment opportunities, limit access to public services, and cause fear and stress related to immigration law enforcement.[219] The authors point out that the risk of food insecurity is increased when families in need cannot access assistance programs. They report evidence that food insecurity is associated with high BMI in Hispanic youth. These authors also describe a study among immigrant Mexican American households that found a 10 percent increase in food insecurity after the passage of restrictive immigration-related legislation.

The impact of distance to retail outlets with abundant and appealing healthy food options was borne out in an RCT of a weight management intervention for children.[220] This study found that distance to supermarkets was an effect modifier of 1-year change in fruit and vegetable intake. With each 1-mile shorter distance to a supermarket, intervention participants increased their fruit and vegetable intake by 0.29 servings per day relative to controls (95% CI, 0.01 to 0.57). Distance to a supermarket was also associated with 1-year change in zBMI: each 1-mile reduction in distance was associated with a greater decrease in BMI z-score (differences in zBMI change, -0.05 units [95% CI, -0.01 to -0.10])

Families with limited financial resources must spend a higher proportion of their household income on food, and insufficient food budgets can drive families to prioritize cost-effectiveness over healthfulness in order to help reduce financial strain.[214] Sawyer and colleagues found evidence that energy-dense, low-nutrient foods (e.g., foods high in refined grains, added sugars, and saturated fats) are often cheaper to purchase than healthier foods. In addition, a limited food budget encourages a diet with little variety, as families seek to minimize food waste by choosing foods that are familiar and known to be palatable for all family members. These shopping

patterns can reduce demand for healthy foods in low-income neighborhoods, leading to higher cost for healthier items and lower quality stock due to low turnover.
Sawyer and colleagues noted that research shows that social aspects of food consumption are important for people at all income levels.[214] Sharing food is an important social activity, food provision can be seen as a marker of parenting, and purchasing certain brands or shopping at some specific locations can signify social or cultural status. Preference for specific brands or products can increase the acceptability of energy-dense, low-nutrient snack foods, processed ready-meals, and fast-food restaurant meals.

Limited financial means also increases stress levels for parents. Interviews with low-income parents indicated that long work hours constrain the ability to prepare and serve healthy foods, and that high stress levels are associated with haphazard meal planning, emotional eating, and snacking on sweets among adults with higher BMI.[213] Stress among children and adolescents may also influence eating. A systematic review found that stress was associated with unhealthy eating behaviors in both younger (Hedge's $g = 0.283$, $p < 0.001$) and older (Hedge's $g = 0.274$, $p = 0.001$) children.[221]

Beyond the challenges of purchasing food with limited financial resources, *uncertainty* in important social determinants of health such as housing, employment, and finances puts additional strain on families' ability to eat a healthy diet. A review by Thompson and colleagues noted that insecure work and requirement of social services agencies can create multiple and conflicting constraints on families; securing a basic level of income can be very labor intensive and at times social service agencies can ask parents to be in different places at the same time and provide 'evidence' to support program requirements at short notice.[222] To mitigate challenges related to uncertainty in meeting basic needs, parents in these households tend to prefer foods with easy preparation and a long shelf-life. Unfortunately, these foods tend to be high in fat, salt, and sugar and lower in fruit and vegetables. Similarly, housing insecurity can mean limited or uncertain access to adequate facilities to store and cook food, inadequate space to eat together, and inability to maintain mealtime routines. A study among children in Head Start preschool illustrates that food insecurity may affect BMI particularly in young girls.[223] There were no associations between changes in household food insecurity and changes in zBMI or dietary quality among boys in this study. On the other hand, this study found that girls from households that became food insecure over the year of the study had a 0.21-unit higher gain in zBMI than girls from households that were persistently food secure, after adjustment for potential confounders (95% CI 0.02 to 0.39, $p = 0.03$).

This is similar to the 0.20 mean difference in zBMI change found in the current review among behavioral interventions with 26 or more hours of estimated contact time (MD, -0.20 [95% -0.32 to -0.08]), and substantially higher than that of interventions with less than 26 hours of contact time (MD, -0.05 [95% CI, -0.07 to -0.03)]. Girls from households that became food secure had improvements in dietary quality over the year compared to girls from persistently food insecure households (adjusted difference in HEI score change, 9.1 points; 95% CI 3.0 to 15.0; $p = 0.003$). One study included in our review reported on change in the HEI.[141] This study, among families with a 2- to 5-year-old child with BMI ≥95th percentile for age and sex, found an 8.7-point greater increase in HEI in the intervention group with an estimated 23 hours of contact (95% CI,

3.75 to 13.65), but no group differences between a lower-contact intervention group and the control group (MD, 1.2 points, [95% CI, -3.6 to 6]).

Neighborhood environment also has an impact on physical activity. Young people are less likely to walk to the store or play outside if they live in neighborhoods with high crime rates.[213] Neighborhoods with a greater proportion of Black, Hispanic/Latino, Native American, or lower income families also tend to have higher crime rates.[224] Individuals in neighborhoods with a high proportion of low-income families or Black, Hispanic/Latino, and Native families also have less access to recreational facilities.[213] In addition, a recent survey found that there was a higher likelihood of having no nearby park for children in families with incomes below the federal poverty level (OR, 1.48 [95% CI, 1.38 to 1.58]).[225] This study also found that children who did not have a nearby park were more likely to be physically inactive (OR, 1.36 [95% CI, 1.24, 1.48]) and have excessive screen-time (OR, 1.19 [95% CI, 1.14, 1.25]).[225] Other features are also associated with amount of physical activity: one study found girls living in neighborhoods with more traffic lights for street crossing had higher activity levels, as did boys living on cul-de-sacs and on streets with speed bumps.[213] A review of bike lanes found that bike lane access was associated with higher levels of physical activity in children and adolescents.[226] Environment may affect young children too. Accelerometer data have shown than toddlers in low-income families are less likely to have at least 60 minutes per day of physical activity.[227]

This literature is primarily derived from correlational studies, where causal mechanisms cannot be clearly identified. The impact of environmental factors would be reinforced by evidence showing that diet and physical activity change when the environment is changed. Among the included studies in this review, we found no pattern indicating smaller or larger effects in studies that included intervention components that addressed barriers to participation, including social risk factors. Beyond the studies included in our review, one cluster randomized trial implemented a year-long multi-level intervention in public housing developments that included components to change the dietary and physical activity-related environments of the developments.[228] Surveys at baseline and one-year followup found that participants living in the intervention housing developments changed their eating and activity behaviors and body weight from baseline to one-year followup (p's < 0.05) while participants in control group housing developments reported no changes in study outcomes. Intervention components included a weekly mobile market that provided healthy affordable groceries, weekly group walks led by lay health advisors, cooking demonstrations of culturally and economically tailored healthy meals, and resource maps of local health-related resources such as local gyms, walking parks, and places to with healthful eating options.

CQ6. What Are the Inequities in Access to or Participation in Weight Management Interventions?

Summary: *The literature suggests that there are several contributing factors that could lead to downstream inequities in access to and participation in weight management interventions within the healthcare setting. There is strong evidence documenting important barriers to healthcare for families with lower income that could lead to lower participation in weight management interventions in healthcare settings. Further, differences in intervention attendance in specific groups could modify the success of weight management programs. The evidence is sparse and*

inconclusive regarding whether there are differences in intervention efficacy among specific groups. Finally, evidence suggests substantial inconsistency in perceptions about barriers to weight loss between patients and their providers.

One important source of inequity in access to and participation in professionally supported weight management interventions is inequities in access to healthcare in general. Health insurance coverage, and type of coverage, affect access to care. According to the 2019 National Health Interview Survey (NHIS), Hispanic/Latino children were more likely to be uninsured (7%) compared with White (4%) and Black (3%) children. In addition, White children were more likely to have private health insurance (69%) compared with Black (36%) and Hispanic (36%) children. Black (59%) and Hispanic (55%) children were more likely to have public health insurance compared with White children (23%).[229]

Insurance coverage is important because children are less likely to attend well child visits if they lack health insurance; one study found that children without insurance attended 31% of recommended well child visits, compared with 59% of recommended visits for children with public insurance coverage and 66% of recommended visits for children with private insurance coverage.[230] Well child visits present opportunities to measure height and weight and determine weight status. Other factors that are associated with a lower likelihood of attending well child visits include:

- Lower income (56% of recommended visits attended among children in families <200% of the Federal Poverty Line (FPL), vs. 73% among >400% of FPL)
- Lower parental educational attainment (50% among children of parents with no high school degree vs. 68% among children of parents who had at least attended some college)
- Race (Black, 53%; Hispanic/Latino, 58%; nonHispanic White, 68% of recommended visits)[230]

Relatedly, low-income levels are also associated with a lack of a usual source of health care. Children in families with incomes at or below 200 percent of the federal poverty level were more likely to lack a usual source of care (4%) compared with children in families with incomes at 200 percent poverty and above (2%) in 2019."[231]

Although we found no information directly related to weight stigma and children in the United States healthcare setting, evidence in adults suggests that weight stigma may be another source of inequity in receiving high quality health care.[232] For example, studies have found that clinicians are not immune to weight bias, and are more likely to perceive patients with high BMI as lazy, weak-willed, and noncompliant.[54] In turn, patients with high BMI are more likely to cancel appointments or delay care.[233] Parents' experience with weight stigma in the healthcare setting may affect higher BMI children as well, particularly those whose parents have directly experienced stigma due to their own weight. Concern about weight-based stigma may be compounded for families in other communities who have experienced widespread discrimination, such as Black, Hispanic/Latino, and Native American, whose intersection of weight and race or ethnicity may put them at even higher risk of negative, stigmatizing experiences. For further discussion on the harms of weight stigma **see Contextual Question 7**.

Inequities may arise in the identification of patients with high BMI as assessed in healthcare settings. While reported rates of identification of high BMI by social determinants of health among children are not available, NHANES data showed that Black American adults were less likely to report being told that they are overweight by a clinician than White Americans regardless of clinical weight status and weight-associated comorbidities, especially when their BMI was close to the 30 kg/m^2 threshold.[234] While this may reflect inequities in identification of higher BMI (and treatment that may flow from the diagnosis), it may also reflect clinicians' acknowledgement of evidence that BMI may not track with adiposity as well in Black persons compared with White persons.[14, 173, 174] Another study found that adult women with a BMI ≥30 kg/m^2 were more than twice as likely to be diagnosed with obesity than adult men with BMI ≥30 kg/m^2.[235]

There may also be inequities in the likelihood of being advised to lose weight among people with high BMI. Again, we did not find evidence on patterns of advice among children, but evidence among adults suggests differences based on social factors. Among a representative sample of 1,109 adult residents of New Jersey with overweight or obesity who completed a phone survey in 2009-2010, multivariate models showed that a number of factors were associated with a lower likelihood of being advised by a healthcare provider to lose weight in the prior 12 months: lower income, Hispanic ethnicity (vs. White and Black), lower educational attainment, lacking health insurance, male sex, and not having diabetes.[236] A smaller study (n=282) found a very similar pattern of results among patients recruited from a primary care setting in South Carolina.[237] As with identification of high weight, some discrepancies in advice might not reflect inequities, but instead reflect an effort to minimize burden for patients facing significant barriers to weight loss, or setting a higher priority on building trust and respecting patient preferences than on weight loss.

A survey of 5275 teens across 10 (nonUS) countries and their caregivers and health care clinicians suggests potentially important differences between adolescents and their parents or caregivers and their health care clinicians concerning motivation and barriers to weight loss and healthy lifestyle.[238] This study found that 72 percent of the teens reported feeling that obesity had a strong or very strong impact on their life, compared to 89 percent of health care clinicians assuming a strong or very strong impact on the teens' lives. Caregivers tended to underestimate how worried their teenager was about their own weight and were often unaware of their teenager's recent attempts to lose weight. As a group, the health care clinicians did not know the main reasons why teenagers want to lose weight. They also did not know the main reasons preventing teenagers from losing weight.

We found no information on inequities in the likelihood of being referred to or initiating behavioral weight management treatment among children. For pharmacotherapy, one study found that, among youth seen in a pediatric weight management clinic, prescription medication use was lower in Hispanic/Latino individuals compared to nonHispanic White patients, and use of interpreters was associated with higher prescription incidence rates among non-primary English speakers.[239] In addition, there may be unequal access to weight loss medication based on insurance status and income. Weight loss medications can be expensive; according to the Goodrx website, the monthly costs of medications approved for weight loss in children and adolescents are $198 for phentermine/topiramate, $746 for orlistat, and $1,334 - $1,345 for liraglutide and

semaglutide (costs shown to be "as low as" the listed costs).[240] These costs represent substantial barriers for lower income households. One study found that, as of 2016, only 8 states covered weight management medications for Medicaid beneficiaries: Alabama, North Dakota, South Carolina, South Dakota, Texas, Virginia, Wisconsin and Delaware.[241]

Some reviews have examined factors that predict the likelihood of remaining in treatment and high attendance of intervention sessions in weight management studies among children and adolescents.[242, 243] One review found that lower socioeconomic status was associated with lower attendance rates, reported in six studies.[242] This review also found four studies that examined the association of treatment attendance and psychological factors. Three of the four studies reporting such exploration did find associations with lower attendance among young people with high levels of psychological distress, bulimia, depressed mood, lower emotional regulation, higher anorexic symptoms, and poorer health-related quality of life.[242] The other review found that Black race was associated with higher intervention dropout, and that low family income was associated with lower attendance.[243] These findings raise questions as to whether the interventions were feasible and relevant to participants with higher dropout and lower attendance.

Finally, disparities could be exacerbated if young people across different groups and social determinants of health do not benefit equally from interventions. We found no studies examining differences in benefit for weight loss medications, but one systematic review looked at social factors as potential effect modifiers of benefit in behavioral weight management interventions for children aged 3 to 10 years.[244] Similar to our review, they found very limited evidence on the impact of social risk factors on intervention effects. Specifically, they examined 81 studies of child weight management interventions and found that only five examined effect modification by any of: ethnicity, migrant status, educational status, household income, health insurance status or other related socioeconomic measure, such as area deprivation index. Three of these studies were included in our review.[107, 114, 145] Of these five studies, findings were mixed. One study found no association between socioeconomic status and intervention effect, two found larger intervention effects among children with *lower* income or socioeconomic status, and two studies found larger intervention effects among children whose mothers had *higher* education levels.

CQ7. What Are the Harms of Stigma and Weight Bias? What Is the Extent of Weight Bias in Healthcare?

Summary: *Weight stigma and bias are pervasive and harmful. Youth with high BMI commonly experience weight-based victimization, teasing, and bullying by peers, parents, or teachers. The impact of stigma is even felt in young children, prior to age 11, who already evaluate their own bodies and may feel anxious about their weight. These experiences put youth with high BMI at an increased risk for psychological distress, including low self-esteem, anxiety, depression, and suicidal ideation; substance abuse; poor social and academic outcomes; avoidance of health care services; and adverse physical health consequences including increased unhealthy behaviors (e.g., binge eating) and decreased healthy behaviors (e.g., dietary, physical activity), and weight gain. Weight bias has been documented among healthcare clinicians, which can have deleterious effects on patients, leading to substandard care and avoidance of care.*[245]

Harms of Stigma and Weight Bias

According to both the recent AAP clinical practice guideline and a 2017 AAP policy statement on stigma experienced by children and adolescents with obesity, the stigmatization of people with overweight or obesity in our society is both pervasive and harmful.[46,4] Weight stigma is defined as the societal devaluation of individuals with overweight or obesity and is frequently associated with stereotypes suggesting that these individuals are lazy, sloppy, sedentary, unmotivated, or lacking in willpower or discipline.[43, 246] These stereotypes may lead to individuals with higher BMI being subjected to social rejection, prejudice, or overt discrimination (aka, "anti-fat bias").

In youth, weight stigma tends to be experienced primarily as weight-based victimization, teasing, and bullying by peers, parents, or teachers.[47] A systematic review of attitudes toward people with high BMI among children age 4 to 11 years found that children were primarily aware of the social impact of body size, describing experiences and awareness of abuse and isolation for children with a greater weight.[245] This review further found that body size was seen as under the individual's control and children attributed negative characteristics to people high BMI. Children actively assessed their own size; many wished their bodies were different and some were anxious about their shape.

Weight stigma may be tolerated in society due to the false belief that stigma and shame can motivate people with higher BMI to lose weight.[247] Indeed, news coverage and entertainment media overwhelmingly reinforce the message that both the cause and the solution for high BMI reside within the individual.[248] However, rather than motivating positive change, weight stigma may put youth at an increased risk for psychological distress, including low self-esteem, anxiety, depression, and suicidal ideation; substance abuse; poor social and academic outcomes; avoidance of health care services; and adverse physical health consequences including increased unhealthy behaviors (e.g., binge eating) and decreased healthy behaviors (e.g., dietary, physical activity), and weight gain.[49-51] Furthermore, experiences of weight stigma also impact overall quality of life, especially for children and adolescents. For example, one study reported that children and adolescents with severe obesity had quality-of-life scores that were worse than age matched children who had cancer.[249]

In the school environment, weight-based bullying is one of the most common types of bullying reported by students. As early as preschool, children attribute negative characteristics and stereotypes to peers with larger body sizes.[250, 251] By elementary school, youth with higher BMI commonly experience negative weight-based stereotypes and weight bias. For example, children with higher BMI are less likely to receive help from their peers and are more likely to be bullied than are students with lower BMI.[252, 253] Longitudinal evidence suggests that weight status significantly predicts future victimization, and youth with higher BMI are the most likely to be bullied.[254] Recent evidence also demonstrates that the primary reason that adolescents are teased or bullied at school is because of their weight.[255] Among racially diverse samples of adolescents, weight-based harassment was the most common form of harassment self-reported by girls and the second-most common form of harassment reported among boys.[256] Such harassment is linked to future attempts to lose weight. A study of adolescents seeking weight loss treatment reported that 71 percent had been bullied about their weight within the past year, and more than one-third reported that the bullying had persisted for five years or more.[255]

Beyond bullying, there is also evidence that weight bias affects educational outcomes. Students with high BMI show no statistically significant differences in intelligence or achievement test scores, yet receive lower grades in middle school, community college, and university, after controlling for demographic variables, intelligence, personality, and well-being.[257] And, students with high BMI are less likely to attend college, irrespective of their level of competence to do so,[258] and get less financial support from their parents.[259]

Stigma and Weight Bias in Healthcare

According to a 2020 joint international consensus statement of experts, the quality of health care is known to be adversely affected by weight-based stigma.[50] Prior studies have found that health care professionals regularly express weight stigma toward patients meeting criteria for obesity, and patients meeting criteria for obesity commonly feel stigmatized in health care settings.[43, 50, 52] Health care providers may hold assumptions that body weight is entirely under their patients' personal control. However, the belief that voluntarily improving diet and/or increasing exercise can entirely prevent or reverse obesity is not well supported by biological or clinical evidence. Furthermore, health care providers' causal attributions of personal responsibility for higher BMI are associated with stronger weight bias, whereas beliefs in genetic, physiological, or environmental causes of higher BMI are associated with lower levels of weight bias.[50] Health promotion strategies for weight loss that solely target the individual may therefore perpetuate weight stigma and also avoid addressing societal inequities that may be associated with health and weight disparities.[44]

One study reported that more than two-thirds of women meeting criteria for overweight or obesity have experienced stigma about their weight perpetuated by health care providers.[260] Prior research has demonstrated that a variety of health care professionals (including medical students, physicians, nurses, dietitians, mental health providers, and obesity specialists) exhibit bias and prejudice toward patients with higher BMI.[54, 261, 262]For example, one survey of over four thousand medical students reported that nearly 75 percent of the students displayed implicit bias and roughly two-thirds exhibited explicit bias towards patients with overweight and obesity.[263] Other research has demonstrated that physicians associate obesity with treatment noncompliance, decreased medication adherence, and poor self-control. They may also attribute other negative characteristics to these patients including hostility, dishonestly, laziness, lower intelligence, and poor hygiene.[55] These biases, in turn, can negatively affect quality of care. For example, prior research suggests that physicians spend less time in office visits with patients with higher BMI than they do with patients with a lower BMI and are more hesitant to perform or recommend preventive health screenings, such as pelvic examinations or cancer screenings.[52] Patients with high BMI have also reported not being provided with appropriate-sized medical equipment, such as blood pressure cuffs and patient gowns, resulting in a less hospitable medical experience that may affect the quality of the health care received.[50, 54-56] These experiences may result in patients with obesity being less likely to seek future preventive care, delaying treatment, or canceling appointments.[57-59, 264] For example, a systematic review of 10 studies found that adults with high BMI are more likely to report delaying or avoiding of care and that women with high BMI have lower likelihood of completing colorectal cancer, breast, and cervical cancer screening.[264]

For children and adolescents, subtleties in the terminology health care providers utilize to discuss weight-related issues with patients or their parents can contribute to stigma and avoidance of

future health care. Parents may experience feelings of isolation, a sense of blame for their child's weight issues (especially for parents who themselves have experienced weight issues), and fear regarding their child's future health.[35] However, limited research has assessed how health care providers can sensitively and effectively discuss weight with patients and families.[265, 266] One national study of parents of children 2 to 18 years old examined parental perceptions of words commonly used to describe higher body weight.[267] Parents were asked to rate whether ten commonly used words were stigmatizing, blaming, desirable, or motivating for weight loss. The terms "fat," "obese," and "extremely obese" were rated as the most undesirable, stigmatizing, blaming, and least motivating. Terms like "weight," or "unhealthy weight" were rated as the most desirable and motivating for weight loss. Furthermore, parents were asked how they would respond if a healthcare provider referred to their child's weight using stigmatizing terminology. A substantial proportion of parents indicated that they would switch doctors (35%) or avoid future medical appointments for their children (24%). These findings warrant further research and highlight the importance of how health care providers discuss weight-related health with their patients and with patients' families.

Historically, medical schools and residencies have offered limited training about effective strategies for promoting positive health behavior change (e.g., motivational interviewing) and discussing weight related issues with patients and families. Therefore, many health care providers report that they do not feel competent or comfortable discussing weight with their patients.[268-270] There are various techniques for educating medical students and health care providers about weight stigma, including educational strategies that highlight biological, genetic, and environmental contributors to higher BMI beyond personal control; communication skills training; role-playing with virtual patients; educational films, in addition to traditional lecture-style learning.[271-276] More training is needed for health care providers and trainees to empower children and families to make healthy changes that do not contribute to weight stigma or weight bias.

In addition to recommendations surrounding sensitive handling of weight-related discussions, current NICE guidelines highlight the importance of informed consent before embarking on discussions related to weight, recommending that healthcare clinicians ask the person's permission before talking about the degree of overweight, obesity, and central adiposity.[277] The 2017 AAP policy statement provides multiple clinical practice and advocacy recommendations for pediatricians in addressing weight stigma.[46] These recommendations include modeling best practices for nonbiased behaviors and language[278]; using empathetic and empowering counseling techniques (e.g., motivational interviewing); inquiring about experiences with weight stigma and bullying during clinic visits; and advocating for inclusion of training and education about weight stigma in medical schools, residency programs, and continuing medical education programs. Finally, the policy statement recommends empowering families to advocate for confronting weight stigma in both the home and school environments.

C1Q8. Are There Long-Term Harms of Weight Loss Attempts During Childhood or Adolescence?

Summary: *Studies show that weight loss is typically followed by weight gain. This is consistent with physiologic adaptations in hormonal signaling and energy expenditure in response to*

weight loss and calorie restriction that promote weight regain. Evidence among adults suggests that multiple cycles of weight loss and regain increase the risk of higher ultimate weight and may also increase the likelihood of diabetes incidence. While studies of weight management interventions in health care settings among children and adolescents do not demonstrate psychosocial harms in the short term, evidence on the etiology of eating disorders suggests that dieting combined with body dissatisfaction is an important risk factor for binging- and purging-spectrum eating disorders. We found no studies of adults reflecting on the psychosocial impact of weight management interventions during childhood or adolescence, which may be an important perspective for fully understanding the psychosocial impact of weight management interventions.

The RCTs of weight interventions included in our systematic review were of short duration, and therefore could not report on potential longer-term harms such as hormonal or metabolic adaptations that may promote weight regain, disordered eating tendencies, or psychological harms that appeared in the longer term or after weight re-gain. Therefore, we sought information on longer-term harms from the broader literature.

Future Weight Gain

Weight regain after weight loss is the norm among adults with intentional weight loss, commonly overshooting baseline weight, even among participants who are well-supported by thoughtfully constructed evidence-based weight loss interventions.[279-281] In our systematic review we found very limited evidence on weight maintenance beyond 12 months for children and adolescents, but the limited evidence we found suggests that weight regain was common. This could be purely due to the natural history of weight to increase over time, or this effect could be exacerbated by the impact of weight loss. Indeed, prospective observational studies in adolescents and college-aged adults have found that greater weight suppression (i.e., discrepancy between current and highest weight) is associated with greater weight gain.[282-284] Among members of the National Weight Control Registry, comprised of people who lost at least 30 pounds and maintained it for at least 1 year, researchers identified a cluster of participants who were vulnerable to weight regain, characterized as people who had struggled with weight since childhood, noting that they employed the greatest number of resources and strategies to lose and maintain weight, and reported higher levels of stress and depression.[285]

There are several mechanisms known to promote weight regain among adults who have lost weight, presumed to have conferred evolutionary advantage by improving survival when food was scarce. These mechanisms are two-fold, increasing the drive to eat and decreasing energy expenditure.[286] Calorie restriction induces reductions in the body's energy expenditure that exceed what would be expected based on the mechanics of reduced mass.[287] For adults, this amounts to approximately 300-400 kcal/day that must be compensated for by eating even less.[286] Physiologic compensatory reactions include changes in in the neuroendocrine system (reduced T3, T4, leptin, and TSH; increased rT3), autonomic systems (decreased sympathetic nervous system tone, increased parasympathetic nervous system tone), and muscles (increased efficiency). While energy expenditure is reduced, hormonal adaptations result in delayed satiation, reduced perception of amount eaten, heightened positive response to food, and reduced restraint in response to food.[286] Mathematical models have estimated that, for each kilogram of lost weight, calorie expenditure decreases by approximately 25 kcal/day and appetite increases by approximately 95 kcal/day above baseline levels prior to weight loss.[288] Collectively, these

findings explain why weight regain is common among adults, and suggest that there may be limits on the amount of weight loss that individuals can sustain. We did not find studies examining these compensatory mechanisms in children and adolescents.

Impact of Weight Regain and Weight Cycling

If weight regain is benign, cycles of weight loss and weight regain would not be problematic. We found no research on the physiologic impacts of repeated cycles of weight loss followed by weight gain in children and adolescents. The evidence in adults is mixed but suggests that these cycles may lead to greater ultimate weight gain. Eleven of 19 studies in a systematic review found that a history of weight cycling was correlated with increased body fat and central adiposity, and four of eight studies found that weight cycling increased the likelihood of future weight gain.[289] These studies were observational and often cross-sectional, however, and there may be confounding factors behind these associations and cannot demonstrate causality. A study of 4,129 twins found that twins who had a higher number of episodes of intentional weight loss (of ≥5 kg) gained more weight than their paired twin over the course of 25 years. The effect was smaller for monozygotic twins (0.4 kg/m^2) than dizygotic twins (2.2 kg/m^2).[290]

We were unable to find information on the association between weight cycling and glucose metabolism in children or adolescents. The systematic review of weight cycling in adults also looked at its impact on diabetes and glucose parameters.[289] This review found that most included studies (13/17; 76%) showed no association between weight cycling and blood glucose measures. However, four of eight studies reporting on type 2 diabetes incidence found an increased risk of type 2 diabetes with higher levels of weight cycling. Although not all findings were statistically significant, the best available evidence of these studies (the large prospective studies and a prospective analysis of the Diabetes Prevention Project participants) consistently found higher type 2 diabetes incidence associated with more weight cycling (**Table 22**). None of the studies found that weight cycling was associated any improved weight or cardiometabolic outcome at followup. Again, however, the observational nature of these studies limits our understanding of whether weight cycling is causing the increased risk or if there are other confounding factors.

Psychosocial Impact of Intentional Weight Loss

We found very limited evidence on young people's experiences with weight loss or weight management programs beyond the initial period of involvement, typically lasting six to 24 months. Psychosocial impact immediately after weight management interventions generally indicated no increased risk of psychosocial harm in the trials included in this review. A separate longitudinal cohort study among 1,291 children and adolescents who participated in a multidisciplinary childhood obesity treatment program in clinical practice in Denmark found improvements in the domains of quality of life, mood, appetite, and body image satisfaction after a median of 14 months of participation.[291] A systematic review of studies of treatment-seeking young people participating in weight management programs confirms these findings, where most included studies followed participants for six to 24 months.[292]

However, there may be a subset of young people who are vulnerable to eating disorders. A number of studies have indicated that self-reported efforts to lose weight, not necessarily

associated with a formal program, are associated with future eating disorders. Prospective data from three eating disorder prevention trials of young women with body dissatisfaction (mean age 18) followed for 3 years found that a history of weight loss efforts was associated with future onset of binge- and purge-spectrum eating disorders.[197] A history of weight loss efforts was the strongest predictor of purging disorder, and negative affect and strong desire for thinness amplified this association.[293] Further, a separate study found that weight suppression predicted future onset of anorexia nervosa (OR: 1.36; 95% CI: 1.03, 1.80), bulimia nervosa (OR: 1.34; 95% CI: 1.11, 1.62), and purging disorder (OR: 1.46; 95% CI: 1.23, 1.74).[294] In this sample, women with the largest difference between their highest past weight and current weight were at greatest risk of eating disorders. Another study of people with binge eating disorder found that 65 percent of participants reported that dieting preceded binge eating.[295] While formal, sensitively delivered weight management programs appear not to show associations with disordered eating in the short term, and may even reduce it with interpersonal therapy as a treatment modality,[143,144] it is unknown whether such experiences would inoculate young people from developing eating disorders who continue to receive messages that they should lose weight over many years.

Psychosocial impacts may become more pronounced over the years, as people continue to struggle with their weight in the longer term. We found no qualitative studies of adults reflecting on their experiences with weight management programs during their childhood or adolescence, but anecdotal first-person accounts among people with lived experience suggest that weight loss interventions during childhood, in the context of the larger culture of weight stigma, were damaging to their psychosocial health.

Further research is needed to understand the longer-term psychosocial impact of weight management interventions for children and adolescents.

Chapter 4. Discussion

Summary of Evidence

The evidence in this review demonstrated that structured behavioral weight management interventions in children and adolescents typically resulted in modest reductions in weight (~2-3 kg) compared to control groups for up to one year, particularly interventions with at least 26 hours of contact and that included physical activity sessions (**Table 23**). The clinical significance of this amount of weight loss is unclear. Very limited evidence suggests that these higher-dose interventions also resulted in small reductions in blood pressure, fasting glucose, and quality of life but had no apparent impact on lipids, other psychosocial outcomes, dietary pattern, or minutes per week of physical activity outside of the intervention sessions. Lower-contact interventions generally had minimal impact on weight or other outcomes, although some individual lower-contact trials did show a benefit. A fairly large (n=452) trial of a 26-session family-based behavioral intervention published after our search was completed supports our finding that behavioral interventions are associated with small weight changes.[98] In this study, group differences were maintained for up to 24 months with continued intervention; children in the intervention group had returned to baseline BMI percentile after 24 months while those in the usual care group had a 6.5 percent increase their percent above median BMI. There was a larger effect among White children than among Black children in this study. The impact on quality of life, cardiometabolic parameters or longer-term followup were not reported. A summary of intervention characteristics for trials that were effective in reducing weight is available in **Appendix D Table 20**.

Very limited evidence was available on whether weight loss was maintained beyond one year, and we found no information on longer-term impacts on health or psychosocial well-being. Very minimal evidence suggested that behavioral interventions did not have negative impact on self-esteem, body satisfaction, or disordered eating; an interpersonal therapy intervention that primarily addressed psychosocial aspects of eating (rather than diet and physical activity) reduced binge eating. Potential harms of behavioral interventions were reported in just a small subset of trials reporting weight outcomes and reporting was highly variable, thus, the strength of evidence for harms is much lower than for weight outcomes. These findings are consistent with those of the previous USPSTF review on this topic,[94] as well as another recently-published review, which found difference in BMI ranging from -0.87 kg/m^2 (95% Credible Interval, -1.63 to -0.09) to 0.98 kg/m^2 (95% Credible Interval, -1.19 to -0.77 across several different types of behavioral interventions.[296]

In terms of pharmacotherapy, orlistat showed a similar effect size to behavioral interventions and no information on weight maintenance after discontinuation of orlistat was provided, as was the case in the previous review. Liraglutide and phentermine/topiramate showed larger effects on weight (~4 to 16 kg) than was observed with behavioral interventions. However, group differences with liraglutide and phentermine/topiramate plateaued at approximately 6 months to 1 year, and weight began to rebound quickly when liraglutide was discontinued. No information was provided on whether weight loss was maintained after the phentermine/topiramate was discontinued. Gastrointestinal complaints were common with orlistat and liraglutide in the short

term, and there was no information on the harms of medication use beyond 13 months, which is problematic if long-term use of medications is necessary to maintain the weight loss. As with the behavioral interventions, pharmacotherapy trials reported that their interventions were not associated with an increased risk of harmful psychosocial outcomes such as poorer quality of life, mental health, body dissatisfaction, or disordered eating. However, these outcomes were measured in the short-term, when young people had, on average, reduced their weight and may have been appreciative of this outcome, as it moved them closer to cultural beauty standards and in a direction widely presumed to improve their health.

Long Term Weight Maintenance

The lack of evidence on long-term maintenance of weight loss is a critical limitation of this literature, and weight relapse after weight management interventions is acknowledged as common by the American Academy of Pediatrics.[4] Epstein and colleagues, who conducted much of the formative work in the area of family-based weight management interventions for children, published 10-year followup results from 176 children participating in four trials of a family-based comprehensive weight management intervention, which involved an estimated 30 or more hours of contact.[297] They found that 52.5 percent of the children undergoing these interventions met criteria for obesity at the 10-year followup. For comparison, a separate systematic review of naturalistic longitudinal studies found that approximately 65 percent of children who met criteria for obesity continued to meet criteria in adulthood.[298] This evidence suggests that higher contact family-based weight management programs might improve the likelihood of avoiding future obesity, at least during early adulthood. However, this is the only long-term study we found, and included only 176 children. Further, the comparability of participants in the treatment trials to participants in the naturalistic longitudinal studies is unknown. More data are needed.

Studies conducted in adults show that weight loss is typically followed by weight gain (see **Contextual Question 8**).[281-284] Limited evidence among the studies included in this review suggested that weight may also commonly rebound for children and adolescents. This is not surprising, given the known weight gain-promoting physiologic adaptations in hormone signaling and energy expenditure in response to weight loss and calorie restriction.[286] Evidence among adults suggests that multiple cycles of weight loss and regain increase the risk of higher ultimate weight, and may also increase the likelihood of diabetes incidence.[289]

Potential Harms of Weight Management Interventions

Another systematic review confirmed our finding that studies of weight management interventions among children and adolescents do not demonstrate psychosocial harms in the short term.[292] However, evidence on the etiology of eating disorders suggests that dieting combined with body dissatisfaction is an important risk factor for binging- and purging-spectrum eating disorders.[197, 293, 294] While formal, sensitively delivered weight management programs appear not to show associations with disordered eating, and may even reduce it with interpersonal therapy as a treatment modality,[143,144] it is unknown whether such experiences would inoculate young people from developing eating disorders who continue to receive messages that they should lose weight over many years. We found no studies of adults reflecting

on the psychosocial impact of weight management interventions during childhood or adolescence.

A panoply of critiques have been published about the weight-centered health paradigm (i.e., discourse about health that centers on the importance of body weight), raising concerns about the harms of treating higher weight as a problem that must be solved or a disease that must be treated.[299] Their arguments center on the widespread and harmful stigma and inequities faced by people with higher weight. Some critiques also point out that maltreatment of people with high weight has racist historic roots[300] and disproportionately affects people who are already disadvantaged by stigma and prejudice, such as people who are Black, Native American, and gender nonconforming.[299,301] This is particularly unfortunate given that economic factors have an impact on diet, access to food, and safe physical activity spaces, which disproportionately affect Black, Hispanic/Latino, and Native Americans in the United States (**Contextual Question 5**), who also may have more limited access to weight management resources (**Contextual Question 6**).

Citing the association of high BMI with harmful health and social consequences, the American Academy of Pediatrics developed a series of recommendations for assessment, treatment, and monitoring of high BMI and potentially related comorbidies.[4] This report seeks to limit harm by emphasizing the need to avoid stigmatizing language and urges clinicians to be supportive, empathetic, and nonjudgmental. The report states that "the natural course of obesity across the lifespan is characterized by responses to treatment and relapse when treatment ends; thus, children and adolescents with obesity will need appropriate reassessments of medical and psychological risks and comorbidities and appropriate modifications to their treatment plan throughout childhood and adolescence into young adulthood." While many young people may benefit from participation in a thoughtful and sensitively-developed weight management treatment that incorporates disordered eating prevention, they do not discuss when and whether to shift the focus away from weight outcomes to other health-promoting outcomes if children continue to fail to meet weight-related goals. However, their endorsement of shared decision-making creates an important opportunity for such discussions.

The included pharmacotherapy intervention trials also showed no increased risk of serious harm. However, FDA materials suggest that there may be a risk of serious harms. For phentermine/topiramate, the FDA materials note that it may increase the risk of cleft lip and cleft palate in offspring if taken during pregnancy.[302] Other FDA warnings for phentermine/topiramate include increased heart rate, suicidal thoughts, and serious eye problems can lead to permanent vision loss if not treated. Also, phentermine/topiramate is a federally controlled substance (Schedule IV) because it contains phentermine and can be abused or lead to drug dependence. Liraglutide and semaglutide are also contraindicated during pregnancy and are associated with an increased risk of thyroid tumors, including cancer, as well as pancreatitis, gall bladder problems, acute kidney injury, serious allergic reaction, heart rate increase, depression, thoughts of suicide, and, among patients with type 2 diabetes, hypoglycemia and vision changes.[303]Very limited evidence suggests that weight loss is not maintained when these medications are discontinued, so young people may need to continuing using the medication for years to decades to maintain lower weight, and the impact of many years of use are not known.

Evidence on Health Benefits of Weight Loss

The only improvement in health outcomes identified in the included studies was a small increase in quality of life, which was statistically significant among the high-contact (but not the lower-contact) behavioral interventions and with semaglutide. The semaglutide and the higher-contact trials showed consistent improvements of approximately 4 points more than control groups on (mostly) 100-point scales. We found published minimal clinically important differences (MCID) for the Peds QL:

- Enrollees in California State's Children's Health Insurance Program: 4.5 for parent report, 4.4 for child report[304]
- Youth with type 2 DM: 6.3 for parent report, 5.4 for youth report[305]
- Youth with type 1 DM: 4.9 for parent report, 4.7 for youth report[305]

These MCIDs are based on standard error of measurement rather than the preferred anchor-based method. The anchor-based method is more patient-centered and uses direct response from the patient on some other measure of impact on the patient to elucidate the meaning of a particular degree of change.[306] The two higher-contact intervention trials that used the PedsQL found improvements of 6.7 to 10.2 points in the intervention groups, and 2.9 to 6.1-point improvements in the control groups.[111, 129] While this evidence is promising, it represents only two of the 17 trials of higher contact interventions, so must be interpreted with caution.[106, 109, 111, 117, 118, 121, 126, 127, 129, 131, 133, 135, 138, 139, 141, 151, 154] Few other health outcomes were reported in the included studies and none showed a benefit. A separate systematic review did show reductions in depression (SMD, −0.31 [95% CI, -0.39 to -0.22]; 36 studies [N=1878]) and anxiety (SMD, −0.38 [95% CI, -0.57 to -0.19]; 10 studies [N=530]) after 6 to 16 months among young people with high BMI participating in weight management interventions. This review included a wide range of study designs, including non-controlled pre-post studies, and followup beyond 16 months was extremely limited.[307]

Evidence from large cohort studies suggests that high BMI in childhood is associated with an increased risk of premature mortality, but this evidence is observational in nature and cannot control for potentially important confounding factors such genetic predisposition for early mortality, and behavioral factors such as fitness, diet, or engagement with health care (**Contextual Question 2**). Further, we found no evidence on whether weight *loss* in children and adolescents would help prevent poor health outcomes in the future, so it is unclear if the excess premature deaths associated with high childhood BMI could be prevented by weight loss.
Even among adults, there is some uncertainty about the extent to which high BMI harms an individual's health, especially in the range of 25 to 35 kg/m^2 (see **Contextual Question 2**). The evidence on the impact of BMI on mortality and cardiovascular events in adults has some important limitations: it is primarily observational in nature; some studies have found that the associations are eliminated or substantially attenuated by cardiorespiratory fitness and other healthy lifestyle habits; and other potential confounders are not accounted for, such as the impact of weight stigma (e.g., via the chronic stress of discrimination and abuse related to weight, treatment delays and inferior treatment stemming from weight stigma [see **Contextual Question 7**]). Further, some studies show no increased risk or even improved survival for adults experiencing certain acute health events with BMI in the 25 to 35 kg/m^2 range, suggesting a

potentially protective effect in some instances, although this evidence is again observational only.[308-313] The applicability of evidence in adults to children may be limited, however, since most adults with BMI of 30 or higher did not have higher BMI as children.[27]

Conclusions about clinically important differences in weight change are difficult to draw because most evidence does not attempt to disentangle potential benefits from improved diet and physical activity from potential benefits of weight loss alone. In our review, the mean difference between intervention and control groups in BMI and weight was typically in the range of 1 to 2 kg/m^2 or 2 to 3 kg, which is similar to the range in adults.[21] The clinical significance of this level of weight loss is unclear (see **Contextual Question 4**). The most robust evidence in pediatric populations suggests that zBMI reductions of at least 0.7 are needed to confer benefit for cardiometabolic measures. Mean reductions in zBMI found in the behavioral intervention trials included in our review were far smaller, generally ranging from 0.2 to 0.4 with higher-contact interventions, 0 to 0.2 in lower contact interventions. Semaglutide use was associated with zBMI reductions in this range, however, with a 1.1 zBMI reduction (compared to 0.1 reduction among those receiving a placebo injection).

The weight changes found in our review likely leave most participants with a BMI that would still put them in the "overweight" or "obese" categories after the intervention ended. One large 20-year prospective study of adults found that the annual probability of attaining "normal weight" was 0.005 for men and 0.008 women with BMI in the 30 to 34.9 kg/m^2 range, and was 0.0008 for men and 0.001 for women with BMI in the 40-44.9 kg/m^2 range.[314] Even if the rates of these levels of weight change are substantially higher in children than in adults, it suggests that weight loss in an amount needed to achieve BMI below the 85^{th} percentile for age and sex will be the exception. It follows, then, that even after successful participation in weight loss programs, many young people will still be faced with continued pressure to continue to lose more weight, which may be an essentially impossible task for those at the highest weight levels, given what we know about physiologic adaptations to weight loss (see **Contextual Question 8**).

This issue raises the question of whether continued emphasis on weight is helpful after initial efforts, particularly given the association of weight cycling with ultimate weight gain and the known association between dieting and eating disorders, particularly in the context of body dissatisfaction (see **Contextual Question 8**). Weight stigma is pervasive and damaging (see **Contextual Question 7**)**,** and young people who perceive themselves as being too heavy are prone to potentially damaging weight loss methods and poor psychosocial outcomes (see **Contextual Question 4**). Youth are getting that message that they should lose weight; data from the Youth Risk Factor Behavior Surveillance System show that 48.3 percent of U.S.-based 9^{th} to 12^{th} graders were trying to lose weight in 2019, with dramatically higher rates among females (59.8%) than males (37.0%).[17] While monitoring weight may be an important part of medical care for young people, telling pediatric patients that they have overweight or obesity may have some unintended negative consequences for some patients and should be handled carefully and sensitively as noted in the AAP guidance.[4]

Approaches for Improving the Health of Children and Adolescents With High Weight

Understanding individual patients' preferences and concerns seems paramount, given the complex, heterogeneous, and poorly understood etiology of high BMI; growing evidence that weight is largely influenced by factors that are not under control of the individual; limited information on longer term outcomes; and relatively modest weight loss associated with most weight management interventions. The AAP clinic practice guideline supports shared decision-making and encourages clinicians to consider patients' circumstances, preferences, underlying conditions, special needs, and developmental status.[4]

Some advocates and researchers have called for a change to a more weight-inclusive paradigm of health, which focuses on promotion of high quality, non-stigmatizing health care designed to promote health in a manner that is equitable across the weight spectrum, including a focus on health-enhancing eating and body movement rather than weight loss for people with high weight.[190, 315-317] For example, the position statement by the Academy of Nutrition and Dietetics on prevention of childhood and adolescent obesity states that "Evidence supports that improvements in diet and physical activity can improve metabolic health in youth independent of weight loss and that a singular focus on weight loss can have harmful effects (i.e. weight stigma) among minority youth."[317] The "Health at Every Size" organization principles encourage "Eating for well-being," which they describe as promoting "flexible, individualized eating based on hunger, satiety, nutritional needs, and pleasure, rather than any externally regulated eating plan focused on weight control."[318] Mindful and "Intuitive Eating" approaches promote focusing on eating in response to hunger and satiety clues.[319] Intervention trials among adults indicate that mindfulness-based approaches may be effective in addressing binge eating, emotional eating, and eating in response to external cues, and may help prevent weight gain,[319] and interventions in children commonly include advice and instruction on attending to internal satiety signals. Intuitive eating was found to predict better psychological health and lower use of disordered eating behaviors in an 8-year longitudinal study of adolescents followed into young adulthood.[320] Further, a systematic review of intuitive eating interventions delivered to children and adolescents to *prevent* high BMI found that the interventions were associated with changes in eating habits, food portions, reduction of stress, or reduction of cravings. While some of the interventions included in our review likely provided coaching in identifying hunger and satiety signals, none of the studies specifically mentioned "mindful" or "intuitive" approaches in their interventions, suggesting that these alternate approaches have not been widely studied in children and adolescents with high BMI.

Applicability of the Included Studies to the U.S. Population

Sixty percent of the included trials were conducted in the United States. Most participants were non-Hispanic White, but persons of Hispanic/Latino heritage were fairly well-represented in these studies as well. Four studies were focused on populations with financial challenges. One author has pointed out, however, that families who have participated in research trials are likely to be relatively high functioning and have a certain level of organization and cohesion in order to be able to participate in an intervention program and to complete the program over the course of

many weeks.[321] Few of the studies included in our review had elements that addressed social risk factors, and we were unable to determine the impact of these efforts in the studies that did attempt to address barriers related to social risk, since the mitigation efforts were highly heterogeneous and could not be disentangled from other factors such as contact time. In addition, psychosocial outcomes may be subject to social desirability bias (i.e., desire to report outcomes that are socially normative or that are perceived to be expected or hoped for by those conducting the study) and demand characteristics, (i.e., cues that may indicate the purpose of the study) since participants in weight management interventions cannot be blinded to their intervention status. Thus, the effect sizes seen in the included studies may be more favorable than those found in typical clinical settings.

Methodologic Differences Between the Previous and Current Reviews

Despite similar findings, there were some methodologic differences between the previous USPSTF review[94] on this topic and the current review. First, because height and weight measures are the standard of care for children and adolescents, we did not address key questions on screening for high BMI, which is consistent with the adult weight management review conducted for the USPSTF.[21] Second, the included medications changed. Liraglutide, semaglutide, and phentermine/topiramate were newly included because they received FDA approval for use in young people since the previous review. Metformin was previously included but excluded in the current review because it is not FDA approved for weight management. Third, we did not include non-randomized trials of interventions in the current review but had previously included such studies. Sensitivity analyses including NRSIs showed no to minimal impact on effect size (data not shown).

Finally, there were also differences in the approaches to data analysis. Most importantly, the previous review used BMI z-score or standard deviation score (zBMI) as the primary outcome and did not pool change in BMI or weight. The rationale was that zBMI is more directly comparable across the age spectrum than other weight outcomes, however more recent research has shown that zBMI does a poor job of capturing change in weight above the 97th percentile of weight for age and sex and has other problematic properties.[100, 322] The CDC recently modified their z-scores and percentiles to more accurately characterize children with a BMI ≥95th percentile, but most of the included studies were published prior to this update.[7] And, z-scores and percentiles published by CDC, WHO, and IOTF were developed using different methods and normative samples, so may exhibit different properties, which could result in different conclusions across systems. We used BMI as the primary outcome in this review because it was the most widely-reported outcome among those recommended for measuring weight outcomes in children.[100] Both BMI and weight were quantitatively pooled. We report zBMI as a secondary outcome because many studies do report this measure, and to allow comparison with the prior review. Finally, the previous review stratified the results by four levels of intervention contact hours (0-5, 6-26, 26-51, ≥52). In the current review, we stratified results by two levels of intervention contact hours (<26, ≥26), which allowed for more robust estimates with more studies per strata, and was consistent with the clinical considerations of the existing USPSTF recommendation statement.[1]

Limitations of Our Review

We did not include some evidence that may have relevance for understanding the impact of weight management interventions in young people. Because our review was scoped for weight management interventions as a clinical preventive service, we did not include studies that did not have a connection to a healthcare setting. However, given the broad reach of diet and physical activity considerations in everyday life and in typical community settings, many of which may also address weight concerns, there are bodies of evidence not captured by our review. The Community Preventive Services Task Force has issued several findings for community-based intervention approaches to prevent and control 'obesity,' including eight reviews of school-based interventions.[323, 324]

Our review included studies among children and adolescents meeting criteria for higher BMI, such as being at or above the 85th percentile for age and sex, and in some cases inclusion criteria had even lower thresholds.[137, 142, 143, 144] We found no differences in effect sizes for BMI between studies limited to young people with BMI at or above the 95th percentile for age and sex compared to lower weight thresholds for study participation. However, contextual evidence suggests that misclassification of young people with high adiposity is common below the 95th percentile threshold, so future updates to this review may consider a more narrow focus on the young people meeting a higher weight threshold. Further, our review did not address the promotion of healthy behaviors in children and adolescents with BMI <85th percentile. Given the findings that weight management interventions have only modest effects, and given the harms associated with weight labeling and weight stigma, it may be valuable to consider the role and effectiveness of broad interventions to promote healthy diet and physical activity in children and adolescents of all weights.

We limited our examination of pharmacotherapy to agents that were approved by the FDA for long-term use for weight loss in children or adolescents as of December 12, 2022. Thus, while metformin is used in practice, it was excluded from the current review. Our previous review found that it was associated with BMI reductions of -0.86 kg/m^2 (95% CI, -1.44 to -0.29; k=6; I^2=0%), with most trials limited to youth with insulin or glucose metabolism abnormalities, most of whom met adult criteria for severe obesity.[94]

Surgical interventions were excluded from the current review, as they were from previous reviews for the USPSTF on this topic, although may be relevant for some adolescents and are recommended by some organizations under certain circumstances.[4] However, we focused on first and second-line treatment, which we consider to fall most clearly under the umbrella of preventive services (versus disease management), and therefore limited the included interventions to behavioral and pharmacotherapy.

To maximize applicability of the evidence to U.S.-based primary care settings, this review was limited to studies conducted in countries rated has having very high development. And, consistent with the methods of the USPSTF, we included only studies that were rated as fair- and good-quality studies. Due to resource constraints, we only included studies published in English.

Future Research Needs

A list of ongoing studies can be found in **Appendix F**. Several areas of further research are urgently needed to help the field understand the impact of weight management programs in children and adolescents:

1. Longer-term followup of weight management interventions. The minimal evidence available in children suggests that group differences in weight diminish beyond one year with behavioral interventions. Evidence on pharmacotherapy indicates that weight loss is maximized after 6 to 12 months and rebounds when medication is discontinued. If children and adolescents must continue medications indefinitely in order to maintain weight loss, study of the harms of long-term use is essential, as is the long-term efficacy of the medications. Since most medical conditions that are associated with high weight take many years to develop, temporary weight loss may not have an important impact on longer-term health. Recommended outcomes for such longer-term studies include absolute change in BMI and BMI change expressed as a percentage of the median and of the 95th percentile for age and sex. Despite its limitations, it would also be useful to report zBMI change as a secondary outcome for comparison with previous studies.
2. Long-term psychosocial outcomes. For example, qualitative research is needed to understand the impact of child weight management interventions from the perspective of adults who participated as children, from a broad, representative sample of people. Anecdotal reports suggest a risk of harm in terms of eating disorders, body image issues, and other mental health challenges related to participation in weight management interventions in childhood, but we found no systematic approach to examining these harms. These harms may not be apparent to children in the moment when they are reducing their BMI percentile but may become more clear in retrospect. Researchers may seek to understand what proportion are vulnerable to harms, and more broadly whether harm stems from being labeled as having "overweight" or "obesity" in the medical setting, participation in a weight management program, or self-initiated attempts outside of the clinical setting. Further understanding of what characteristics are associated with longer term harms, and if there are elements that could mitigate the risk of longer-term emotional harms would be beneficial.
3. Best practices for weight-related discussions. Given the sensitivity of discussions with children and parents about children's weight, continued work is needed to understand best practices for clinicians from the patient perspective, to promote trust, respectful language, and shared decision-making. Research should include best practices for counseling parents in how they can best communicate with their child, as research suggests parent-child communication surrounding weight has an impact on child well-being. Research should also include preferred terminology. While the Obesity Action Coalition recommends "person-first" language (i.e., "person with obesity" rather than "obese person"),[325] this does not appear to be universally preferred.[326, 327] Further, preferences may differ between treatment-seeking and non-treatment-seeking individuals, so a broad cross section of individuals with high BMI should inform this research.[326]

4. Biochemical compensatory responses to weight loss in children and adolescents. Studies in adults have identified a number of hormonal and other biochemical compensatory mechanisms that promote weight regain after weight loss, but information on such mechanisms in children and adolescents is lacking. We are aware of one study that is underway with the aim of examining hormonal regulatory mechanisms,[328] but more research is needed.
5. Benefits and harms of weight-neutral interventions among children and adolescents with high BMI. RCTs are needed that examine the health (including psychosocial) and behavioral outcomes of interventions that focus on healthy lifestyle interventions in young people with high weight, without promoting weight loss. We are aware of examples of this approach in the youth population,[329] but a recent systematic review confirms very limited evidence on weight-neutral interventions in young people with high BMI.[330]Several studies are underway to examine behavioral interventions to prevent diabetes incidence among youth with high BMI and prediabetes that do not appear to have a strong weight loss aim.[331-333] A systematic review commissioned by the USPSTF evaluating the effects of behavioral counseling to promote a healthy diet and physical activity in adults without cardiovascular risk factors shows that such interventions may be promising for intermediate and behavioral outcomes.[334] Studies with weight loss as a primary aim were excluded in this review and thus approximate a weight neutral approach. Although studies were not limited to adults with higher BMI, the mean BMI was between 25.0 and 29.9 kg/m^2 in nearly half of the included studies (k=54/79) and ≥30 kg/m^2 in 18 of 79 included studies. This review found that weight-neutral behavioral counseling interventions in this population of adults were associated with small statistically significant reductions in blood pressure, LDL, measures of adiposity, improvements in dietary outcomes, and physical activity. For example, behavioral counseling interventions were associated with a mean increase of approximately 33 minutes of physical activity per week (95% CI, 21.9 to 44.2). This review found no association between behavioral counseling interventions and mortality, CVD outcomes, quality of life, or harms; however, these outcomes were sparsely reported.
6. Overall dietary pattern. Reporting of dietary pattern quality is scant (e.g., HEI). Improved understanding of the impact on overall diet quality of these interventions would be valuable.
7. Weight-related quality of life. Very few trials reported quality of life measures that were specific to weight concerns, such as impacts on physical comfort, body esteem, social life, and family relations due to their weight. While the impact on overall quality of life and functioning are important, it would also be helpful to understand the impact on aspects of quality of life that are most directly affected by weight.
8. Intervention timing. Very limited information was available to determine whether intervention effects varied by age. It would be useful to better understand how development intersects with interventions for weight management and whether there are certain ages that provide a higher likelihood of benefit. Future studies could take a life course perspective and identify key periods where certain types of interventions may be most beneficial.

Conclusion

Weight management interventions led to improvement in weight status in children and adolescents that ranged in size from modest (for behavioral interventions, orlistat, and liraglutide) to substantial (for semaglutide and phentermine/topiramate), with no evidence of serious harm and modest impact on health or intermediate cardiometabolic outcomes. Maintenance of weight changes beyond one year are unknown, as are longer-term impact on psychosocial outcomes or adverse events associated with pharmacotherapy.

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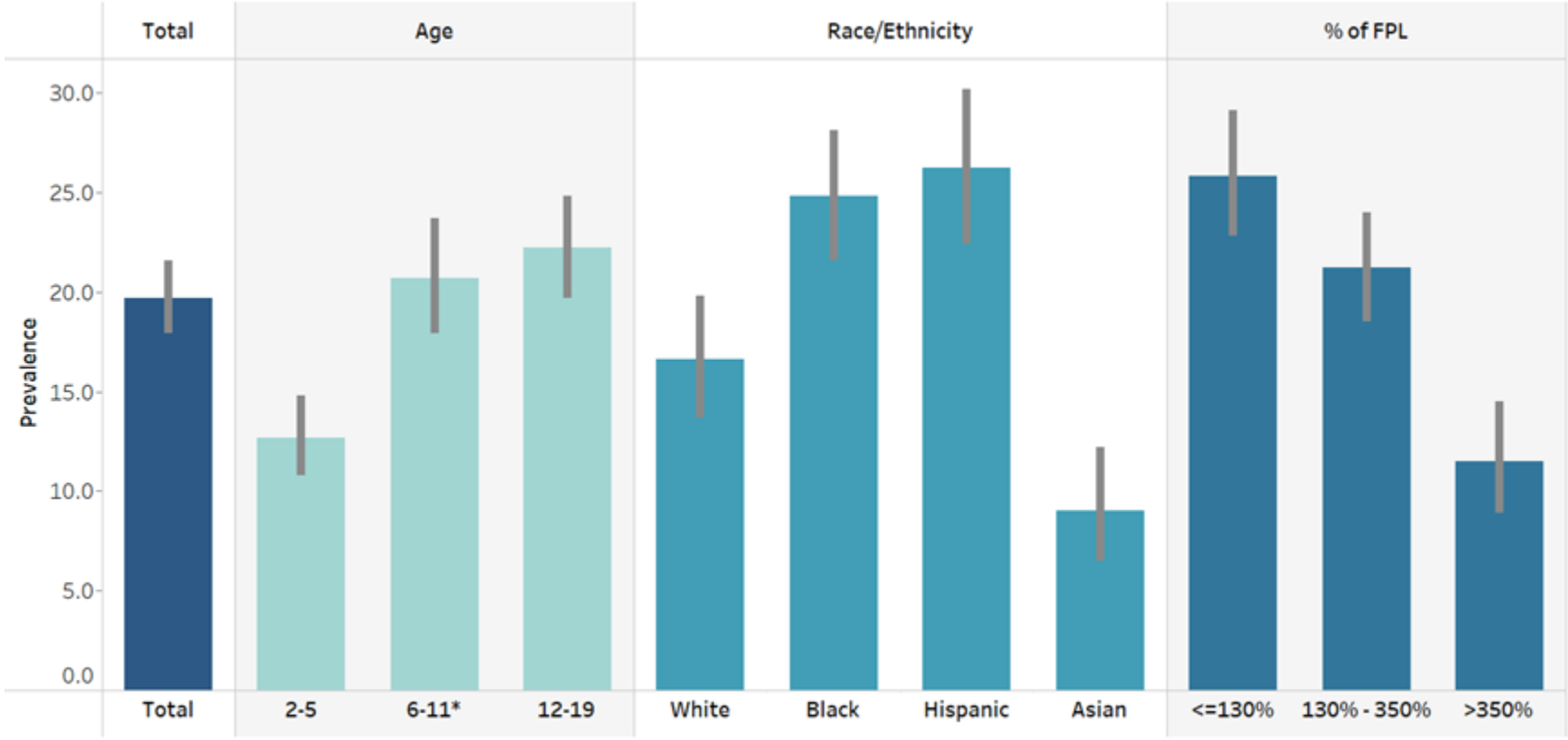
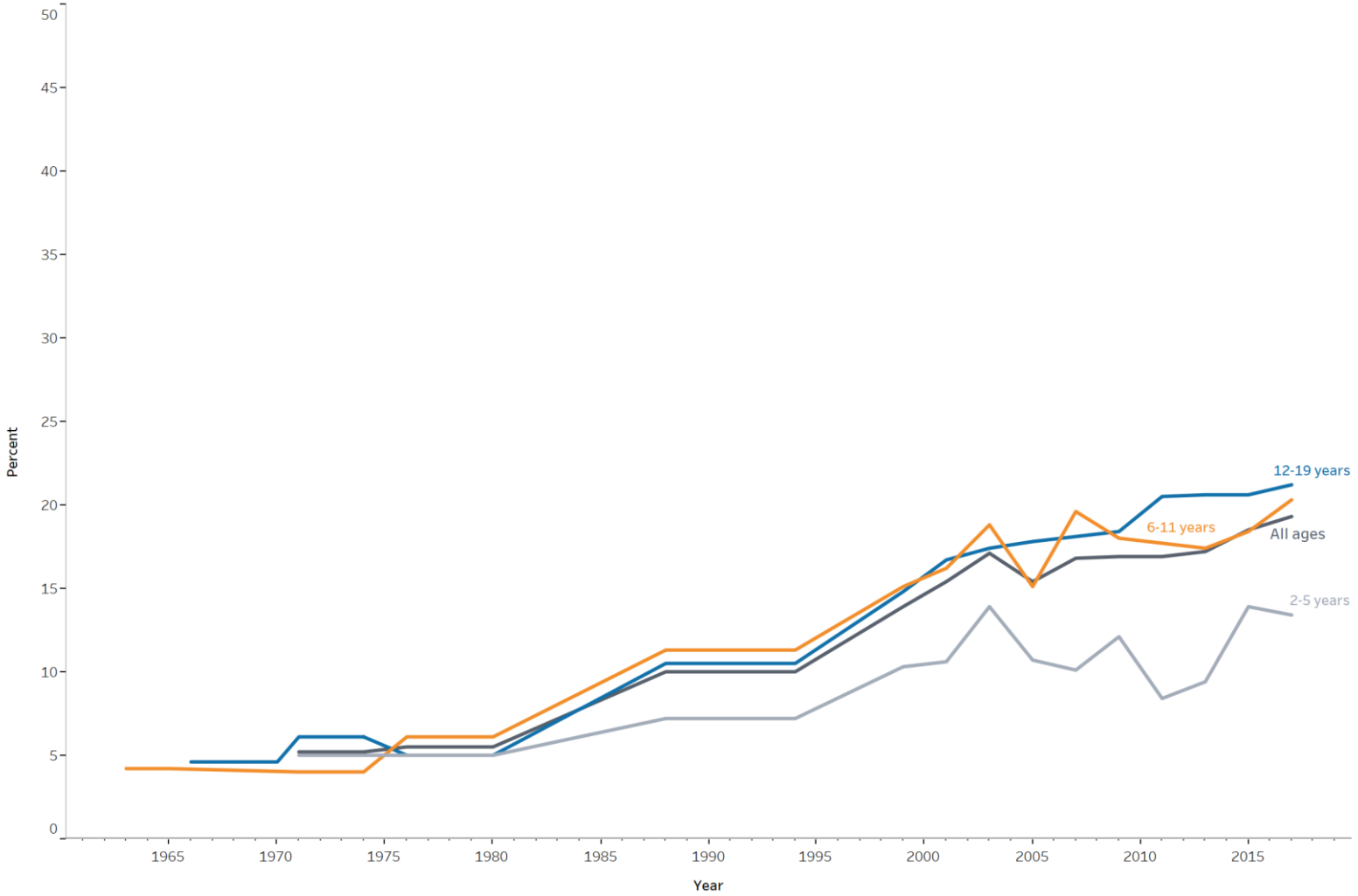
Figure 1. Prevalence of Children and Adolescents Aged 2–19 Years With BMI ≥95th Percentile for Age and Sex, by Demographic Characteristics: United States, 2017 to March 2020 (NHANES)[15]



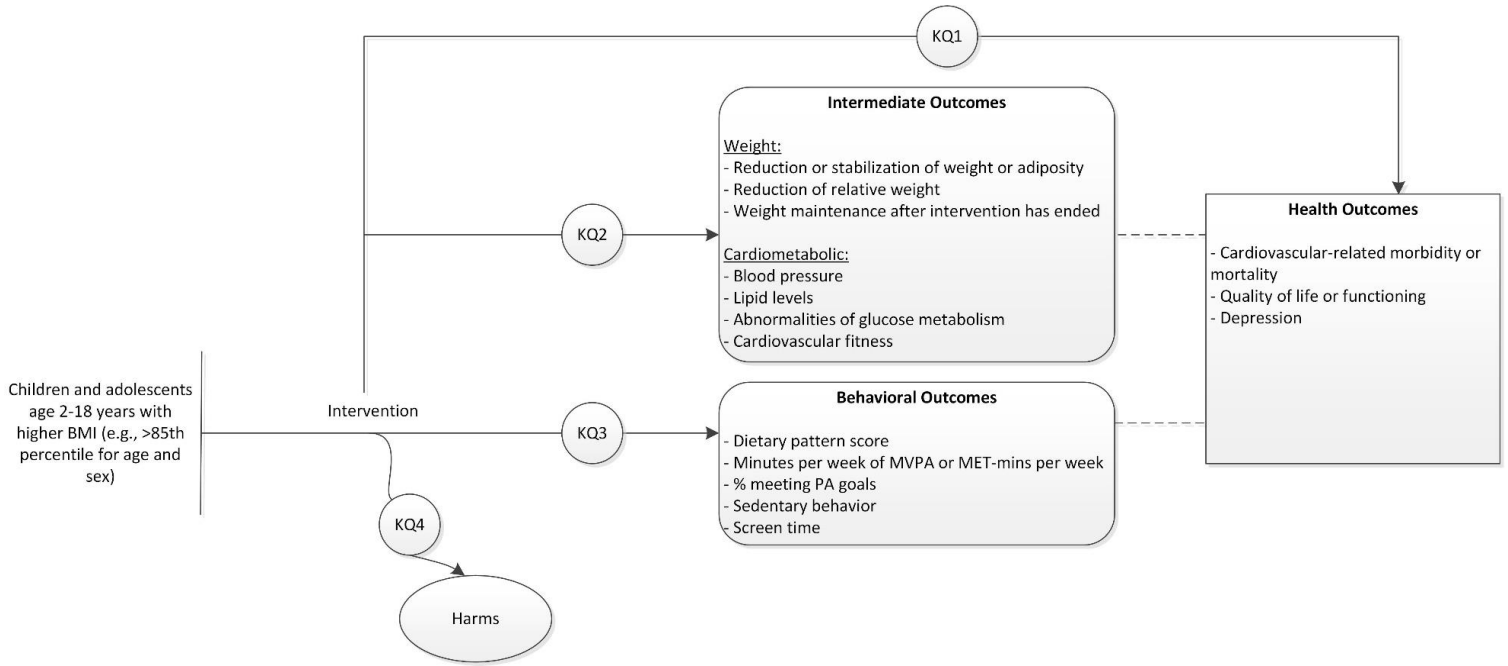
Abbreviations: BMI = body mass index; NHANES = National Health and Nutrition Examination Survey; % of FPL = percent of the federal poverty line;
*Differences in high BMI prevalence by sex are significant for the 6- to 11-year-old age group where prevalence is higher in boys than girls (22.9% vs 18.5%).

Figure 2. Trends in Prevalence of BMI ≥95th Percentile for Age and Sex Among Children and Adolescents Aged 2–19 Years, by Age: United States, 1963–1965 Through 2017–2018



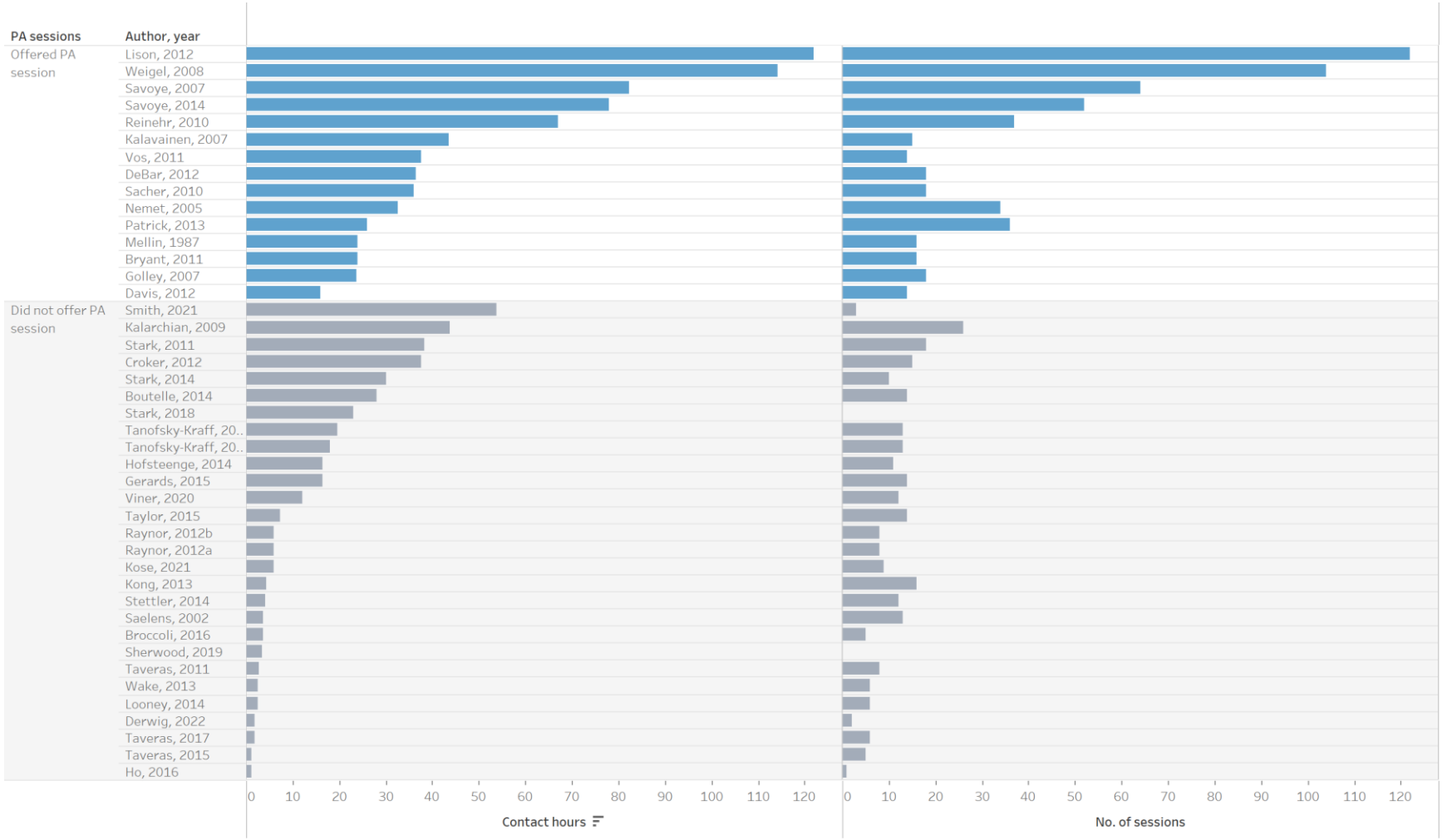
Abbreviations: BMI = Body mass index;
Source: National Center for Health Statistics, National Health Examination Surveys II (ages 6–11), III (ages 12–17); and National Health and Nutrition Examination Surveys (NHANES) I–III, and NHANES 1999–2000, 2001–2002, 2003–2004, 2005–2006, 2007–2008, 2009–2010, 2011–2012, 2013–2014, 2015–2016, and 2017–2018

Figure 3. Analytic Framework



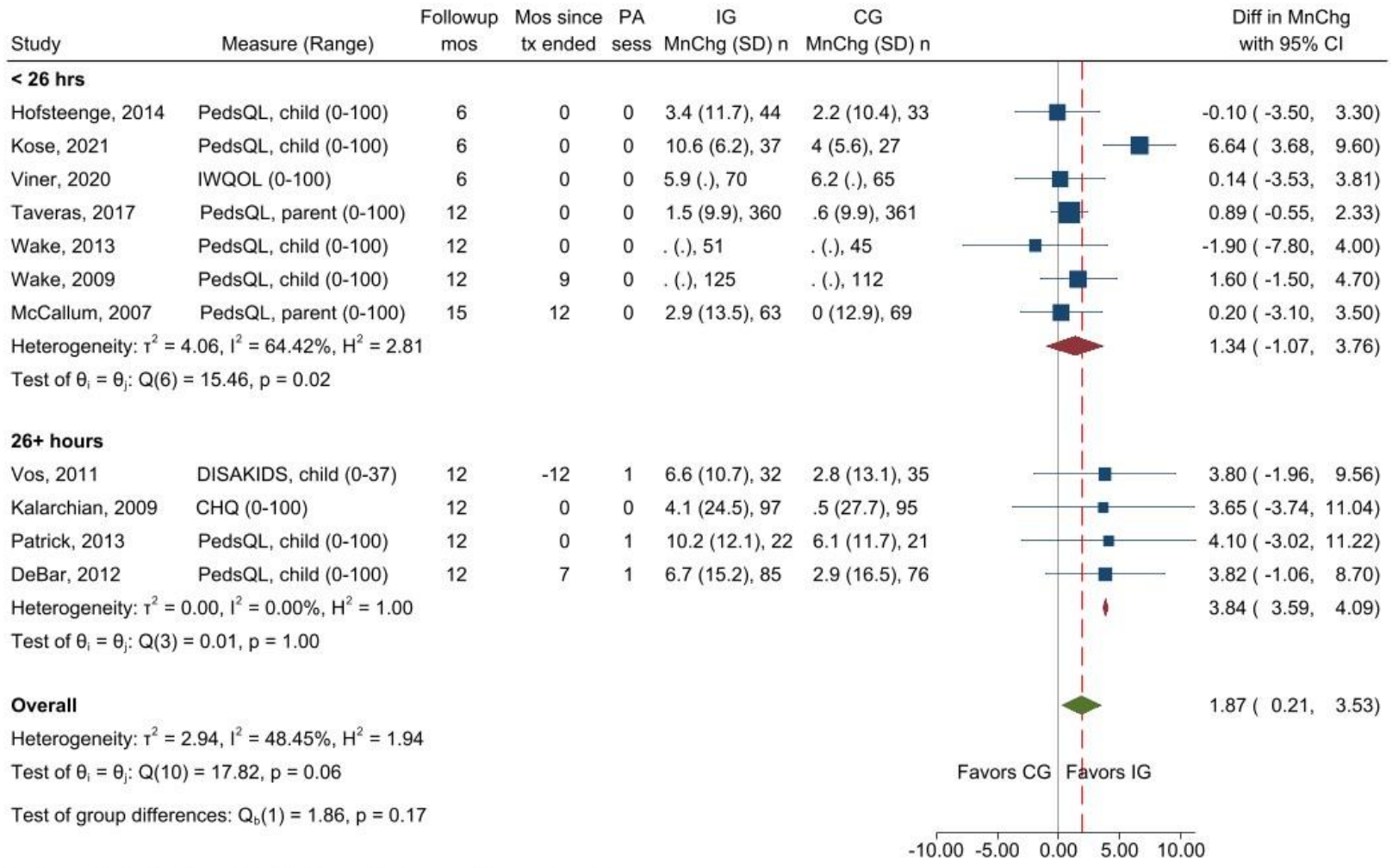
Abbreviations: BMI = Body mass index; KQ = Key Question; MET = Metabolic equivalent; Mins = Minutes; MVPA = Moderate to vigorous physical activity; PA = Physical activity

Figure 4. Estimated Contact Hours and Number of Sessions for Behavioral Intervention Trials, Stratified by Whether Physical Activity Sessions Were Offered



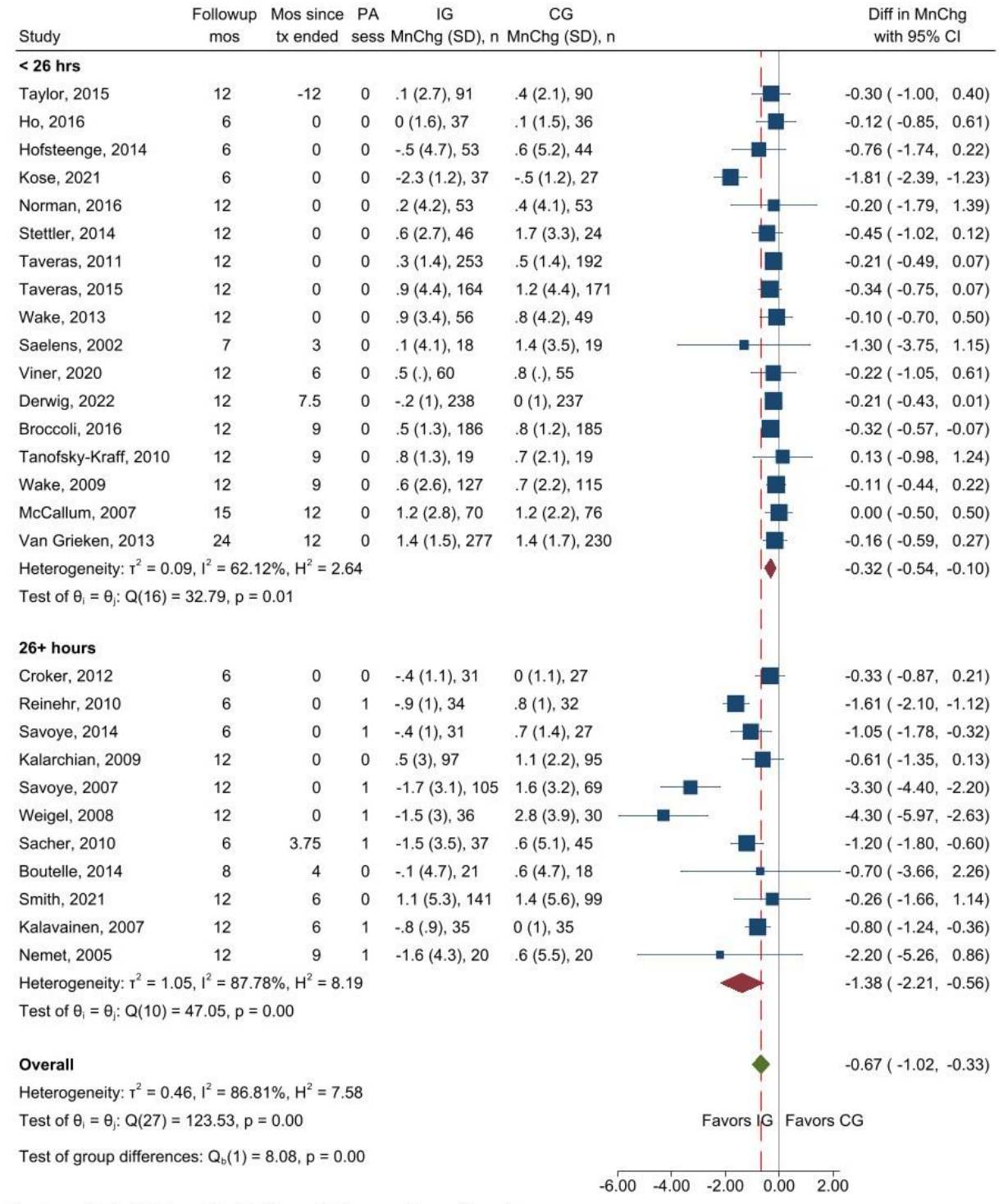
Abbreviations: PA = Physical activity

Figure 5. Pooled Analysis of Change in Total or Global Quality of Life in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



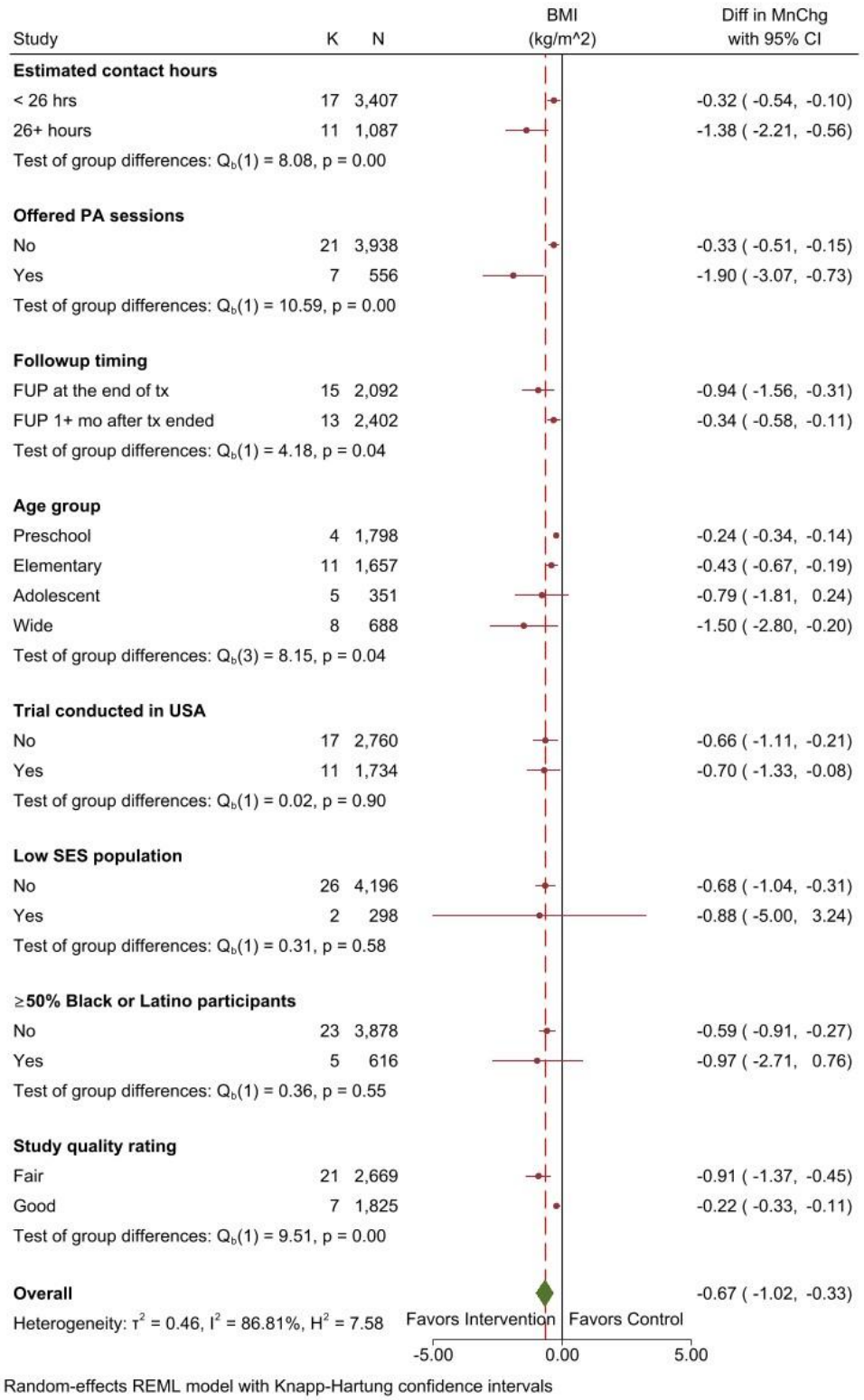
Abbreviations: CG= Control group; CHQ = Child Health Questionnaire; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; IWQOL = Impact of Weight on Quality of Life; MnChg = Mean change; Mos = Months; n = Number of participants; PA = Physical activity; PedsQL = Pediatric Quality of Life Inventory; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Figure 6. Pooled Analysis of Change in Body Mass Index (kg/m^2) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



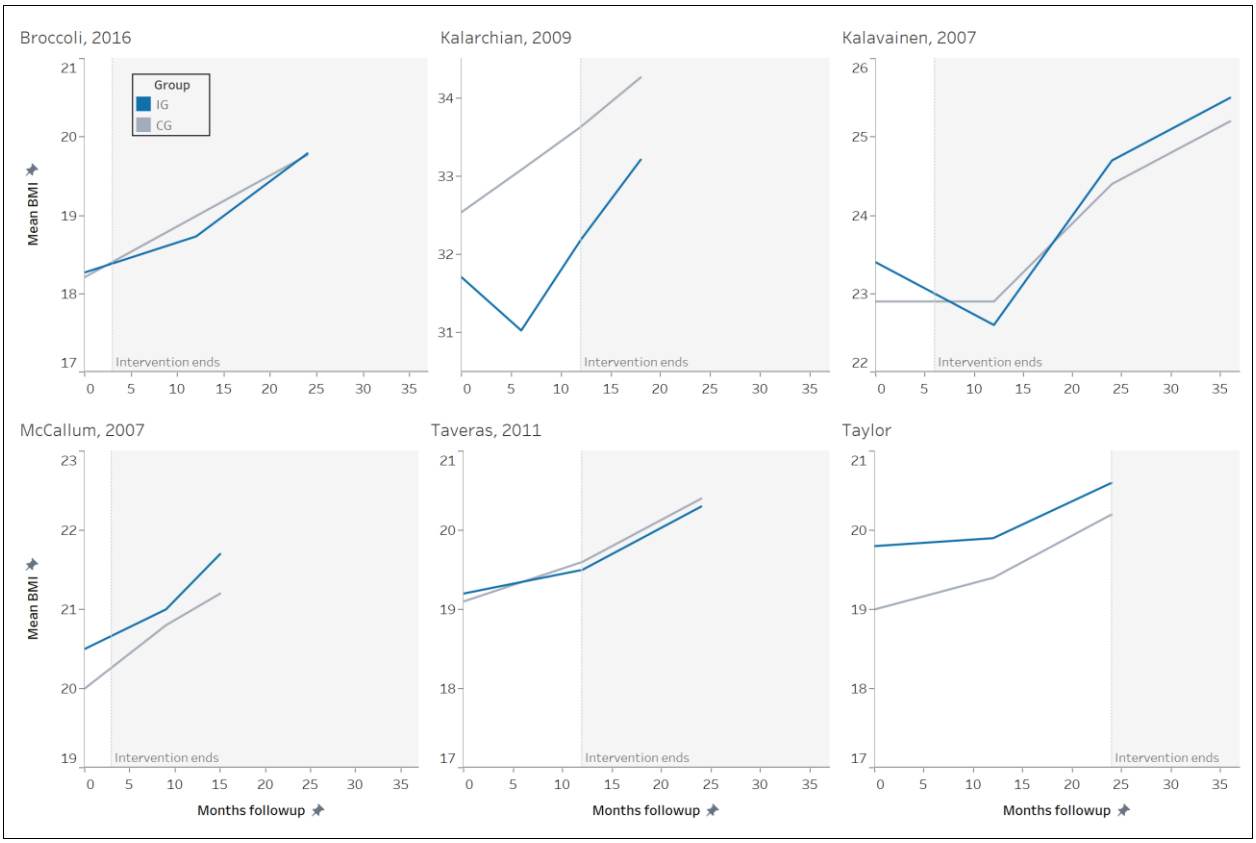
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Kg/m^2 = Kilograms per meters squared; MnChg = Mean change; Mos = Months; n = Number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Figure 7. Stratified Analyses of Body Mass Index (kg/m^2) in Behavioral Interventions Compared With Controls



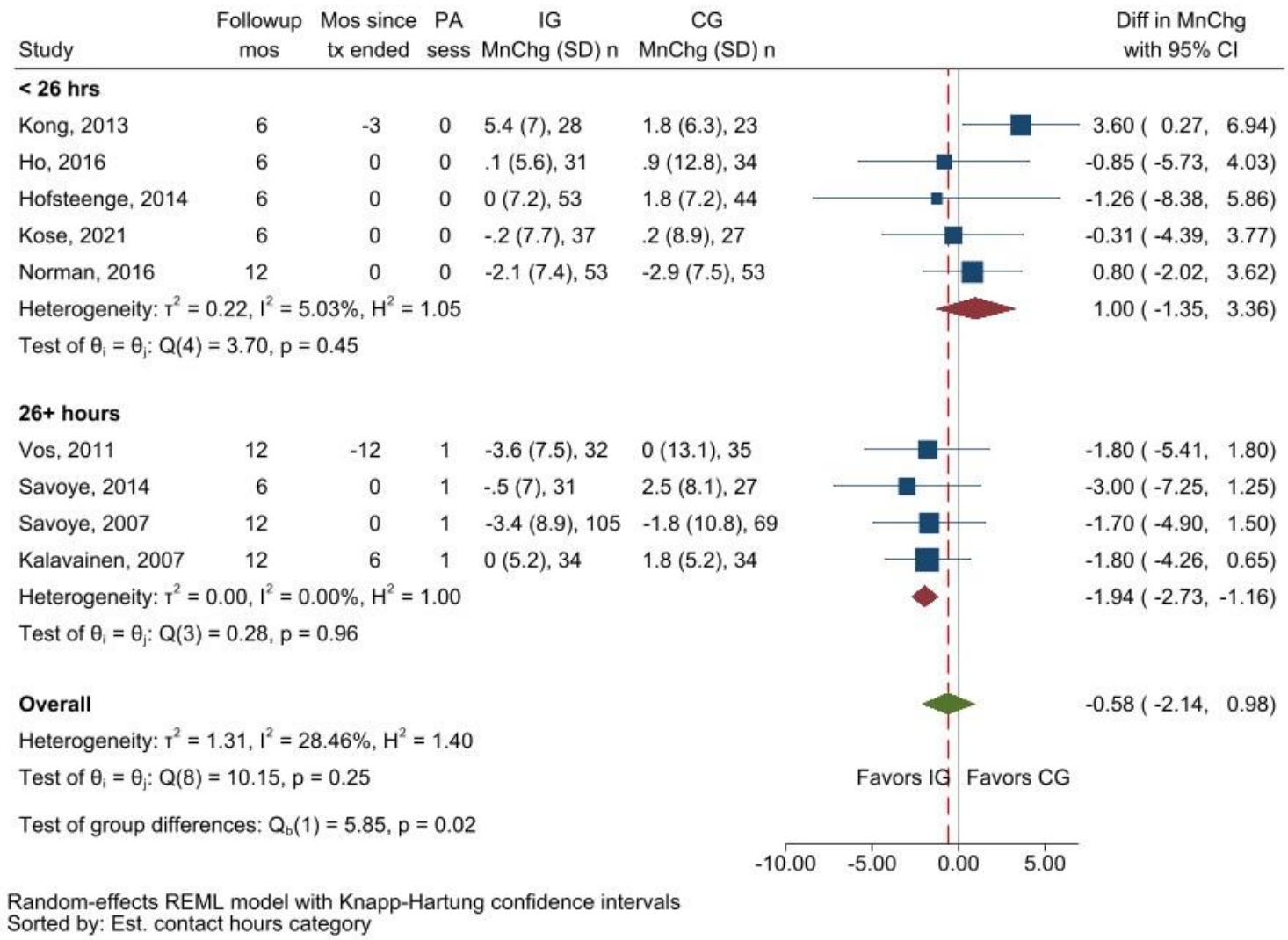
Abbreviations: BMI = Body mass index; CI = Confidence interval; Diff = Difference; Hrs = Hours; K = Number of studies; Kg/m^2 = Kilograms per meters squared; MnChg = Mean change; N = Number of participants; PA = Physical activity; REML = Restricted maximum likelihood

Figure 8. Mean Body Mass Index (kg/m^2) Over Time Among Trials With Three Assessments



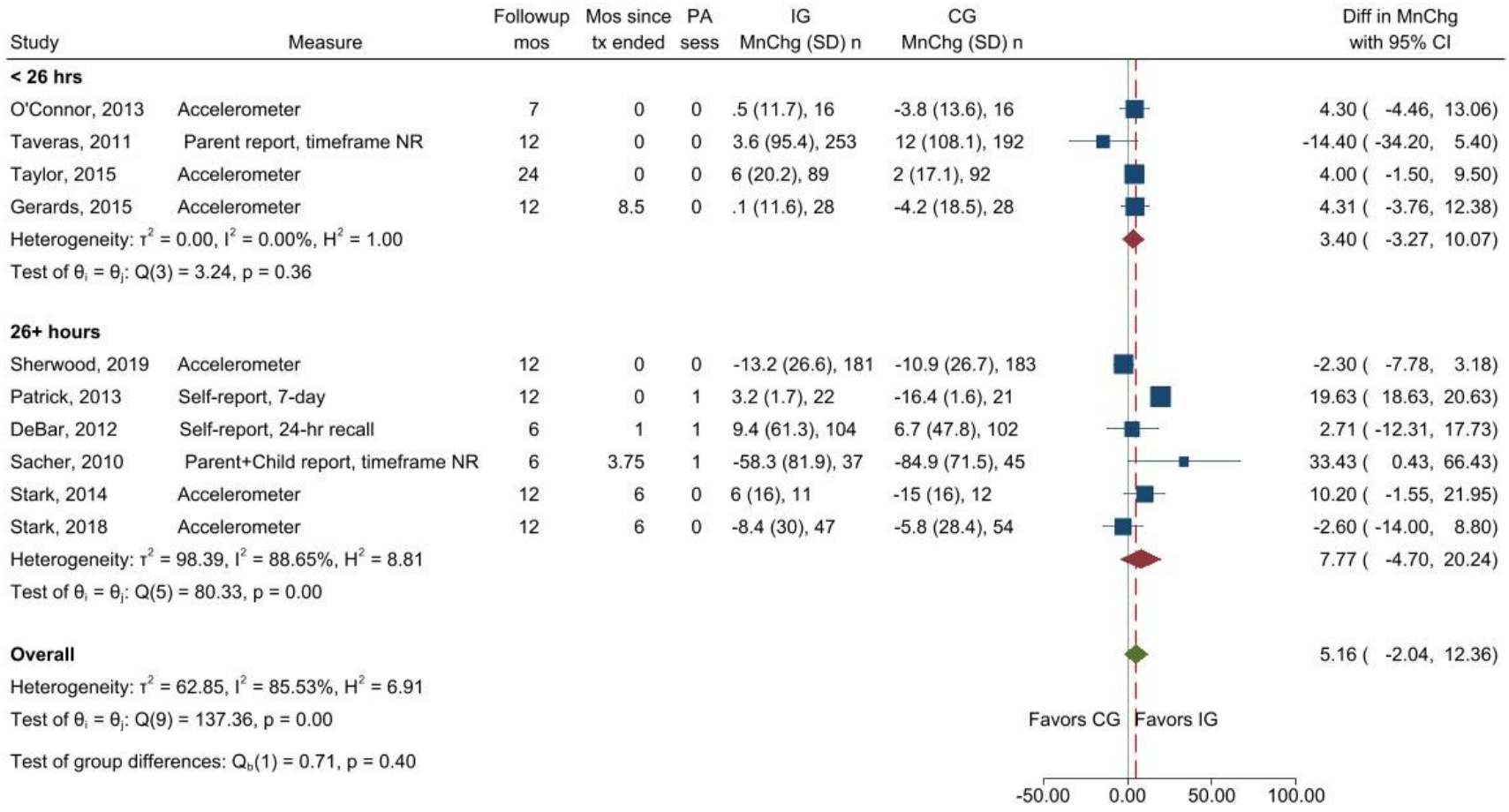
Abbreviations: BMI = Body mass index; CG= Control group; Est. = Estimated; IG = Intervention group; Kg/m^2 = Kilograms per meters squared; Mo = Months
Note: Gray sections of the graphs show followup after treatment ended. There were no group differences ($p<.05$) beyond 12 months.

Figure 9. Pooled Analysis of Change in Fasting Plasma Glucose (mg/dL) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



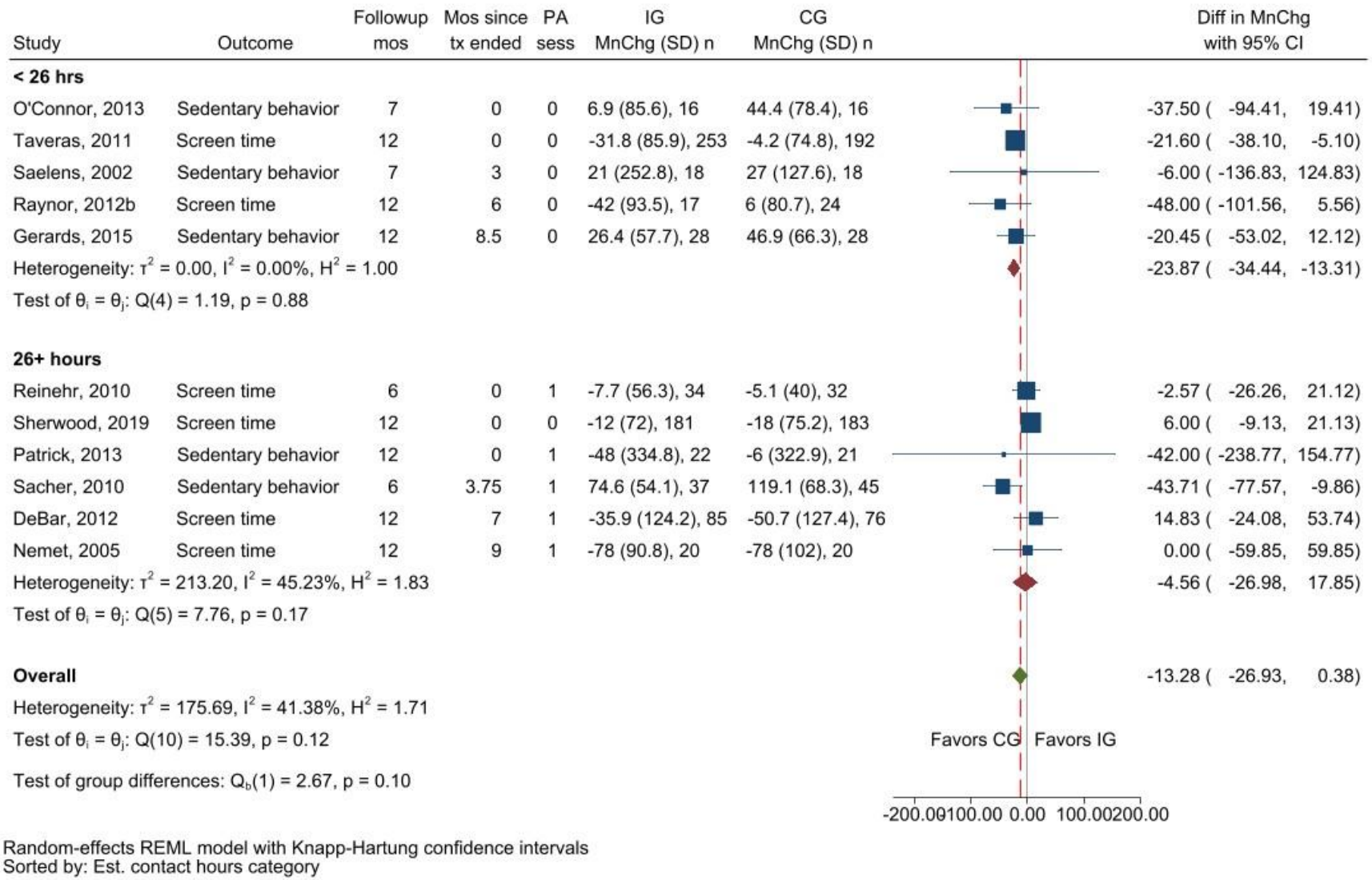
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Mg/dL = Milligrams per deciliter; MnChg = Mean change; Mos = Months; n = Number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Figure 10. Pooled Analysis of Change in Physical Activity (minutes/day) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



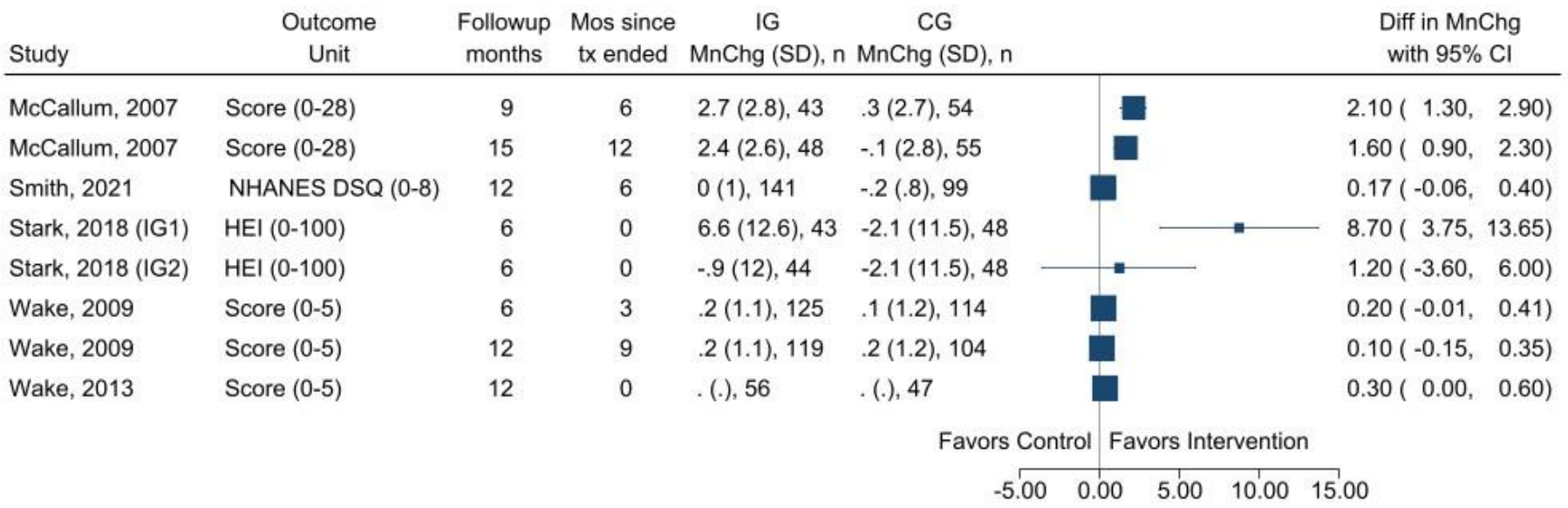
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hr = Hour; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = Number of participants; NR = Not reported; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Figure 11. Pooled Analysis of Change in Sedentary Behavior (minutes/day) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



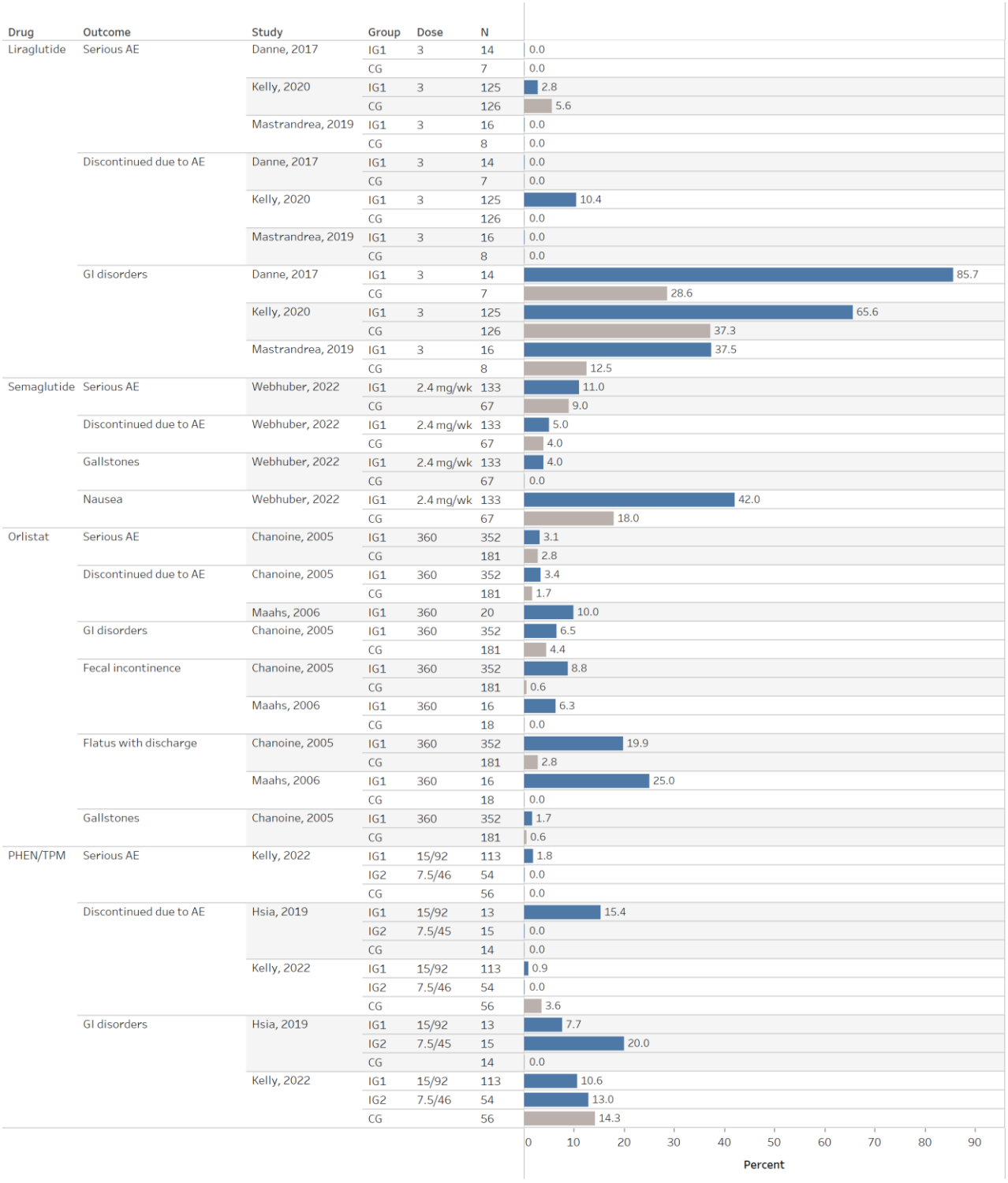
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = Number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Figure 12. Change in Dietary Outcomes in Behavioral Interventions Compared With Controls



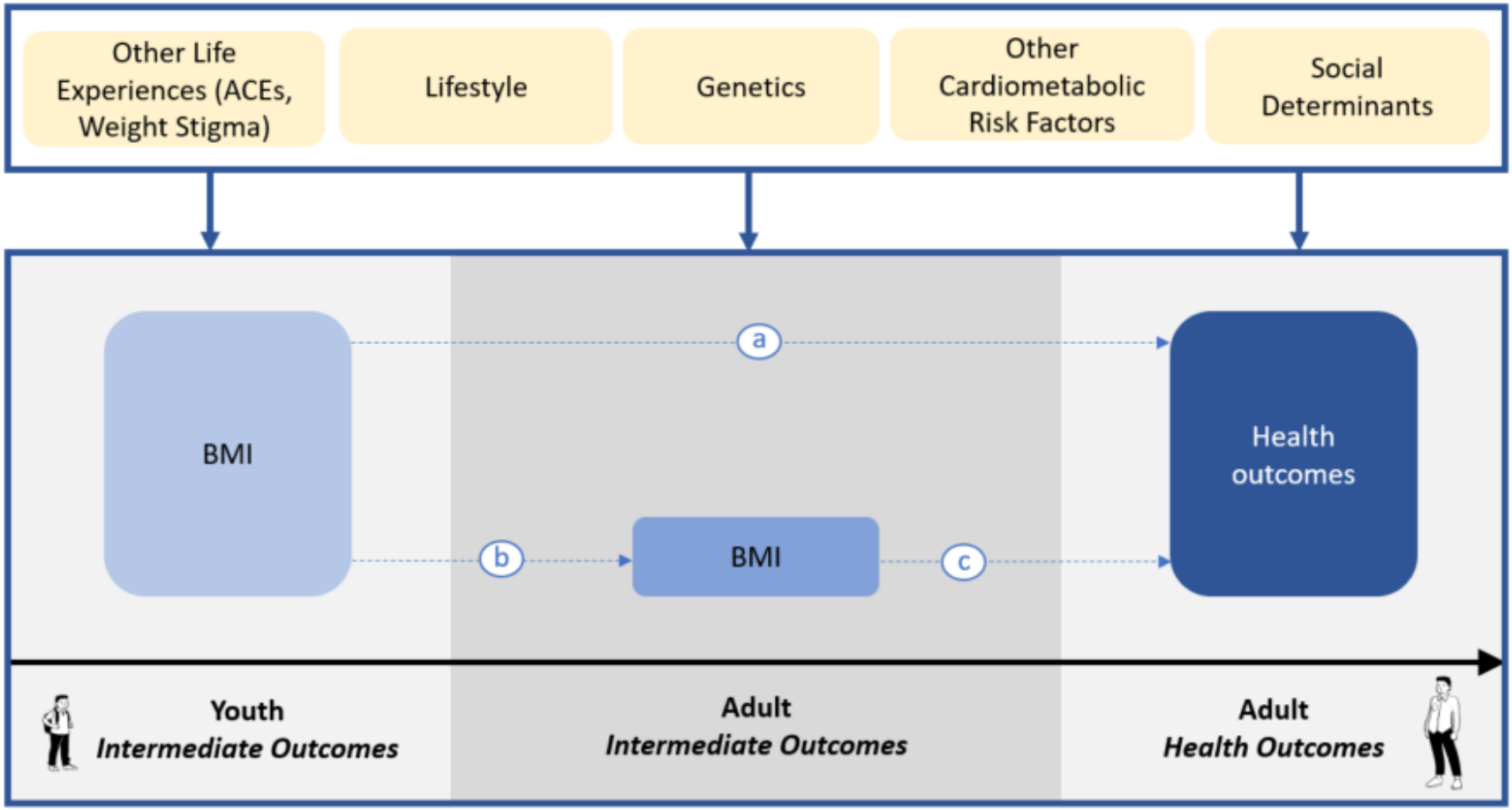
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; HEI = Healthy Eating Index; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = Number of participants; NHANES DSQ = National Health and Nutrition Examination Survey Dietary Screener Questionnaire; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Tx = Treatment

Figure 13. Main Harms Outcomes in Pharmacotherapy Studies (KQ4)



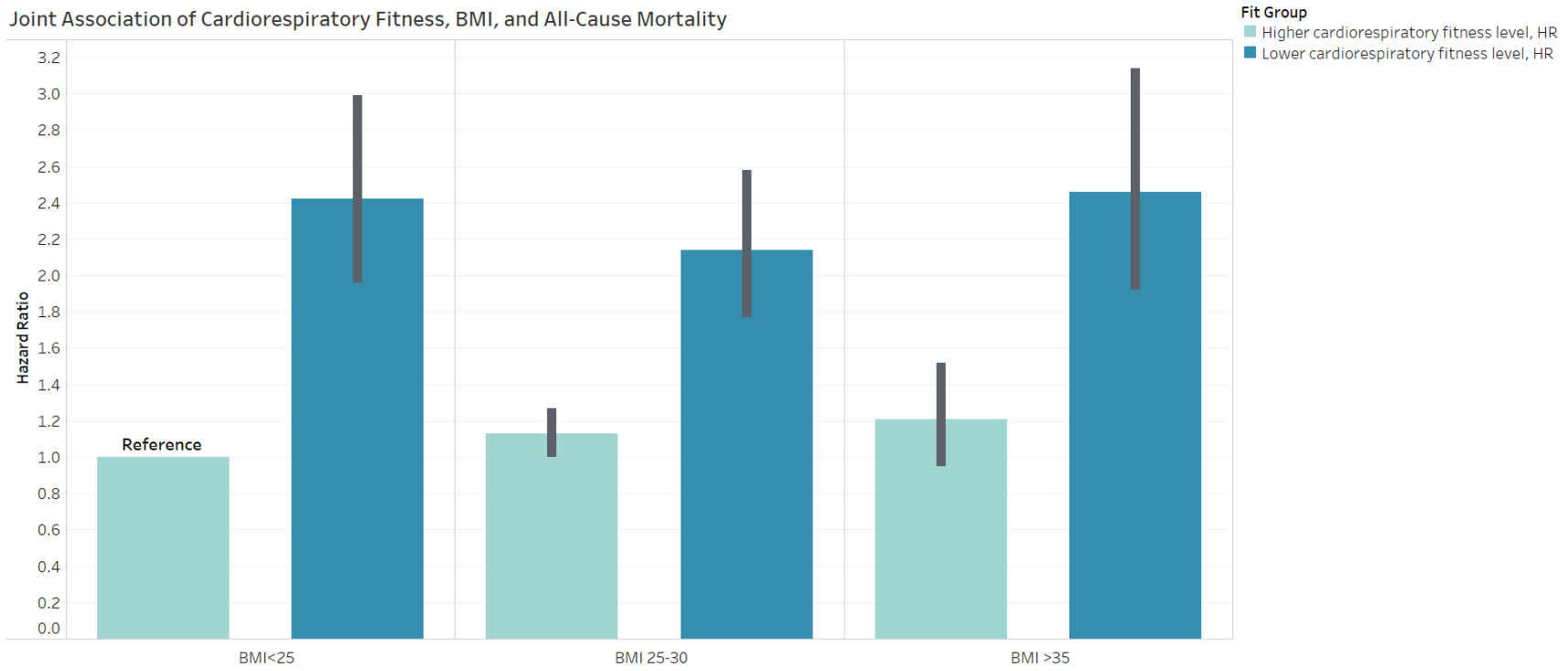
Abbreviations: AE = Adverse event; CG= Control group; GI = gastrointestinal; IG1 = Intervention group one; KQ = Key question; PHEN = Phentermine; TPM = Topiramate

Figure 14. Linkages From Child BMI to Adult Health Outcomes With Model of BMI Influences



Abbreviations: ACEs = adverse childhood experiences; BMI = body mass index

Figure 15. Joint Association of Cardiorespiratory Fitness, BMI, and All-Cause Mortality[32]



Abbreviations: BMI = body mass index

Lower cardiorespiratory fitness: 1st quintile of objectively measured cardiorespiratory fitness (7 of 10 included studies) or study-specific criteria; Higher cardiorespiratory fitness: 2nd-5th quintile of objectively measured cardiorespiratory fitness (7 of 10 included studies) or study-specific criteria

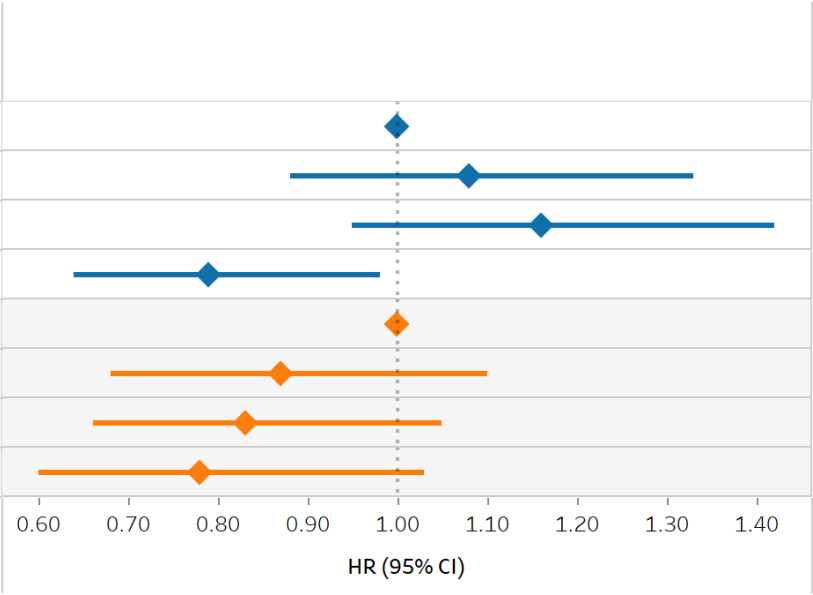
Figure 16. Risk of All-Cause Mortality for Adults by Adherence to Health Habits, Stratified by BMI[33]

Abbreviations: BMI = body mass index; CI = Confidence interval; HR = hazard ratio

Healthy habits: eating ≥5 fruits or vegetables per day, regular exercise >12 times per month, moderate alcohol use (up to 1 drink per day for women and 2 per day for men), not smoking

Figure 17. CVD Outcomes Associated With Changes in Weight or Fitness From the Look AHEAD Study[188]

Outcome	Change categories	Rate per 100 person-years	HR (95% CI)
Weight change	Gain or stable (<2% loss)	1.69	1 (reference)
	Small loss (≥2 to <5%)	1.79	1.08 (0.88, 1.33)
	Medium loss (≥5 to <10%)	1.80	1.16 (0.95, 1.42)
	Large loss (≥10%)	1.43	0.79 (0.64, 0.98)
Fitness change	Loss or stable (<0.5 loss)	1.74	1 (reference)
	Small gain (≥0.5 to <1.0)	1.56	0.87 (0.68, 1.1)
	Medium gain (≥1.0 to <2.0)	1.42	0.83 (0.66, 1.05)
	Large gain (≥2.0)	1.36	0.78 (0.60, 1.03)



Abbreviations: AHEAD = Action for Health in Diabetes; CVD = cardiovascular disease; CI = Confidence interval; HR = hazard ratio

Primary outcome = composite of the first occurrence of death from cardiovascular causes, non-fatal acute myocardial infarction, stroke, or admission to hospital for angina. Secondary outcome = primary outcome plus coronary artery bypass grafting, carotid endartectomy, percutaneous coronary intervention, admission to hospital for congestive heart failure, peripheral vascular disease, and total mortality

HRs are adjusted for sex, age, baseline weight (from weight-change models), baseline fitness (from fitness-change models), history of cardiovascular disease, insulin use, diabetes duration, smoking status, LDL cholesterol, systolic blood pressure, and diastolic blood pressure.

Table 1. BMI Screening and Weight Management Intervention Recommendation From Other Organizations

Organization (Year)	Recommendation
American Academy of Pediatrics (2023)[4]	Measure height and weight, calculate BMI, and assess BMI percentile using age- and sex-specific CDC growth charts or growth charts for children with severe obesity at least annually for all children 2 to 18 y of age to screen for overweight (BMI ≥85th percentile to <95th percentile), obesity (BMI ≥95th percentile), and severe obesity (BMI ≥120% of the 95th percentile for age and sex). Evaluate children 2 to 18 y of age with overweight (BMI ≥85th percentile to <95th percentile) and obesity (BMI ≥95th percentile) for obesity-related comorbidities by using a comprehensive patient history, mental and behavioral health screening, social determinants of health evaluation, physical examination, and diagnostic studies. In children 10 y and older, evaluate for lipid abnormalities, abnormal glucose metabolism, and abnormal liver function in children and adolescents with obesity (BMI ≥95th percentile) and for lipid abnormalities in children and adolescents with overweight (BMI ≥85th percentile to <95th percentile). In children 10 y and older with overweight (BMI ≥85th percentile to <95th percentile), pediatricians and pediatric providers may evaluate for abnormal glucose metabolism and liver function in the presence of risk factors for type 2 diabetes or nonalcoholic fatty liver disease. In children 2 to 9 y of age with obesity (BMI ≥95th percentile), pediatricians and other pediatric providers may evaluate for lipid abnormalities. Treat children and adolescents for overweight (BMI ≥85th percentile to <95th percentile) or obesity (BMI ≥95th percentile) and comorbidities concurrently. Evaluate for dyslipidemia by obtaining a fasting lipid panel in children 10 y and older with overweight (BMI ≥85th percentile to <95th percentile) and obesity (BMI ≥95th percentile); pediatricians and pediatric providers may evaluate for dyslipidemia in children 2 through 9 y of age with obesity. Evaluate for prediabetes and/or diabetes mellitus with fasting plasma glucose, 2-h plasma glucose after 75-g oral glucose tolerance test (OGTT), or glycosylated hemoglobin (HbA1c). Evaluate for nonalcoholic fatty liver disease by obtaining an alanine transaminase test. Evaluate for hypertension by measuring blood pressure at every visit starting at 3 y of age in children and adolescents with overweight (BMI ≥85 to <95th percentile) and obesity (BMI ≥95th percentile). Treat overweight (BMI ≥85th percentile to <95th percentile) and obesity (BMI ≥95th percentile) in children and adolescents, following the principles of the medical home and the chronic care model, using a family-centered and nonstigmatizing approach that acknowledges obesity's biologic, social, and structural drivers. Use motivational interviewing to engage patients and families in treating overweight (BMI ≥85th percentile to <95th percentile) and obesity (BMI ≥95th percentile). Pediatricians and other pediatric care providers should provide or refer children 6 y and older (Grade B) and may provide or refer children 2 through 5 y of age (Grade C) with overweight (BMI ≥85th percentile to <95th percentile) and obesity (BMI ≥95th percentile) to intensive health behavior and lifestyle treatment. Health behavior and lifestyle treatment is more effective with

Table 1. BMI Screening and Weight Management Intervention Recommendation From Other Organizations

Organization (Year)	Recommendation
	greater contact hours; the most effective treatment includes 26 or more hours of face-to-face, family-based, multicomponent treatment over a 3- to 12-mo period. Offer adolescents 12 y and older with obesity (BMI ≥95th percentile) weight loss pharmacotherapy, according to medication indications, risks, and benefits, as an adjunct to health behavior and lifestyle treatment. Offer referral for adolescents 13 y and older with severe obesity (BMI ≥120% of the 95th percentile for age and sex) for evaluation for metabolic and bariatric surgery to local or regional comprehensive multidisciplinary pediatric metabolic and bariatric surgery centers.
Academy of Nutrition and Dietetics (2021)[337]	Prevention of pediatric overweight and obesity requires multilevel, multicomponent, and culturally appropriate interventions with family involvement to improve and sustain intake of healthy dietary patterns and physical activity in a developmentally appropriate manner throughout childhood and adolescence.
American Psychological Association (2018)[338]	Strongly recommends providing family-based multicomponent behavioral interventions with a minimum of 26 contact hours initiated at an early age for children and adolescents with overweight or obesity.
American Academy of Pediatrics (2022)[339]	Recommends BMI measurement and charting at all pediatric visits for all patients two years and older.
The Endocrine Society (2017)[340]	Recommends using BMI to screen children for overweight or obesity and also recommends age-appropriate lifestyle interventions for treating obesity. It additionally recommends that use of weight loss medications during childhood and adolescence should be restricted to clinical trials, and that bariatric surgery should be considered only in exceptional circumstances.
The American College of Obstetricians and Gynecologists (2017)[341]	Recommends screening for adolescent overweight and obesity, and additionally that overweight or obese adolescents should been screened for depression, bullying, and peer victimization and appropriately referred. Recommends that providers initiate behavioral counseling or other multidisciplinary management as necessary. Metformin is not recommended for adolescent weight loss alone, clinicians should caution against the use of weight loss supplements, and bariatric surgery should only be considered after careful candidate selection by a multidisciplinary team.
The Canadian Task Force on Preventive Health Care (2015)[342]	Recommends growth monitoring in all children and adolescents 17 years and younger at all primary care visits. Also recommends structured behavioral interventions focused on weight management for children and adolescents with overweight or obesity. The Task Force recommends against routinely offering orlistat for healthy weight management in children 12 to 17 years and against routine referral of obese children and adolescents 2 to 17 years for surgical interventions.
The National Association of Pediatric Nurse Practitioners (2021)[343, 344]	Recommends measuring BMI in children two years and older and evaluating family eating and physical activity patterns and amount of daily screen time and sedentary time in all children. Recommends evaluating children or adolescents with BMI ≥85th percentile for obesity-related comorbidities. Encourage healthy nutrition, activity, and sleep practices for prevention of high BMI and management. Use motivational interviewing techniques to encourage behavior change and highlight the role of parental and family modeling. Weight loss programs should be multicomponent and considered within a clinical setting or in schools or community settings. Recognize adolescents with severe obesity may require tertiary care and refer early to a Metabolic and Bariatric Surgery Center (direct readers to American Society for Metabolic and Bariatric Surgery guidelines).
The National Heart, Lung, and Blood Institute (2011)[345]	Recommends charting height, weight, and BMI and classifying weight by BMI in children and adolescents ≥2 years. If BMI ≥85th percentile, intensify focus on diet and physical activity for 6 months and refer to dietician if no change. If BMI ≥95th percentile, specifically assess for comorbidities (hypertension, dyslipidemia, diabetes), encourage family-based weight gain prevention with parents as focus, dietician counseling and followup for energy-balanced diet, physical activity prescription, and limit sedentary time with followup in 3 months for ages 2-5 years and 6 months for 6-11 years. For those ≥6

Table 1. BMI Screening and Weight Management Intervention Recommendation From Other Organizations

Organization (Year)	Recommendation
	years, refer to comprehensive multidisciplinary lifestyle weight loss program if no reduction in BMI percentile, further consideration of orlistat in those ≥12 years if no further change. If BMI ≥95th percentile with comorbidities or >97th percentile tile or progressive rise in BMI despite therapy, refer to comprehensive multidisciplinary weight loss program for intensive management for 6 months if ≥6 years. If >12 years, consider orlistat, and further consider bariatric surgery if BMI far above 35 kg/m^2 with comorbidities if unresponsive to lifestyle therapy for >1 year.
The National Institute for Health and Care Excellence (UK; 2022)[346]	Use BMI as a practical estimate of overweight and obesity, and ensure that charts are appropriate for children and young people and are adjusted for age and sex. Interpret BMI with caution because it is not a direct measure of central adiposity. Consider using waist-to-height ratio in those ≥5 years to assess and predict health risks associated with central adiposity. Recommend the following BMI classifications: Overweight: BMI 91st centile + 1.34 standard deviations (SDs) Clinical obesity: BMI 98th centile + 2.05 SDs Severe obesity: BMI 99.6th centile + 2.68 SDs. Define the degree of central adiposity based on waist-to-height ratio in children and young people as follows: • healthy central adiposity: waist-to-height ratio 0.4 to 0.49, indicating no increased health risk • increased central adiposity: waist-to-height ratio 0.5 to 0.59, indicating increased health risk • high central adiposity: waist-to-height ratio 0.6 or more, indicating further increased health risk. When talking to a child, young person, and their families and carers, explain that they should try and keep their waist to half their height (so a waist-to-height-ratio of under 0.5). Recommend asking permission from children, young people, and their families and carers, before talking about the degree of overweight, obesity and central adiposity, and discussing in a sensitive and age-appropriate manner. Recommend considering tailored interventions for children and young people who are living with overweight or obesity or have increased health risk based on their waist-to-height ratio. Take into account their individual needs and preferences, and factors such as weight-related comorbidities, ethnicity, socioeconomic status, social complexity (for example, looked-after children and young people), family medical history, mental and emotional health and wellbeing, developmental age, and special educational needs and disabilities (SEND). Multicomponent interventions are the treatment of choice. Ensure weight management programs include behavior change strategies to increase people's physical activity levels or decrease inactivity, improve eating behavior and the quality of the person's diet, and reduce energy intake. Encourage people to increase physical activity and improve their diet even if they do not lose weight, because there can be other health benefits. Additional details recommended in the full guideline. Drug treatment is not generally recommended for children younger than 12 years. In children aged 12 years and older, treatment with orlistat is recommended only if physical comorbidities (such as orthopedic problems or sleep apnea) or severe psychological comorbidities are present. If orlistat is prescribed for children, a 6- to 12-month trial is recommended, with regular review to assess effectiveness, adverse effects and adherence.

Table 1. BMI Screening and Weight Management Intervention Recommendation From Other Organizations

Organization (Year)	Recommendation
	Surgical intervention is not generally recommended in children or young people. Bariatric surgery may be considered for young people only in exceptional circumstances, and if they have achieved or nearly achieved physiological maturity.
The Society for Adolescent Health and Medicine (2016)[347]	Recommends calculating BMI and identifying BMI percentile for age and sex for all adolescents. Assessing for medical complications, and screening for behaviors, including physical activity, and family history, that increase the risk of, or worsen, obesity. Reinforce healthy behaviors, and when appropriate, counsel adolescents regarding body-image, inappropriate dieting, and weight stigmatization. Once a diagnosis of obesity has been established, providers should work with dietitians, behavioral health providers, and exercise specialists to guide the patient through an evaluation for comorbidities, deliver evidence-based lifestyle counseling, and if indicated, refer to more intensive treatment options such as weight loss surgery, monitored diets, or residential care.

Abbreviations: BMI = Body mass index; UK = United Kingdom

Table 2. Study Characteristics of Trials of Behavioral Interventions for Weight Management

Author, Year and Quality	Setting	N Rand	Population	Intervention	Offered PA session	Est hrs contact (Sessions)	Months duration	Assessment months (Retention @ 12 months or closest)	KQ 1	KQ 2	KQ 3	KQ 4
Boutelle, 2014[106] Fair	US Other	44	8 to 12 year olds meeting criteria for eating in the absence of hunger and BMI≥ 85th percentile (CDC)	IG1: Regulation of Cues (ROC) program		28 (14)	4	8 (89%)		X		
Broccoli, 2016[107] Good	Italy Primary Care	372	4 to 7 year olds who with BMI in 85th-95th percentile (CDC)	IG1: Motivational Interviewing		3.75 (5)	3	12; 24 (95%)		X	X	
Bryant, 2011[108] Fair	UK Other	70	8 to 16 year olds with BMI > 98th percentile (norms NR)	IG1: WATCH IT	X	24 (16)	12	12 (76%)		X		
Croker, 2012[109] Fair	UK Health Care*	72	8 to 12 year olds with BMI classified as overweight or with obesity (IOTF)	IG1: Family-based behavioral therapy		37.5 (15)	6	6 (68%)		X		X
Davis, 2012[110] Fair	US Other	61	Black or Latino youth in grades 9 through 12 who had completed initial 4-month weight loss intervention with BMI≥85th percentile prior to weight loss (CDC)	IG1: Maintenance (Group classes)	X	16 (14)	8	8 (87%)		X		
DeBar, 2012[111] Good	US Primary Care	208	12 to 17 year old girls BMI ≥ 90th percentile (CDC)	IG1: Multicomponent behavioral intervention	X	36.5 (18)	5	6; 12 (83%)	X	X	X	X
Derwig, 2022[112] Fair	Sweden Primary Care	490	4-year olds with BMI classified as overweight (and not obese) (IOTF).	IG1: Targeted Child-Centered Health Dialogue		1.9 (2)	4.5	12 (97%)		X		X
Gerards, 2015[113] Fair	Netherlands Primary Care	86	4 to 8 year olds with BMI classified as overweight or having obesity (IOTF)	IG1: Lifestyle Triple P		16.5 (14)	3.5	12 (78%)		X	X	
Golley, 2007[114] Fair	Australia Health Care*	111	6 to 9 year olds with BMI classified as overweight or having obesity, but zBMI ≤3.5 (IOTF)	IG1: Triple P + healthy lifestyle group IG2: Triple P	X	IG1: 23.75 (18) IG2: 9.75 (11)	5	12 (82%)		X	X	
Ho, 2016[115] Fair	Canada Health Care*	99	8 to 16 years old with BMI ≥85th percentile [norm criteria NR]	IG1: Nutrition counseling and portion control strategy		1.25 (1)	6	6 (74%)		X		X

Table 2. Study Characteristics of Trials of Behavioral Interventions for Weight Management

Author, Year and Quality	Setting	N Rand	Population	Intervention	Offered PA session	Est hrs contact (Sessions)	Months duration	Assessment months (Retention @ 12 months or closest)	KQ 1	KQ 2	KQ 3	KQ 4
Hofsteenge, 2014[116] Fair	Netherlands Health Care*	122	11 to 18 year olds with BMI classified as overweight or with obesity (IOTF)	IG1: Go4it		16.5 (11)	6	6 (80%)	X	X		X
Kalarchian, 2009[117] Fair	US Health Care*	192	8 to 12 year olds with BMI ≥ 97th percentile (CDC)	IG1: Family-based lifestyle intervention		43.75 (26)	12	6;12;18 (72%)	X	X		
Kalavainen, 2007[118] Fair	Finland Health Care*	70	7 to 9 year olds with weight for height 120-200% of median (UK norms)	IG1: Health-promoting lifestyle	X	43.5 (15)	6	6;12;24;36 (99%)		X		
Kong, 2013[119] Fair	US Primary Care	60	Students in 9th - 11th grades with BMI ≥85th percentile (CDC)	IG1: ACTION		4.25 (16)	9	6 (85%)		X	X	
Kose, 2021[120] Fair	Turkey Primary Care	80	12 to 18 year olds with BMI categorized as overweight or with obesity (IOTF)	IG1: Motivational support programme		6 (9)	6	6 (80%)	X	X		
Lison, 2012[121] Fair	Spain Health Care*	110	6 to 16 year old White youth with BMI ≥85th percentile but zBMI≤2.5 (IOTF)	IG1: Hospital-based group exercise IG2: Home-based exercise	X	IG1: 122 (122) IG2: 2 (2)	6	6 (76%)		X		
Looney, 2014[122] Fair	US Primary Care	22	4 to 10 year olds with BMI≥ 85th percentile (CDC)	IG1: Newsletters + Growth Monitoring + Family-based Behavioral Counseling IG2: Newsletters + Growth Monitoring		IG1: 2.5 (6) IG2: 1.25 (6)	6	6 (95%)		X	X	
Love-Osborne, 2014[123] Fair	US Primary Care	165	Middle and high school students at schools with high percentages of underserved, largely ethnic minority students with BMI ≥ 85th percentile (norms NR)	IG1: Health educator visits		NR (5)	8	8 (90%)		X		
McCallum, 2007[124] Good	Australia Primary Care	163	5 to 9 year olds with BMI classified as overweight or having mild obesity, but zBMI <3.0 (IOTF)	IG1: LEAP		NR (4)	3	9.1; 15.0 (90%)	X	X	X	X

Table 2. Study Characteristics of Trials of Behavioral Interventions for Weight Management

Author, Year and Quality	Setting	N Rand	Population	Intervention	Offered PA session	Est hrs contact (Sessions)	Months duration	Assessment months (Retention @ 12 months or closest)	KQ 1	KQ 2	KQ 3	KQ 4
Mellin, 1987[125] Fair	US Health Care*	66	12 to 18 year olds, weight criteria NR; mean weight 136% of mean for age and sex (norms NR)	IG1: SHAPEDOWN	X	24 (16)	3	6 (96%)		X		
Nemet, 2005[126] Fair	Israel Health Care*	54	6 to 16 year olds with "obesity" (definition NR)	IG1: Dietitian + PA sessions	X	32.5 (34)	3	12 (74%)		X	X	
Norman, 2016[127] Fair	US Primary Care	106	11 to 13 year olds with BMI ≥ 95 percentile (CDC)	IG1: Stepped-down Care		NR (27)	12	8; 12 (80%)		X		
O'Connor, 2013[128] Fair	US Primary Care	40	5 to 8 year olds with BMI in 85th-98th percentile (CDC)	IG1: Helping HAND		NR (12)	7	7 (85%)		X	X	
Patrick, 2013[129] Fair	US Other	101	12 to 16 year olds at high risk for T2DM with [BMI >85th percentile, weight and height >85th percentile, or weight >120% of ideal for height (CDC)	IG1: Group sessions + website IG2: Website + text messages IG3: Website alone	X	IG1: 26 (36) IG2: 0 (0) IG3: 0 (0)	12	6;12 (65%)	X	X	X	X
Raynor, 2012a[130] Fair	US Other	101	4 to 9 year olds with BMI ≥ 85th percentile (CDC)	IG1: DECREASE + Growth Monitoring IG2: INCREASE + Growth Monitoring		IG1: 6 (8) IG2: 6 (8)	6	6; 12 (89%)		X		X
Raynor, 2012b[130] Fair	US Other	81	4 to 9 year olds with BMI≥ 85th percentile (CDC)	IG1: TRADITIONAL + Growth Monitoring IG2: SUBSTITUTES + Growth Monitoring		IG1: 6 (8) IG2: 6 (8)	6	6; 12 (91%)		X	X	X
Reinehr, 2010[131] Fair	Germany Health Care*	71	8 to 16 year olds with BMI in 90-97th percentile (German norms)	IG1: Obeldicks light	X	67 (37)	6	6 (84%)		X	X	X
Resnicow, 2015[132] Fair	US Primary Care	645	2 to 8 year olds who with in BMI 85-97th percentile (CDC)	IG1: PCP + RD MI IG2: PCP MI		IG1: NR (10) IG2: NR (4)	24	24 (71%)		X		

Table 2. Study Characteristics of Trials of Behavioral Interventions for Weight Management

Author, Year and Quality	Setting	N Rand	Population	Intervention	Offered PA session	Est hrs contact (Sessions)	Months duration	Assessment months (Retention @ 12 months or closest)	KQ 1	KQ 2	KQ 3	KQ 4
Sacher, 2010[133] Fair	United Kingdom Other	116	8 to 12 year olds with BMI ≥ 98th percentile (UK norms)	IG1: MEND	X	36 (18)	2.25	6 (71%)		X	X	X
Saelens, 2002[134] Fair	US Primary Care	44	12 to 16 year olds who are 20% to 100% above median for BMI (NHANES)	IG1: Healthy Habits Intervention		3.75 (13)	4	7 (84%)		X	X	X
Savoye, 2007[135] Fair	US Health Care*	209	8 to 16 year olds with BMI > 95th percentile (CDC)	IG1: Bright Bodies	X	82.33 (64)	12	6; 12 (68%)		X		
Savoye, 2014[136] Fair	US Health Care*	75	10 to 16 year olds with BMI > 95th percentile (CDC)	IG1: Bright Bodies	X	78 (52)	6	6 (77%)		X		
Sherwood, 2019[137] Fair	US Primary Care	421	5 to 10 year olds with BMI in 70th-95th percentile (CDC)	IG1: Healthy Homes/Healthy Kids 5-10		3.5 ()	12	12; 24 (86%)		X	X	
Smith, 2021[138] Fair	US Primary Care	240	5.5 to 12 year olds with BMI ≥85th percentile (CDC)	IG1: Family Check-Up 4 Health (FCU4Health)		53.79 (3)	6	6; 12 (78%)		X	X	
Stark, 2011[139] Fair	US Primary Care	18	2 to 5 year olds with at least one parent with BMI≥25 and who have BMI ≥95th percentile but <100% above the mean BMI (CDC)	IG1: LAUNCH		38.25 (18)	6	6; 12 (89%)	X	X	X	
Stark, 2014[140] Fair	US Primary Care	27	2 to 5 year olds with at least one parent with BMI≥25 and who have BMI ≥95th percentile but <100% above the mean BMI (CDC)	IG1: LAUNCH-clinic		30 (10)	6	6; 12 (78%)		X	X	
Stark, 2018[141] Fair	US Primary Care	167	2 to 5 year olds with at least one parent with BMI ≥25 and with BMI ≥95th percentile but <100% above the mean BMI (CDC)	IG1: LAUNCH IG2: Motivational interviewing		IG1: 38 (NR) IG2: 7.5 (NR)	6	6; 12; 18 (76%)		X	X	X
Stettler, 2014[142] Fair	US Primary Care	173	8 to 12 year olds with BMI in 75th-95th percentile (CDC) and consuming average of ≥ 4 ounces of sugar sweetened beverages/day	IG1: Multiple-behavior change IG2: Combined IG3: Beverage-only intervention		IG1: 4 (12) IG2: 4 (12) IG3: 4 (12)	12	6;12;24 (70%)		X		
Tanofsky-Kraff, 2010[143]	US Other	38	Adolescent girls who BMI in 75-97th percentile (norms	IG1: IPT-Weight Gain Prevention		17.9 (13)	3	6; 12 (92%)		X		X

Table 2. Study Characteristics of Trials of Behavioral Interventions for Weight Management

Author, Year and Quality	Setting	N Rand	Population	Intervention	Offered PA session	Est hrs contact (Sessions)	Months duration	Assessment months (Retention @ 12 months or closest)	KQ 1	KQ 2	KQ 3	KQ 4
Fair			NR)									
Tanofsky-Kraff, 2014[144] Fair	US Other	116	12 to 17 year old girls with BMI in 75th-97th percentiles (CDC), and loss-of control eating in the past month	IG1: Interpersonal psychotherapy		19.5 (13)	3	6; 12; 36 (84%)	X	X		X
Taveras, 2011[145] Good	US Primary Care	475	2 to 6 year olds with BMI≥ 85th percentile (CDC) and have a parent with BMI ≥ 25, or with BMI≥ 95th percentile (CDC)	IG1: MI + enhanced EMR and training		2.67 (8)	12	12; 24 (94%)		X	X	
Taveras, 2015[146] Good	US Primary Care	549	6 to 12 years olds BMI≥ 95th percentile (CDC)	IG1: CDS+coaching IG2: CDS		IG1: 1.25 (5) IG2: 0.25 (1)	12	12 (94%)		X		
Taveras, 2017[147] Good	US Primary Care	721	2 to 12 year olds with BMI ≥85th percentile (CDC)	IG1: Enhanced primary care and coaching		1.75 (6)	12	12 (92%)	X	X		
Taylor, 2015[148] Good	New Zealand University and home	206	4 to 8 years old with BMI ≥ 85th percentile (CDC)	IG1: Tailored lifestyle support		7.2 (14)	24	12; 24 (88%)	X	X	X	
Van Grieken, 2013[149] Fair	Netherlands Primary Care	637	5 year olds with BMI classifed as overweight but do not have obesity (IOTF)	IG1: Be Active Eat Right		NR (4)	12	24 (80%)		X		
Viner, 2020[150] Fair	UK Primary Care	174	12 to 19 year olds with BMI >95th percentile (UK norms)	IG1: Healthy Eating and Lifestyle Program (HELP)		12 (12)	6	6; 12 (66%)	X	X		X
Vos, 2011[151] Fair	Netherlands Primary Care	81	8 to 17 year olds with BMI classified as with obesity (IOTF)	IG1: Family-based multidisciplinary lifestyle intervention	X	37.5 (14)	24	12 (83%)	X	X		
Wake, 2009[152] Good	Australia Primary Care	258	5 to 10 year olds with BMI classified as overweight or having obesity but zBMI <3.0 (IOTF and UK norms)	IG1: LEAP-2		NR (4)	3	6; 12 (95%)	X	X	X	X
Wake, 2013[153] Good	Australia Primary Care	118	3 to 10 year olds with BMI≥95th percentile (CDC)	IG1: HopSCOTCH		2.5 (6)	12	12 (91%)	X	X	X	X

Table 2. Study Characteristics of Trials of Behavioral Interventions for Weight Management

Author, Year and Quality	Setting	N Rand	Population	Intervention	Offered PA session	Est hrs contact (Sessions)	Months duration	Assessment months (Retention @ 12 months or closest)	KQ 1	KQ 2	KQ 3	KQ 4
Weigel, 2008[154] Fair	Germany Other	73	7 to 15 year olds BMI>97th percentile (German norms)	IG1: Sea Lion Club	X	114.1 (104)	12	6; 12 (90%)		X		

*Broad health system recruitment, not specifically primary care

Abbreviations: BMI = Body mass index; CDC = Centers for Disease Control & Prevention; CDS = Clinical decision support; EMR = Electronic medical record; Est = Estimated Hrs = Hours; IG = Intervention group; IOTF = *International Obesity Task Force;* KQ = key question; MI = Motivational interviewing; NHANES = National Health and Nutrition Examination Survey; NR = Not reported; PA = Physical activity; PCP = Primary care physician; Rand = Randomized; RD = Registered dietician; ROC = Regulation of Cues; T2DM = Type II Diabetes mellitus; UK = United Kingdom; US = United States

Table 3. Study Characteristics of Trials of Pharmacotherapy for Weight Management, Sorted by Type of Medication

Author, Year and Quality	Setting	N Rand	Population	Drug	Daily dose mg	Mos duration	Assessment months (Retention @ 12mos or closest)	Control	KQ 1	KQ 2	KQ 4
Danne, 2017[155] Fair	Germany Health Care	21	Adolescents, BMI ≥95th percentile and a BMI between 30 and 45 kg/m^2	Liraglutide	3.0	1.25	1.25 (95%)	Placebo			X
Kelly, 2020[156] Good	Belgium, Mexico, Russia, Sweden, and the US Health Care	251	12 to <18 year olds with BMI categorized as with obesity (IOTF)	Liraglutide	3.0	13	13;19 (80%)	Placebo	X	X	X
Mastrandrea, 2019[157] Fair	US Health Care	24	7 to 11 year olds with BMI ≥95th percentile and BMI categorized as with obesity (IOTF)	Liraglutide	3.0	2	2 (83%)	Placebo			X
Weghuber, 2022 [162] Good	Austria, Belgium, Croatia, Ireland, Mexico, Russian Federation, UK, and US Other	201	Adolescents ≥12 years and <18 years of age with BMI ≥95th percentile OR ≥85th percentile for age and sex (CDC) with ≥1 weight related comobidity	Semaglutide	2.4/wk	17	17 (90%)	Placebo	X	X	X
Chanoine, 2005[158] Fair	US and Canada Health Care	539	12 to 16 year olds ≥2 BMI units above US mean for 95th percentile, and BMI <44	Orlistat	360	12	12 (65%)	Placebo + Diet, PA, and Behavior Therapy	X	X	X
Maahs, 2006[159] Fair	US Other	40	14 to 18 year olds with BMI >85th percentile [norms NR])	Orlistat	360	6	6 (85%)	Placebo + dietician counseling	X	X	X
Hsia, 2019[160] Fair	US Health Care	42	Adolescents aged 12 - 17 years, BMI ≥95th percentile for age and sex	PHEN/TPM	IG1: 15/92 IG2: 7.5/45	2	2 (88%)	Placebo			X

Table 3. Study Characteristics of Trials of Pharmacotherapy for Weight Management, Sorted by Type of Medication

Kelly, 2022[161] Good	US Other	227	Adolescents ≥12 years and <17 years of age with BMI ≥95th percentile for age and sex (CDC)	PHEN/TPM	IG1: 15/92 IG2: 7.5/45	13	13 (61.2%)	Placebo + diet and PA training	X	X	X

Abbreviations: BMI = Body mass index; IOTF = *International Obesity Task Force;* Kg/m^2 = kilograms/meters^2; KQ = key question; Mg = milligrams; Mos = Months; NR = Not reported; PA = Physical activity; PHEN = Phentermine; TPM = Topiramate; US = United States

Table 4. Summary of Study Characteristics of Trials of Behavioral Interventions (N randomized=8,798)

Characteristics	No. studies	%
All studies	50	100
Study design		
RCT	44	88
Cluster RCT	6	12
Quality rating*		
Good	9	18
Fair	41	82
Conducted in the US	28	56
Weight focus		
85-<95th percentile for age and sex (or comparable)	6	12
≥85th percentile (or comparable)	29	58
≥95th percentile (or comparable)	15	30
Recruitment setting		
Primary care	21	42
Other health care (only)	8	16
Mixed or other	20	40
Not reported	1	2
Median sample size (IQR), Range	108 (70 to 206)	18 to 721
Median % followup at 6 to 12 months (IQR), Range	84 (76 to 90)	65 to 99

*8 additional studies were rated as poor quality and excluded from the review.

Abbreviations: IQR = Interquartile range; No. = Number; RCT = Randomized controlled trial; US = United States

Table 5. Summary of Population Characteristics of Trials of Behavioral Interventions (N randomized=8,798)

Characteristics	No. of trials	% of all trials or SD
Age; Mean, SD*	9	3
Age group		
Preschool (~2-5)	7	14
Elementary (~6-12)	18	36
Adolescent (~13-18)	12	24
Wide age range	13	26
Majority Hispanic/Latino or Black†	10	20
	Total % across all trials reporting	**Range (No. trials reporting)**
Female	57	33 to 100 (50)
Race†		
% Asian	4	1 to 11 (11)
% Black	21	3 to 47 (18)
% Native American	3	0 to 6 (4)
% White	52	5 to 90 (25)
Hispanic ethnicity	25	1 to 88 (18)
BMI percentile for age and sex, Mean (SD)		
Overall	93 (5)	85 to 99 (16)
Preschool (~2-5)	93 (4)	91 to 99 (3)
Elementary (~6-12)	90 (7)	85 to 99 (4)
Adolescent (~13-18)	95 (3)	88 to 98 (6)
Wide age range	93 (3)	92 to 99 (3)
BMI, Mean (SD)		
Overall	24 (6)	18 to 36 (38)
Preschool (~2-5)	18 (1)	18 to 19 (4)
Elementary (~6-12)	23 (4)	18 to 32 (14)
Adolescent (~13-18)	31 (2)	25 to 35 (9)
Wide age range	27 (5)	23 to 36 (11)

*Mean across all trials, weighted by number randomized in each trial.
†Limited to trials conducted in the United States (28 trials).
‡Assuming majority White, nonHispanic if race and ethnicity were not reported.

Abbreviations: BMI = Body mass index; SD = Standard deviation

Table 6. Summary of Intervention Characteristics of Trials of Behavioral Interventions (62 Intervention Arms)

Characteristics	Median (IQR)	Range
Median months duration (IQR), Range	6 (5 to 12)	2.2 to 24
Median no. sessions (IQR), Range	12 (6 to 16)	0 to 122
Median estimated planned contact hours (IQR), Range	16.2 (4 to 37.5)	0 to 122
	No. groups	**%**
≥26 hours contact (estimated)	19	30.6
Physical activity sessions	16	25.8
Intervention participant		
Child only	5	8.1
Child and parent	47	75.8
Parent only	10	16.1
Format		
Individual counseling only (in person or phone-based)	31	50.0
Individual and group sessions	17	27.4
Group sessions only	14	22.6
Electronic delivery		
Computer-based component*	10	16.1
Computer-based (only, other than print materials)	1	1.6
Components		
Dietary advice	57	91.9
Physical activity advice	51	82.3
Behavior change advice	59	95.2
Primary care clinician or staff involved in intervention delivery	22	35.5

Abbreviations: IQR = Interquartile range; No = Number

Table 7. Meta-Analysis Results for Quality of Life for Behavioral Interventions

Outcome	All Studies in MA			<26 Contact hrs			≥26 Contact hrs			P-value
	K (N)	I^2, %	Mean Diff in Change (95% CI)	K (N)	I^2, %	Mean Diff in Change (95% CI)	K (N)	I^2, %	Mean Diff in Change (95% CI)	(diff b/t dose levels)
Total score, MD	11 (1922)	48.4	1.9 (0.2 to 3.5)	7 (1459)	64.4	1.3 (-1.1 to 3.8)	4 (463)	0.0	3.8 (3.6 to 4.1)	0.173
Total score, SMD	8 (1457)	47.3	0.2 (0.0 to 0.5)	4 (994)	84.6	0.3 (-0.4 to 1.1)	4 (463)	0.0	0.2 (0.1 to 0.4)	0.607
Physical domain, MD	5 (1232)	87.5	4.6 (-2.6 to 11.9)	4 (1216)	0.0	1.7 (0.1 to 3.4)	1 (16)	-	16.5 (9.5 to 23.5)	<0.001
Psychosocial domain, MD	4 (1216)	0.0	0.7 (-0.6 to 1.9)	4 (1216)	0.0	0.7 (-0.6 to 1.9)	0 (0)		N/A	N/A

Abbreviations: B/t = Between; CI = Confidence interval; Diff = Difference; Hrs = Hours; K = Number of studies; MA = Meta-analysis; MD = Mean difference (in native units); SMD = Standardized mean difference

Table 8. Health Outcomes for Glucagon-Like-Peptide-1 at End of Treatment[156, 162]

Study	Medication	FU, mos	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			Quality of life									
Kelly, 2020[156]	Liraglutide	13	IWQOL, Total (range 0-100, higher is better)	84.5 (12.4)	82.4 (14.5)	7.9 (11.6)	125	6.6 (11.9)	126	MD in change	1.3 (-1.6 to 4.2)	NR
Weghuber, 2022[162]	Semaglutide	16	IWQOL, Total (range 0-100, higher is better)	84.2 (15.0)	83.5 (14.6)	5.3 (NR)	134	1.0 (NR)	67	MD in change	5.3 (0.2 to 8.3)	NR
			Depression			**IG n events (%)**		**CG n events (%)**				
Kelly, 2020[156]	Liraglutide	13	Depression incidence, %	N/A	N/A	5 (4)	125	3 (2.4)	126	RR	1.71 (0.40 to 7.31)	NR
			PHQ-9 Score Moderate (10 - <15), %	N/A	N/A	13 (10.4)	125	26 (20.6)	126	RR	0.45 (0.22 to 0.92)	NR
			PHQ-9 Score Moderate to Severe (15 - <20), %	N/A	N/A	4 (3.2)	125	7 (5.6)	126	RR	0.56 (0.16 to 1.97)	NR
			PHQ-9 Score Severe (20+), %	N/A	N/A	6 (4.8)	125	2 (1.6)	126	RR	3.13 (0.62 to 15.8)	NR

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence interval; FU = Followup; IG = Intervention group; IWQOL = The Impact of Weight on Quality of Life; MD = Mean difference; Mos = Months; N/A = Not applicable; NR = Not reported; PHQ = Patient Health Questionnaire; RR = Relative risk; SD = Standard deviation; Stat = Statistic; Tx = Treatment

Table 9. Health Outcomes for Orlistat at End of Treatment

Study	Followup, mos	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		Quality of Life									
Maahs, 2006[159]	6	IWQOL, Total	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
		Depression			**IG n events (%)**		**CG n events (%)**				
Chanoine, 2005[158]	12	Depression incidence, %	N/A	N/A	2 (0.6)	352	0 (0)	181	RR	2.59 (0.12 to 54.22)	NR

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence interval; FU = Followup; IG = Intervention group; IWQOL = The Impact of Weight on Quality of Life; MD = Mean difference; Mos = Months; N/A = Not applicable; NSD = No significant difference; NR = Not reported; RR = Relative risk; SD = Standard deviation; Stat = Statistic; Tx = Treatment

Table 10. Health Outcomes for Phentermine/Topiramate at End of Treatment (13 Months Post-Baseline)[161]

Outcome, Daily Dose	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Quality of life: IWQOL, Total (range 0-100, higher is better)									
IG1 PHEN (15 mg)/ TOP (92 mg):	82.7 (14.2)	87.1 (10.2)	3.1 (12.8)	113	2.9 (14.1)	56	MD in change	0.17 (-4.25 to 4.6)	NR
IG2: PHEN (7.5 mg)/ TOP (46 mg):	85.1 (13.1)	87.1 (10.2)	4.3 (12.5)	54	2.9 (14.1)	56	MD in change	1.37 (-3.64 to 6.39)	NR
Depression Incidence, %			**IG n events (%)**		**CG n events (%)**				
IG1 PHEN (15 mg)/ TOP (92 mg):	N/A	N/A	5 (4.4)	113	0 (0)	56	RR	5.73 (0.31 to 105.45)	NR
IG2: PHEN (7.5 mg)/ TOP (46 mg):	N/A	N/A	1 (1.9)	54	0 (0)	56	RR	3.17 (0.13 to 79.48)	NR

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence interval; FU = Followup; IG = Intervention group; IWQOL = Impact of Weight on Quality of Life; MD = Mean difference; Mg = milligram; NR = Not reported; PHEN = Phentermine; RR = Relative risk; SD = Standard deviation; Stat = Statistic; TOP = Topiramate

Table 11. Meta-Analysis Results for Weight-Related Outcomes for Behavioral Interventions

Outcome	All Studies in MA			<26 Contact hrs			≥26 Contact hrs			P-value
	K (N)	I^2, %	Mean Diff in Change (95% CI)	K (N)	I^2, %	Mean Diff in Change (95% CI)	K (N)	I^2, %	Mean Diff in Change (95% CI)	(diff b/t contact levels)
Weight										
BMI, kg/m^2	28 (4494)	86.8	-0.7 (-1.0 to -0.3)	17 (3407)	62.1	-0.3 (-0.5 to -0.1)	11 (1087)	87.8	-1.4 (-2.2 to -0.6)	0.004
Weight, kg	18 (1625)	69.2	-2.1 (-3.0 to -1.2)	8 (718)	69.5	-1.5 (-3.0 to 0.1)	10 (907)	58.2	-2.6 (-3.8 to -1.3)	0.23
zBMI/BMI SDS	34 (4995)	67.0	-0.09 (-0.13 to -0.05)	19 (3527)	0.01	-0.05 (-0.08 to -0.03)	15 (1468)	83.1	-0.17 (-0.27 to -0.07)	0.009
Adiposity										
Waist circumference, cm	16 (2065)	79.2	-1.5 (-2.4 to -0.6)	11 (1597)	14.4	-0.3 (-0.8 to 0.2)	5 (468)	77.6	-3.0 (-5.5 to -0.4)	0.005
% Body Fat	11 (1191)	81.2	-1.5 (-3.1 to 0.1)	5 (583)	0.0	-0.2 (-1.1 to 0.8)	6 (608)	74.2	-3.1 (-5.8 to -0.3)	0.014

Abbreviations: BMI = Body mass index; BMI SDS = Standardized BMI; B/t = Between; CI = Confidence interval; Cm = centimeter; Diff = Difference; Hrs = Hours; K = Number of studies; Kg/m^2 = kilograms per meters squared; MA = Meta-analysis

Table 12. Meta-Analysis Results for Lipids, Blood Pressure, and Insulin Outcomes for Behavioral Interventions

Outcome	All Studies in MA			<26 Contact hrs			≥26 Contact hrs			P-value
	K (N)	I^2, %	Mean Diff in Change (95% CI)	K (N)	I^2, %	Mean Diff in Change (95% CI)	K (N)	I^2, %	Mean Diff in Change (95% CI)	(diff b/t contact levels)
Blood pressure										
SBP, mm Hg	12 (1189)	63.5	-2.0 (-4.1 to 0.2)	4 (416)	0.0	1.4 (-1.3 to 4.1)	8 (773)	47.3	-3.6 (-5.7 to -1.5)	0.001
DBP, mm Hg	12 (1190)	35.2	-2.2 (-3.8 to -0.7)	4 (417)	0.0	-0.8 (-2.3 to 0.7)	8 (773)	49.3	-3.0 (-5.2 to -0.7)	0.121
Lipids										
LDL, mg/dL	7 (648)	56.9	-3.2 (-9.0 to 2.6)	4 (347)	74.6	-3.9 (-17.4 to 9.5)	3 (301)	0.0	-2.4 (-9.7 to 4.8)	0.765
HDL, mg/dL	11 (916)	0.0	0.7 (-0.0 to 1.4)	7 (548)	0.0	0.6 (-.2 to 1.3)	4 (368)	0.0	0.8 (-1.6 to 3.2)	0.839
TC, mg/dL	6 (534)	46.5	-4.3 (-12.1 to 3.4)	3 (233)	14.0	-2.2 (-18.4 to 13.9)	3 (301)	63.0	-5.9 (-28.2 to 16.4)	0.567
TG, mg/dL	9 (800)	53.0	-4.7 (-14.5 to 5.1)	5 (433)	0.0	5.5 (0.6 to 10.5)	4 (367)	0.0	-16.9 (-29.7 to -4.0)	<0.001
Glucose										
FPG, mg/dL	9 (750)	28.5	-0.6 (-2.1 to 1.0)	5 (383)	5.0	1.0 (-1.4 to 3.4)	4 (367)	0.0	-1.9 (-2.7 to -1.2)	.016

Abbreviations: B/t = Between; CI = Confidence Interval; DBP = Diastolic blood pressure; Diff = Difference; FPG = Fasting plasma glucose; HDL = High-density lipoprotein*;* Hrs = Hours; K = Number of studies; LDL = *low-density lipoprotein;* MA = Meta-analysis; Mg/dL = Milligrams per deciliter; mmHg = Milligrams mercury; SBP = Systolic blood pressure; TC = Total cholesterol; TG = Triglycerides

Table 13. Weight-Related Outcomes for Glucagon-Like Peptide 1 Agonists

Study	Medication	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Between-group difference in mean change (95% CI)	Study-reported p-value
Kelly, 2020[156]	Liraglutide	13 (0)	BMI, kg/m^2	35.3 (5.1)	35.8 (5.7)	-1.4 (3.5)	125	0.2 (3.7)	126	-1.6 (-2.5 to -0.7)	NR
		19 (6)	BMI, kg/m^2	35.3 (5.1)	35.8 (5.7)	-0.2 (3.5)	112	0.8 (4)	102	-1.0 (-2.0 to 0.01)	NR
		13 (0)	Weight, kg	99.3 (19.7)	102.2 (21.6)	-2.3 (10.5)	125	2.2 (11)	126	-4.5 (-7.2 to -1.8)	NR
		19 (6)	Weight, kg	99.3 (19.7)	102.2 (21.6)	1.7 (10.1)	112	4.4 (11.7)	102	-2.7 (-5.6 to 0.2)	NR
Weghuber, 2022[162]	Semaglutide	16 (0)	BMI, kg/m^2	37.7 (6.7)	35.7 (5.4)	-5.8 (NR)	134	0.1 (NR)	67	-6 (-7.3 to -4.6)	NR
			Weight, kg	109.9 (25.2)	102.6 (22.3)	15.3 (NR)	134	2.4 (NR)	67	-17.7 (-21.8 to -13.7)	NR
						IG n events (%)		**CG n events (%)**		**RR (95% CI)**	
Kelly, 2020[156]	Liraglutide	13 (0)	≥5% BMI loss, %	--	--	51 (45.1)	113	20 (19)	105	3.50 (1.78 to 6.16)	NR
		13 (0)	≥10% BMI loss, %	--	--	33 (29.2)	113	9 (8.6)	105	4.40 (1.81 to 8.83)	NR
Weghuber, 2022[162]	Semaglutide	16 (0)	≥5% BMI loss, %	--	--	95 (72.5)	131	11 (17.7)	62	12.2 (6.3 to 31)	<0.001
			≥10% weight loss, %	--	--	81 (61.8)	131	5 (8.1)	62	18.5 (8.3 to 63.7)	NR

Abbreviations: BL = Baseline; BMI = Body mass index; CI = Confidence Interval; FU = Followup; IG = Intervention group; Kg/m^2 = Kilograms per meters squared; NR = Not reported; RR = Relative risk; SD = Standard deviation; Tx = Treatment

Table 14. Weight-Related Outcomes for Orlistat, Sorted by Outcome

Study	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Between-group difference in mean change (95% CI)	Study-reported p-value
Chanoine, 2005[158]	12 (0)	BMI, kg/m^2	35.7 (4.2)	35.4 (4.1)	-0.6 (NR)	352	0.3 (NR)	181	-0.9 (NR)	0.001
Maahs, 2006[159]	6 (0)	BMI, kg/m^2	39.2 (5.3)	41.7 (11.7)	-1.3 (7.2)	16	-0.8 (13.4)	18	-0.5 (-7.9 to 6.9)	0.70
Chanoine, 2005[158]	12 (0)	Weight, kg	97.7 (15)	95.1 (14.2)	0.5 (NR)	352	3.1 (NR)	181	-2.6 (NR)	<0.001
Maahs, 2006[159]	6 (0)	Weight, kg	111.1 (22.9)	114.3 (38.4)	-5.5 (23.9)	16	-1.6 (39.4)	18	-3.9 (-26.2 to 18.3)	0.76
					IG n events (%)		**CG n events (%)**		**RR (95% CI)**	
Chanoine, 2005[158]	12 (0)	≥5% BMI loss, %	--	--	93 (26.4)	352	29 (16.0)	181	1.9 (1.2 to 3.0)	0.005
		≥10% BMI loss, %	--	--	46 (13.1)	352	8 (4.4)	181	3.2 (1.5 to 7.0)	0.002
		≥5% Weight loss, %			67 (19.0)	352	21 (11.6)	181	1.8 (1.1 to 3.0)	0.03
		≥10% Weight loss, %			34 (9.7)	352	6 (3.3)	181	3.1 (1.3 to 7.6)	0.01

Abbreviations: BL = Baseline; BMI = Body mass index; CG = Control group; CI = Confidence Interval; FU = Followup; IG = Intervention group; Kg/m^2 = Kilograms per meters squared; NR = Not reported; SD = Standard deviation; Tx = Treatment

Table 15. Weight-Related Outcomes for Phentermine/Topiramate at End of Treatment (13 Months Post-Baseline)[161]

Dose	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Between-group difference in mean change (95% CI)	Study-reported p-value
IG1: PHEN (15 mg)/ TOP (92 mg)	BMI, kg/m^2	39 (7.4)	36.4 (6.4)	-4.2 (3.3)	113	1.2 (3.4)	56	-5.4 (-6.4 to -4.3)	NR
IG2: PHEN (7.5 mg)/ TOP (46 mg)	BMI, kg/m^2	36.9 (6.8)	36.4 (6.4)	-2.5 (3.2)	54	1.2 (3.4)	56	-3.7 (-5.0 to -2.5)	NR
IG1: PHEN (15 mg)/ TOP (92 mg)	Weight, kg	108.5 (25)	102.2 (21.8)	-9.2 (9.1)	113	6.6 (9.6)	56	-15.8 (-18.8 to -12.8)	NR
IG2: PHEN (7.5 mg)/ TOP (46 mg)	Weight, kg	105.2 (22.4)	102.2 (21.8)	-5.5 (9.0)	54	6.6 (9.6)	56	-12.1 (-15.6 to -8.6)	NR
				IG n events (%)		**CG n events (%)**		**RR (95% CI)**	
IG1: PHEN (15 mg)/ TOP (92 mg)	≥5% BMI loss, %	--	--	53 (46.9)	113	3 (5.4)	56	5.6 (2.2 to 14.4)	<0.001
IG2: PHEN (7.5 mg)/ TOP (46 mg)	≥5% BMI loss, %			21 (38.9)	54	3 (5.4)	56	4.6 (1.7 to 12.7)	<0.001
IG1: PHEN (15 mg)/ TOP (92 mg)	≥10% BMI loss, %	--	--	48 (42.5)	113	0 (0)	56	12.2 (3.1 to 48.3)	<0.001
IG2: PHEN (7.5 mg)/ TOP (46 mg)	≥10% BMI loss, %			17 (31.5)	54	0 (0)	56	9.3 (2.3 to 38.0)	<0.001

Abbreviations: BL = Baseline; BMI = Body mass index; CI = Confidence Interval; FU = Followup; IG = Intervention group; Kg/m^2 = Kilograms per meters squared; NR = Not reported; RR = Relative risk; SD = Standard deviation; Tx = Treatment

Table 16. Blood Pressure, Lipids, and Insulin Outcomes for Glucagon-Like Peptide 1 Agonists

Study	Medication	FU mos	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Between-group difference in mean change (95% CI)	Study-reported p-value
Kelly, 2020[156]	Liraglutide	13	SBP, mmHg	116 (10)	117 (12)	-1.2 (10.1)	125	0.8 (10.1)	126	-2.0 (-4.5 to 0.4)	NR
			DBP, mmHg	72 (8)	73 (8)	0.8 (7.7)	125	-0.5 (7.7)	126	1.2 (-0.7 to 3.1)	NR
			LDL-C, mg/dL	88.6 (24)	86.6 (25.2)	1 (0.2)	125	1 (0.2)	126	1.0 (0.9 to 1.0)	NR
			HDL-C, mg/dL	43.8 (10)	43.8 (10.3)	1 (0.2)	125	1 (0.2)	126	1.0 (1.0 to 1.07)	NR
			TC, mg/dL	156.4 (27)	154.9 (29.6)	1 (0.1)	125	1 (0.1)	126	1.0 (1.0 to 1.04)	NR
			FPG, mg/dL	94.1 (7.6)	94.5 (11.1)	-2 (9.5)	125	-0.2 (9.7)	126	-1.8 (-4.1 to 0.5)	NR
Weghuber, 2022[162]	Semaglutide	16	SBP, mmHg	120 (11)	120 (12)	-2.7 (NR)	134	-0.8 (NR)	67	-1.9 (-5 to 1.1)	NR
			DBP, mmHg	73 (9)	73 (9)	-1.4 (NR)	134	-0.8 (NR)	67	-0.6 (NR)	NR
			LDL-C, mg/dL	89.8 (29.8)	91.7 (26.9)	-10.2 (NR)	134	-3.4 (NR)	67	-7 (-11.9 to -1.8)	NR
			HDL-C, mg/dL	43.7 ()	43.3 ()	8 (NR)	134	3.2 (NR)	67	4.7 (-1 to 10.7)	NR
			TC, mg/dL	159.4 (19.3)	160.1 (18.9)	-8.3 (NR)	134	-1.3 (NR)	67	-7.1 (-10.5 to -3.5)	NR

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence Interval; DBP = Diastolic blood pressure; FPG = Fasting plasma glucose; FU = Followup; HDL-C = *High-density lipoprotein cholesterol;* IG = Intervention group; LDL-C = *low-density lipoprotein cholesterol;* Mg/dL = Milligrams per deciliter; mmHg = Milligrams mercury; Mos = Months; NR = Not reported; SBP = Systolic blood pressure; SD = Standard deviation; TC = Total cholesterol

Table 17. Blood Pressure, Lipids, and Insulin Outcomes for Orlistat, Sorted by Outcome

Study	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Between-group difference in mean change (95% CI)	Study-reported p-value
Chanoine, 2005[158]	12 (0)	SBP, mm Hg	114 (12)	114 (12)	1.1 (NR)	347	1.3 ()	180	-0.2 (NR)	0.84
		DBP, mm Hg	68 (10)	67 (10)	-0.5 (NR)	347	1.3 ()	180	-1.8 (NR)	0.04
Chanoine, 2005[158]	12 (0)	LDL-C, mg/dL	97 (28)	97 (27)	-1 (NR)	322	0.9 ()	162	-1.9 (NR)	0.29
Maahs, 2006[159]	6 (0)	LDL-C, mg/dL	87.1 (34.9)	89.6 (20.6)	1.4 (31.6)	16	-4 (25.7)	18	5.4 (-13.9 to 24.7)	0.13
Chanoine, 2005[158]	12 (0)	HDL-C, mg/dL	42 (10)	42 (8)	0.1 (NR)	323	-0.3 ()	163	0.4 (NR)	0.62
Maahs, 2006[159]	6 (0)	HDL-C, mg/dL	42.2 (8.9)	40 (7.6)	-0.2 (8.7)	16	0.9 (8.6)	18	-1.1 (-6.9 to 4.7)	0.47
Chanoine, 2005[158]	12 (0)	TC, mg/dL	161 (32)	163 (33)	2.3 (NR)	323	3.4 ()	163	-1.1 (NR)	0.59
Maahs, 2006[159]	6 (0)	TC, mg/dL	155.8 (43.8)	159.3 (29.1)	-1.1 (39.7)	16	-3 (35.4)	18	1.9 (-23.4 to 27.2)	0.49
Chanoine, 2005[158]	12 (0)	FPG, mg/dL	90 (11)	92 (12)	-2.4 (NR)	282	-5.2 ()	136	2.8 (NR)	0.06
Maahs, 2006[159]	6 (0)	FPG, mg/dL	87 (8.5)	87.4 (8.9)	2.8 (7.8)	16	4.8 (8.2)	18	-2 (-7.4 to 3.4)	0.12

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence Interval; DBP = Diastolic blood pressure; FPG = Fasting plasma glucose; HDL-C = High-density lipoprotein cholesterol; IG = Intervention group; LDL-C = low-density lipoprotein cholesterol; Mg/dL = Milligrams per deciliter; mmHg = Milligrams mercury; NR = Not reported; SBP = Systolic blood pressure; SD = Standard deviation; TC = Total cholesterol; Tx = Treatment

Table 18. Blood Pressure, Lipids, and Insulin Outcomes for Phentermine/Topiramate at End of Treatment (13 Months Post-Baseline)[161]

Dose	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD)	IG N	CG FU change mean (SD)	CG N	Between-group difference in mean change (95% CI)	Study-reported p-value
IG1: PHEN (15 mg)/ TOP (92 mg)	SBP, mm Hg	117.4 (10.2)	117.7 (10.4)	1 (11.1)	113	2.8 (12.1)	56	-1.80 (-5.58 to 1.97)	NR
IG2: PHEN (7.5 mg)/ TOP (46 mg)	SBP, mm Hg	121.4 (9.2)	117.7 (10.4)	-1 (11)	54	2.8 (12.1)	56	-3.76 (-8.09 to 0.56)	NR
IG1: PHEN (15 mg)/ TOP (92 mg)	DBP, mm Hg	72.9 (7.3)	71.7 (8.3)	0.1 (9)	113	3.1 (10)	56	-2.97 (-6.07 to 0.12)	NR
IG2: PHEN (7.5 mg)/ TOP (46 mg)	DBP, mm Hg	75.8 (6.7)	71.7 (8.3)	-0.9 (9)	54	3.1 (10)	56	-3.99 (-7.53 to -0.45)	NR
IG1: PHEN (15 mg)/ TOP (92 mg)	HDL-C, % change	--	--	5.1 (18.7)	113	-3.7 (21.3)	56	8.75 (2.15 to 15.35)	NR
IG2: PHEN (7.5 mg)/ TOP (46 mg)	HDL-C, % change	--	--	6.7 (18.0)	54	-3.7 (21.3)	56	10.30 (2.91 to 17.7)	NR
IG1: PHEN (15 mg)/ TOP (92 mg)	Insulin, mg/dL	2.7 (2.1)	2.5 (1.7)	1.9 (4)	113	1.1 (4.6)	56	0.80 (-0.64 to 2.24)	NR
IG2: PHEN (7.5 mg)/ TOP (46 mg)	Insulin, mg/dL	3 (2.5)	2.5 (1.7)	1.2 (4)	54	1.1 (4.6)	56	0.19 (-1.45 to 1.82)	NR

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence Interval; DBP = Diastolic blood pressure; FPG = Fasting plasma glucose; FU = Followup; HDL-C = High-density lipoprotein cholesterol; IG = Intervention group Mg/dL = Milligrams per deciliter; mmHg = Milligrams mercury; NR = Not reported; SBP = Systolic blood pressure; SD = Standard deviation

Table 19. Weight Outcomes for Studies That Address Potential Barriers to Participation or Mitigate Social Risk Factors, Sorted by Estimated Intervention Contact Hours

Estimated Intervention Contact Hrs	Study Country	Key intervention components	Est hrs contact (Sessions)	Group Analyzed	Followup (months since tx ended)	Outcome	Between-group difference in mean change (95% CI)	Study-reported p-value
< 26	Love-Osborne, 2014[123] US	Health Educator linked patients to existing resources for healthy eating and PA; facilitated applications for free parks and recreation memberships.	NR (5)	BL BMI 85-95%	8 (0)	zBMI, z-score	0.14 (NR)	0.65
				BL BMI 95-99%	8 (0)	zBMI, z-score	0.09 (NR)	0.81
				BL BMI >99%	8 (0)	zBMI, z-score	0 (NR)	0.36
	Mellin, 1987[125] US	Content integrated ethnic, cultural, and economic differences and used examples of a broad range of family types.	24 (16)	All	6 (3)	Weight, kg	-0.35 (NR)	NSD
	Resnicow, 2015[132] US	Added RD sessions offered either in-person or by phone.	NR (10)	All	24 (0)	BMI percentile	-3.1 (-6.32 to 0.12)	0.02
≥26	DeBar, 2012[111] US	Offered option for phone sessions in lieu of in-person sessions.	36.5 (18)	All	6 (1)	Weight, kg	-1.46 (-5.94 to 3.03)	0.015
	Sacher, 2010[133] UK	Free access to community swimming pool for 12 weeks.	36 (18)	All	6 (3.75)	BMI, kg/m^2	-1.2 (-1.8 to -0.6)	<0.001
	Savoye, 2014[136] US	One of the two groups had Spanish bilingual instructors.	78 (52)	All	6 (0)	BMI, kg/m^2	-1.05 (-1.78 to -0.32)	0.005
						Weight, kg	-3.1 (-5.3 to -0.9)	0.006
	Smith, 2021[138] US	Provided families with referrals to existing resources in collaboration with partner agencies (employment, food and housing insecurity, insurance coverage)	53.79 (3)	All	6 (0)	BMI, kg/m^2	0.63 (-0.74 to 2)	0.242
					12 (6)	BMI, kg/m^2	-0.26 (-1.66 to 1.14)	0.833
	Stark, 2011[139] US	Parents provided w/ vegetables for 14 days' worth of taste tests at each group session. Included in-home sessions; interventionist assisted family in setting up a safe place in the home for active play.	38.25 (18)	All	6 (0)	Weight, kg	-2.7 (-4.4 to -1)	0.004
					12 (6)	Weight, kg	-4.3 (-7 to -1.5)	0.005

Table 19. Weight Outcomes for Studies That Address Potential Barriers to Participation or Mitigate Social Risk Factors, Sorted by Estimated Intervention Contact Hours

Estimated Intervention Contact Hrs	Study Country	Key intervention components	Est hrs contact (Sessions)	Group Analyzed	Followup (months since tx ended)	Outcome	Between-group difference in mean change (95% CI)	Study-reported p-value
	Stark, 2014[140] US	Parents provided w/ vegetables for 14 days' worth of taste tests at each group session. Included in-home sessions; interventionist assisted family in setting up a safe place in the home for active play.	30 (10)	All	6 (0)	Weight, kg	-0.7 (-2.2 to 0.9)	0.37
					12 (6)	Weight, kg	-3 (-5.5 to -0.4)	0.03
	Stark, 2018[141] US	Included in-home sessions; interventionist assisted family in setting up a safe place in the home for active play.	38 (18)	All	6 (0)	Weight, kg	-1.36 (-2.09 to -0.63)	<0.001
					12 (6)	Weight, kg	-1.1 (-2.08 to -0.12)	0.02

Abbreviations: BL = Baseline; BMI = Body mass index; CI = Confidence interval; Est = Estimated Hrs = Hours; Kg = kilogram; NR = Not reported; NSD = No significant difference; PA = Physical activity; Tx = Treatment; US = United States

Table 20. Meta-Analysis Results for Minutes per Day of Physical Activity and Sedentary Behavior for Behavioral Interventions

Outcome	All Studies in MA			<26 Contact hrs			≥26 Contact hrs			P-value
	K (N)	I^2, %	Mean Diff in Change (95% CI)	K (N)	I^2, %	Mean Diff in Change (95% CI)	K (N)	I^2, %	Mean Diff in Change (95% CI)	(diff b/t dose levels)
PA, Min/day	10 (1533)	85.5	5.2 (-2.0 to 12.4)	4 (714)	0	3.4 (-3.3 to 10.1)	6 (819)	88.6	7.8 (-4.7 to 20.2)	0.007
Sedentary Min/day	11 (1366)	41.4	-13.3 (-26.9 to 0.4)	5 (610)	0.0	-23.9 (-34.4 to -13.3)	6 (756)	45.2	-4.7 (-27.0 to 17.8)	0.702

Abbreviations: B/t = Between; CI = Confidence Interval; Diff = Difference; Hrs = Hours; K = Number of studies; MA = Meta-analysis; Min = Minutes; PA = Physical activity

Table 21. Adverse Events for Pharmacotherapy Trials, Sorted by Type of Medication

Medication	Author, Year	Serious Adverse Events, n/N (%)		Any Adverse Events, n/N (%)		Dropout due to Adverse Events, n/N (%)		Most common non-serious AEs
-	-	Medication	Placebo	Medication	Placebo	Medication	Placebo	-
Liraglutide (3 mg/day)	Danne, 2017[155]	0/14 (0)	0/7 (0)	14/14 (100)	4/7 (57)	0/14 (0)	0/7 (0)	GI, nervous system, infections or infestations, administration site irritation
	Kelly, 2020[156]	3/125 (2)	5/126 (4)	111/125 (89)	107/126 (85)	13/125 (10)	0/126 (0)	GI, hypoglycemic episodes
	Mastrandrea, 2019[157]	0/16 (0)	0/8 (0)	9/16 (56)	5/8 (62)	0/16 (0)	0/8 (0)	GI, hypoglycemic episodes
Semaglutide (2.4 mg/week)	Weghuber, 2022[162]	15/133 (11)	6/67 (9)	105/133 (79)	55/67 (82)	6/133 (4)	3/67 (4)	GI
Orlistat (360 mg/day)	Chanoine, 2005[158]	11/352 (3)	5/181 (3)	341/352 (97)	170/181 (94)	12/352 (3)	3/181 (2)	Abdominal pain, flatus with discharge, fecal urgency, fecal incontinence
	Maahs, 2006[159]	NR	NR	NR	NR	2/20 (10)	0/20 (0)	Flatus with discharge, fecal urgency
Phentermine/ Topiramate (15/92 mg/day)	Hsia, 2019[160]	NR	NR	10/13 (77)	7/14 (50)	2/13 (15)	0/14 (0)	Nervous system, GI
	Kelly, 2022[161]	2/113 (2)	0/56 (0)	59/113 (52)	29/56 (52)	1/113 (1)	2/56 (4)	Musculoskeletal, psychiatric
Phentermine/ Topiramate (7.5/46 mg/day)	Hsia, 2019[160]	NR	NR	6/15 (40)	7/14 (50)	0/15 (0)	0/14 (0)	None
	Kelly, 2022[161]	0/54 (0)	0/56 (0)	20/54 (37)	29/56 (52)	0/54 (0)	2/56 (4)	None

Abbreviations: AEs = Adverse events; GI = Gastrointestinal; Mg = Milligrams; n = Number; N = Total number; NR = Not reported

Table 22. The Association Between Weight Cycling and Type 2 Diabetes Incidence Reported in Mackie et al Review[289]

Study	N	Effect (95% CI) (higher number corresponds to increased risk of type 2 diabetes)
Nurses' Health Study II[348]	46,634 women	RR, 1.11 (95% CI 0.89 to 1.37) for mild weight cycling; RR, 1.39 (95% CI 0.90 to 2.13) for severe weight cycling
Iowa Women's Health Study[349]	33,834 women	RR, 1.72 (95% CI 1.29 to 2.30)
Alpha-Tocopherol, Beta-Carotene Cancer Prevention Study[350]	20,952 male smokers	RR, 1.64 (95% CI 1.24 to 2.17)
European Prospective Investigation into Cancer and Nutrition[351]	26,010 women	HR, 1.36 (95% CI 1.09 to 1.68)
Framingham Heart Study[352]	1476	Crude HR = 1.6 (95% CI 1.2 to 2.1), but no effect after adjustment for BMI (details NR)
Diabetes Prevention Project[353]	1000	HR, 1.33 (95% CI 1.12 to 1.58)
"Obesity Day" participant cross-sectional survey[354]	914	No association (details NR)
Longitudinal study of Pima Indians[355]	584	IRR comparing 75th percentile vs 25th percentile in weight fluctuation, 1.03 (95% CI 0.85 to 1.25).

Abbreviations: BMI = Body mass index; CI = Confidence interval; HR = Hazard ratio; IRR = incidence rate ratio; NR = Not reported; RR = Relative risk

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
Key Question 1 (health outcomes) ***Behavioral interventions***	14 RCTs N=2,674	Very few studies found any statistically significant improvements in quality of life at any timepoint. However, pooled analyses found small increases in total and physical quality of life after 6 to 12 months, reported in only a very small subset of the included trials (e.g., Total quality of life: MD, 1.9 [95% CI, 0.2 to 3.5]; 11 RCTs [n=1,922]). Other health outcomes were very sparsely reported and none suggested a benefit.	Quality of life: Consistent, imprecise Other health outcomes, consistency inconsistent or NA, imprecise	Sparse reporting of health outcomes. Quality of life: Only one study included a weight-specific quality of life instrument; studies varied in the use of child report vs parent proxy report of QoL; variation in the use of subscales vs total QoL scales	Quality of life: Low Other health outcomes: Insufficient	6 trials conducted in the US; Limited information on effects in specific populations at risk of health inequities and higher than average BMI (Black, Hispanic, Native, limited financial resources or other social needs)
Key Question 1 (health outcomes) ***Liraglutide***	1 RCT N=251	No group differences in mean change in either weight-related quality of life (MD, 1.3 [95% CI, -1.6 to 4.2]) depression incidence (RR, 1.71 [95% CI, 0.40 to 7.31]) after 13 months of treatment.	Consistency NA, imprecise	Body of evidence limited to 1 study, followup limited to 13 months, no post-treatment followup.	Insufficient	Multinational study, including cites in Belgium, Mexico, Russia, Sweden, and the US.
Key Question 1 (health outcomes) ***Semaglutide***	1 RCT N=201	Semaglutide was associated with small improvement in weight-related quality of life (MD, 4.3 [95%CI, 0.2 to 8.3]) on a 100-point scale.	Consistency NA, imprecise	Body of evidence limited to 1 study, followup limited to 16 months, no post-treatment followup.	Insufficient	Multinational study, including cites in Austria, Belgium, Croatia, Ireland, Mexico, Russian Federation, UK, and the US
Key Question 1 (health outcomes) ***Orlistat***	2 RCTs N=579	One trial each reported weight-related quality of life and depression incidence, with no group differences on	Consistency NA, imprecise	Very small body of evidence, followup limited to 6 to 12 months, no post-treatment followup.	Insufficient	Both studies conducted in the US, recruited from healthcare settings; smaller study (n=40)

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
		either outcome after 6 to 12 months.				included 62% Hispanic/Latino participants.
Key Question 1 (health outcomes) ***Phentermine/ Topiramate***	1 RCT N=227	No group differences in quality of life or depression incidence	Consistency NA, imprecise	Body of evidence limited to 1 study, followup limited to 13 months, no post-treatment followup.	Insufficient	Study conducted in the US, included 32% Hispanic/Latino participants, 27% Black participants.
Key Question 2 (intermediate outcomes) ***Behavioral interventions: Weight or adiposity***	50 RCTs N= 8,798	Pooled analysis indicated average small reductions in BMI with weight management interventions compared to control conditions in the short-term (6-12 months; MD, -0.65 kg/m^2 [95% CI, -0.98 to -0.32]; 29 RCTs [n=4,639]). Effects on BMI were larger for interventions offering an estimated ≥26 hours of contact and for those that provided physical activity sessions. Evidence was extremely limited beyond 12 months and very limited evidence suggested attenuation of effects after treatment ended. Other weight and adiposity outcomes showed similar patterns of results.	Consistent, Precise	Could not disentangle the impact of contact hours and inclusion of physical activity sessions during intervention sessions. Clinical significance of the effect is unknown. Minimal information on effects after 12 months or maintenance after treatment ends.	High for benefit up to 12 months	Limited information on effects in specific populations at risk of health inequities and higher than average BMI (Black, Hispanic, Native, limited financial resources or other social needs)
Key Question 2 (intermediate outcomes) ***Behavioral***	16 RCTs N=1,700	Pooled effects indicated no impact on measures of cholesterol but suggested slightly	Blood Pressure, fasting plasma glucose: Consistent (that benefit only seen with >26 hrs),	Very few trials reporting. Could not disentangle the	Blood Pressure, Fasting plasma glucose: Low (benefit only with higher contact hours	Limited information on effects in specific populations at risk of health inequities and higher than average

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
Interventions: Other intermediate outcomes		larger improvements in blood pressure and fasting plasma glucose compared to control groups, only in trials offering 26 or more hrs of contact, almost all of which also offered physical activity sessions. For example, among trials with ≥26 contact hrs, MD (95% CI): HDL: 0.8 mg/dL (-1.6 to 3.2); 4 RCTs SBP: -3.6 mmHg (-5.7 to -1.5); 8 RCTs DBP: -3.0 mmHg (-5.2 to -0.7); 8 RCTs FPG -1.9 mg/dL (-2.7 to -1.2); 4 RCTs	Imprecise Lipids: Inconsistent, Imprecise	impact of contact hours and inclusion of physical activity sessions during intervention sessions. Clinical significance of the effects are unknown. No information on effects after 12 months, minimal information on maintenance after treatment ends.	and physical activity sessions) Lipids: Low (no benefit)	BMI (Black, Hispanic, Native, limited financial resources or other social needs)
Key Question 2 (intermediate outcomes) ***Liraglutide***	1 RCT N=251	Pharmacotherapy was associated with larger mean BMI reduction than placebo after 13 months (MD, -1.6 kg/m^2 [95% CI, -2.5 to -0.7]), which translated to 4.5 kg greater weight reduction (MD, -4.5 [95% CI, -7.2 to -1.8]). Group differences were not maintained 6 months after treatment ended (BMI MD, -1.0 kg/m^2 [95% CI, -2.0 to 0.01]). Liraglutide was associated with very small increases in all lipid measures	Consistency NA, precise	Evidence is limited to one trial. Clinical significance of the effects are unknown. Effect on weight deteriorated after treatment ended, impact on other intermediate outcomes after treatment ended is unknown.	Weight: Low for benefit at up to 13 months IOs: Low with mixed findings	Multinational study, including cites in Belgium, Mexico, Russia, Sweden, and the US.

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
		including HDL, LDL, total cholesterol, and triglycerides (e.g., LDL MD, 1.0 [95% CI, 0.94 to 1.05]), but had no impact on blood pressure or glucose metabolism after 13 months of treatment.				
Key Question 2 (intermediate outcomes) ***Semaglutide***	1 RCT N=201	Pharmacotherapy was associated with larger mean BMI reduction than placebo after 16 months (MD, -6.0 kg/m^2 [95% CI, -7.3 to -4.6]), which translated to 4.5 kg greater weight reduction (MD, -17.7 [95% CI, -21.8 to -13.7]). Group differences were not reported after discontinuation. Semaglutide was associated with greater percent reductions in LDL, total cholesterol, and triglycerides from baseline levels (e.g., LDL MD, -7.0% [95% CI, -11.9 to -1.8]) and a statistically nonsignificant increase in HDL (MD, 4.7% [95% CI, (-1 to 10.7), but had no impact on blood pressure or glucose metabolism after 16 months of treatment.	Consistency NA, precise	Evidence is limited to one trial with no followup after medication was discontinued Clinical significance of the effects on cardiometabolic outcomes are unknown	Low for benefit	Multinational study, including cites in Austria, Belgium, Croatia, Ireland, Mexico, Russian Federation, UK, and the US

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
Key Question 2 (intermediate outcomes) ***Orlistat***	2 RCTs N=579	Pharmacotherapy was associated with larger mean BMI reduction than placebo after 12 months in 1 of the 2 included trials (MD, -0.9 kg/m^2 [95% CI, NR, p=0.001], n=537), which was associated with 2.6 kg greater weight reduction (CI NR). One orlistat study (n=537) found no improvement in lipids, glucose or SBP with orlistat use compared to placebo after 12 months, but a slightly larger improvement in DBP compared with placebo (MD, -1.8 kg/m^2 [95% CI NR, p=0.04]).	Consistent, precise	Evidence is limited to two trials. Clinical significance of the effects are unknown. No information on maintenance of effects after treatment ended.	Weight: Low for benefit at up to 12 months IOs: Low for no benefit	Both studies conducted in the US, recruited from healthcare settings; smaller study (n=40) included 62% Hispanic/Latino participants.
Key Question 2 (intermediate outcomes) ***Phentermine/ Topiramate***	1 RCT N=227	After 13 months, phentermine/topiramate was associated with greater reductions in BMI: • 15/92 mg dose: MD, -5.4 kg/m^2 (95% CI, -6.4 to -4.3) • 7.5/46 mg dose: MD, -3.7 kg/m^2 (95% CI, -5.0 to -2.5). and weight: • 15/92 mg dose: MD, -15.8 kg (95%	Consistency NA, Precise	Evidence is limited to one trial. Clinical significance of the effects on cardiometabolic outcomes is unknown. No information on maintenance of effects after treatment ended.	Low for benefit	Study conducted in the US, included 32% Hispanic/Latino participants, 27% Black participants.

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
		CI, -18.8 to -12.8]) • 7.5/46 mg dose: (MD, -12.1 kg (95% CI, -15.6 to 8.6). HDL cholesterol increased from baseline by 9 to 10 percentage points more with phentermine/topiramate than placebo, and the lower-dose arm of the phentermine/topiramate study showed a reduction in DBP, but no group differences were found for SBP or insulin sensitivity at either dose level.				
Key Question 3 (behavioral outcomes) ***Behavioral Interventions***	23 RCTs (N=3,459)	Most evidence and meta-analyses indicated no impact on minutes per day of physical activity or sedentary behavior: Physical activity: MD, 5.2 (95% CI, -2.0 to 12.4); 10 RCTs Sedentary behavior: MD, -13.3 [95% CI, -26.9 to 0.4]; 11 RCTs. Findings were mixed among 5 trials reporting overall dietary pattern.	Physical activity, sedentary behavior: consistent, imprecise Dietary pattern: inconsistent, imprecise	Sparse reporting of behavioral outcomes. Heterogeneity in specific measures.	Low for no benefit	Limited information on effects in specific populations at risk of health inequities and higher than average BMI (Black, Hispanic, Native, limited financial resources or other social needs)
Key Question 3 (behavioral outcomes)	0 studies	NA	NA	NA	Insufficient	NA

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
Pharmacotherapy						
Key Question 4 (harms) ***Behavioral interventions***	18 RCTs (N= 2,539)	None of the 18 trials reporting potential harms of behavioral weight management interventions found an increase in the risk of: any adverse events, serious adverse events, self-esteem, body satisfaction, or disordered eating. Outcomes were reported 6 to 12 months after baseline assessments.	Consistent, Imprecise	Very sparse evidence for all outcomes. No information was available on the risk of harm beyond 12 months. Body satisfaction and self-esteem may be culturally influenced, but the evidence was insufficient to examine cross-culturally. Outcomes address only immediate harms of the intervention, and none examined larger impacts related, for example, to labelling, stigma, or potential weight regain.	Low for no increased risk of harm	Limited information on effects in specific populations at risk of health inequities and higher than average BMI (Black, Hispanic, Native, limited financial resources or other social needs)
Key Question 4 (harms) ***Liraglutide***	3 RCTs N=296	The best data, from the largest study (n=251), indicated an increased risk of gastrointestinal effects (RR, 3.20 [95% CI, 1.91 to 5.36], 65% vs 36%) and discontinuation due to adverse effects (RR, 30.36 [95% CI, 2.78 to 516.57], 10% vs 0%).	Consistent, imprecise	There may be rare harms that RCTs were underpowered to detect. No information on harms of long-term use.	Serious AEs: Insufficient Any AEs: Low for increased harm	Largest trial providing most of the evidence was a multinational study, including cites in Belgium, Mexico, Russia, Sweden, and the US.
Key Question 4 (harms)	1 RCTs N=201	Gastrointestinal side effects were the most	Consistent, imprecise	There may be rare harms that RCTs	Serious AEs: Insufficient	Multinational study, including cites in

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
Semaglutide		common harm (RR, 2.24 [95% CI, 1.23 to 4.07]; 62% vs 42%). Although not significantly different, five participants taking semaglutide (3.8%) developed gallstones, compared to none taking placebo (calculated RR, 5.8 [95% CI, 0.3 to 106.1])		were underpowered to detect. No information on harms of long-term use.	Any AEs: High for increased harm	Austria, Belgium, Croatia, Ireland, Mexico, Russian Federation, UK, and the US
Key Question 4 (harms) ***Orlistat***	2 RCTs N=579	Gastrointestinal side effects were more common with orlistat use, including flatus with discharge (RR, 8.74 [95% CI, 3.46 to 22.07], 20% vs. 3%) and fecal incontinence (RR, 17.38 [95 % CI, 2.35 to 128.4] in the larger study, 9% vs 1%) in the larger study. Discontinuation and serious AEs did not differ between groups.	Consistent, imprecise	There may be rare harms that RCTs were underpowered to detect. No information on harms of long-term use.	Serious AE: Insufficient Any AEs: Low for increased harm	Both studies conducted in the US, recruited from healthcare settings; smaller study (n=40) included 62% Hispanic/Latino participants.
Key Question 4 (harms) ***Phentermine/ topiramate***	2 RCTs N=269	Combining both studies, withdrawals due to AEs was 2.4% in both participants taking phentermine/topiramate and those taking placebo. Two persons experienced serious AEs: bile duct stone and depression with suicidal ideation. In the larger study, the side effects that were	Consistent, imprecise	There may be rare harms that RCTs were underpowered to detect. No information on harms of long-term use.	Serious AE: Insufficient Any AEs: Low for increased harm	Larger study conducted in the US, included 32% Hispanic/Latino participants, 27% Black participants.

Table 23. Summary of Evidence

Key Question	Studies (k) Observations (n) Study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
		slightly more common with higher-dose phentermine/topiramate were musculoskeletal (experienced by 10 persons [8.8%] with phentermine/topiramate vs 1 [1.8%] with placebo) and psychiatric (10 persons [8.8%] with phentermine/topiramate vs 1 [1.8%] with placebo), although group differences were not statistically significant				

Abbreviations: AEs = Adverse events; BMI = Body mass index; CI = Confidence Interval; DBP = Diastolic blood pressure; FPG = Fasting plasma glucose; HDL = High-density lipoprotein; Hrs = Hours; IOs = Intermediate outcomes; Kg/m^2 = Kilograms per meters squared; LDL = low-density lipoprotein; MD = Mean difference; Mg/dL = Milligrams per deciliter; mmHg = Milligrams mercury; NA = Not applicable; NR = Not reported; QoL = Quality of Life; RCT = Randomized controlled trial; RR = Relative risk; SBP = Systolic blood pressure; SD = Standard deviation; SMD = Standardized mean difference; US = United States

Literature Search Strategies for Primary Literature

Key:
/ = MeSH subject heading
$ = truncation
ti = word in title
ab = word in abstract
pt = publication type
* = truncation
kw = keyword

Bridge Searches
Medline via Ovid
Ovid MEDLINE(R) ALL <1946 to January 12, 2023>

1 Obesity/ 210460
2 Obesity, Morbid/ 25365
3 Obesity, Abdominal/ 4942
4 Overweight/ 31984
5 Weight Gain/ 34937
6 Weight Loss/ 42637
7 Weight Cycling/ 10
8 obesity.ti,ab,kf. 310125
9 obese.ti,ab,kf. 146676
10 overweight.ti,ab,kf. 85422
11 over weight.ti,ab,kf. 544
12 (weight adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,kf. 208887
13 ((bmi or body mass ind$) adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,kf. 11474
14 weight maintenance.ti,ab,kf. 2445
15 weight control.ti,ab,kf. 7079
16 weight manag$.ti,ab,kf. 8295
17 or/1-16 599637
18 Child/ or Child, Preschool/ or Adolescent/ or Young Adult/ or Minors/ 3774002
19 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,kf. 1386171
20 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,ab,kf. 2151548
21 limit 20 to ("in data review" or in process or "pubmed not medline") 208901
22 17 and (18 or 19 or 21) 132262
23 Pediatric Obesity/ 13126
24 22 or 23 133266
25 Counseling/ 39225
26 Directive Counseling/ 2429
27 Behavior therapy/ 30006

28 Aversive therapy/ 821
29 Biofeedback, Psychology/ 7694
30 Feedback, Psychological/ 3733
31 Cognitive therapy/ 29660
32 "Acceptance and commitment therapy"/ 798
33 Mindfulness/ 5839
34 Desensitization, psychologic/ 1581
35 Relaxation therapy/ 6542
36 Meditation/ 3658
37 Social Support/ 77959
38 Psychotherapy, Group/ 14449
39 Family Therapy/ 9150
40 Persuasive Communication/ 4002
41 Risk Reduction Behavior/ 14201
42 Health Education/ 63330
43 Health Promotion/ 80523
44 Patient Education as Topic/ 88171
45 "Early Intervention (Education)"/ 3469
46 ((psychological or behavio?r$) adj (therap$ or modif$ or chang$ or strateg$ or intervention$)).ti,ab,kf. 105180
47 (group therap$ or family therap$ or cognitive therap$).ti,ab,kf. 13341
48 (cbt or dcbt).ti,ab,kf. 14254
49 ((lifestyle or life style) adj (chang$ or interven$ or modif$)).ti,ab,kf. 28302
50 counsel?ing.ti,ab,kf. 113861
51 social$ support$.ti,ab,kf. 52640
52 (peer$ adj2 support$).ti,ab,kf. 8340
53 ((child$ adj3 parent$) and therap$).ti,ab,kf. 5834
54 (family intervention$ or parent$ intervention$).ti,ab,kf. 3438
55 (parent$ adj2 (behavio?r$ or involv$ or control$ or attitude$ or educat$)).ti,ab,kf. 33284
56 health education.ti,ab,kf. 41094
57 health promotion.ti,ab,kf. 40733
58 patient education.ti,ab,kf. 23284
59 nonpharmacologic intervention$.ti,ab,kf. 974
60 non pharmacologic intervention$.ti,ab,kf. 330
61 self regulat$.ti,ab,kf. 15711
62 (school$ adj5 (intervention$ or program$)).ti,ab,kf. 27739
63 or/25-62 752201
64 Exercise/ 137564
65 Physical Conditioning, Human/ 2878
66 (exercise or physical activity).ti,kf. 203885
67 aerobic$.ti,kf. 26830
68 (fitness adj (class$ or regime$ or program$)).ti,kf. 316
69 (physical training or physical education).ti,kf. 5855
70 (sedentary behavio?r$ adj3 reduc$).ti,ab,kf. 1019
71 ((exercise or physical activity) adj5 (intervention$ or promot$)).ti,ab,kf. 36048
72 telerehabilitation/ 890
73 or/64-72 289519
74 diet, fat-restricted/ 3979

75 diet, reducing/ 11497
76 Diet, Carbohydrate-Restricted/ 2045
77 diet therapy/ 10914
78 Caloric Restriction/ 7087
79 Food Habits/ 91711
80 (diet or diets or dieting or dietary).ti,kf. 228742
81 (diet$ adj (modif$ or therap$ or intervention$ or strateg$)).ti,ab,kf. 23185
82 (low calorie or calori$ control$ or healthy eating).ti,ab,kf. 13790
83 formula diet$.ti,ab,kf. 722
84 (weightwatcher$ or weight watcher$).ti,ab,kf. 161
85 or/74-84 338885
86 Case management/ 10566
87 Patient care team/ 69189
88 Cooperative behavior/ 45836
89 Interprofessional Relations/ 53140
90 Continuity of patient care/ 20521
91 Patient-centered care/ 22559
92 Patient care management/ 4742
93 Delivery of Health Care, Integrated/ 14139
94 collaborat$.ti,ab,kf. 190454
95 (interdisciplinary or inter disciplinary).ti,ab,kf. 47558
96 (multidisciplinary or multi disciplinary).ti,ab,kf. 120023
97 (integrated adj5 (healthcare or care)).ti,ab,kf. 20442
98 care manag$.ti,ab,kf. 12737
99 case manag$.ti,ab,kf. 15096
100 cooperative care.ti,ab,kf. 105
101 coordinated care.ti,ab,kf. 1618
102 patient centered care.ti,ab,kf. 7236
103 stepped care.ti,ab,kf. 1614
104 telemedicine/ 35834
105 or/86-104 570476
106 Anti-Obesity Agents/ 5695
107 pharmacotherap$.ti,kf. 12701
108 Lactones/ 19723
109 Orlistat/ 1355
110 Orlistat.ti,ab,kf. 1890
111 tetrahydrolipstatin.ti,ab,kf. 213
112 Xenical.ti,ab,kf. 105
113 Alli.ti,ab,kf. 111
114 glucagon-like peptide 1/ 9231
115 liraglutide/ 2373
116 liraglutide.ti,ab,kf. 3592
117 Saxenda.ti,ab,kf. 41
118 (setmelanotide or imcivree).ti,ab,kf. 67
119 (Phentermine/ or (Phentermine or adipex-p or Lomaira or Suprenza or sentis).ti,ab,kf.) and (Topiramate/ or (Topiramate or Trokendi XR or Qudexy XR or Topamax or eprontia or Topiramic acid).ti,ab,kf.) 305
120 "PHEN/TPM".ti,ab,kf. 16

121 or/106-120 49633
122 Weight Reduction Programs/ 2782
123 ((weight loss or weight reduction) adj3 (intervention$ or promot$ or program$)).ti,ab,kf. 9191
124 24 and (63 or 73 or 85 or 105 or 121 or 122 or 123) 42527
125 Pediatric Obesity/dh, dt, pc, rh, th [Diet Therapy, Drug Therapy, Prevention & Control, Rehabilitation, Therapy]5173
126 Obesity/dh, dt, pc, rh, th 52758
127 Obesity, Morbid/dh, dt, pc, rh, th 1924
128 Obesity, Abdominal/dh, dt, pc, rh, th 524
129 Overweight/dh, dt, pc, rh, th 7012
130 or/126-129 58113
131 130 and (18 or 19 or 21)15440
132 124 or 125 or 131 48070
133 (randomized controlled trial or controlled clinical trial or clinical trial or meta analysis).pt. or clinical trials as topic.sh. or exp Randomized Controlled Trials as Topic/ or (randomized or randomised or placebo or randomly or phase iii or phase 3 or clinical trial or controlled trial).ti,ab,kf. or trial.ti,kf. 1982975
134 control groups/ or double-blind method/ or single-blind method/ or random allocation/ or placebos/ 324427
135 (RCT or placebo or sham or dummy or single blind$ or double blind$ or allocated or allocation or triple blind$ or treble blind$ or random$).ti,ab,kf. not medline.st. 235216
136 or/133-135 2134569
137 132 and 136 10601
138 limit 137 to (english language and yr="2016 -Current") 4847
139 24 and 121 942
140 Pediatric Obesity/dt 111
141 Obesity/dt or Obesity, Morbid/dt or Obesity, Abdominal/dt or Overweight/dt 12569
142 141 and (18 or 19 or 21)1345
143 139 or 140 or 142 2073
144 limit 143 to (english language and yr="2016 -Current") 689
145 138 or 144 5159
146 145 not (animals/ not humans/) 5149
147 (202201* or 202202* or 202203* or 202204* or 202205* or 202206* or 202207* or 202208* or 202209* or 202210* or 202211* or 202212* or 2023*).dt,da,ez. 2003086
148 146 and 147 703

Bridge PsycInfo via Ovid
APA PsycInfo <1806 to January Week 2 2023>

1 obesity/ 27902
2 overweight/ 5205
3 weight gain/ 3484
4 weight control/ 5364
5 weight loss/ 4435
6 (Obesity or Obesity, Morbid or Obesity, Abdominal or Overweight).mh. 18058
7 Weight Cycling.mh. 1
8 obesity.ti,ab,id. 40033
9 obese.ti,ab,id. 17344

10 overweight.ti,ab,id. 17203
11 over weight.ti,ab,id. 124
12 (weight adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,id. 27329
13 ((bmi or body mass ind$) adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,id. 1936
14 weight maintenance.ti,ab,id. 602
15 weight control.ti,ab,id. 3004
16 weight manag$.ti,ab,id. 2728
17 or/1-16 70905
18 limit 17 to (100 childhood <birth to age 12 yrs> or 200 adolescence <age 13 to 17 yrs>) 17300
19 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,ab,id. 1043844
20 17 and 19 21497
21 18 or 20 23929
22 Behavior Therapy/ 15610
23 Cognitive Behavior Therapy/ 23211
24 Cognitive Therapy/ 13954
25 Cognitive Techniques/ 1723
26 Behavior Modification/ 10693
27 Behavior Change/ 13410
28 Lifestyle Changes/ 1486
29 Lifestyle/ 11903
30 School Counseling/ 6472
31 Psychotherapeutic Counseling/ 1621
32 Peer Counseling/ 1212
33 Group Counseling/ 5149
34 Community Counseling/117
35 Motivational Interviewing/ 2958
36 Feedback/ 21041
37 Biofeedback/ 2567
38 Health Education/ 14518
39 Health Promotion/ 27904
40 Client Education/ 4505
41 Self Regulation/ 11599
42 Intervention/ 83110
43 School Based Intervention/ 21736
44 Family Intervention/ or Family Therapy/ 26018
45 Early Intervention/ 12203
46 aversion therapy/ 588
47 "Acceptance and commitment therapy"/ 2450
48 Mindfulness/ 12093
49 Social Support/ 42049
50 support groups/ 4549
51 ((psychological or behavio?r$) adj (therap$ or modif$ or chang$ or strateg$ or intervention$)).ti,ab,id. 103049
52 (group therap$ or family therap$ or cognitive therap$).ti,ab,id. 42113
53 cbt.ti,ab,id. 16803
54 ((lifestyle or life style) adj (chang$ or interven$ or modifi$)).ti,ab,id. 5380

55 counsel$.ti,ab,id. 120553
56 social$ support$.ti,ab,id. 59330
57 (peer adj2 support).ti,ab,id. 6606
58 ((child$ adj3 parent$) and therapy).ti,ab,id. 6082
59 (family intervention$ or parent$ intervention$).ti,ab,id. 5565
60 (parent$ adj2 (behavio?r$ or involv$ or control$ or attitude$ or educat$)).ti,ab. 46180
61 health education.ti,ab,id. 12195
62 health promotion.ti,ab,id. 22260
63 patient education.ti,ab,id. 4260
64 nonpharmacologic intervention$.ti,ab,id. 253
65 non pharmacologic intervention$.ti,ab,id. 110
66 self regulat$.ti,ab,id. 25786
67 (school$ adj5 (intervention$ or program$)).ti,ab,id. 44095
68 or/22-67 624627
69 Physical Activity/ 25136
70 Physical Fitness/ 4783
71 Exercise/ 26718
72 Aerobic Exercise/ 2265
73 Active Living/ 275
74 (exercise or physical activity).ti,id. 46482
75 aerobic$.ti,id. 2611
76 (fitness adj (class$ or regime$ or program$)).ti,id. 228
77 (physical training or physical education).ti,id. 4815
78 (sedentary behavio?r$ adj3 reduc$).ti,ab,id. 376
79 ((exercise or physical activity) adj5 (intervention$ or promot$)).ti,ab,id. 11861
80 or/69-79 62268
81 Diets/ 14955
82 Dietary Restraint/ 1860
83 Food Intake/ 15487
84 Eating Behavior/ 16013
85 Healthy Eating/ 161
86 "obesity (attitudes toward)"/ 476
87 (diet or diets or dieting or dietary).ti. 11361
88 (diet$ adj (modif$ or therapy or intervention$ or strateg$)).ti,ab,id. 1661
89 (low calorie or calori$ control$ or healthy eating or formula diet$).ti,ab,id. 4398
90 (weightwatcher$ or weight watcher$).ti,ab,id. 71
91 or/81-90 47415
92 Interdisciplinary Treatment Approach/ 7854
93 Collaboration/ 14393
94 Cooperation/ 16167
95 Case Management/ 3443
96 Work Teams/ 5869
97 Community Mental Health Services/ 8030
98 Health Care Delivery/ 22200
99 Community Psychology/ 2525
100 Community Psychiatry/ 906
101 client centered therapy/ 3587
102 "continuum of care"/ 2218

103 collaborat$.ti,ab,id. 99407
104 (interdisciplinary or inter disciplinary).ti,ab,id. 27449
105 (multidisciplinary or multi disciplinary).ti,ab,id. 24114
106 (integrated adj5 (healthcare or care)).ti,ab,id. 6492
107 care manag$.ti,ab,id. 3093
108 case manag$.ti,ab,id. 7387
109 cooperative care.ti,ab,id. 45
110 coordinated care.ti,ab,id. 448
111 patient centered care.ti,ab,id. 2045
112 or/92-111 210605
113 ((weight loss or weight reduction or weight control or weight maintenance or weight management) adj3 (intervention$ or promot$ or program$)).ti,ab,id. 3970
114 21 and (68 or 80 or 91 or 112 or 113) 12796
115 random$.ti,ab,id,hw. 233976
116 placebo$.ti,ab,hw,id. 43783
117 (controlled trial$ or control group$).ti,ab,id,hw,md. 135129
118 clinical trial$.ti,ab,id,hw. 44636
119 meta analy$.ti,ab,hw,id. 48648
120 treatment outcome.md. 23075
121 (sham or dummy).ti,ab,id. 15750
122 (single blind$ or double blind$ or triple blind$ or treble blind$).ti,ab,id. 28441
123 (allocated or allocation).ti,ab,id. 30851
124 (phase iii or phase 3).ti,ab,id. 3850
125 or/115-124 425050
126 114 and 125 2268
127 (exp Overweight/ or weight loss/ or weight control/) and exp Drug Therapy/ 1018
128 Orlistat.ti,ab,id. 105
129 tetrahydrolipstatin.ti,ab,id. 16
130 Xenical.ti,ab,id. 3
131 Alli.ti,ab,id. 42
132 liraglutide.ti,ab,id. 111
133 Saxenda.ti,ab,id. 1
134 (setmelanotide or imcivree).ti,ab,id. 2
135 ((Phentermine or adipex-p or Lomaira or Suprenza or sentis) and (Topiramate or Trokendi XR or Qudexy XR or Topamax or eprontia or Topiramic acid)).ti,ab,id. 25
136 "PHEN/TPM".ti,ab,id. 2
137 or/127-136 1231
138 21 and 137 155
139 126 or 138 2403
140 limit 139 to (english language and yr="2016 -Current") 960
141 (202201* or 202202* or 202203* or 202204* or 202205* or 202206* or 202207* or 202208* or 202209* or 202210* or 202211* or 202212* or 2023*).up. 189553
142 140 and 141 122

Appendix A. Detailed Methods

Bridge Cochrane via Wiley
Date Run: 13/01/2023 17:54:35

ID Search Hits
#1 (child* or teen or teens or teenage* or adolescen* or youth or youths or young people or (young next adult*) or pediatric* or paediatric* or schoolchildren or school children or preschool* or (pre next school*) or toddler*):ti,ab,kw 344849
#2 (obese or obesity or overweight or "over weight"):ti,ab,kw 54014
#3 (weight next gain*):ti,ab,kw or (weight next loss*):ti,ab,kw 35513
#4 ((weight next change*) or (weight next reduc*)):ti,ab,kw 11278
#5 (bmi or body mass index):ti,ab,kw near/2 (gain* or loss* or change* or reduc*):ti,ab,kw 25964
#6 "weight maintenance":ti,ab,kw 1333
#7 "weight control":ti,ab,kw 1877
#8 "weight management":ti,ab,kw 2791
#9 {or #2-#8} 84479
#10 (psychological or behavior* or behaviour*):ti,ab,kw next (therap* or modif* or chang* or strateg* or intervention*):ti,ab,kw 46259
#11 psychotherapy:ti,ab,kw 14232
#12 (group or family or cognitive):ti,ab,kw next therap*:ti,ab,kw 11822
#13 cbt:ti,ab,kw 9974
#14 (lifestyle or "life style"):ti,ab,kw next (chang* or interven* or modif*):ti,ab,kw 11227
#15 counsel*:ti,ab,kw 27093
#16 (social* next support*):ti,ab,kw 9585
#17 (peer* near/2 support*):ti,ab,kw 1927
#18 (child* near/3 parent*):ti,ab,kw and therap*:ti,ab,kw 4972
#19 (family or parent*):ti,ab,kw next intervention*:ti,ab,kw 1955
#20 parent*:ti,ab,kw near/2 (behavior* or behaviour* or involv* or control* or attitude* or educat*):ti,ab,kw 6777
#21 health:ti,ab,kw next (education or promotion):ti,ab,kw 22106
#22 "patient education":ti,ab,kw 14852
#23 (nonpharmacologic or "non pharmacologic"):ti,ab,kw next intervention*:ti,ab,kw 312
#24 (self next regulat*):ti,ab,kw 2734
#25 school*:ti,ab,kw near/5 (intervention* or program*):ti,ab,kw 8482
#26 {or #10-#25} 136617
#27 (exercise or "physical activity"):ti 53259
#28 fitness:ti,ab,kw next (class* or regime* or program*):ti 319
#29 ("physical training" or "physical education"):ti 1025
#30 (sedentary next (behavior* or behaviour*)):ti,ab,kw near/3 (reduc* or mimim* or less*):ti,ab,kw 469
#31 (exercise or "physical activity"):ti,ab,kw near/5 (intervention* or promot*):ti,ab,kw 22770
#32 {or #27-#31} 63279
#33 (diet or diets or dieting or dietary):ti 23487
#34 diet*:ti,ab,kw next (modif* or therap* or intervention* or strateg*):ti,ab,kw 17683
#35 ("low calorie" or (calori* next control*) or "healthy eating"):ti,ab,kw 4637
#36 (formula next diet*):ti,ab,kw 247
#37 weightwatcher*:ti,ab,kw or (weight next watcher*):ti,ab,kw 139
#38 {or #33-#37} 36728
#39 collaborat*:ti,ab,kw 14184

#40 (interdisciplinary or "inter disciplinary"):ti,ab,kw 2498
#41 (multidisciplinary or multi-disciplinary):ti,ab,kw 7630
#42 integrated:ti,ab,kw near/5 (healthcare or care):ti,ab,kw 3026
#43 (care or case):ti,ab,kw next manag*:ti,ab,kw 5410
#44 "cooperative care":ti,ab,kw 4
#45 "patient centered care":ti,ab,kw1259
#46 "stepped care":ti,ab,kw 930
#47 "coordinated care":ti,ab,kw 165
#48 335-#47 31580
#49 Orlistat:ti,ab,kw577
#50 tetrahydrolipstatin:ti,ab,kw 93
#51 Xenical:ti,ab,kw 43
#52 Alli:ti,ab,kw 33
#53 liraglutide:ti,ab,kw 2186
#54 Saxenda:ti,ab,kw 28
#55 (setmelanotide or imcivree):ti,ab,kw 26
#56 (Phentermine or adipex-p or Lomaira or Suprenza or sentis) AND (Topiramate or "Trokendi XR" or "Qudexy XR" or Topamax or eprontia or "Topiramic acid"):ti,ab,kw 110
#57 "PHEN/TPM":ti,ab,kw 47
#58 pharmacotherap*:ti,kw 3078
#59 336-#58 5960
#60 (("weight loss" or "weight reduction" or "weight control" or "weight maintenance" or "weight management") near/3 (intervention* or promot* or program*)):ti,ab,kw 6495
#61 #26 or #32 or #38 or #48 or #59 or #60 244977
#62 #1 and #9 and #61 with Publication Year from 2016 to present, with Cochrane Library publication date from Jan 2022 to present, in Trials 730

Original Searches

MEDLINE

Database: Ovid MEDLINE(R) ALL <1946 to February 15, 2022>
Search Strategy:

---

1 Obesity/ (199295)
2 Obesity, Morbid/ (23494)
3 Obesity, Abdominal/ (4451)
4 Overweight/ (29183)
5 Weight Gain/ (33615)
6 Weight Loss/ (40391)
7 Weight Cycling/ (4)
8 obesity.ti,ab,kf. (288333)
9 obese.ti,ab,kf. (139651)
10 overweight.ti,ab,kf. (79612)
11 over weight.ti,ab,kf. (512)
12 (weight adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,kf. (196865)
13 ((bmi or body mass ind$) adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,kf. (10724)
14 weight maintenance.ti,ab,kf. (2329)
15 weight control.ti,ab,kf. (6765)
16 weight manag$.ti,ab,kf. (7606)

17 or/1-16 (564853)
18 Child/ or Child, Preschool/ or Adolescent/ or Young Adult/ or Minors/ (3671966)
19 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,kf. (1314801)
20 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,ab,kf. (2042844)
21 limit 20 to ("in data review" or in process or "pubmed not medline") (192036)
22 17 and (18 or 19 or 21) (126129)
23 Pediatric Obesity/ (11751)
24 22 or 23 (127096)
25 Counseling/ (38203)
26 Directive Counseling/ (2424)
27 Behavior therapy/ (29432)
28 Aversive therapy/ (820)
29 Biofeedback, Psychology/ (7554)
30 Feedback, Psychological/ (3697)
31 Cognitive therapy/ (28431)
32 "Acceptance and commitment therapy"/ (648)
33 Mindfulness/ (4983)
34 Desensitization, psychologic/ (1581)
35 Relaxation therapy/ (6511)
36 Meditation/ (3380)
37 Social Support/ (76093)
38 Psychotherapy, Group/ (14353)
39 Family Therapy/ (9079)
40 Persuasive Communication/ (3915)
41 Risk Reduction Behavior/ (13994)
42 Health Education/ (62655)
43 Health Promotion/ (78732)
44 Patient Education as Topic/ (87897)
45 "Early Intervention (Education)"/ (3342)
46 ((psychological or behavio?r$) adj (therap$ or modif$ or chang$ or strateg$ or intervention$)).ti,ab,kf. (96952)
47 (group therap$ or family therap$ or cognitive therap$).ti,ab,kf. (12812)
48 (cbt or dcbt).ti,ab,kf. (13069)
49 ((lifestyle or life style) adj (chang$ or interven$ or modif$)).ti,ab,kf. (25942)
50 counsel?ing.ti,ab,kf. (106933)
51 social$ support$.ti,ab,kf. (47918)
52 (peer$ adj2 support$).ti,ab,kf. (7289)
53 ((child$ adj3 parent$) and therap$).ti,ab,kf. (5441)
54 (family intervention$ or parent$ intervention$).ti,ab,kf. (3171)
55 (parent$ adj2 (behavio?r$ or involv$ or control$ or attitude$ or educat$)).ti,ab,kf. (31015)
56 health education.ti,ab,kf. (38536)
57 health promotion.ti,ab,kf. (37776)
58 patient education.ti,ab,kf. (21784)
59 nonpharmacologic intervention$.ti,ab,kf. (927)

60 non pharmacologic intervention$.ti,ab,kf. (292)
61 self regulat$.ti,ab,kf. (14483)
62 (school$ adj5 (intervention$ or program$)).ti,ab,kf. (25979)
63 or/25-62 (715551)
64 Exercise/ (128647)
65 Physical Conditioning, Human/ (2826)
66 (exercise or physical activity).ti,kf. (189850)
67 aerobic$.ti,kf. (24976)
68 (fitness adj (class$ or regime$ or program$)).ti,kf. (310)
69 (physical training or physical education).ti,kf. (5422)
70 (sedentary behavio?r$ adj3 reduc$).ti,ab,kf. (912)
71 ((exercise or physical activity) adj5 (intervention$ or promot$)).ti,ab,kf. (32646)
72 telerehabilitation/ (721)
73 or/64-72 (271353)
74 diet, fat-restricted/ (3901)
75 diet, reducing/ (11403)
76 Diet, Carbohydrate-Restricted/ (1902)
77 diet therapy/ (10896)
78 Caloric Restriction/ (6862)
79 Food Habits/ (89545)
80 (diet or diets or dieting or dietary).ti,kf. (214538)
81 (diet$ adj (modif$ or therap$ or intervention$ or strateg$)).ti,ab,kf. (21422)
82 (low calorie or calori$ control$ or healthy eating).ti,ab,kf. (12637)
83 formula diet$.ti,ab,kf. (707)
84 (weightwatcher$ or weight watcher$).ti,ab,kf. (150)
85 or/74-84 (321815)
86 Case management/ (10415)
87 Patient care team/ (68523)
88 Cooperative behavior/ (45443)
89 Interprofessional Relations/ (52701)
90 Continuity of patient care/ (20259)
91 Patient-centered care/ (21813)
92 Patient care management/ (4728)
93 Delivery of Health Care, Integrated/ (13829)
94 collaborat$.ti,ab,kf. (174063)
95 (interdisciplinary or inter disciplinary).ti,ab,kf. (43783)
96 (multidisciplinary or multi disciplinary).ti,ab,kf. (109197)
97 (integrated adj5 (healthcare or care)).ti,ab,kf. (18536)
98 care manag$.ti,ab,kf. (11831)
99 case manag$.ti,ab,kf. (14483)
100 cooperative care.ti,ab,kf. (102)
101 coordinated care.ti,ab,kf. (1503)
102 patient centered care.ti,ab,kf. (6473)
103 stepped care.ti,ab,kf. (1483)
104 telemedicine/ (32355)
105 or/86-104 (533605)
106 Anti-Obesity Agents/ (5541)
107 pharmacotherap$.ti,kf. (11879)

108 Lactones/ (19170)
109 Orlistat/ (1304)
110 Orlistat.ti,ab,kf. (1790)
111 tetrahydrolipstatin.ti,ab,kf. (212)
112 Xenical.ti,ab,kf. (103)
113 Alli.ti,ab,kf. (103)
114 glucagon-like peptide 1/ (8591)
115 liraglutide/ (2125)
116 liraglutide.ti,ab,kf. (3280)
117 Saxenda.ti,ab,kf. (31)
118 (setmelanotide or imcivree).ti,ab,kf. (49)
119 or/106-118 (47122)
120 Weight Reduction Programs/ (2676)
121 ((weight loss or weight reduction) adj3 (intervention$ or promot$ or program$)).ti,ab,kf. (8575)
122 24 and (63 or 73 or 85 or 105 or 119 or 120 or 121) (40552)
123 Pediatric Obesity/dh, dt, pc, rh, th [Diet Therapy, Drug Therapy, Prevention & Control, Rehabilitation, Therapy] (4760)
124 Obesity/dh, dt, pc, rh, th (50725)
125 Obesity, Morbid/dh, dt, pc, rh, th (1892)
126 Obesity, Abdominal/dh, dt, pc, rh, th (511)
127 Overweight/dh, dt, pc, rh, th (6542)
128 or/124-127 (55856)
129 128 and (18 or 19 or 21) (15144)
130 122 or 123 or 129 (45906)
131 (randomized controlled trial or controlled clinical trial or clinical trial or meta analysis).pt. or clinical trials as topic.sh. or exp Randomized Controlled Trials as Topic/ or (randomized or randomised or placebo or randomly or phase iii or phase 3 or clinical trial or controlled trial).ti,ab,kf. or trial.ti,kf. (1886631)
132 control groups/ or double-blind method/ or single-blind method/ or random allocation/ or placebos/ (319325)
133 (RCT or placebo or sham or dummy or single blind$ or double blind$ or allocated or allocation or triple blind$ or treble blind$ or random$).ti,ab,kf. not medline.st. (217682)
134 or/131-133 (2030116)
135 130 and 134 (10101)
136 limit 135 to (english language and yr="2016 -Current") (4352)
137 24 and 119 (897)
138 Pediatric Obesity/dt (95)
139 Obesity/dt or Obesity, Morbid/dt or Obesity, Abdominal/dt or Overweight/dt (11677)
140 139 and (18 or 19 or 21) (1301)
141 137 or 138 or 140 (1985)
142 limit 141 to (english language and yr="2016 -Current") (604)
143 136 or 142 (4617)
144 143 not (animals/ not humans/) (4608)

Appendix A. Detailed Methods

Original PsycInfo via Ovid

Database: APA PsycInfo <1806 to February Week 1 2022>
Search Strategy:

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1 obesity/ (26739)
2 overweight/ (4921)
3 weight gain/ (3365)
4 weight control/ (5218)
5 weight loss/ (4225)
6 (Obesity or Obesity, Morbid or Obesity, Abdominal or Overweight).mh. (17813)
7 Weight Cycling.mh. (0)
8 obesity.ti,ab,id. (38333)
9 obese.ti,ab,id. (16959)
10 overweight.ti,ab,id. (16509)
11 over weight.ti,ab,id. (121)
12 (weight adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,id. (26448)
13 ((bmi or body mass ind$) adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,id. (1857)
14 weight maintenance.ti,ab,id. (585)
15 weight control.ti,ab,id. (2915)
16 weight manag$.ti,ab,id. (2573)
17 or/1-16 (68359)
18 limit 17 to (100 childhood <birth to age 12 yrs> or 200 adolescence <age 13 to 17 yrs>) (16674)
19 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,ab,id. (1007163)
20 17 and 19 (20601)
21 18 or 20 (22971)
22 Behavior Therapy/ (14969)
23 Cognitive Behavior Therapy/ (22006)
24 Cognitive Therapy/ (13758)
25 Cognitive Techniques/ (1714)
26 Behavior Modification/ (10616)
27 Behavior Change/ (12862)
28 Lifestyle Changes/ (1430)
29 Lifestyle/ (11356)
30 School Counseling/ (6249)
31 Psychotherapeutic Counseling/ (1582)
32 Peer Counseling/ (1193)
33 Group Counseling/ (5095)
34 Community Counseling/ (100)
35 Motivational Interviewing/ (2791)
36 Feedback/ (19799)
37 Biofeedback/ (2516)
38 Health Education/ (14055)
39 Health Promotion/ (26814)
40 Client Education/ (4324)
41 Self Regulation/ (11030)
42 Intervention/ (76044)

43 School Based Intervention/ (20729)
44 Family Intervention/ or Family Therapy/ (25344)
45 Early Intervention/ (11728)
46 aversion therapy/ (579)
47 "Acceptance and commitment therapy"/ (2199)
48 Mindfulness/ (11311)
49 Social Support/ (40010)
50 support groups/ (4452)
51 ((psychological or behavio?r$) adj (therap$ or modif$ or chang$ or strateg$ or intervention$)).ti,ab,id. (98049)
52 (group therap$ or family therap$ or cognitive therap$).ti,ab,id. (41148)
53 cbt.ti,ab,id. (15767)
54 ((lifestyle or life style) adj (chang$ or interven$ or modifi$)).ti,ab,id. (5015)
55 counsel$.ti,ab,id. (117155)
56 social$ support$.ti,ab,id. (56247)
57 (peer adj2 support).ti,ab,id. (6007)
58 ((child$ adj3 parent$) and therapy).ti,ab,id. (5834)
59 (family intervention$ or parent$ intervention$).ti,ab,id. (5311)
60 (parent$ adj2 (behavio?r$ or involv$ or control$ or attitude$ or educat$)).ti,ab. (44322)
61 health education.ti,ab,id. (11617)
62 health promotion.ti,ab,id. (21338)
63 patient education.ti,ab,id. (4030)
64 nonpharmacologic intervention$.ti,ab,id. (241)
65 non pharmacologic intervention$.ti,ab,id. (101)
66 self regulat$.ti,ab,id. (24357)
67 (school$ adj5 (intervention$ or program$)).ti,ab,id. (42385)
68 or/22-67 (596742)
69 Physical Activity/ (23149)
70 Physical Fitness/ (4617)
71 Exercise/ (25329)
72 Aerobic Exercise/ (2115)
73 Active Living/ (272)
74 (exercise or physical activity).ti,id. (43563)
75 aerobic$.ti,id. (2484)
76 (fitness adj (class$ or regime$ or program$)).ti,id. (221)
77 (physical training or physical education).ti,id. (4587)
78 (sedentary behavio?r$ adj3 reduc$).ti,ab,id. (327)
79 ((exercise or physical activity) adj5 (intervention$ or promot$)).ti,ab,id. (10999)
80 or/69-79 (58400)
81 Diets/ (14215)
82 Dietary Restraint/ (1810)
83 Food Intake/ (15257)
84 Eating Behavior/ (15100)
85 Healthy Eating/ (17)
86 "obesity (attitudes toward)"/ (423)
87 (diet or diets or dieting or dietary).ti. (10909)
88 (diet$ adj (modif$ or therapy or intervention$ or strateg$)).ti,ab,id. (1562)
89 (low calorie or calori$ control$ or healthy eating or formula diet$).ti,ab,id. (4115)

90 (weightwatcher$ or weight watcher$).ti,ab,id. (66)
91 or/81-90 (45405)
92 Interdisciplinary Treatment Approach/ (7627)
93 Collaboration/ (12978)
94 Cooperation/ (15681)
95 Case Management/ (3341)
96 Work Teams/ (5619)
97 Community Mental Health Services/ (7911)
98 Health Care Delivery/ (21685)
99 Community Psychology/ (2406)
100 Community Psychiatry/ (893)
101 client centered therapy/ (3517)
102 "continuum of care"/ (2074)
103 collaborat$.ti,ab,id. (93626)
104 (interdisciplinary or inter disciplinary).ti,ab,id. (26086)
105 (multidisciplinary or multi disciplinary).ti,ab,id. (22840)
106 (integrated adj5 (healthcare or care)).ti,ab,id. (6002)
107 care manag$.ti,ab,id. (2940)
108 case manag$.ti,ab,id. (7158)
109 cooperative care.ti,ab,id. (43)
110 coordinated care.ti,ab,id. (419)
111 patient centered care.ti,ab,id. (1878)
112 or/92-111 (200393)
113 ((weight loss or weight reduction or weight control or weight maintenance or weight management) adj3 (intervention$ or promot$ or program$)).ti,ab,id. (3796)
114 21 and (68 or 80 or 91 or 112 or 113) (12236)
115 random$.ti,ab,id,hw. (222452)
116 placebo$.ti,ab,hw,id. (42734)
117 (controlled trial$ or control group$).ti,ab,id,hw,md. (128455)
118 clinical trial$.ti,ab,id,hw. (42444)
119 meta analy$.ti,ab,hw,id. (44562)
120 treatment outcome.md. (22302)
121 (sham or dummy).ti,ab,id. (15073)
122 (single blind$ or double blind$ or triple blind$ or treble blind$).ti,ab,id. (27654)
123 (allocated or allocation).ti,ab,id. (29340)
124 (phase iii or phase 3).ti,ab,id. (3665)
125 or/115-124 (405727)
126 114 and 125 (2144)
127 (exp Overweight/ or weight loss/ or weight control/) and exp Drug Therapy/ (993)
128 Orlistat.ti,ab,id. (105)
129 tetrahydrolipstatin.ti,ab,id. (16)
130 Xenical.ti,ab,id. (3)
131 Alli.ti,ab,id. (39)
132 liraglutide.ti,ab,id. (99)
133 Saxenda.ti,ab,id. (1)
134 (setmelanotide or imcivree).ti,ab,id. (2)
135 or/127-134 (1186)
136 21 and 135 (152)

137 126 or 136 (2276)
138 limit 137 to (english language and yr="2016 -Current") (844)

Original *Cochrane Central Register of Controlled Clinical Trials (CENTRAL) via Wiley*
Date Run: 17/02/2022 01:04:16
ID Search Hits
#1 (child* or teen or teens or teenage* or adolescen* or youth or youths or young people or (young next adult*) or pediatric* or paediatric* or schoolchildren or school children or preschool* or (pre next school*) or toddler*):ti,ab,kw 327523
#2 (obese or obesity or overweight or "over weight"):ti,ab,kw 50546
#3 (weight next gain*):ti,ab,kw or (weight next loss*):ti,ab,kw 33810
#4 ((weight next change*) or (weight next reduc*)):ti,ab,kw 11144
#5 (bmi or body mass index):ti,ab,kw near/2 (gain* or loss* or change* or reduc*):ti,ab,kw 24183
#6 "weight maintenance":ti,ab,kw 1276
#7 "weight control":ti,ab,kw 1811
#8 "weight management":ti,ab,kw 2590
#9 {or #2-#8} 79480
#10 (psychological or behavior* or behaviour*):ti,ab,kw next (therap* or modif* or chang* or strateg* or intervention*):ti,ab,kw 43072
#11 psychotherapy:ti,ab,kw 13553
#12 (group or family or cognitive):ti,ab,kw next therap*:ti,ab,kw 11434
#13 cbt:ti,ab,kw 9270
#14 (lifestyle or "life style"):ti,ab,kw next (chang* or interven* or modif*):ti,ab,kw 10281
#15 counsel*:ti,ab,kw 25377
#16 (social* next support*):ti,ab,kw 8910
#17 (peer* near/2 support*):ti,ab,kw 1723
#18 (child* near/3 parent*):ti,ab,kw and therap*:ti,ab,kw 4569
#19 (family or parent*):ti,ab,kw next intervention*:ti,ab,kw 1797
#20 parent*:ti,ab,kw near/2 (behavior* or behaviour* or involv* or control* or attitude* or educat*):ti,ab,kw 6234
#21 health:ti,ab,kw next (education or promotion):ti,ab,kw 20436
#22 "patient education":ti,ab,kw 14323
#23 (nonpharmacologic or "non pharmacologic"):ti,ab,kw next intervention*:ti,ab,kw 298
#24 (self next regulat*):ti,ab,kw 2490
#25 school*:ti,ab,kw near/5 (intervention* or program*):ti,ab,kw 7916
#26 {or #10-#25} 127173
#27 (exercise or "physical activity"):ti 49281
#28 fitness:ti,ab,kw next (class* or regime* or program*):ti 301
#29 ("physical training" or "physical education"):ti 949
#30 (sedentary next (behavior* or behaviour*)):ti,ab,kw near/3 (reduc* or mimim* or less*):ti,ab,kw 424
#31 (exercise or "physical activity"):ti,ab,kw near/5 (intervention* or promot*):ti,ab,kw 20432
#32 {or #27-#31} 58252
#33 (diet or diets or dieting or dietary):ti 22266
#34 diet*:ti,ab,kw next (modif* or therap* or intervention* or strateg*):ti,ab,kw 17057
#35 ("low calorie" or (calori* next control*) or "healthy eating"):ti,ab,kw 4284
#36 (formula next diet*):ti,ab,kw 240
#37 weightwatcher*:ti,ab,kw or (weight next watcher*):ti,ab,kw 138

#38 {or #33-#37} 34957
#39 collaborat*:ti,ab,kw 13212
#40 (interdisciplinary or "inter disciplinary"):ti,ab,kw 2302
#41 (multidisciplinary or multi-disciplinary):ti,ab,kw 6970
#42 integrated:ti,ab,kw near/5 (healthcare or care):ti,ab,kw 2777
#43 (care or case):ti,ab,kw next manag*:ti,ab,kw 5134
#44 "cooperative care":ti,ab,kw 4
#45 "patient centered care":ti,ab,kw 1153
#46 "stepped care":ti,ab,kw 885
#47 "coordinated care":ti,ab,kw 154
#48 335-#47 29336
#49 Orlistat:ti,ab,kw 564
#50 tetrahydrolipstatin:ti,ab,kw 95
#51 Xenical:ti,ab,kw 41
#52 Alli:ti,ab,kw 33
#53 liraglutide:ti,ab,kw 2081
#54 Saxenda:ti,ab,kw 26
#55 (setmelanotide or imcivree):ti,ab,kw 14
#56 pharmacotherap*:ti,kw 3050
#57 336-#56 5715
#58 (("weight loss" or "weight reduction" or "weight control" or "weight maintenance" or "weight management") near/3 (intervention* or promot* or program*)):ti,ab,kw 6204
#59 #26 or #32 or #38 or #48 or #57 or #58 228422
#60 #1 and #9 and #59 with Publication Year from 2016 to present, in Trials 4378

Phen/TPM
Ovid MEDLINE(R) ALL <1946 to August 04, 2022>

1 Obesity/ 205894
2 Obesity, Morbid/ 24797
3 Obesity, Abdominal/ 4716
4 Overweight/ 30788
5 Weight Gain/ 34388
6 Weight Loss/ 41804
7 Weight Cycling/ 7
8 obesity.ti,ab,kf. 299932
9 obese.ti,ab,kf. 143414
10 overweight.ti,ab,kf. 82625
11 over weight.ti,ab,kf. 529
12 (weight adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,kf. 203138
13 ((bmi or body mass ind$) adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,kf. 11138
14 weight maintenance.ti,ab,kf. 2398
15 weight control.ti,ab,kf. 6928
16 weight manag$.ti,ab,kf. 7962
17 or/1-16 583323
18 Child/ or Child, Preschool/ or Adolescent/ or Young Adult/ or Minors/ 3735743

19 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,kf. 1352057
20 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,ab,kf. 2099675
21 limit 20 to ("in data review" or in process or "pubmed not medline") 193816
22 17 and (18 or 19 or 21) 129454
23 Pediatric Obesity/ 12582
24 22 or 23 130446
25 Counseling/ 38848
26 Directive Counseling/ 2429
27 Behavior therapy/ 29784
28 Aversive therapy/ 821
29 Biofeedback, Psychology/ 7632
30 Feedback, Psychological/ 3722
31 Cognitive therapy/ 29194
32 "Acceptance and commitment therapy"/ 739
33 Mindfulness/ 5476
34 Desensitization, psychologic/ 1581
35 Relaxation therapy/ 6530
36 Meditation/ 3553
37 Social Support/ 77185
38 Psychotherapy, Group/ 14412
39 Family Therapy/ 9124
40 Persuasive Communication/ 3965
41 Risk Reduction Behavior/ 14130
42 Health Education/ 63044
43 Health Promotion/ 79829
44 Patient Education as Topic/ 88112
45 "Early Intervention (Education)"/ 3422
46 ((psychological or behavio?r$) adj (therap$ or modif$ or chang$ or strateg$ or intervention$)).ti,ab,kf. 101199
47 (group therap$ or family therap$ or cognitive therap$).ti,ab,kf. 13080
48 (cbt or dcbt).ti,ab,kf. 13692
49 ((lifestyle or life style) adj (chang$ or interven$ or modif$)).ti,ab,kf. 27185
50 counsel?ing.ti,ab,kf. 110510
51 social$ support$.ti,ab,kf. 50358
52 (peer$ adj2 support$).ti,ab,kf. 7845
53 ((child$ adj3 parent$) and therap$).ti,ab,kf. 5645
54 (family intervention$ or parent$ intervention$).ti,ab,kf. 3324
55 (parent$ adj2 (behavio?r$ or involv$ or control$ or attitude$ or educat$)).ti,ab,kf. 32199
56 health education.ti,ab,kf. 39799
57 health promotion.ti,ab,kf. 39269
58 patient education.ti,ab,kf. 22608
59 nonpharmacologic intervention$.ti,ab,kf. 952
60 non pharmacologic intervention$.ti,ab,kf. 317
61 self regulat$.ti,ab,kf. 15108

62 (school$ adj5 (intervention$ or program$)).ti,ab,kf. 26858
63 or/25-62 734721
64 Exercise/ 134123
65 Physical Conditioning, Human/ 2869
66 (exercise or physical activity).ti,kf. 197107
67 aerobic$.ti,kf. 25953
68 (fitness adj (class$ or regime$ or program$)).ti,kf. 313
69 (physical training or physical education).ti,kf. 5633
70 (sedentary behavio?r$ adj3 reduc$).ti,ab,kf. 980
71 ((exercise or physical activity) adj5 (intervention$ or promot$)).ti,ab,kf. 34377
72 telerehabilitation/ 836
73 or/64-72 280908
74 diet, fat-restricted/ 3957
75 diet, reducing/ 11464
76 Diet, Carbohydrate-Restricted/ 1987
77 diet therapy/ 10915
78 Caloric Restriction/ 7024
79 Food Habits/ 90878
80 (diet or diets or dieting or dietary).ti,kf. 221781
81 (diet$ adj (modif$ or therap$ or intervention$ or strateg$)).ti,ab,kf. 22350
82 (low calorie or calori$ control$ or healthy eating).ti,ab,kf. 13225
83 formula diet$.ti,ab,kf. 716
84 (weightwatcher$ or weight watcher$).ti,ab,kf. 157
85 or/74-84 330707
86 Case management/ 10489
87 Patient care team/ 68939
88 Cooperative behavior/ 45705
89 Interprofessional Relations/ 52927
90 Continuity of patient care/ 20415
91 Patient-centered care/ 22291
92 Patient care management/ 4742
93 Delivery of Health Care, Integrated/ 14000
94 collaborat$.ti,ab,kf. 182560
95 (interdisciplinary or inter disciplinary).ti,ab,kf. 45755
96 (multidisciplinary or multi disciplinary).ti,ab,kf. 114836
97 (integrated adj5 (healthcare or care)).ti,ab,kf. 19527
98 care manag$.ti,ab,kf. 12311
99 case manag$.ti,ab,kf. 14828
100 cooperative care.ti,ab,kf. 103
101 coordinated care.ti,ab,kf. 1554
102 patient centered care.ti,ab,kf. 6879
103 stepped care.ti,ab,kf. 1551
104 telemedicine/ 34465
105 or/86-104 553153
106 Anti-Obesity Agents/ 5630
107 pharmacotherap$.ti,kf. 12269
108 Lactones/ 19481
109 Orlistat/ 1332

110 Orlistat.ti,ab,kf. 1847
111 tetrahydrolipstatin.ti,ab,kf. 212
112 Xenical.ti,ab,kf. 105
113 Alli.ti,ab,kf. 109
114 glucagon-like peptide 1/ 8986
115 liraglutide/ 2277
116 liraglutide.ti,ab,kf. 3451
117 Saxenda.ti,ab,kf. 38
118 (setmelanotide or imcivree).ti,ab,kf. 57
119 or/106-118 48475
120 Weight Reduction Programs/ 2752
121 ((weight loss or weight reduction) adj3 (intervention$ or promot$ or program$)).ti,ab,kf. 8899
122 24 and (63 or 73 or 85 or 105 or 119 or 120 or 121) 41596
123 Pediatric Obesity/dh, dt, pc, rh, th [Diet Therapy, Drug Therapy, Prevention & Control, Rehabilitation, Therapy] 5026
124 Obesity/dh, dt, pc, rh, th 51954
125 Obesity, Morbid/dh, dt, pc, rh, th 1909
126 Obesity, Abdominal/dh, dt, pc, rh, th 521
127 Overweight/dh, dt, pc, rh, th 6813
128 or/124-127 57214
129 128 and (18 or 19 or 21) 15327
130 122 or 123 or 129 47070
131 (randomized controlled trial or controlled clinical trial or clinical trial or meta analysis).pt. or clinical trials as topic.sh. or exp Randomized Controlled Trials as Topic/ or (randomized or randomised or placebo or randomly or phase iii or phase 3 or clinical trial or controlled trial).ti,ab,kf. or trial.ti,kf. 1939010
132 control groups/ or double-blind method/ or single-blind method/ or random allocation/ or placebos/ 322738
133 (RCT or placebo or sham or dummy or single blind$ or double blind$ or allocated or allocation or triple blind$ or treble blind$ or random$).ti,ab,kf. not medline.st. 220278
134 or/131-133 2084987
135 130 and 134 10392
136 limit 135 to (english language and yr="2016 -Current") 4642
137 24 and 119 917
138 Pediatric Obesity/dt 102
139 Obesity/dt or Obesity, Morbid/dt or Obesity, Abdominal/dt or Overweight/dt 12207
140 139 and (18 or 19 or 21) 1331
141 137 or 138 or 140 2035
142 limit 141 to (english language and yr="2016 -Current") 654
143 136 or 142 4934
144 143 not (animals/ not humans/) 4924
145 (Phentermine/ or (Phentermine or adipex-p or Lomaira or Suprenza or sentis).ti,ab,kf.) and (Topiramate/ or (Topiramate or Trokendi XR or Qudexy XR or Topamax or eprontia or Topiramic acid).ti,ab,kf.) 295
146 "PHEN/TPM".ti,ab,kf. 16
147 145 or 146 296
148 24 and 147 24
149 limit 148 to (english language and yr="2012 -Current") 23

150 149 not (animals/ not humans/) 23
151 150 not 144 7

Phen/TPM
APA PsycInfo <1806 to July Week 4 2022>

1 obesity/ 27306
2 overweight/ 5063
3 weight gain/ 3426
4 weight control/ 5290
5 weight loss/ 4342
6 (Obesity or Obesity, Morbid or Obesity, Abdominal or Overweight).mh. 17947
7 Weight Cycling.mh. 0
8 obesity.ti,ab,id. 39147
9 obese.ti,ab,id. 17144
10 overweight.ti,ab,id. 16830
11 over weight.ti,ab,id. 124
12 (weight adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,id. 26887
13 ((bmi or body mass ind$) adj2 (gain$ or loss$ or change$ or reduc$)).ti,ab,id. 1885
14 weight maintenance.ti,ab,id. 593
15 weight control.ti,ab,id. 2964
16 weight manag$.ti,ab,id. 2642
17 or/1-16 69572
18 limit 17 to (100 childhood <birth to age 12 yrs> or 200 adolescence <age 13 to 17 yrs>) 16967
19 (child$ or teen or teens or teenage$ or adolescen$ or youth or youths or young people or young adult$ or pediatric$ or paediatric$ or schoolchildren or school children or preschool$ or pre school$ or toddler$).ti,ab,id. 1026546
20 17 and 19 21024
21 18 or 20 23423
22 Behavior Therapy/ 15299
23 Cognitive Behavior Therapy/ 22693
24 Cognitive Therapy/ 13857
25 Cognitive Techniques/ 1720
26 Behavior Modification/ 10657
27 Behavior Change/ 13191
28 Lifestyle Changes/ 1460
29 Lifestyle/ 11633
30 School Counseling/ 6416
31 Psychotherapeutic Counseling/ 1606
32 Peer Counseling/ 1204
33 Group Counseling/ 5136
34 Community Counseling/110
35 Motivational Interviewing/ 2899
36 Feedback/ 20494
37 Biofeedback/ 2544
38 Health Education/ 14296
39 Health Promotion/ 27389
40 Client Education/ 4417

41 Self Regulation/ 11344
42 Intervention/ 79834
43 School Based Intervention/ 21323
44 Family Intervention/ or Family Therapy/ 25723
45 Early Intervention/ 11992
46 aversion therapy/ 584
47 "Acceptance and commitment therapy"/ 2348
48 Mindfulness/ 11737
49 Social Support/ 41097
50 support groups/ 4516
51 ((psychological or behavio?r$) adj (therap$ or modif$ or chang$ or strateg$ or intervention$)).ti,ab,id. 100740
52 (group therap$ or family therap$ or cognitive therap$).ti,ab,id. 41665
53 cbt.ti,ab,id. 16335
54 ((lifestyle or life style) adj (chang$ or interven$ or modifi$)).ti,ab,id. 5200
55 counsel$.ti,ab,id. 119083
56 social$ support$.ti,ab,id. 57804
57 (peer adj2 support).ti,ab,id. 6318
58 ((child$ adj3 parent$) and therapy).ti,ab,id. 5962
59 (family intervention$ or parent$ intervention$).ti,ab,id. 5445
60 (parent$ adj2 (behavio?r$ or involv$ or control$ or attitude$ or educat$)).ti,ab. 45252
61 health education.ti,ab,id. 11920
62 health promotion.ti,ab,id. 21762
63 patient education.ti,ab,id. 4143
64 nonpharmacologic intervention$.ti,ab,id. 250
65 non pharmacologic intervention$.ti,ab,id. 106
66 self regulat$.ti,ab,id. 25123
67 (school$ adj5 (intervention$ or program$)).ti,ab,id. 43297
68 or/22-67 611669
69 Physical Activity/ 24164
70 Physical Fitness/ 4714
71 Exercise/ 26025
72 Aerobic Exercise/ 2192
73 Active Living/ 273
74 (exercise or physical activity).ti,id. 44979
75 aerobic$.ti,id. 2554
76 (fitness adj (class$ or regime$ or program$)).ti,id. 224
77 (physical training or physical education).ti,id. 4741
78 (sedentary behavio?r$ adj3 reduc$).ti,ab,id. 350
79 ((exercise or physical activity) adj5 (intervention$ or promot$)).ti,ab,id. 11418
80 or/69-79 60342
81 Diets/ 14620
82 Dietary Restraint/ 1832
83 Food Intake/ 15385
84 Eating Behavior/ 15602
85 Healthy Eating/ 99
86 "obesity (attitudes toward)"/ 453
87 (diet or diets or dieting or dietary).ti. 11141

88 (diet$ adj (modif$ or therapy or intervention$ or strateg$)).ti,ab,id. 1608
89 (low calorie or calori$ control$ or healthy eating or formula diet$).ti,ab,id. 4261
90 (weightwatcher$ or weight watcher$).ti,ab,id. 68
91 or/81-90 46469
92 Interdisciplinary Treatment Approach/ 7778
93 Collaboration/ 13746
94 Cooperation/ 15925
95 Case Management/ 3387
96 Work Teams/ 5771
97 Community Mental Health Services/ 7979
98 Health Care Delivery/ 21995
99 Community Psychology/ 2449
100 Community Psychiatry/ 904
101 client centered therapy/ 3568
102 "continuum of care"/ 2136
103 collaborat$.ti,ab,id. 96686
104 (interdisciplinary or inter disciplinary).ti,ab,id. 26834
105 (multidisciplinary or multi disciplinary).ti,ab,id. 23506
106 (integrated adj5 (healthcare or care)).ti,ab,id. 6248
107 care manag$.ti,ab,id. 3017
108 case manag$.ti,ab,id. 7285
109 cooperative care.ti,ab,id. 45
110 coordinated care.ti,ab,id. 438
111 patient centered care.ti,ab,id. 1972
112 or/92-111 205848
113 ((weight loss or weight reduction or weight control or weight maintenance or weight management) adj3 (intervention$ or promot$ or program$)).ti,ab,id. 3872
114 21 and (68 or 80 or 91 or 112 or 113) 12507
115 random$.ti,ab,id,hw. 228121
116 placebo$.ti,ab,hw,id. 43245
117 (controlled trial$ or control group$).ti,ab,id,hw,md. 131751
118 clinical trial$.ti,ab,id,hw. 43475
119 meta analy$.ti,ab,hw,id. 46548
120 treatment outcome.md. 22707
121 (sham or dummy).ti,ab,id. 15434
122 (single blind$ or double blind$ or triple blind$ or treble blind$).ti,ab,id. 28058
123 (allocated or allocation).ti,ab,id. 30101
124 (phase iii or phase 3).ti,ab,id. 3751
125 or/115-124 415291
126 114 and 125 2205
127 (exp Overweight/ or weight loss/ or weight control/) and exp Drug Therapy/ 1007
128 Orlistat.ti,ab,id. 105
129 tetrahydrolipstatin.ti,ab,id. 16
130 Xenical.ti,ab,id. 3
131 Alli.ti,ab,id. 40
132 liraglutide.ti,ab,id. 106
133 Saxenda.ti,ab,id. 1
134 (setmelanotide or imcivree).ti,ab,id. 2

135 or/127-134 1206
136 21 and 135 153
137 126 or 136 2338
138 limit 137 to (english language and yr="2016 -Current") 900
139 ((Phentermine or adipex-p or Lomaira or Suprenza or sentis) and (Topiramate or Trokendi XR or Qudexy XR or Topamax or eprontia or Topiramic acid)).ti,ab,id. 25
140 "PHEN/TPM".ti,ab,id. 2
141 139 or 140 25
142 21 and 141 0

Phen/TPM
Cochane via Wiley
Date Run: 06/08/2022 03:08:18
ID Search Hits
#1 (child* or teen or teens or teenage* or adolescen* or youth or youths or young people or (young next adult*) or pediatric* or paediatric* or schoolchildren or school children or preschool* or (pre next school*) or toddler*):ti,ab,kw 334893
#2 (obese or obesity or overweight or "over weight"):ti,ab,kw 51655
#3 (weight next gain*):ti,ab,kw or (weight next loss*):ti,ab,kw 34377
#4 ((weight next change*) or (weight next reduc*)):ti,ab,kw 11022
#5 (bmi or body mass index):ti,ab,kw near/2 (gain* or loss* or change* or reduc*):ti,ab,kw 24845
#6 "weight maintenance":ti,ab,kw 1288
#7 "weight control":ti,ab,kw 1821
#8 "weight management":ti,ab,kw 2654
#9 {or #2-#8} 81090
#10 (psychological or behavior* or behaviour*):ti,ab,kw next (therap* or modif* or chang* or strateg* or intervention*):ti,ab,kw 44336
#11 psychotherapy:ti,ab,kw 13876
#12 (group or family or cognitive):ti,ab,kw next therap*:ti,ab,kw 11484
#13 cbt:ti,ab,kw 9473
#14 (lifestyle or "life style"):ti,ab,kw next (chang* or interven* or modif*):ti,ab,kw 10689
#15 counsel*:ti,ab,kw 26085
#16 (social* next support*):ti,ab,kw 9198
#17 (peer* near/2 support*):ti,ab,kw 1795
#18 (child* near/3 parent*):ti,ab,kw and therap*:ti,ab,kw 4745
#19 (family or parent*):ti,ab,kw next intervention*:ti,ab,kw 1842
#20 parent*:ti,ab,kw near/2 (behavior* or behaviour* or involv* or control* or attitude* or educat*):ti,ab,kw 6440
#21 health:ti,ab,kw next (education or promotion):ti,ab,kw 21203
#22 "patient education":ti,ab,kw 14568
#23 (nonpharmacologic or "non pharmacologic"):ti,ab,kw next intervention*:ti,ab,kw 298
#24 (self next regulat*):ti,ab,kw 2578
#25 school*:ti,ab,kw near/5 (intervention* or program*):ti,ab,kw 8120
#26 {or #10-#25} 130896
#27 (exercise or "physical activity"):ti 50809
#28 fitness:ti,ab,kw next (class* or regime* or program*):ti 305
#29 ("physical training" or "physical education"):ti 984

#30 (sedentary next (behavior* or behaviour*)):ti,ab,kw near/3 (reduc* or mimim* or less*):ti,ab,kw 436
#31 (exercise or "physical activity"):ti,ab,kw near/5 (intervention* or promot*):ti,ab,kw 21201
#32 {or #27-#31} 60183
#33 (diet or diets or dieting or dietary):ti 22625
#34 diet*:ti,ab,kw next (modif* or therap* or intervention* or strateg*):ti,ab,kw 17251
#35 ("low calorie" or (calori* next control*) or "healthy eating"):ti,ab,kw 4361
#36 (formula next diet*):ti,ab,kw 242
#37 weightwatcher*:ti,ab,kw or (weight next watcher*):ti,ab,kw 137
#38 {or #33-#37} 35465
#39 collaborat*:ti,ab,kw 13707
#40 (interdisciplinary or "inter disciplinary"):ti,ab,kw 2398
#41 (multidisciplinary or multi-disciplinary):ti,ab,kw 7266
#42 integrated:ti,ab,kw near/5 (healthcare or care):ti,ab,kw 2881
#43 (care or case):ti,ab,kw next manag*:ti,ab,kw 5239
#44 "cooperative care":ti,ab,kw 4
#45 "patient centered care":ti,ab,kw 1206
#46 "stepped care":ti,ab,kw 894
#47 "coordinated care":ti,ab,kw 158
#48 335-#47 30372
#49 Orlistat:ti,ab,kw 569
#50 tetrahydrolipstatin:ti,ab,kw 93
#51 Xenical:ti,ab,kw 42
#52 Alli:ti,ab,kw 33
#53 liraglutide:ti,ab,kw 2118
#54 Saxenda:ti,ab,kw 27
#55 (setmelanotide or imcivree):ti,ab,kw 24
#56 pharmacotherap*:ti,kw 3059
#57 336-#56 5775
#58 (("weight loss" or "weight reduction" or "weight control" or "weight maintenance" or "weight management") near/3 (intervention* or promot* or program*)):ti,ab,kw 6286
#59 #26 or #32 or #38 or #48 or #57 or #58 234840
#60 #1 and #9 and #59 with Publication Year from 2016 to present, in Trials 4582
#61 (Phentermine or adipex-p or Lomaira or Suprenza or sentis) AND (Topiramate or "Trokendi XR" or "Qudexy XR" or Topamax or eprontia or "Topiramic acid"):ti,ab,kw 106
#62 "PHEN/TPM":ti,ab,kw 47
#63 #61 or #62 108
#64 #1 and #9 and #63 with Publication Year from 2012 to present, in Trials 15
#65 #64 not #60 10

Appendix A Table 1. Inclusion and Exclusion Criteria

	Include	Exclude
Condition definition	Studies identifying children with higher BMI, using measures such as BMI percentile (e.g., ≥85th percentile or ≥95th percentile), BMI z-score, percent overweight, or waist circumference	
Aim	Studies with a primary aim of promoting weight reduction or stabilization, or maintenance of previous weight reduction or stabilization	Healthy lifestyle counseling with no weight-related aim
Population	Children and adolescents ages 2 to 18 years • Age- and sex-specific BMI ≥85th percentile or meets other similar criteria for higher BMI • Previously had higher BMI and is now engaged in maintenance of weight loss or improved weight trajectory	• Studies with an average age younger than 2 years or older than 18 years • Populations limited exclusively to youth who: ○ Have an eating disorder ○ Are pregnant or postpartum ○ Have medical conditions, such as diabetes (type 1 or 2), polycystic ovarian syndrome, hypothyroidism, Cushing's syndrome, growth hormone deficiency, insulinoma, hypothalamic disorders (e.g., Froelich syndrome, Bardet-Biedl syndrome, or Prader-Willi syndrome), asthma, or intellectual and developmental disabilities, or who are using medication associated with weight gain (e.g., antipsychotics) ○ Are in college (unless primarily includes persons age 18 years and younger)
Intervention	• Weight management interventions include behavioral counseling, pharmacotherapy, and healthcare system–level approaches • Designed to promote weight reduction or stabilization, or maintenance of previous weight reduction or stabilization • May include the following, alone or in combination: ○ Behavioral-based interventions (e.g., behavior modification, cognitive behavioral therapy, mindfulness interventions, or health-behavior change counseling and coaching) ○ Pharmacologic interventions approved by the FDA for weight loss (i.e., orlistat and liraglutide) ○ Health system–level interventions (e.g., stepped care or collaborative care) • Must be either conducted in a primary care setting, feasible in "usual" primary care, or referable from primary care. Must at least involve the healthcare system in some way (may be limited to recruitment)	• Primary prevention in children who are normal weight • Surgical interventions • Studies that include elements that cannot be implemented in the healthcare setting (e.g., changes in the physical/built environment or legislation) • Complementary and alternative medicine approaches (e.g., herbal supplements, acupuncture, Chinese medicine, or yoga) • Studies that provide all or most of participants' food • Pharmacologic interventions not approved for weight loss by the FDA (e.g., metformin)

Appendix A Table 1. Inclusion and Exclusion Criteria

	Include	Exclude
Comparator	Control groups with: • No intervention (e.g., wait-list control or usual care) • Minimal intervention (e.g., pamphlets or single annual session presenting information similar to what intervention groups receive through usual care in a primary care setting) • Attention control (e.g., similar format and intensity of intervention on a different content area) • Weight-neutral healthy lifestyle intervention • Placebo or no medication control for medication trials (both groups may include a behavioral weight management component)	Comparative effectiveness studies; the following components are too intensive to be considered usual care, so would be considered active comparators, including: • Personalized prescription for weight loss and exercise based on standardized dietary assessment • Homework, such as study-provided self-help workbooks with a weight loss focus • More than two annual intervention contacts (unless content not related to weight loss)

Appendix A Table 1. Inclusion and Exclusion Criteria

	Include	Exclude
Outcomes	**Health outcomes:** • Cardiovascular or weight-related morbidity or mortality • Quality of life or functioning • Depression **Intermediate outcomes:** • Reduction or stabilization of weight or adiposity (required outcome). Acceptable measures include weight (kilograms or pounds), age- and sex-normative weight (BMI percentile, percent of the median BMI, percent of the 95th percentile BMI, or z-score for age and sex), relative weight (BMI or percent overweight), total adiposity (e.g., dual-energy x-ray absorptiometry, underwater weight, or comparable), other similar measures, or change in any of these measures • Weight maintenance after an intervention has ended • Cardiometabolic measures (included only when weight-related measures are also reported): insulin resistance/blood glucose/diabetes, blood pressure/hypertension, lipid levels/dyslipidemia, or metabolic syndrome • Liver dysfunction/nonalcoholic fatty liver disease • Physical fitness capacity or performance **Behavioral Outcomes:** • Dietary pattern score • Minutes per week of moderate-to-vigorous physical activity or MET-minutes per week • Percent meeting physical activity goals • Sedentary behavior or screen time **Harms:** • Harms associated with labeling • Stigma or increased body image concerns or negative mental health effects • Negative impacts on provider-patient relationship (e.g., care avoidance or dissatisfaction with care) • Unhealthy weight management efforts (e.g., using laxatives or self-induced vomiting) or eating patterns (excessive fasting, overly restrictive eating, or binging) • Suppressed growth • Exercise-induced injury • Serious treatment-related harms at any time after initiation of intervention (i.e., death or medical issue requiring hospitalization or urgent medical treatment) or other treatment-related harms reported in trials meeting inclusion criteria for intermediate or health outcomes	• Individual dietary intake components (e.g., fats, fiber, fruits, and vegetables) • Kilocalories/day
Timing of outcome assessment	**All KQs (except serious harms of pharmacotherapy):** ≥6 months after baseline or beginning of weight loss phase **KQ 4 (serious harms of pharmacotherapy):** No minimum followup. Serious harms are events resulting in death, hospitalization, or the need for urgent medical treatment	

Appendix A Table 1. Inclusion and Exclusion Criteria

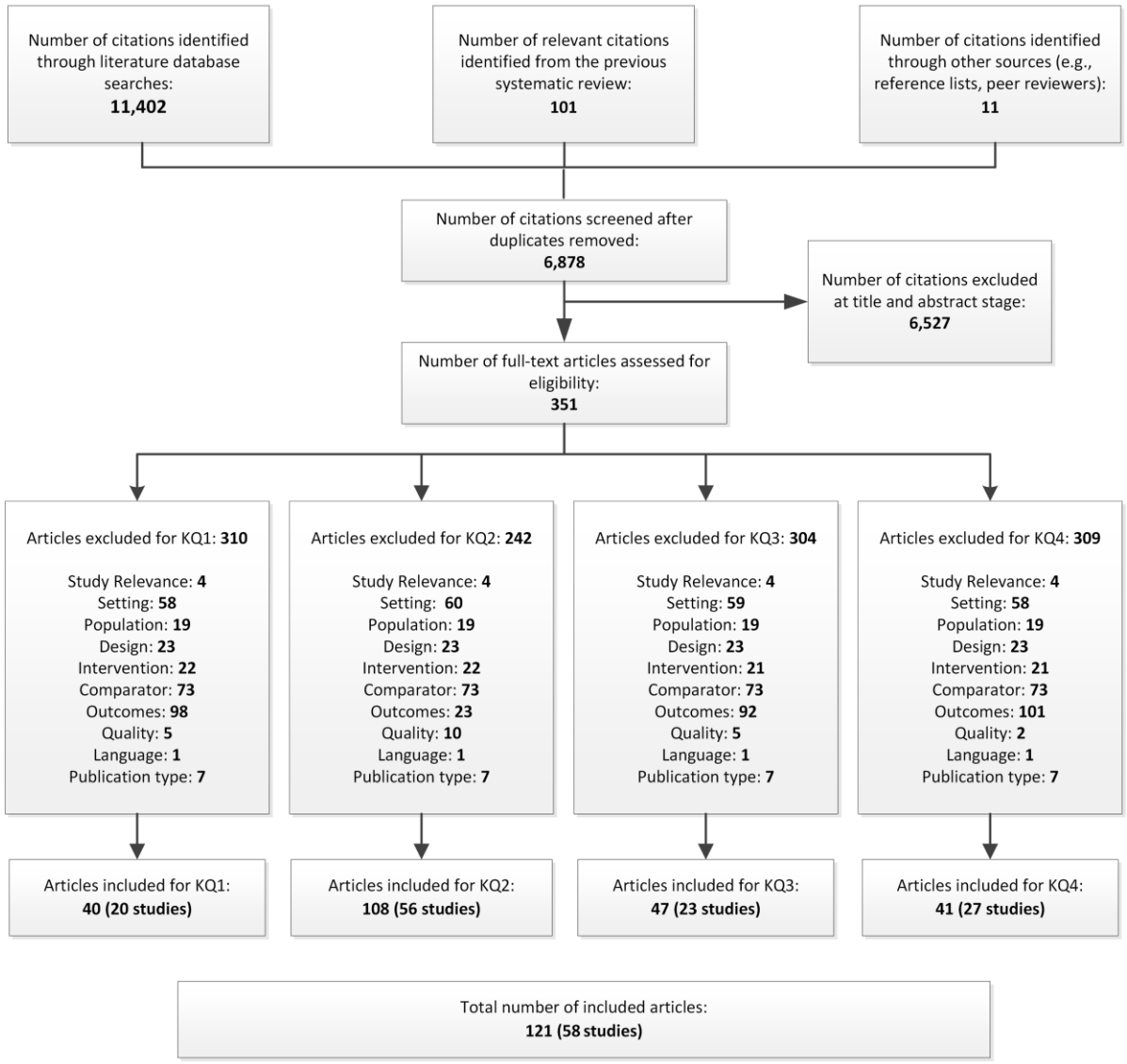
	Include	Exclude
Setting	• Primary care settings (e.g., pediatrics, family medicine, or school-based health clinics) • Other outpatient healthcare settings • Phone, mobile, or virtual settings (e.g., online intervention, if there is some connection to a health setting, such as recruitment from a healthcare setting) • Community or research settings, if there is some connection to a health setting (e.g., recruitment from a healthcare setting)	• Community/university research laboratories or other nonmedical centers • College settings • Mental health clinics (unless recruitment is through primary care screening) • Correctional facilities • School classrooms • Worksites • Inpatient/residential facilities • Emergency departments
Study design	**All KQs:** Randomized, controlled trials **KQ 4 (serious harms of pharmacotherapy):** Large nonrandomized studies of interventions, defined as quantitative studies estimating the harms of an intervention that does not use randomization to allocate units to intervention groups. Such studies include those in which allocation occurs in the course of usual treatment decisions or according to patients' choices	All other study designs
Country	Studies that take place in countries categorized as "Very High" on the 2019 Human Development Index (as defined by the United Nations Development Programme)	Primary studies that are conducted in countries that are not categorized as "Very High" on the Human Development Index
Language	English	Languages other than English
Study quality	Fair or good	Poor, according to design-specific USPSTF criteria

Appendix A Table 2. Study-Specific Quality Rating Criteria*

Study Design	Adapted Quality Criteria
Randomized and non-randomized controlled trials, adapted from the U.S. Preventive Services Task Force methods	**Bias arising in the randomization process or due to confounding** • Valid random assignment/random sequence generation method used • Allocation concealed • Balance in baseline characteristics **Bias in selecting participants into the study** • CCT only: No evidence of biased selection of sample **Bias due to departures from intended interventions** • Fidelity to the intervention protocol • Low risk of contamination between groups • Participants were analyzed as originally allocated **Bias from missing data** • No, or minimal, post-randomization exclusions • Outcome data are reasonably complete and comparable between groups • Reasons for missing data are similar across groups • Missing data are unlikely to bias results **Bias in measurement of outcomes** • Blinding of outcome assessors • Outcomes are measured using consistent and appropriate procedures and instruments across treatment groups • No evidence of inferential statistics **Bias in reporting results selectively** • No evidence that the measures, analyses, or subgroup analyses are selectively reported

*Good quality studies generally meet all quality criteria. Fair quality studies do not meet all the criteria but do not have critical limitations that could invalidate study findings. Poor quality studies have a single fatal flaw or multiple important limitations that could invalidate study findings. Critical appraisal of studies using *a priori* quality criteria are conducted independently by at least two reviewers. Disagreements in final quality assessment are resolved by consensus, and, if needed, consultation with a third independent reviewer

Appendix A Figure 1. Literature Flow Diagram



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Davoli, AM, Broccoli, S, et al. Pediatrician-led motivational interviewing to treat overweight children: an RCT. Pediatrics. 132(5): e1236-46. 2013. PMID: 24144717. https://dx.doi.org/10.1542/peds.2013-1738

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Appendix C. Excluded Studies

Reason for Exclusion*
E1. Study relevance
E2. Setting (not in a very high HDI country)
E2a. Insufficient connection to health care
E3. Population (other than age or listed below)
E3a. Limited to average age younger than 2 yrs old or older than 18 yrs
E3b. Limited exclusively to youth who have an active eating disorder, are pregnant or postpartum, have overweight or obesity secondary to a genetic or medical condition, are in college
E4. Study design
E5. Intervention
E5a. Primary prevention in children who are normal weight
E5b. Intervention: Metformin
E5c. Surgical interventions
E5d. Complementary and alternative medicine approaches
E5e. Study provides all or most of participants' food
E6. Comparator
E7. No relevant outcomes
E7a. Timing of outcome assessment <6 mo after baseline
E8. Study quality
E9. Language
E10. Conference abstract only/study on-going with no results published yet

1. Aagaard, L, Hallgreen, CE, et al. Serious adverse events reported for antiobesity medicines: postmarketing experiences from the EU adverse event reporting system EudraVigilance. Int J Obes. 40(11): 1742-1747. 2016. PMID: 27478924. https://dx.doi.org/https://dx.doi.org/10.1038/ijo.2016.135 **KQ1E4, KQ2E4, KQ3E4, KQ4E4**
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Appendix D Table 1. Population Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Recruitment Setting	% Female	Age range (mean)	% Race/Ethnicity	Relative weight measures	Economically disadvantaged
Boutelle, 2014[106] Fair	Mixed	50	8-12 (10)	Asian: NR Black: NR Latino: NR Native Amer: NR White: 69	BMI: 27.3 zBMI: 2.10 % >95th %ile: NR	No
Broccoli, 20161[107] Good	Primary Health Care	62	4-7 (7)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 18.2 zBMI: 1.35 % >95th %ile: NR	No
Bryant, 2011[108] Fair	Mixed	64	8-16 (11)	Asian: 4.3 Black: 4.3 Latino: NR Native Amer: NR White: 87	BMI: NR zBMI: 2.99 % >95th %ile: 100	Yes: Author states "The majority of families were economically disadvantaged".
Croker, 2012[109] Fair	Mixed	69	8-12 (10)	Asian: 13.9 Black: 19.4 Latino: NR Native Amer: NR White: 57	BMI: 30.6 zBMI: 3.2 % >95th %ile: NR	No
Davis, 2012[110] Fair	Other	55	NR (16)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 34.9 zBMI: 2.2 % >95th %ile: NR	No
DeBar, 2012[111] Good	Primary Health Care	100	12-17 (14)	Asian: NR Black: NR Latino: NR Native Amer: NR White: 72	BMI: 31.9 zBMI: 2.00 % >95th %ile: 84.1	No
Derwig, 2022[112] Fair	Primary Health Care	54	4 (4)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 18.1 zBMI: 1.6 % >95th %ile: 24.1	No
Gerards, 2015[113] Fair	Mixed	56	4-8 (7)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 20.5 zBMI: 1.84 % >95th %ile: 63	No
Golley, 2007[114] Fair	Other	63	6-9 (8)	Asian: NR Black: NR Latino: NR Native Amer: NR White: 98	BMI: 24.3 zBMI: 2.75 % >95th %ile: 73.9	No

Appendix D Table 1. Population Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Recruitment Setting	% Female	Age range (mean)	% Race/Ethnicity	Relative weight measures	Economically disadvantaged
Ho, 2016[115] Fair	Health Care	55	8-16 (11)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 29.1 zBMI: 2.7 % >95th %ile:	No
Hofsteenge, 2014[116] Fair	Health Care	56	11-18 (14)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 33.4 zBMI: 2.93 % >95th %ile: 90.2	No
Kalarchian, 2009[117] Fair	Health Care	57	8-12 (10)	Asian: 0.5 Black: 26 Latino: 1 Native Amer: 0 White: 73	BMI: 32.1 zBMI: NR % >95th %ile: 100	No
Kalavainen, 2007[118] Fair	Mixed	60	7-9 (8)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 23.2 zBMI: 2.6 % >95th %ile: 100	No
Kong, 2013[119] Fair	Other	59	NR (15)	Asian: 10 Black: NR Latino: 69 Native Amer: 6 White: NR	BMI: NR zBMI: NR % >95th %ile: NR	No
Kose, 2021[120] Fair	Primary Health Care	61	12-18 (14.4)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 30.4 zBMI: NR % >95th %ile:	No
Lison, 2012[121] Fair	Health Care	49	6-16 (12)	Asian: NR Black: NR Latino: NR Native Amer: NR White: 100	BMI: 29.1 zBMI: 2.13 % >95th %ile: 87.3	No
Looney, 2014[122] Fair	Mixed	68	4-10 (8)	Asian: 4.5 Black: 4.5 Latino: 9.1 Native Amer: NR White: 73	BMI: NR zBMI: 2.34 % >95th %ile: NR	No
Love-Osborne, 2014[123] Fair	Other	52	12-18 (16)	Asian: NR Black: NR Latino: 88.5 Native Amer: NR White: NR	BMI: 31.7 zBMI: 1.90 % >95th %ile: NR	No

Appendix D Table 1. Population Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Recruitment Setting	% Female	Age range (mean)	% Race/Ethnicity	Relative weight measures	Economically disadvantaged
McCallum, 2007[124] Good	Primary Health Care	52	5-9 (7)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 20.3 zBMI: 1.9 % >95th %ile: 28.2	No
Mellin, 1987[125] Fair	Mixed	79	12-18 (16)	Asian: 1.5 Black: 3 Latino: 7.6 Native Amer: NR White: 88	BMI: NR zBMI: NR % >95th %ile: 100	No
Nemet, 2005[126] Fair	Not reported	44	6-16 (11)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 28.2 zBMI: NR % >95th %ile: 100	No
Norman, 2016[127] Fair	Primary Health Care	51	11-13 (12)	Asian: 1.9 Black: 3.8 Latino: 82.1 Native Amer: NR White: 8	BMI: 29.3 zBMI: 2.1 % >95th %ile: 100	No
O'Connor, 2013[128] Fair	Primary Health Care	80	5-8 (7)	Asian: NR Black: 12.5 Latino: 82.5 Native Amer: NR White: 5	BMI: NR zBMI: NR % >95th %ile: NR	Yes: 100% recipient of Medicaid/CHIP
Patrick, 2013[129] Fair	Mixed	63	12-16 (14)	Asian: 4 Black: 16 Latino: 74 Native Amer: 4 White: 18	BMI: NR zBMI: 2.2 % >95th %ile:	No
Raynor, 2012a[130] Fair	Mixed	61	4-9 (7)	Asian: NR Black: NR Latino: 18.8 Native Amer: NR White: 86	BMI: NR zBMI: 2.32 % >95th %ile: 100	No
Raynor, 2012b[130] Fair	Mixed	60	4-9 (7)	Asian: NR Black: NR Latino: 11.1 Native Amer: NR White: 90	BMI: NR zBMI: 2.27 % >95th %ile: 100	No
Reinehr, 2010[131] Fair	Mixed	61	8-16 (12)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 23.8 zBMI: 1.66 % >95th %ile: 0	No

Appendix D Table 1. Population Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Recruitment Setting	% Female	Age range (mean)	% Race/Ethnicity	Relative weight measures	Economically disadvantaged
Resnicow, 2015[132] Fair	Primary Health Care	57	2-8 (5)	Asian: 5.7 Black: 6.6 Latino: 21.6 Native Amer: NR White: 60	BMI: NR zBMI: NR % >95th %ile: NR	No
Sacher, 2010[133] Fair	Mixed	54	8-12 (10)	Asian: NR Black: NR Latino: NR Native Amer: NR White: 50	BMI: 27.2 zBMI: 2.77 % >95th %ile: 100	No
Saelens, 2002[134] Fair	Primary Health Care	41	12-16 (14)	Asian: 2 Black: 4 Latino: 16 Native Amer: NR White: 70	BMI: 30.7 zBMI: 2.07 % >95th %ile: NR	No
Savoye, 2007[135] Fair	Health Care	61	8-16 (12)	Asian: NR Black: 38.5 Latino: 24.7 Native Amer: NR White: 37	BMI: 36.0 zBMI: NR % >95th %ile: NR	No
Savoye, 2014[136] Fair	Health Care	65	10-16 (13)	Asian: NR Black: 28 Latino: 36 Native Amer: NR White: 20	BMI: 33.3 zBMI: 2.2 % >95th %ile: 100	Yes: 80% of children lived in homes w/ incomes less than $30,000
Sherwood, 2019[137] Fair	Primary Health Care	49	5-10 (6.6)	Asian: NR Black: NR Latino: 6.9 Native Amer: NR White: 69.1	BMI: 17.8 zBMI: 1.08 % >95th %ile:	No
Smith, 2021[138] Fair	Primary Health Care	49	5-12 (9.5)	Asian: 1 Black: 7 Latino: 75 Native Amer: 4 White: 13	BMI: 25.6 zBMI: 2.2 % >95th %ile: 47	Yes: 77% of children and 43% of caregivers were Medicaid recipients
Stark, 2011[139] Fair	Primary Health Care	33	2-5 (4)	Asian: NR Black: NR Latino: 17 Native Amer: NR White: 83	BMI: NR zBMI: NR % >95th %ile: 100	No
Stark, 2014[140] Fair	Primary Health Care	65	2-5 (4)	Asian: NR Black: NR Latino: NR Native Amer: NR White: 83	BMI: NR zBMI: 2.4 % >95th %ile: 100	No

Appendix D Table 1. Population Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Recruitment Setting	% Female	Age range (mean)	% Race/Ethnicity	Relative weight measures	Economically disadvantaged
Stark, 2018[141] Fair	Primary Health Care	57	2-5 (4.6)	Asian: NR Black: 9.3 Latino: 6.0 Native Amer: NR White: 76.2	BMI: NR zBMI: 2.44 % >95th %ile: 100	No
Stettler, 2014[142] Fair	Primary Health Care	52	8-12 (11)	Asian: NR Black: 42.4 Latino: 6.4 Native Amer: NR White: 53	BMI: 21.6 zBMI: 1.24 % >95th %ile: 18.6	No
Tanofsky-Kraff, 2010[143] Fair	Mixed	100	NR (15)	Asian: 10.5 Black: 47.4 Latino: 5.3 Native Amer: NR White: 37	BMI: 25.4 zBMI: 1.3 % >95th %ile: NR	No
Tanofsky-Kraff, 2014[144] Fair	Other	100	12-17 (14.5)	Asian: NR Black: 24 Latino: 9 Native Amer: NR White: 57	BMI: 27.0 zBMI: 1.5 % >95th %ile: 31	No
Taveras, 2011[145] Good	Health Care	48	2-6 (5)	Asian: NR Black: 18.9 Latino: 16.6 Native Amer: NR White: 57	BMI: 19.2 zBMI: 1.85 % >95th %ile: 56.2	No
Taveras, 2015[146] Good	Primary Health Care	47	6-12 (10)	Asian: 4.9 Black: 21.1 Latino: 14 Native Amer: NR White: 51	BMI: 25.8 zBMI: 2.06 % >95th %ile: 100	No
Taveras, 2017[147] Good	Primary Health Care	51	2.0-12.9 (8.0)	Asian: NR Black: 33 Latino: 22 Native Amer: NR White: 35	BMI: 22.9 zBMI: 1.88 % >95th %ile: 64	No
Taylor, 2015[148] Good	Health Care	55	4-8 (6)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 19.4 zBMI: 1.63 % >95th %ile: NR	No
Van Grieken, 2013[149] Fair	Primary Health Care	62	5-6 (6)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 18.1 zBMI: NR % >95th %ile: 0	No

Appendix D Table 1. Population Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Recruitment Setting	% Female	Age range (mean)	% Race/Ethnicity	Relative weight measures	Economically disadvantaged
Viner, 2020[150] Fair	Mixed	63	12-19 (15)	Asian: 20 Black: 30 Latino: NR Native Amer: NR White: 46	BMI: 32.0 zBMI: NR % >95th %ile: 100	No
Vos, 2011[151] Fair	Primary Health Care	53	8-17 (13)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 32.5 zBMI: 4.3 % >95th %ile: 100	No
Wake, 2009[152] Good	Primary Health Care	60	5-10 (8)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 20.2 zBMI: 1.9 % >95th %ile: 23.6	No
Wake, 2013[153] Good	Primary Health Care	54	3-10 (7)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 22.5 zBMI: 2.2 % >95th %ile: 100	No
Weigel, 2008[154] Fair	Mixed	55	7-15 (11)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 28.6 zBMI: 2.36 % >95th %ile: 100	No

Abbreviations: Amer = American; BMI = Body mass index; CHIP = Children's Health Insurance Program; NR = Not reported

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
Boutelle, 2014[106] Fair	IG1	Regulation of Cues (ROC) program	14 group behavioral counseling sessions based on appetite awareness and cue exposure treatment; core components included psychoeducation, parenting skills, coping skills, self-monitoring of hunger and cravings, and experiential learning	Beh strategies	In Person, Print Group	Parent, Child, Family	14	45 (separate child and parent groups); 30 (joint child and parent)	4 28	Doctoral-level psychologists assisted by masters-level co-therapists and undergraduate volunteers
Broccoli, 2016[107]* Good	IG1	Motivational Interviewing	5 motivational interviewing sessions with parent and child and pediatrician; families decided on goals, progress discussed at subsequent meetings	HD advice PA advice Beh strategies	In Person Individual	Parent, Child, Family	5	30-60	3 3.75	Family pediatrician
Bryant, 2011[108] Fair	IG1	WATCH IT	16 weekly 30-min individual sessions for support and encouragement and 1-hr PA group sessions; motivational enhancement and solution-focused approach to lifestyle change	HD advice PA advice Beh strategies PA sessions	In Person Group Individual	Child, Family	16	30 (individual, parent), 60 (group PA)	12 24	WATCH IT trainers, sports coaches; support and supervision by nurse, dietician, psychologist, and pediatrician
Croker, 2012[109] Fair	IG1	Family-based behavioral therapy	Fifteen 90-min comprehensive multicomponent family-based behavioral therapy group sessions, parents and children meeting separately for 10 sessions and together for 5 sessions	HD advice PA advice Beh strategies	In Person Group	Parent, Child, Family	15	90	6 37.5	Psychologist, family therapist, dietitian

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Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
Davis, 2012[110] Fair	IG1	Maintenance (Group classes)	Eight 90-min group classes for adolescents after completion of weight loss program; 4 additional motivational telephone calls to explore and resolve ambivalence; separate parent classes, asked to attend 2.	HD advice PA advice Beh strategies PA sessions	In Person, Phone Group, Individual	Parent, Child	14	15 (phone), 90 (group)	8 16	Trained research staff; certified personal trainer
DeBar, 2012[111]* Good	IG1	Multicomponent behavioral intervention	Sixteen 90-min group behavioral intervention sessions for adolescent girls; 12 with concurrent parent sessions; trained PCP to support behavioral weight management goals; 2 PCP meetings	HD advice PA advice Beh strategies PA sessions	In Person, Phone Group, Individual	Parent, Child	18	90 (group), NR, est 15 min (PCP)	5 36.5	Nutritionists, health educators and clinical psychologists; primary care physicians
Derwig, 2022[112]* Fair	IG1	Targeted Child-Centered Health Dialogue	60-min individual usual care well-child visit, one 10-min structured discussion about healthy lifestyle, and one 45-min family session 1-3 weeks later (or 30-min followup session after 3-6 mos if initial followup session not attended).	HD advice PA advice Beh strategies	In Person Individual	Parent, Child	2	115	4.5 1.9	Nurse
Gerards, 2015[113] Fair	IG1	Lifestyle Triple P	10 90-min group sessions and four individual 15-30 min phone sessions aimed at changing parenting practices and styles with specific strategies around	HD advice PA advice Beh strategies	In Person, Phone, Print Group,	Parent	14	90 (group), 15-30 (telephone)	3.5 16.5	Health professionals (not further specified)

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
			lifestyle change; workbook, recipes and active games booklet		Individual					
Golley, 2007[114] Fair	IG1	Triple P + healthy lifestyle group	Four 2-hr group sessions + 7 individual phone calls aimed at changing parenting practices and style, 7- session behavioral healthy lifestyle group for parents and concurrent child PA sessions	HD advice PA advice Beh strategies PA sessions	In Person, Phone, Print Group, Individual	Parent, Child	18	120 (group), 15-20 (phone)	5 23.75	Dietitian; nonexpert staff
	IG2	Triple P	Four 2-hr group sessions and 7 individual phone calls aimed at changing parenting practices and style, incorporating healthy lifestyle examples; healthy lifestyle pamphlet	HD advice PA advice Beh strategies	In Person, Phone, Print Group, Individual	Parent	11	120 (group), 15-20 (phone)	5 9.75	Dietitian
Ho, 2016[115] Fair	IG1	Nutrition counseling and portion control strategy	1 75-min individual family counseling session with registered dietician	HD advice	In Person Individual	Parent, Child	1	75	6 1.25	Dietician
Hofsteenge, 2014[116] Fair	IG1	Go4it	Seven 90-min group sessions plus 2 booster sessions covering diet, PA, and cognitive behavior therapy for adolescents; 2 separate parent sessions	HD advice PA advice Beh strategies	In Person, Print Group	Parent, Child	11	90	6 16.5	Dietician, pediatrician/endocrinologist, psychologist

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
Kalarchian, 2009[117] Fair	IG1	Family-based lifestyle intervention	Twenty 60-min separate adult and child group sessions including weekly family meeting with lifestyle coach; adult also set goals, modeled behavior change; 6 booster sessions (3 group, 3 phone)	HD advice PA advice Beh strategies	In Person, Phone Group, Individual	Parent, Child, Family	26	60 (sessions)	12 43.75	Lifestyle coach
Kalavainen, 2007[118] Fair	IG1	Health-promoting lifestyle	15 90-min group sessions, parents and children mostly separate; parents targeted as main agents of change; interactive activities and PA for children; manuals for parents, workbooks for children and homework assigned	HD advice PA advice Beh strategies PA sessions	In Person, Print Group	Parent, Child, Family	15	90	6 43.5	Dietitian (parent sessions); advanced clinical nutrition students (child sessions)
Kong, 2013[119]* Fair	IG1	ACTION	Initial MI visit with PCP to review medical history/lab results, assess diet and PA, receive DVD; 7 followup MI visits with PCP to discuss healthy lifestyle goals; newsletter and 8 post-visit MI calls to parents/caregivers	HD advice PA advice Beh strategies	In Person, Phone, Electronic, Print Individual	Parent, Child	16	47 (mean, first session), 24 (mean, subsequent sessions)	9 4.25	School-based health center clinician (family medicine nurse practitioner)
Kose, 2021[120] Fair	IG1	Motivational support programme (MSP)	Eight 30-min MI interviewing sessions followed by text messages sent twice a week; one 2 hr education session for	HD advice PA advice Beh strategies	In Person, Phone Individual	Parent, Child	9	30 min (child), 2 hours (parent)	6 6	Researcher

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
			parents							
Lison, 2012[121] Fair	IG1	Hospital-based group exercise	Two 1-hr parent/child lifestyle education sessions with behavior change strategies; 120 1-hr group PA sessions (offered 5 times/week, families encouraged to attend at least 3 sessions/week)	HD advice PA advice Beh strategies PA sessions	In Person Group	Child, Family	122	60	6 122	Pediatrician (education sessions), PE instructor (exercise sessions)
	IG2	Home-based exercise	Two 1-hr parent/child lifestyle education sessions with behavior change strategies and Mediterranean diet focus; detailed home-based PA plan with demonstration, written instructions, and log	HD advice PA advice Beh strategies PA sessions	In Person, Print Individual	Child, Family	2	60	6 2	Pediatrician (education sessions), PA instructor (assumed, exercise demonstration)
Looney, 2014[122] Fair	IG1	Newsletters + Growth Monitoring + Family-based Beh Counseling	Six 20-30 min in-person or phone sessions for growth monitoring/feedback and caretaker behavioral counseling; 6 monthly educational newsletters on nutrition and activity; usual care from the pediatrician	HD advice PA advice Beh strategies	In Person, Phone, Print Individual	Parent, Child, Family	6	30 (in-person), 20 (telephone)	6 2.5	Trained interventionist + pediatrician
	IG2	Newsletters + Growth Monitoring	Six 10-15 min in-person or phone growth monitoring sessions with standardized feedback; 6 monthly educational newsletters on	HD advice PA advice	In Person, Phone, Print	Child, Family	6	15 (in-person), 10 (telephone)	6 1.25	Trained interventionist + pediatrician

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
			nutrition and leisure-lime activity; usual care from the pediatrician		Individual					
Love-Osborne, 2014[123] Fair	IG1	Health educator visits	Avg of 5 visits with health educator using motivational interviewing, goal-setting, self-monitoring, with or without supporting text messages; participants linked to existing resources and facilitated applications for free recreation memberships	HD advice PA advice Beh strategies	In Person, Electronic Individual	Child	5	NR	8 NR	Health educator
McCallum, 2007[124]* Good	IG1	LEAP	Four GP consultations using brief solution-focused family therapy for healthy lifestyle goals; 16-page folder of print materials	HD advice PA advice Beh strategies	In Person, Print Individual	Parent, Family	4	"Brief"	3 NR	General practitioner
Mellin, 1987[125] Fair	IG1	SHAPEDOWN	14 90-min weekly group adolescent sessions and 2 90-min parent sessions plus separate workbooks for parent and adolescent; focus on successive, sustainable, small lifestyle modifications	HD advice PA advice Beh strategies PA sessions	In Person, Print Group	Parent, Child	16	90	3 24	Nutritionists
Nemet, 2005[126]* Fair	IG1	Dietitian + PA sessions	4 evening lectures for parents, 6 dietician meetings, and twice-weekly PA sessions for 3 months	HD advice PA advice Beh strategies	In Person, Print Group,	Parent, Child, Family	34	45 (dietician), 60 (exercise and	3 32.5	Physicians, dieticians, youth coaches

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
				PA sessions	Individual			lectures)		
Norman, 2016[127]* Fair	IG1	Stepped-down Care	Brief PCP visits + "stepped-down" care tailored to progress of individuals; Step 1: 4 health ed visits + 8 calls, Step 2: 2 visits + 8 calls, Step 3: 4 calls	HD advice PA advice Beh strategies	In Person, Phone, Print Individual	Parent, Child, Family	27	NR	12 NR	Physician, health education counselor
O'Connor, 2013[128] Fair	IG1	Helping HAND	6 monthly individual family sessions with health advisors with follow-up phone call after each session; set monthly child-behavior goals with implementation plan and behavior-specific parenting practice goals	HD advice PA advice Beh strategies	In Person, Phone Individual	Family	12	NR	7 NR	Trained allied health staff "health advisors"
Patrick, 2013[129] Fair	IG1	Group sessions + website	Twelve 90 min group sessions, 24 bimonthly 20 min phone calls and interactive website	HD advice PA advice Beh strategies PA sessions	In Person, Phone, Electronic, Print Group, Individual	Parent, Child	36	90 (group); 20 (phone)	12 26	Health counselor
	IG2	Website + text messages	3 text messages per week plus interactive website use	HD advice PA advice Beh strategies	Phone, Electronic, Print Individual	Child	0	NA	12 0	NA

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
Patrick, 2013[129] Fair	IG3	Website alone	Interactive website	HD advice PA advice Beh strategies	Electronic, Print Individual	Child	0	NA	12 0	NA
Raynor, 2012a[130] Fair	IG1	DECREASE + Growth Monitoring	Eight 45-min parent group sessions covering behavioral strategies to decrease high-calorie non-nutrient dense foods; growth assessed at 0, 3, 6 mos with accompanying letter providing anthropometric information and interpretation	HD advice Beh strategies	In Person Group	Parent	8	45	6 6	Research-staff therapist (master or doctoral-level with expertise in nutrition or exercise and behavior modification)
	IG2	INCREASE + Growth Monitoring	Eight 45-min parent group sessions covering behavioral strategies to increase healthy food intake; growth assessed at 0, 3, 6 mos with accompanying letter providing anthropometric information and interpretation	HD advice Beh strategies	In Person Group	Parent	8	45	6 6	Research-staff therapist (master or doctoral-level with expertise in nutrition or exercise and behavior modification)
Raynor, 2012b[130] Fair	IG1	TRADITIONAL + Growth Monitoring	Eight 45-min parent group sessions covering behavioral strategies to increase PA and reduce sugar-sweetened beverage consumption; growth assessed at 0, 3, 6 mos	HD advice PA advice Beh strategies	In Person Group	Parent	8	45	6 6	Research-staff therapist (master or doctoral-level with expertise in nutrition or exercise and behavior

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
			with accompanying letter providing anthropometric information and interpretation							modification)
	IG2	SUBSTITUTES + Growth Monitoring	Eight 45-min parent group sessions covering behavioral strategies to increase low-fat milk and decrease TV as substitute behaviors; growth assessed at 0, 3, 6 mos with accompanying letter providing anthropometric information and interpretation	HD advice PA advice Beh strategies	In Person Group	Parent	8	45	6 6	Research-staff therapist (master or doctoral-level with expertise in nutrition or exercise and behavior modification)
Reinehr, 2010[131] Fair	IG1	Obeldicks light	37 child sessions, 6 parent sessions, 5 child+parent sessions; PA training, nutrition education, and behavior counseling performed in group sessions with individual counseling for child and family.	HD advice PA advice Beh strategies PA sessions	In Person Group, Individual	Parent, Child, Family	37	PA: 90; parent: 90; individual child/parent counseling: 30	6 67	Pediatricians, diet-assistants, psychologists, exercise physiologists
Resnicow, 2015[132]* Fair	IG1	PCP + RD MI	4 brief MI counseling sessions by PCP + 6 MI counseling sessions from RD conducted over 2 years, targeting diet and activity behaviors	HD advice PA advice Beh strategies	In Person, Phone, Print Individual	Parent	10	NR	24 NR	PCP (pediatrician and NPs) and RD

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
	IG2	PCP MI	4 brief MI counseling sessions over 2 years conducted by PCP, targeting diet and activity behaviors	HD advice PA advice Beh strategies	In Person, Print Individual	Parent	4	NR	24 NR	PCP (pediatrician and NPs)
Sacher, 2010[133] Fair	IG1	MEND	Eighteen 2-hr family-based behavioral healthy lifestyle group sessions targeting education, skills training, and motivational enhancement; included 1-hr PA sessions in 16 of the sessions; free access to community pool	HD advice PA advice Beh strategies PA sessions	In Person, Print Group	Child, Family	18	120	2.25 36	Health, social, education, or exercise professionals
Saelens, 2002[134]* Fair	IG1	Healthy Habits Intervention	Computer assessment with 1 pediatrician session to discuss results with family; 11 phone counseling calls, 3 mailings	HD advice PA advice Beh strategies	In Person, Phone, Electronic, Print Individual	Child, Family	13	10-20 (phone [mean, 16.4]); others NR	4 3.75	Pediatrician; phone counselors
Savoye, 2007[135] Fair	IG1	Bright Bodies	26 weekly nutrition education and behavioral management sessions using Smart Moves Workbook, twice-weekly PA sessions tapering to twice-monthly after 6 months	HD advice PA advice Beh strategies PA sessions	In Person, Print Group	Parent, Child, Family	64	40 (diet+ behavioral), 50 (PA, 1st 6m), 100 (PA, 2nd 6m)	12 82.33	Dietitian or social worker; exercise physiologists
Savoye, 2014[136] Fair	IG1	Bright Bodies	26 weekly nutrition education and behavioral management sessions	HD advice Beh	In Person	Parent, Child, Family	52	50 (exercise), 40	6	Dietitian, physical therapist

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
			using Smart Moves Workbook; twice-weekly physical activity sessions tapering to twice-monthly after 6 months; 26 parent support sessions	strategies PA sessions	Group			(therapy)	78	
Sherwood, 2019[137] Fair	IG1	Healthy Homes/Healthy Kids 5-10	6 biweekly phone coaching calls from a trained phone coach + 8 monthly phone coaching calls on healthy diet and limiting screen time; primary care team gave 1-time brief message/endorsement	HD advice	Phone, Print Group, Individual	Parent, Child		15	12 3.5	Brief PCP visit; phone coach
Smith, 2021[138] Fair	IG1	Family Check-Up 4 Health (FCU4Health)	3 family feedback sessions combined with parenting classes, community services, and organized physical activities	HD advice PA advice Beh strategies	In Person, Phone Individual	Parent, Child	3	Varied	6 53.79	Study coordinator
Stark, 2011[139] Fair	IG1	LAUNCH	Nine 90-min comprehensive behavioral lifestyle group sessions for parents and children separately plus 9 home visits; vegetable taste tests, pedometers, parents received 2 weeks worth of vegetables, child sessions included 15-min PA.	HD advice PA advice Beh strategies	In Person Group, Individual	Parent, Child, Family	18	90 (clinic), 60-90 (in-home)	6 38.25	Licensed clinical psychologist, post doc and research coordinator

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
Stark, 2014[140] Fair	IG1	LAUNCH-clinic	Ten 90-min comprehensive behavioral lifestyle group sessions for parents and children separately; vegetable taste tests, pedometers, parents received 2 weeks worth of vegetables, child sessions included 15-min of moderate-to-vigorous PA.	HD advice PA advice Beh strategies	In Person Group, Individual	Parent, Child	10	90	6 30	Clinical psychologist, pediatric psychologist, research coordinator
Stark, 2018[141] Fair	IG1	LAUNCH	Ten-90-min clinic sessions + eight-60-min home sessions on family-based behavioral weight management	HD advice PA advice Beh strategies	In Person, Phone Group, Individual	Parent, Child		90 (clinic), 60 (home)	6 23	Licensed clinical psychologist; postdoctoral fellow in clinical psychology or nutrition
	IG2	Motivational interviewing	One-60-min initial individual session + three-60-min home sessions + 14, 15-min phone sessions	HD advice PA advice Beh strategies	In Person, Phone Individual	Parent		60-min home session and 15-min phone session	6 7.5	Pediatrician; licensed clinical psychologist
Stettler, 2014[142]* Fair	IG1	Multiple-behavior change	Twelve 15-25 min sessions targeting healthy beverages, increased PA, and reduced sedentary activity, incorporating behavior change techniques	HD advice PA advice Beh strategies	In Person Individual	Family	12	15-25	12 4	Trained primary care clinician
	IG2	Combined	Twelve 15-25 min sessions incorporating behavior change techniques	HD advice PA advice Beh	In Person	Family	12	15-25	12	Trained primary care physician

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
			targeting healthy beverages, increased PA, and reduced sedentary activity (IG2), or targeting health beverage consumption only (IG3)	strategies	Individual				4	
	IG3	Beverage-only intervention	Twelve 15-25 min sessions to reduce intake of sugary drinks and increase intake of water and milk, incorporating behavior change techniques	HD advice Beh strategies	In Person Individual	Family	12	15-25	12 4	Trained primary care clinician
Tanofsky-Kraff, 2010[143] Fair	IG1	IPT-Weight Gain Prevention	Twelve 75-90-min IPT group meetings + individual 1.5-hr pre-group meeting; overeating and loss-of-control eating linked to interpersonal functioning	Beh strategies	In Person Group, Individual	Child	13	1.5 (individual), 75-90 (group)	3 17.9	Psychologist, graduate student
Tanofsky-Kraff, 2014[144] Fair	IG1	Interpersonal psychotherapy	One 90-min individual session and 12 weekly 90-min group sessions.	Beh strategies	In Person Group, Individual	Child	13	1 90-min individual session; 12 90-min weekly group sessions	3 19.5	Clinical psychologist
Taveras, 2011[145]* Good	IG1	MI + enhanced EMR and training	Four 25-min in-person + three 15-min phone motivational interviewing sessions with nurse practitioner. Pediatricians endorsed messages during	HD advice PA advice Beh strategies	In Person, Phone, Electronic, Print	Family	8	15-25	12 2.67	Nurse practitioner (primary interventionist), pediatrician

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
			well-child visits. Tailored materials, behavior monitoring tools, enhanced EMR.		Individual					
Taveras, 2015[146]* Good	IG1	CDS+coaching	Computerized clinical decision support system with point of care prompts at well-child visit, MI, pt materials + 4 phone motivational interviewing sessions by health coach and optional text msg program	HD advice PA advice Beh strategies	In Person, Phone, Electronic, Print Individual	Parent, Family	5	75	12 1.25	Pediatrician, health coach
	IG2	CDS	Computerized clinical decision support system with point of care prompts at well-child visit, motivational interview, pt materials	HD advice PA advice Beh strategies	In Person, Electronic, Print Individual	Family	1	15	12 0.25	Pediatrician
Taveras, 2017[147] Good	IG1	Enhanced primary care and coaching	Six 15-20 min family sessions with health coaches and followup mailings of educational materials after each session; 2x-weekly text messages or emails; primary care team gave 1-time brief message/endorsement	HD advice PA advice Beh strategies	In Person, Phone, Electronic, Print Individual	Parent, Child	6	18	12 1.75	Study health coaches

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
Taylor, 2015[148] Good	IG1	Tailored lifestyle support	One individual 1-2 hr multidisciplinary session with parents followed by 16 brief contacts for tailored behavioral lifestyle change support.	HD advice PA advice Beh strategies	In Person, Phone Individual	Parent	14	60-120 (multidisc consult), 30-40 (in-person visits), 5-10 (phone calls)	24 7.2	Mentor, nutritionist/dietician, exercise specialist/trainer, clinical psychologist
Van Grieken, 2013[149]* Fair	IG1	Be Active Eat Right	Prevention protocol involving motivational interviewing during a well-child visit. 3 additional structured healthy lifestyle counseling sessions matched to parents' stage of change could be offered.	HD advice PA advice Beh strategies	In Person, Print Individual	Parent, Family	4	NR, average duration of first additional session, 24.76 (range, 0-60)	12 NR	Youth Health Care Team (pediatrician, nurse, assistant)
Viner, 2020[150] Fair	IG1	Healthy Eating and Lifestyle Program (HELP)	12, 60-minute family-based sessions	HD advice PA advice Beh strategies	In Person Individual	Parent, Child	12	60	6 12	Psychologist (undergraduate degree)
Vos, 2011[151] Fair	IG1	Family-based multidisciplinary lifestyle intervention	Two individual family assessment and advice visits followed by seven 2.5-hr group comprehensive behavioral lifestyle meetings, parents and children usually separate, plus 2-3 booster group sessions/yr	HD advice PA advice Beh strategies PA sessions	In Person Group, Individual	Parent, Child, Family	14	150 (group) 180-270 (individual)	24 37.5	Dietician, child physiotherapist, child psychologist, social worker

Appendix D Table 2. Intervention Characteristics of Trials of Behavioral Interventions

Author, Year and Quality	Group	Intervention Name	Description	Components	Delivery Format	Target	# Sessions	Session length, min	Duration, mos Est hours	Provider
Wake, 2009[152]* Good	IG1	LEAP-2	Four GP consultations using brief solution-focused family therapy for healthy lifestyle goals; 16-page folder of materials including topic sheets, wall chart, reward stickers, and shopping tips	HD advice PA advice Beh strategies	In Person, Print Individual	Family	4	"Brief"	3 NR	General practitioner
Wake, 2013[153]* Good	IG1	HopSCOTCH	1 hr-long family visit with obesity specialist team to develop plan and goals, followed by GP visits every 4-8 weeks using brief solution-focused techniques; web-based software (HopSCOTCH) used to track progress and link specialist team with GP	HD advice PA advice Beh strategies	In Person Individual	Family	6	60 (specialist), 20-40 (long GP), 6-20 (standard GP)	12 2.5	General practitioner, obesity specialist team (pediatrician and dietician)
Weigel, 2008[154] Fair	IG1	Sea Lion Club	Twice weekly 45-60-min child group sessions for 12 mos, including PA, dietary education, and coping strategies; 12 separate monthly 2-hr parent support meetings that included some parent-child activities	HD advice PA advice Beh strategies PA sessions	In Person Group	Parent, Child, Family	104	45-60 (child), 120 (parent)	12 114.1	Dietitians, psychologists, sports coaches

*PC team participated in intervention

Abbreviations: Avg = Average; Beh = Behavioral; Ed = Education; EMR = Electronic medical record; Est = Estimated; GP = General practice; IG = Intervention groups; HD = Healthy diet; Hr = Hour; MI = Motivational interviewing; IPT = interpersonal psychotherapy; Min = Minutes; Mos = Months; NP = Nurse practitioner; NR = Not reported; PA = Physical activity; PCP = Primary care physician; Pt = Patient; RD = Registered dietician; Yr = year

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
Boutelle, 2014[106] Fair	IG1	Regulation of Cues (ROC) program	Weekly 45-minute group sessions for 12 weeks and biweekly for an additional two visits. Parents and children had separate but simultaneous meetings (content similar, delivery targeted for children). After group session, parents and children participated in an additional 30-min experiential exercise together. Components included psychoeducation (10 sessions) to increase awareness of overeating in relation to environment, parenting skills, coping skills (e.g., behavioral alternatives, relaxation, attentional focus, motivation to resist cues), self-monitoring of hunger and craving, experiential learning (cue exposure treatment, appetite awareness training). Included workbooks and handouts for parents and children. Individual followup provided when a meeting was missed.	Waitlist	No intervention during the 4 months of treatment. At posttreatment assessment, participants given a binder for the program including at-home version of the curriculum with handouts and a brief 5-min orientation to the program. No other information provided to control group. Assessments provided at BL, 4 months and 8 months.
Broccoli, 2016[107] Good	IG1	Motivational Interviewing	Family pediatrician-led MI consisting of 5 individual meetings based on transtheoretical model of addiction and behavior change; child and parents always had to leave the meeting having agreed on two objectives (1 food, 1 physical activity); during each subsequent interview, degree of achievement of the objectives set at previous meeting assessed; objectives reinforced or redefined and recorded. Pediatricians attended 20-hr training course on motivational interviewing prior to study start.	Obesity prevention booklet	Received a booklet with the main information on obesity prevention, then usual care currently offered by pediatricians (i.e., opportunistic advice if the pediatrician is seeing the child for other reasons).
Bryant, 2011[108] Fair	IG1	WATCH IT	Encourage lifestyle changes by taking motivational enhancement and solution focused approach. Included 16 weekly 30-min individual appointments for child and parent together for encouragement, support and motivational counseling using HELP manual. Session included healthy diet and physical activity information as well as discussions on the degree to which behavior change is important to the individual, their confidence in their ability to achieve behavior change, the degree to which change is a priority; views the patient as the expert in "what works" for them. Activities make links between thoughts and emotional responses that contribute to overeating. 16 1-hr weekly group physical activity sessions. Optional further 4 or 8 months of continuing sessions offered. Group parenting sessions mentioned in source article (number NR, may be part of optional additional 4 to 8 months' treatment, unclear if offered in current study).	Waitlist	12-month waitlist control
Croker, 2012[109] Fair	IG1	Family-based behavioral therapy	Family-based behavioral treatment consisting of 15 90-minute group sessions over 6 months (10 weekly, 3 fortnightly, 2 monthly) with parents and children meeting separately but concurrently for 10 sessions and 5 joint parent-child sessions. Behavior modification techniques included: self-monitoring, goal setting, positive reinforcement, stimulus control, and relapse prevention. Advice provided on managing teasing and general problem-solving. Parents taught behavior management principles to assist child's	Waitlist	6-month waitlist control. Baseline assessment included "motivational assessment" including children and parents' independent rating of motivation for making lifestyle changes as well as perceived

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			behavior change and modify home environment for family-wide lifestyle change. Specific dietary targets included regular eating patterns, reduced snacks (≤2 times/day), balanced diet (as described in 'eatwell plate' and 'Traffic Light' system). Specific physical activity targets included reducing sedentary behavior and 60 mins/day lifestyle or structured activity. Baseline assessment included "motivational assessment" including children and parents' independent rating of motivation for making lifestyle changes as well as perceived benefits of and barriers to change.		benefits of and barriers to change.
Davis, 2012[110] Fair	IG1	Maintenance (Group classes)	Prior to randomization, participant completed either nutrition only (N) or nutrition + strength training (N+ST) classes that included a cooking component, a snack, nutrition lesson (focused on reducing sugar and increasing fiber intake), and a 45-minute strength training session (for those in N +ST) led by a certified personal trainer. Participants were encouraged to eat healthy and do strength training on their own at home throughout the entire program. All participants received a variety of cooking utensils and gadgets (cutting boards, apple cutters, etc.) throughout the program. Participants in the N+ST group also received resistance bands and an instructional video of exercises to do with the bands. Parents and children had separate classes. For current study, randomized adolescents attended 8 monthly 90-minute weight loss maintenance group classes, similar to those received during the 4-month intervention preceding this maintenance trial. Participants also received 4 motivational interviewing sessions over the phone and lasting approximately 15 minutes designed to help participants resolve ambivalence and engage in healthier eating and strength training in their own home. Parents were also offered separate monthly classes, which were held simultaneously with the teen group classes with the same curriculum that the youth were receiving. Parents were asked to attend a minimum of 2 classes.	Newsletters	8 monthly newsletters that matched previous 4-month intervention group assignment (nutrition or nutrition plus strength training). Newsletters included dietary tips and recipes, information about benefits of strength training and sample exercises, and information on community resources. Participants were called twice to make sure newsletters were received and to verify contact information; no lifestyle content was delivered. Anthropomorthic measurements taken before and after maintenance phase.
DeBar, 2012[111] Good	IG1	Multicomponent behavioral intervention	16 90-minute group meetings; weekly for 3 months than biweekly during months 4 and 5 where teens were weighed, revised dietary and physical activity self-monitoring records. Telephone sessions offered if unable to attend sessions. Multicomponent intervention included change in dietary intake and eating patterns (e.g., decreasing portion sizes, limiting energy-dense foods, consume lower energy-dense foods); increasing physical activity by using developmentally tailored forms of exercise (e.g., exergaming equipment, yoga, strength training, pedometers, developing goal of 30-60 minutes at least 5 days per week, limiting screen time to 2 hours per day); addressing issues associated w/ obesity in adolescent girls (mood regulation, body image, self esteem, media education, sleep); and training the primary	PCP Meeting + materials	Received a packet of materials, including approaches to weight management, a parents' guide to help teens make healthy lifestyle changes, local resources for weight management and healthy activity, and suggested books and online materials on healthy lifestyle change. Met

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			care physician to support behavioral weight management goals. Each sessions reviewed goals, problem solving to overcome barriers and challenges in increased activity. Specific behavioral and cognitive tools for coping included regular self monitoring of dietary intake, physical activity and screen time; stimulus control and environmental changes, stepwise goal-setting and problem solving; setting goals for increasing pleasant activities; and cognitive restructuring techniques to combat negative self-talk. Parents invited to separate weekly group meetings in first 3 months where they learned to support their daughter and address potential barriers to success; encourage appropriate teen autonomy and improve understanding of how parents' own attitudes, eating behavior, monitoring and comments may affect daughters. Adolescents met w/ their PCPs who were trained in motivational enhancement techniques at BL and 6 months where they received a health status summary and targeted areas of improvement (e.g., physical activity); PCPs encouraged to help pt select 1-2 of these targets.		with PCP at study onset to encourage healthy lifestyle changes.
Derwig, 2022[112] Fair	IG1	Targeted Child-Centered Health Dialogue	All 4-year old children received 60-minute child-centered health dialogue (CCHD) and BMI screening at the 4-years health visit. Children with overweight were offered the targeted part of CCHD and extra visits or a referral to an overweight team, dietician, or CHS psychologist on the caregiver's request. Children with obesity were referred to specialized care (multidisciplinary team consisting of specialized nurse, a dietician and a pediatrician for treatment outside primary care setting) and were not included in this study. CCHD is a low-intensive multicomponent child-centered intervention based on a Logic model described elsewhere. CCHD builds on a salutogenic family-therapeutic solution-focused approach which emphasizes a relationship based on trust and facilitates the family to allocate protective factors and make healthy choices. CCHD is furthermore based on Child Centered Care (CCC), which acknowledges children in their right to take active part in their own health care. CCHD consist of two parts: (1) a universal part directed to all 4-year-olds, regardless of their weight, and their families and (2) a targeted part offered to families when the child is identified with overweight. The universal part encompasses a 10-minute structured dialogue between the 4-year-old, the caregivers, and the nurse using eight animated illustrations based on important healthy choices associated with a long term healthy lifestyle (fruit and vegetable consumption, drinking water, portion size, physical activity, tooth brushing and bedtime routines), as well as a neutral discussion on the child's growth using the BMI growth chart. Using illustrations and the BMI growth chart strengthens health literacy and enables family members to understand, use, and internalize health information. The 45-minute targeted part, the Family Guidance (FG), is offered 1 to 3 weeks after the universal health visit to children identified with	Usual care	4-year health visit includes a health dialogue and screening for overweight using child-centered health dialogue illustrations from handbook and BMI growth chart. Nurses received a 30-minute introduction to illustrations in the National Handbook, but were not trained in the child-centered health dialogue approach. Nurses also received a traditional 120-minute lecture on child overweight and the BMI growth chart, without possibility for discussion or reflection. Children with overweight and obesity are referred to a multidisciplinary team consisting of a specialized nurse, dietician, and pediatrician for treatment outside primary care setting.

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			overweight, their caregivers, and other adults important to the family. FG is inspired by Standardized Obesity Family Therapy (SOFT). SOFT is an evidence-based treatment model that engages family members through collaborative family support in either identifying already existing protective factors or finding changes in lifestyle that are sustainable. FG is a continuation of the non-judgmental discussion started during the first part of CCHD and acknowledges the complexity underlying the development of overweight and not blaming caregivers. The nurse emphasizes concerns about the child's health and clarifies the importance of sustainable weight stabilization instead of weight loss and the advantage of small changes at an early age. CCHD builds on trust and partnership to promote child health and offers caregivers the choice to receive additional extra visits or a referral, which is based on the knowledge that compulsory care without choice might not give sustainable healthy behaviors. An extra 30-minute visit could be scheduled on caregivers' request. Nurses allocated to intervention care received an extra interactive 1-day training in small groups. The training focused on how to promote child participation and how to apply a family-therapeutic solution focused approach. The training was followed by four tutorial sessions of one hour, once every two months. These tutorials were used to reflect on how to build trust with the family, how to contextualize and reframe into positive reflections and how to handle the challenges encountered in the early communication about overweight.		
Gerards, 2015[113] Fair	IG1	Lifestyle Triple P	14 week parent-only program with 10 90-minute group sessions and four individual 15-30 minute phone sessions. Aimed at changing parenting practices and general parenting styles; used active skills training methods based on self-regulation. Parents individually formulated goals in the first session and were instructed in the following strategies: positive parenting skills, modeling, stimulus control, shopping and cooking, behavior charts/monitoring, managing behavior and using rewards. Telephone sessions provided parents individualized support in implementing strategies at home. Materials included a parent workbook, recipes, and active games booklet.	Control	2 brochures (1 on healthy nutrition and PA and 1 on positive parenting) and a short internet-based knowledge quiz (sent via email) including tailored advice and suggestions for active exercises at home.
Golley, 2007[114] Fair	IG1	Triple P + healthy lifestyle group	Positive Parenting Program (Triple P) (4 weekly 2-hour group sessions with 7 15-20 minute individual followup calls) followed by 7 group lifestyle support sessions for parents and concurrent child PA sessions. Lifestyle sessions focused on knowledge and skills including family-focused healthy eating including specific food recommendations, monitoring, label reading, snacks, modifying recipes, being active, and roles and responsibilities about eating, managing appetite, self-esteem and teasing. While parents attended group sessions, children attended supervised PA sessions focused on fun aerobic	Waitlist	Waitlist control for 12 months; healthy-lifestyle pamphlet and 3-4 telephone calls for retention purposes (content not specified)

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			games designed for play and easily replicated at home; PA sessions were diversional rather than interventional. Triple P parenting component aimed at changing parenting practices and general parenting styles; used active skills training methods based on self-regulation. Core parenting skills included: parent-child relationship enhancement, encouraging desirable behavior, teaching new skills and behaviors, managing misbehavior, preventing problems in high-risk situations, self-regulation, mood management and coping, partner support and communication. Telephone sessions provided parents individualized support in implementing strategies at home. Materials included standard Triple P resources (workbook and video) and a healthy lifestyle pamphlet.		
Golley, 2007[114] Fair	IG2	Triple P	Positive Parenting Program (Triple P): 4 weekly 2-hour group sessions with 7 15-20 minute individual followup calls. Aimed at changing parenting practices and general parenting styles; used active skills training methods based on self-regulation. Core parenting skills included: parent-child relationship enhancement, encouraging desirable behavior, teaching new skills and behaviors, managing misbehavior, preventing problems in high-risk situations, self-regulation, mood management and coping, partner support and communication. Lifestyle-specific strategies not addressed. Telephone sessions provided parents individualized support in implementing strategies at home. Materials included standard Triple P resources (workbook and video shown during session) and a healthy lifestyle pamphlet.	Waitlist	Waitlist control for 12 months; healthy-lifestyle pamphlet and 3-4 telephone calls for retention purposes (content not specified)
Ho, 2016[115] Fair	IG1	Portion control device + dietary counseling	1-hour session of standard nutrition and healthy lifestyle counseling regarding healthy eating habits, appropriate portion sizes, and based on the Canada Food Guide. Intervention group received an additional 10 to 15 minutes instructions on how to use a calibrated dinner plate and breakfast bowl for the child and adults in the family as a means of dietary portion control. Each plate had markings for carbohydrates, proteins, cheese, sauce, and the remainder for vegetables. The cereal bowl had markings for different caloric densities of cereal and is designed to measure a 200-calorie portion of cereal with ½ cup of milk (any type). Participants were instructed to use the calibrated plate at the largest meal of the day and the cereal bowl when cereal was consumed at breakfast.	Nutrition counseling	1-hour session of standard nutrition and healthy lifestyle counseling regarding healthy eating habits, appropriate portion sizes, and based on the Canada Food Guide.
Hofsteenge, 2014[116] Fair	IG1	Go4it	Seven 90-min group sessions every 2-3 weeks over 3 months followed by 2 maintenance booster sessions. Sessions consisted of education on healthy dietary, sedentary, and PA behavior and CBT for lifestyle improvement and maintenance of energy balance; sessions were interactive and included homework. Behavior change strategies included: self-monitoring of diet and activity (via pedometers), setting personal goals, and techniques for coping with difficult situations and teasing. Participants remained in same group	Usual care	Regular care in the Netherlands; consisted of referral to a dietician in the home care setting. Teens had to make the appointment themselves.

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			throughout intervention (8-12 in a group). Two separate parent sessions covered education on health risks of overweight, healthy behavior, and how to support their children. Materials included an information book, workbook, and dietary and PA diaries. [Due to high attrition for 18-month outcomes, only 6-month outcomes used and included in intervention description and intensity calculations].		
Kalarchian, 2009[117] Fair	IG1	Family-based lifestyle intervention	20 60-min group sessions during first 6 months; adult and child groups met separately and presented with complementary material. Before or after these sessions, adult and child jointly met with lifestyle coach to review self-monitoring records and set weekly goals. 6 booster sessions (3 group, 3 telephone calls) between 6 and 12 months with no further contact after 12 months. Intervention adapted from Epstein and included modified Stoplight Eating Plan with daily energy range, and goal to increase PA and decrease PA to less than 15 hours/week. Behavior change techniques included: self-monitoring, environmental changes, step-wise goal setting, stimulus control, and positive reinforcement. Instruction provided in setting realistic expectations, promoting body image, minimizing emotional eating, and coping with teasing. Adults instructed to set goals and model behavior change; overweight adults encouraged to lose weight.	Nutrition consultation	Adults and children offered 2 nutrition consultation sessions to develop an individual nutrition plan based on the Stoplight Eating Plan; offered intervention after completion of 18-month assessment. This group intended as usual care in patients with severe obesity.
Kalavainen, 2007[118] Fair	IG1	Health-promoting lifestyle	15 90-minute group sessions; 14 held separately for parents and children and one session held together (10 weekly sessions, and 5 every 2 weeks). Program focused on healthy lifestyle as opposed to weight management and parents were targeted as the main agents of change; lifestyle changes intended for entire family and overweight parents who desired to lose weight were encouraged. Parent sessions included education on healthy lifestyle, parenting skills, and behavior change techniques (pros and cons, goal-setting, self-monitoring, stimulus control and cue elimination, action planning, problem-solving, and relapse prevention). Child sessions involved functional activities and non-competitive PA. Parents given treatment manuals and children given workbooks; materials based on Magnificent Kids and Magnificent Teens and “Think Good-Feel Good” CBT workbook. Homework assigned to parents and children; the importance of regular weighing at home emphasized.	Brief education + booklets	Booklets for families and 2 30-minute individual sessions for each child with school nurse. Booklets contained information about weight management, eating habits and PA. Appointments intended for child only but parents allowed if willing. Themes of sessions were self-knowledge and PA; weight and height measured at each session. Children completed workbooks with school nurse and at home with parents. Booklets and workbooks based on Magnificent Kids material and “Think Good-Feel Good” CBT workbook.
Kong, 2013[119]	IG1	ACTION	Transtheoretical model based-intervention consisting of 8 motivational interviews with PCP and student over the academic year (1 session every 2-	Single PCP visit +	1 PCP clinic visit at beginning of trial for assessment of diet

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
Fair			3 weeks), DVD and print materials from a toolkit, and 8 motivational interview followup calls with caregivers. At first visit, patient received DVD player and DVD (content included adolescent motivation for change, strategies targeting energy balance and nutritional quality, physical aerobic dance and strength training), and summary of medical results; this visit dedicated to reviewing medical history, assessing diet and PA and stage of change, and feedback about status relative to recommendations. Participants asked to review DVD and followup with topics they would like to discuss at next session. Subsequent visits tailored to stage of change with intention of moving towards goal setting for healthier eating and PA. Print materials included: weight loss guidelines for clinicians, MI for clinicians, newsletter for caregivers, clinic displays, and adolescent session tools (e.g., goal setting, activity/food journal).	booklet	and PA, review of medical results, and feedback about status relative to national recommendations. Provided AAP "Balance for a Healthy Life" booklet.
Kose, 2021[120] Fair	IG1	Motivational support programme (MSP)	The intervention consisted of motivational interviewing (MI) and reminder messages, and education programs were provided to the parents. Each MI interview was limited to approximately 30 min. The MI was performed 8 times by the researcher (twice in the first and second month, once in the other months). First, the adolescent's reason for applying, priorities and ambivalences were determined. Methods of losing weight, physical activity, nutrition and overcoming stress were discussed during the interviews. Messages including recommendations regarding physical activity, nutrition, the development of a healthy attitude and behaviors were sent twice a week for 6 months. Each statement used in the messages was repeated for each adolescent to provide motivation. Reminder messages were sent via text. The parents of adolescents who constituted the experimental group were provided with a 2-hr face-to-face education program on the grouping of nutrition and nutritional elements, adequate and balanced nutrition, food purchasing, storage, preparing and cooking rules (e.g., reducing the amount of oil and boiling instead of frying), causes and prevention of obesity and the importance of physical activity.	Control	NR
Lison, 2012[121] Fair	IG1	Hospital-based group exercise	Two 1-hour parent/child group education sessions and 120 group PA sessions (5 1-hour supervised sessions per week for 6 months). Education sessions covered importance of weight loss and maintenance, therapeutic nutritional approach to childhood obesity, and role of PA in cardiovascular fitness. Dietary focus was Mediterranean diet. Behavior change strategies included stimulus control, pre-planning, problem solving, and skills for shopping and interpreting food labels. Encouraged to reduce sedentary behavior. 60-minute group exercise sessions included stretching, moderate	Lifestyle instruction during regular visits	Instructed about diet and other lifestyle changes during regular visits to the hospital, but did not receive the education or PA sessions. Maintained usual levels of 7 daily activity with no additional exercise components.

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			aerobic activity, and resistance training tailored to each participant with increasing intensity throughout program; parents were allowed to remain present for PA sessions. 5 sessions offered per week with minimum attendance at 3 per week strongly advised. Group sessions aimed to foster positive feeling and attitude toward PA. Participants and parents asked to practice PA during the weekend.		
Lison, 2012[121] Fair	IG2	Home-based exercise	Two 1-hour parent/child education sessions and detailed plan for 120 sessions of home-based exercise (5 1-hour sessions per week for 6 months). Education sessions covered importance of weight loss and maintenance, therapeutic nutritional approach to childhood obesity, and role of PA in cardiovascular fitness. Dietary focus was Mediterranean diet. Behavior change strategies included stimulus control, pre-planning, problem solving, and skills for shopping and interpreting food labels. Encouraged to reduce sedentary behavior. Home-based exercise program included demonstration of how to perform exercises, daily exercise log book, and detailed plan for home exercise sessions which included resistance and aerobic training with progressively increasing duration throughout program. Exercise plan was for 5 1-hr sessions per week for 6 months with minimum participation of 3 per week strongly advised.	Lifestyle instruction during regular visits	Instructed about diet and other lifestyle changes during regular visits to the hospital, but did not receive the education or PA sessions. Maintained usual levels of of daily activity with no additional exercise components.
Looney, 2014[122] Fair	IG1	Newsletters + Growth Monitoring + Family-based Bx Counseling	6 monthly sessions (3 30-min in-person and 3 20-minute calls); half of session time was used for growth monitoring and standardized feedback and half of session time for behavioral counseling for the caretaker. A family-based approach was used where both the caretaker and child were encouraged to change and monitor eating and activity behaviors. Behavioral strategies included: self-monitoring, modeling, stimulus control, and positive reinforcement.	Newsletters	6 monthly educational newsletters on nutrition and leisure-lime activity topics with recommendations to assist with child overweight and obesity plus usual care from the pediatrician (e.g., well-child visits, sick visits).
Looney, 2014[122] Fair	IG2	Newsletters + Growth Monitoring	6 monthly growth monitoring sessions with standardized feedback (3 15-min in-person appointments and 3 10-minute calls) with tools provided: scale, BMI wheel, wall growth chart, BMI-for-age growth chart, plotting tool, and growth self-monitoring diary. 6 monthly educational newsletters on nutrition and leisure-lime activity topics with recommendations to assist with child overweight and obesity plus usual care from the pediatrician (e.g., well-child visits, sick visits).	Newsletters	6 monthly educational newsletters on nutrition and leisure-lime activity topics with recommendations to assist with child overweight and obesity plus usual care from the pediatrician (e.g., well-child visits, sick visits).
Love-Osborne, 2014[123] Fair	IG1	Health educator visits	Initial visit with health educator (HE) consisted of feedback from diet and PA assessment using motivational interviewing to support change and goal-setting. Goals reviewed and modified at each subsequent visit. HE encouraged participants to choose 1 nutrition and 1 PA goal. Frequency of HE visits directed by participant (mean 5, range 1-8 visits). HE linked	Physical exam and lab screening if due,	If physical exam and lab screening for comorbidities of obesity had not been done in previous 2 years, considered standard of care in the

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			patients to existing resources for healthy eating and PA, including facilitating applications for free parks and recreation memberships. Self-monitoring of weight and lifestyle behaviors encouraged and incentives provided for returning log sheets. IG further randomized to 2 weekly text messages (1 individualized goal-related and one log sheet reminder) or no text messages during the first semester. Physical examination and laboratory screening as needed by physician.	followup as needed	organization, a visit was scheduled in the school-based health center. Abnormal lab testing evaluated by physician investigators and addressed within school-based health center with referral for specialty care as needed.
McCallum, 2007[124] Good	IG1	LEAP	Four GP consultations of brief solution-focused family therapy to support healthy lifestyle goals. 20-page family folder included 7 topic sheets targeting areas of behavioral change (sedentary time, physical activity, water consumption, eating habits and lower fat food options). Topic sheets summarized supporting evidence for the target behavior, modelled solutions to common challenges, and provided suggestions for reaching the goal. Materials included wall chart, reward stickers, and shopping tips. Parents encouraged to offer family meals, engage in shared parent-child activities, use praise and non-food rewards, and use contracting for behavior change. Before first appointment, GPs received intervention materials, summary of parent's responses from baseline questionnaire regarding nutrition, physical activity and weight status concern, and child's BMI. GP also provided brief encouragement during non-counseling visits.	Usual care	Usual care. Control families notified of control status via letter and never identified to GPs. Medical records of CG children audited to assess possible contamination (i.e., discussion of weight at a medical visit).
Mellin, 1987[125] Fair	IG1	SHAPEDOWN	14 90-minute weekly group sessions for adolescents and 2 90-minute parent sessions using SHAPEDOWN materials (a Leader's Guide, parent workbook and adolescent workbook). Focus of the program was successive, sustainable, small modifications in diet, exercise, relationships, lifestyle, communication and attitudes; very-low calorie or restrictive diets avoided. Each session included voluntary weigh-in, leader-facilitated group interaction and exercise period. Parents instructed on strategies to support adolescents' weight loss efforts including altering family diet and activity and improving parenting and communication skills. Techniques included: problem-solving, parenting skills (limit-setting and nurturing), cognitive therapy, stress management, body image therapy, and instruction in eating regular meals and eating in response to hunger and satiety. Content integrated ethnic, cultural, and economic differences and used examples of a broad range of family types.	Waitlist	Subjects received no treatment initially and were informed they could enroll in the next program that would commence after 6 months.
Nemet, 2005[126] Fair	IG1	Dietitian + PA sessions	Four evening lectures w/ parents on childhood obesity, general nutrition, therapeutic nutritional approach for childhood obesity, physical activity and childhood obesity). Met w/ dietician 6 times and differed based on age of participant; if 6-8 years, parent only during first 2 sessions then child joined; if 8 year - pubertal, parent and child for all meetings; if adolescent, alternated	Nutrition referral	Control subjects were referred to an ambulatory nutritional consultation at least once and were instructed to perform physical activity 3 times per

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			child-only and parent-only meetings after joint 1st meeting. First session 45-60 minutes, all other sessions 30-45 minutes. Instructed on nutritional education (e.g., food pyramid), food choices, dietary/cooking habits, and motivation for weight loss. Received a balanced hypocaloric diet (5021-8368 kg depending on age and weight), a caloric deficit of 30% from reported intake and intake 15% less than estimated daily required intake. Exercise program consisted of twice-weekly 1-hour training sessions, pts encouraged to add extra 30-45 minutes of walking or weight-bearing sports activities at least once per week. Encouraged to reduce sedentary activities.		week on their own.
Norman, 2016[127] Fair	IG1	Stepped-down Care	Based on a combination of the chronic care model and social cognitive theory; followed recommendations from AAP about treatment of childhood obesity. Consisted of 3 4-month steps with a goal of 4lb weight loss every 4 months. If the participant did not meet the goal, the step was repeated. If the 4-lb weight loss was achieved, the participant 'stepped down' to the next level of reduced intensity. At the start of the program, the physician provided brief counseling on health diet and PA behaviors. If progress is not made, a follow-up physician visit occurred at month 8 and focused on weight management strategies. Face-to-face health educator visits occurred monthly in step 1 and bi-monthly in step 2, and included discussion of weight management concepts, identification of barriers to healthy eating and PA, and brainstorming problem-solving strategies to overcome barriers. These meetings were available to child and parent, but parents were not required to attend. Phone calls (biweekly in steps 1 and 2, monthly in step 3) were used to review progress, help set new goals and discuss barriers and solutions, speak to parents to reinforce parental involvement and emphasize importance of healthy changes in the home environment to encourage goal attainment. Diet and PA education materials were distributed at health education visits at pediatric clinics. Adolescent and parents asked to keep self-monitoring logs for steps and weight that could be shared with health counselor for feedback. Pedometers were distributed at the initial visit to monitor PA and help participants set PA goals.	Enhanced Usual Care	Received an initial counselling visit by physician, one visit with a health educator, materials on how to improve weight-related behaviors, and monthly follow-up mailings on weight-related issues. Labelled "enhanced" because participants received more than the current standard of practice in the Children's Primary Care Medical Group for adolescents with obesity with no medical comorbidities. Participants also received pedometer at initial health educator visit
O'Connor, 2013[128] Fair	IG1	Helping HAND	Six monthly individual family sessions with health advisors with follow-up phone call 2 weeks after each session. Behavior change strategies included: collaborative goal setting for children and parents, action planning, behavioral contract, self-monitoring of goal-specific behavior, and problem solving. Child behavior goals selected from menu of goals about healthy diet, PA, and TV time; goals were for 1-month period with the option to work on the goal for an additional month. Parent goals included behavior-specific parenting practices (responsiveness, structure and non-directed control for diet; logistic support and modelling for PA; and mediation and social co-	Waitlist	Asked to see doctor as regularly scheduled and follow doctor's advice and treatment plans. Recontacted after 7 months for post-intervention data collection and to start intervention; asked to avoid participation in other obesity prevention or treatment

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			viewing for TV). Worksheets used during sessions to facilitate goal-setting and problem-solving.		programmes during this time.
Patrick, 2013[129] Fair	IG1	Group sessions + website	Access to the program website and its web tutorials, monthly mailed tip sheets, and monthly 90 min group sessions of 5–10 adolescents and their parents where they discussed the behavioral skills from the web tutorials. Participants in this condition also received brief (~20 min) bimonthly phone calls from the health counselor reviewing concepts presented in the web tutorial and reinforcing behavioral strategies such as goal setting and problem solving of barriers/solutions. Attendance and participation in the group sessions were rewarded with mileage incentives and a lottery for prizes such as cookbooks or other materials to assist with healthy behavior change. Nutrition demonstrations and physical activities were also integrated in each group session. The program website and its tutorials were designed to promote weight loss and healthy behaviors related to obesity. Based on the "stoplight approach," participants were encouraged to limit red-light foods (low nutrient, high calorie/ fat) and red-light activities (unproductive, low energy), increase green-light foods (high nutrient, low calorie/fat) and green-light activities (high energy), and eat yellow-light foods and do yellow-light activities in moderation. The website and its tutorials provided educational topics and challenges based on weekly nutrition or physical activity goals, skill building exercises, a reward system to encourage success, evaluation for assessment of progress, weekly weigh-in, and feedback on progress. All participants received a pedometer and a body weight scale. Participants were encouraged to report their steps daily and to report their body weight weekly. The website also included information on recommended food portion sizes, categorization of foods into the stoplight plan, and a resource library that included tip sheets, recipes, and web tutorials on several behavior change strategies, such as goal setting, seeking social support, and positive self-statement. The application and content of the program website was divided into three phases, with phase 1 (weeks 1–17) entailing education on healthy behaviors needed for weight loss, phase 2 (weeks 18–34) designed to be both more interactive (e.g., true/false quizzes, interactive activities/games) and allow the participant to select challenges and goals to help to master skills and behaviors introduced in phase 1, and phase 3 (weeks 35–51) designed to be interactive and encourage working on multiple behaviors at the same time. The parent completed an adult version of the program website (except for skills and rewards) and, in the website, monthly group sessions, and follow-	Usual care	Printed materials produced by the American Diabetes Association and the American Heart Association. Participants were encouraged to attend three 1 h group nutrition sessions at Rady Children's Hospital of San Diego during the first 6 weeks at no charge. They also received monthly tip sheets by mail.

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Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			up calls (WG) condition, participated in group counseling aimed at skill building to support their adolescent's behavioral goals. Usability of the program website was monitored and recorded. Parents did not receive the counselor calls or text message intervention components.		
Patrick, 2013[129] Fair	IG2	Website + text messages	Program website and its web tutorials, monthly mailed tip sheets, and a minimum of three text messages per week that related to weekly challenges and intervention goals. Reminder text messages were sent if the participant did not log on to the website by the fourth day of the intervention. Participants could also communicate via text messages with a health counselor if they had questions. Participants were provided with cell phones and prepaid text message plans that allowed research staff to monitor SMS use. The program website and its tutorials were designed to promote weight loss and healthy behaviors related to obesity. Based on the "stoplight approach," participants were encouraged to limit red-light foods (low nutrient, high calorie/ fat) and red-light activities (unproductive, low energy), increase green-light foods (high nutrient, low calorie/fat) and green-light activities (high energy), and eat yellow-light foods and do yellow-light activities in moderation. The website and its tutorials provided educational topics and challenges based on weekly nutrition or physical activity goals, skill building exercises, a reward system to encourage success, evaluation for assessment of progress, weekly weigh-in, and feedback on progress. All participants received a pedometer and a body weight scale. Participants were encouraged to report their steps daily and to report their body weight weekly. The website also included information on recommended food portion sizes, categorization of foods into the stoplight plan, and a resource library that included tip sheets, recipes, and web tutorials on several behavior change strategies, such as goal setting, seeking social support, and positive self-statement. The application and content of the program website was divided into three phases, with phase 1 (weeks 1–17) entailing education on healthy behaviors needed for weight loss, phase 2 (weeks 18–34) designed to be both more interactive (e.g., true/false quizzes, interactive activities/games) and allow the participant to select challenges and goals to help to master skills and behaviors introduced in phase 1, and phase 3 (weeks 35–51) designed to be interactive and encourage working on multiple behaviors at the same time. The parent completed an adult version of the program website (except for skills and rewards) and, in the website, monthly group sessions, and follow-up calls (WG) condition, participated in group counseling aimed at skill	Usual care	Printed materials produced by the American Diabetes Association and the American Heart Association. Participants were encouraged to attend three 1 h group nutrition sessions at Rady Children's Hospital of San Diego during the first 6 weeks at no charge. They also received monthly tip sheets by mail.

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Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			building to support their adolescent's behavioral goals. Usability of the program website was monitored and recorded. Parents did not receive the counselor calls or text message intervention components.		
Patrick, 2013[129] Fair	IG3	Website alone	Individual case management that included weekly "check-in" emails, monthly mailed tip sheets, and access to the program website and its web tutorials. The purpose of the weekly emails was to remind the participants to complete the web tutorials. If participants did not log on to the web program, they received repeated reminders via email and, if necessary, a phone call from a health counselor. The program website and its tutorials were designed to promote weight loss and healthy behaviors related to obesity. Based on the "stoplight approach," participants were encouraged to limit red-light foods (low nutrient, high calorie/ fat) and red-light activities (unproductive, low energy), increase green-light foods (high nutrient, low calorie/fat) and green-light activities (high energy), and eat yellow-light foods and do yellow-light activities in moderation. The website and its tutorials provided educational topics and challenges based on weekly nutrition or physical activity goals, skill building exercises, a reward system to encourage success, evaluation for assessment of progress, weekly weigh-in, and feedback on progress. All participants received a pedometer and a body weight scale. Participants were encouraged to report their steps daily and to report their body weight weekly. The website also included information on recommended food portion sizes, categorization of foods into the stoplight plan, and a resource library that included tip sheets, recipes, and web tutorials on several behavior change strategies, such as goal setting, seeking social support, and positive self-statement. The application and content of the program website was divided into three phases, with phase 1 (weeks 1–17) entailing education on healthy behaviors needed for weight loss, phase 2 (weeks 18–34) designed to be both more interactive (e.g., true/false quizzes, interactive activities/games) and allow the participant to select challenges and goals to help to master skills and behaviors introduced in phase 1, and phase 3 (weeks 35–51) designed to be interactive and encourage working on multiple behaviors at the same time. The parent completed an adult version of the program website (except for skills and rewards) and, in the website, monthly group sessions, and follow-up calls (WG) condition, participated in group counseling aimed at skill building to support their adolescent's behavioral goals. Usability of the program website was monitored and recorded. Parents did not receive the counselor calls or text message intervention components.	Usual care	Printed materials produced by the American Diabetes Association and the American Heart Association. Participants were encouraged to attend three 1 hr group nutrition sessions at Rady Children's Hospital of San Diego during the first 6 weeks at no charge. They also received monthly tip sheets by mail.

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Raynor, 2012a[130] Fair	IG1	DECREASE + Growth Monitoring	Eight 45-minute parent-only group behavioral sessions (biweekly for 2 months and monthly for months 3-6). Behavior change strategies included: self-monitoring, pre-planning, problem-solving, shaping, setting goals, positive reinforcement, stimulus control, and parental modeling. Children and parents self-monitored targeted behaviors and submitted logs at meetings. Used a restrictive approach to reduce intake of non-nutrient-dense, energy-dense foods. Goal was to reduce intake of sweet and salty snacks to ≤3 servings/week and sugar-sweetened beverages to ≤3 servings/week. Growth assessed at 0, 3, and 6 months. Letters providing changes in height, weight, BMI, BMI percentile, and % overweight and interpretation of changes were sent to families and the child's PCP after each growth assessment.	Monthly newsletters + growth monitoring	Monthly newsletter with information about healthy eating and leisure-time behaviors; growth assessed at 0, 3, and 6 months. Letters providing changes in height, weight, BMI, BMI percentile, and % overweight and interpretation of changes were sent to families and the child's PCP after each growth assessment. Families provided with research staff contact information and encouraged to contact staff with any questions about information in the letter.
Raynor, 2012a[130] Fair	IG2	INCREASE + Growth Monitoring	Eight 45-minute parent-only group behavioral sessions (biweekly for 2 months and monthly for months 3-6). Behavior change strategies included: self-monitoring, pre-planning, problem-solving, shaping, setting goals, positive reinforcement, stimulus control, and parental modeling. Children and parents self-monitored targeted behaviors and submitted logs at meetings. Increase healthy food intake to shape food preference for these foods and lower energy density of the diet. Goal was to consume 2 servings/day of whole fruit, 3 servings/day of vegetables, and 2 servings/day of low-fat dairy products. Growth assessed at 0, 3, and 6 months. Letters providing changes in height, weight, BMI, BMI percentile, and % overweight and interpretation of changes were sent to families and the child's PCP after each growth assessment.	Monthly newsletters + growth monitoring	Monthly newsletter with information about healthy eating and leisure-time behaviors; growth assessed at 0, 3, and 6 months. Letters providing changes in height, weight, BMI, BMI percentile, and % overweight and interpretation of changes were sent to families and the child's PCP after each growth assessment. Families provided with research staff contact information and encouraged to contact staff with any questions about information in the letter.
Raynor, 2012b[130] Fair	IG1	TRADITIONAL + Growth Monitoring	Eight 45-minute parent-only group behavioral sessions (biweekly for 2 months and monthly for months 3-6). Behavior change strategies included: self-monitoring, pre-planning, problem-solving, shaping, setting goals, positive reinforcement, stimulus control, and parental modeling. Children and parents self-monitored targeted behaviors and submitted logs at meetings. Focused on two typically targeted behaviors in pediatric weight management	Monthly newsletters + growth monitoring	Monthly newsletter with information about healthy eating and leisure-time behaviors; growth assessed at 0, 3, and 6 months. Letters providing changes in height,

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

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			programs, decreasing sugar-sweetened beverages and increasing PA. Goals were 60 minutes/day of moderate-intensity PA (30 minutes/day for parents) most days of the week and for children and parents to consume ≤3 servings of sugar-sweetened beverages/week. Growth assessed at 0, 3, and 6 months. Letters providing changes in height, weight, BMI, BMI percentile, and % overweight and interpretation of changes were sent to families and the child's PCP after each growth assessment.		weight, BMI, BMI percentile, and % overweight and interpretation of changes were sent to families and the child's PCP after each growth assessment. Families provided with research staff contact information and encouraged to contact staff with any questions about information in the letter.
Raynor, 2012b[130] Fair	IG2	SUBSTITUTES + Growth Monitoring	Eight 45-minute parent-only group behavioral sessions (biweekly for 2 months and monthly for months 3-6). Behavior change strategies included: self-monitoring, pre-planning, problem-solving, shaping, setting goals, positive reinforcement, stimulus control, and parental modeling. Children and parents self-monitored targeted behaviors and submitted logs at meetings. Used behavioral economics approach to enhance the feeling of choice for engaging in and liking the targeted behaviors in order to increase long-term adherence. Goals were to watch ≤2 hours of TV per day (as a substitute for PA) and consume 2 servings of low-fat milk per day (as a substitute for sugar-sweetened beverages). Growth assessed at 0, 3, and 6 months. Letters providing changes in height, weight, BMI, BMI percentile, and % overweight and interpretation of changes were sent to families and the child's PCP after each growth assessment.	Monthly newsletters + growth monitoring	Monthly newsletter with information about healthy eating and leisure-time behaviors; growth assessed at 0, 3, and 6 months. Letters providing changes in height, weight, BMI, BMI percentile, and % overweight and interpretation of changes were sent to families and the child's PCP after each growth assessment. Families provided with research staff contact information and encouraged to contact staff with any questions about information in the letter.
Reinehr, 2010[131] Fair	IG1	Obeldicks light	Intervention included PA training, nutrition education, and behavior counseling and was performed in group sessions with individual counseling for child and family. Children divided into groups based on sex and age. PA training involved weekly 1.5 hour sessions for 6 months with exercise activities and instruction in PA and reduction in TV and computer game time. Nutrition course based on “Optimized Mixed Diet” which was fat and sugar reduced and contained 30% of energy from fat, 15% energy from protein, and 55% energy from carbohydrates. Children followed traffic light system. During intensive phase of first 3 months, 6-1.5 hour group sessions for kids about nutrition and eating behavior and 6-1.5 hour parent sessions which included nutrition, PA and behavior education, 1 30-min individual nutrition counseling session. During "establishing phase" (next 3 months) 4 30-minute	Waitlist	Waitlist control for 6 months

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			individual child/parent counselling sessions were held (2 nutrition-focused), plus continuation of weekly PA sessions.		
Resnicow, 2015[132] Fair	IG1	PCP + RD MI	Same as IG2 + 6 additional motivational interviewing counseling sessions conducted by RD over 2 years. RDs given flexibility in scheduling counseling sessions, though encouraged to provide more visits toward the beginning of the intervention. RD sessions delivered in-person or by phone.	Usual care	Measurements at BL, 1- and 2-year FU and provided routine care by PCP, as well as standard educational materials for parents that addressed healthy eating and exercise. Usual care PCPs attended a half-day orientation session that included current treatment guidelines.
Resnicow, 2015[132] Fair	IG2	PCP MI	3 brief PCP-delivered MI counseling sessions with parents in year 1 and 1 additional “booster” visit in year 2 (flexibility allowed in session scheduling). Techniques include reflective listening, autonomy support, shared decision-making, and eliciting change talk (e.g. building discrepancy through values clarification, importance/confidence rulers). Targeted dietary and activity behaviors included: snack foods, sweetened beverages, eating in restaurants, fruits, vegetables, TV/screen time, video and computer games and PA/exercise. Target behaviors identified by a brief screener. PCPs asked to provide positive feedback on "green" behaviors and collaboratively identify with the parent "red" or "yellow" behaviors they would be willing to discuss and possibly modify. Provided materials were tailored to the chosen targeted behavior. Self-monitoring logs offered.	Usual care	Measurements at BL, 1- and 2-year FU and provided routine care by PCP, as well as standard educational materials for parents that addressed healthy eating and exercise. Usual care PCPs attended a half-day orientation session that included current treatment guidelines.
Sacher, 2010[133] Fair	IG1	MEND	Multicomponent group healthy lifestyle program based on nutritional and sports science plus from psychology, learning and social cognitive theories. Engages family in process of weight management by addressing education, skills training and motivational enhancement. 18 group (8-15 children w/ parents or carers and siblings) sessions over 9 weeks (2-hour health twice a week in early evening) by two MEND leaders and one assistant. Sessions included 1 introduction, 8 behavior change (apply techniques to change such as stimulus control, goal setting, reinforcement, and response prevention), 8 nutrition education (healthy eating, weekly achievable diet targets, label reading, supermarket tour, recipes and food preparation, food samples, discouraged weighing in favor of increasing healthy habits), 16 PA sessions (1 hour exercise) for children, and a closing session. Free access to community swimming pool for 12 weeks.	Waitlist	Received intervention after 6 months wait period
Saelens, 2002[134]	IG1	Healthy Habits Intervention	Healthy habits intervention: 1 computerized assessment followed by 1 meeting with pediatrician to discuss assessment results, develop action plan; 11 10-20 min counseling calls; mailed participant manual in 3 different	Single pediatrician session	Meeting with pediatrician assessing motivation and providing (non-tailored)

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Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
Fair			mailings (part of manual mailed each time, included information sheet for parents); encouraged self-monitoring of food intake and PA; single session to discuss intervention and self-monitoring with child and parents		information on healthy eating and PA
Savoye, 2007[135] Fair	IG1	Bright Bodies	Family group sessions twice per week for 6 months, then twice monthly for 6 months. First 6 months: two 50-min exercise sessions/week (parents and children together), 1 weekly weigh-in (both parents and children), and 1 weekly 40-min class covering nutrition (parents and children together) and behavior modification (parents and children in separate groups). Encouraged to exercise 3 additional days/week. Used motivational tools to increase attendance, such as a game accumulating points for participation in group activities and exercise. Dietician led the nutrition portion of the class using the Smart Moves workbook and emphasized a non-diet approach to healthy eating. Behavior modification portion was facilitated by dietician or social worker, and included self-awareness, goal setting, stimulus control, coping skills training, cognitive behavior strategies, and contingency management. Exercise consisted of warm-up, high-intensity and cool-down; once per month special exercise activities planned (e.g., Zumba class). During behavioral modification portion parents attended a separate coping skills training class that emphasized the important of parent as role model, led by psychologist or dietician.	Semi-annual individual counseling	Seen in pediatric obesity clinic every 6 months; Diet (decrease intake of juice, switching to diet products, bringing lunch to school) and exercise (decrease sedentary activities) counseling by RD and physician, and brief psychological counseling with social worker; caregiver involved in nutrition an activity goal-setting
Savoye, 2014[136] Fair	IG1	Bright Bodies	Group family sessions twice per week for 6 months at two separate locations (one w/ Spanish bilingual instructors); two 50-min exercise sessions/week, 1 weekly weigh-in, and 1 weekly 40-min nutrition and behavior modification class. Encouraged to exercise 3 additional days/week. Earned tickets for monthly raffle for weight maintenance or loss and, in some cases, for turning in exercise logs. Dietician led the nutrition and behavioral modification class using the Smart Moves workbook. Nutrition component emphasized a non-diet approach to healthy eating. Behavior modification included self-awareness, goal setting, stimulus control, coping skills training, cognitive behavior strategies, and contingency management. Exercise consisted of warm-up, high-intensity and cool-down; once per month special exercise activities planned (e.g., Zumba class). During behavioral modification portion parents attended a support class with solution-focused brief therapy elements and tool (e.g., strength cards, so help parent identify their own and their child's strengths), led by psychologist or dietician.	General advice + brief psychosocial counseling	Followed in the clinic every 6 months and received general diet and exercise counseling by dieticians and physicians along with brief psychosocial counseling by a social worker.
Sherwood, 2019[137] Fair	IG1	Healthy Homes/Healthy Kids 5-10	All families received tailored guidance from their primary care provider regarding the child's BMI percentile and obesity and prevention topics. Families in both conditions received a treatment group-specific workbook, six biweekly phone coaching calls from a trained phone coach over the first 3 months, and eight monthly phone coaching calls during the remainder of	Attention control (health and safety)	All families received tailored guidance from their primary care provider regarding the child's BMI percentile and obesity and prevention topics.

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			their first year of the study. OP arm behavioral target areas based on pediatric obesity guidelines included limiting sugar-sweetened beverage consumption, encouraging fruit and vegetable consumption, limiting television and other screen time, eating breakfast daily, limiting restaurant eating, encouraging family meals, and limiting portion size. During the first call, the phone coach focused on establishing rapport with the parent/caregiver, briefly reviewed each behavioral target, and began the process of goal setting by eliciting the parent/caregiver's assessment of their family's current status and interest in making changes in each of the behavioral target areas. During the second and subsequent calls, the phone coach worked with the parent to discuss progress on goals set, problem solve with the parent to overcome barriers to goal adherence, and identify new goals as appropriate. This approach allowed us to tailor the content of the phone calls to accommodate family differences with respect to the number and type of relevant problem areas and parent willingness to work on a goal in a particular area. To accommodate these variations and enhance parent motivation to make changes, we worked with parents to identify the problem areas and goals most relevant to them, while also ensuring that we address the core household recommendations over the course of the phone coaching calls.		Families in both conditions received a treatment group-specific workbook, six biweekly phone coaching calls from a trained phone coach over the first 3 months, and eight monthly phone coaching calls during the remainder of their first year of the study. Contact control focused on home safety and injury prevention, fire safety, bicycle safety, and sun protection. Phone session content for each condition included parent self-assessment and behavior change prioritization, goal setting, and adherence strategies.
Smith, 2021[138] Fair	IG1	Family Check-Up 4 Health (FCU4Health)	FCU4Health focuses on building motivation and providing tailored support to promote children's health. FCU4Health involves a family assessment, feedback and motivation session and individually tailored treatment plan comprised of parenting skill sessions and referrals to services in the community to address participation and retention challenges. Families in the intervention condition were invited to participate in the FCU4Health in addition to receiving usual care through their clinic. The baseline, 3-, and 6-month assessments were each followed by a feedback session, conducted by a trained FCU4Health coordinator, and tailored follow-up sessions, focused on parenting skill development, and care coordination to connect families with community-based services. The first feedback discussed caregiver perception of needs, their child's health and health behaviors, the caregivers' motivation to change, and community referrals. The 3- and 6-month feedbacks additionally focused on family progress and problem-solving barriers. Coordinators also conducted phone-based coaching, based on the needs of families and schedule of in-person visits, to maintain contact with the family, problem-solving challenges and reinforce positive changes. Parenting sessions "Everyday Parenting") were tailored to family's specific needs identified during assessment and focused on specific behavior change goals. Families were expected to engage in 8-16 sessions of "Everyday Parenting."	Usual care	Families randomized to the services-as-usual arm received information about the same community resources offered to families in the FCU4Health arm. They also continued to receive usual care from their providers with frequency of visits determined by BMI classification and progress toward weight management goals.

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
Stark, 2011[139] Fair	IG1	LAUNCH	Phase 1 (intensive intervention), 12 weekly sessions that alternated between group-based clinic session (parent and child concurrent groups) and individual home visits; Phase 2 (maintenance), 6 sessions (every other week over 12 weeks) alternating between group clinic-based sessions and home sessions. Parent clinic-based sessions (90 minutes) addressed dietary education (snacks/beverages, breakfast/lunch, dinner) and kept dietary diaries for child (caloric goal 1000-1200/day); decreasing screen time.	Enhanced standard of care	Each family met with a pediatrician for 1 45-minute session to review child's growth chart and to explain BMI, BMI percentiles, and the child's current BMI percentile. Recommendations were made in accordance with "Prevention Plus" for obese preschool children: <=2 hrs/day screen time, 60 mins/day active play time, eliminating soda and limiting juide to 4 oz/day, >=5 servings/day fruits and vegetables, limiting eating out, and appropriate portion sizes. Received 1- page healthy food and activity brochure.
Stark, 2014[140] Fair	IG1	LAUNCH-clinic	10-session manualized intervention to produce small decreases or stabilize rate of child weight gain consistent w/ current obesity treatment recommendations. Parent-group clinic sessions (90 minutes) concurrent w/ child group sessions (90 minutes). Parent sessions (90 minutes) addressed dietary education (snacks/beverages, breakfast/lunch, dinner) and kept dietary diaries for child (caloric goal 1000-1200/day); decreasing screen time	Enhanced standard of care	Pediatrician met with each family to explain BMI, BMI percentiles, and to review the child's growth chart in a single 45-minute meeting. Modeled on AAP "Prevention Plus" guideline--Pediatrician made recommendations regarding daily screen time, active play, eliminating soda, fruit and vegetable servings, limiting eating out, and appropriate portion sizes for preschoolers. Received 1 page healthy food and activity brochure.
Stark, 2018[141] Fair	IG1	LAUNCH	The overall goal of LAUNCH and motivational interviewing was to follow the Expert Committee Recommendations on Prevention, Assessment and Treatment of Child and Adolescent Overweight and Obesity for reducing obesity in preschoolers by either stabilizing or slowing the rate of children's weight gain or to produce a gradual weight loss of 1 lb/ month. Both interventions targeted (1) limiting portion size; (2) limiting consumption of	Standard care	Standard care informed caregivers of their child's weight status during the recruitment process, but neither the children nor caregivers received any

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			energy-dense foods; (3) limiting eating out; (4) consumption of ≥5 servings of fruit and vegetables per day; (5) minimizing or eliminating sugar sweetened beverages; (6) limiting screen time to ≤2 hours per day, and no TV in the room where child sleeps; and (7) achieving ≥1 hour of moderate to vigorous physical activity per day. LAUNCH is an 18-session clinic and home family-based behavioral weight management intervention, consisting of a 3-month intensive treatment phase (weekly sessions) followed by a 3-month maintenance phase (every other week sessions). Intervention sessions alternated between clinic (10 sessions) and home (8 sessions) visits. Parent clinic-based group sessions were 90 minutes each and led by a licensed clinical psychologist. Sessions consisted of education and problem-solving around parent and child diet, dietary and physical activity changes, and child behavior management strategies such as differential attention (e.g., ignoring complaints about food, praising trying vegetables), contingency management (e.g., rewarding healthy behaviors), limit setting, effective use of time-out to manage tantrums, shaping (e.g., gradually introducing change), and exposure to introduce new foods, and implementing stimulus control measures to improve food choices and physical activity. Sessions 1-7 focused on dietary changes (with dietary tracking conducted throughout treatment), Sessions 8-10 focused on changing sedentary and physical activity, and sessions 11-18 focused on bringing all the skills together and problem-solving barriers to recommended lifestyle changes. A simultaneously held child group provided education about healthy eating, opportunities for moderate to vigorous physical activity, and exposure to a variety of fruits and vegetables through a meal. LAUNCH incorporated home visits (60 minutes) to facilitate generalization of the clinic taught skills to the home including parenting skills and changing the home environment using instruction, modeling and rehearsal of dietary, physical activity, parenting, and stimulus control techniques. Child groups and home visits were conducted by a postdoctoral fellow in clinical psychology or nutrition.		treatment.
Stark, 2018[141] Fair	IG2	Motivational interviewing	The overall goal of LAUNCH and motivational interviewing was to follow the Expert Committee Recommendations on Prevention, Assessment and Treatment of Child and Adolescent Overweight and Obesity for reducing obesity in preschoolers by either stabilizing or slowing the rate of children's weight gain or to produce a gradual weight loss of 1 lb/ month. Both interventions targeted (1) limiting portion size; (2) limiting consumption of energy-dense foods; (3) limiting eating out; (4) consumption of ≥5 servings of fruit and vegetables per day; (5) minimizing or eliminating sugar sweetened beverages; (6) limiting screen time to ≤2 hours per day, and no TV in the room where child sleeps; and (7) achieving ≥1 hour of moderate to vigorous physical activity per day. Motivational interviewing was a parent only	Standard care	Standard care informed caregivers of their child's weight status during the recruitment process, but neither the children nor caregivers received any treatment.

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			intervention consisting of 18 sessions over 6 months, delivered weekly during the initial 3 months and every other week months 4-6. At the initial 60-minute session parents met with a pediatrician trained in motivational interviewing during which 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 "Let's Go 5-2-1-0" program. Following the tenets of motivational interviewing, caregivers were asked about their concern about their preschoolers' weight, diet, and physical activity and asked about their desired child outcome, motivation, and confidence to make changes in any area of concern. If receptive, they were asked to select a nutrition or physical activity as a primary target of discussion from a menu of the AAP recommendations and the Let's Go 5-2-1-0 materials. Subsequent motivational interviewing intervention sessions were delivered by a licensed clinical psychologist trained in motivational interviewing in either the families' home (sessions 2,12,16) or over the telephone (14 sessions). These motivational interviewing intervention sessions consisted of a discussion of previous goals selected by the caregiver, exploration of the caregiver's perception of the success in reaching these goals, determination of caregiver's confidence and willingness to continue working on existing goal(s) or establishing new behavioral goals, and enhancement of motivation to address ambivalence and readiness to change behaviors in the caregivers, and identification of self-selected strategies for goal attainment. Following the tenets of motivational interviewing, the length of the phone sessions was determined by parents. The median phone session length was 15 minutes with 22% (135 of 625 of phone sessions) being ≤10 minutes. All home visits were scheduled for 60 minutes.		
Stettler, 2014[142] Fair	IG1	Multiple-behavior change	12 15-25 min weekly (1-4 sessions), biweekly (5, 6), monthly (7, 8) and bimonthy (9-12) with child, parent/guardian and clinician. Bx goals to reduce intake of "Whoa" sugary drinks (e.g., soda, lemonade), increase intake of "Go" drinks (water, milk), increase pedometer to 15000 steps/day, and reduce screen time ≤ 2 hours/day. Increase knowledge of serving sizes, benefits of water intake, detrimental effects of sugary drinks, importance of parent modeling behavior, healthy eating, screen time, and physical activity. Skill-building of self-monitoring and stimulus control. Point-system used with children for positive reinforcement for both session attendance and behavioral change, behavioral contract signed by parent, child and clinician. Role-playing and other activities (e.g., grocery receipt review, measure targe HR, identify alternatives to sedentary bx).	Attention control (bullying prevention)	12 15-25 min clinician, child, and parent sessions. Bullying prevention attention control condition to aid children in developing strategies for improving friendship making skills and anger management abilities. Children received cartoons of different social situations and discussed them with the clinician. Homework assignments included similar cartoons and other creative assignments including drawing

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
					places where bullying might happen, drawing what different emotions look like, and strategies for handling negative social situations. Point-system used with children for positive reinforcement for positive social behaviors and handling friendship-making problems, but no behavioral contract. Sessions occurred on same schedule and for same length of time as IG conditions.
Stettler, 2014[142] Fair	IG2	Combined	Combined participants from IG2 and IG3	Attention control (bullying prevention)	12 15-25 min clinician, child, and parent sessions. Bullying prevention attention control condition to aid children in developing strategies for improving friendship making skills and anger management abilities. Children received cartoons of different social situations and discussed them with the clinician. Homework assignments included similar cartoons and other creative assignments including drawing places where bullying might happen, drawing what different emotions look like, and strategies for handling negative social situations. Point-system used with children for positive reinforcement for positive social behaviors and handling friendship-making problems, but no behavioral contract. Sessions occurred on same schedule and for same length

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
					of time as IG conditions.
Stettler, 2014[142] Fair	IG3	Beverage-only intervention	12 15-25 min weekly (1-4 sessions), biweekly (5, 6), monthly (7, 8) and bimonthy (9-12) sessions with child, parent/guardian and clinician. Behavioral goals to reduce intake of "Whoa" sugary drinks (e.g., soda, lemonade), increase intake of "Go" drinks (water, milk). Increase Knowledge of serving sizes, benefits of water intake, detrimental effects of sugary drinks, and importance of parent modeling bx. Skill-building of self-monitoring and stimulus control. Point-system used with children for positive reinforcement for both session attendance and behavioral change, behavioral contract signed by parent, child and clinician. Role-playing and other activities (e.g., label reading, tooth brushing).	Attention control (bullying prevention)	12 15-25 min clinician, child, and parent sessions. Bullying prevention attention control condition to aid children in developing strategies for improving friendship making skills and anger management abilities. Children received cartoons of different social situations and discussed them with the clinician. Homework assignments included similar cartoons and other creative assignments including drawing places where bullying might happen, drawing what different emotions look like, and strategies for handling negative social situations. Point-system used with children for positive reinforcement for positive social behaviors and handling friendship-making problems, but no behavioral contract. Sessions occurred on same schedule and for same length of time as IG conditions.
Tanofsky-Kraff, 2010[143] Fair	IG1	IPT-Weight Gain Prevention	One individual 90-minute pre-group session and 12 75-90 minute weekly group sessions for the adolescents of interpersonal psychotherapy (IPT-WG) for the prevention of excessive weight gain. IPT is based on the assumption that binge eating occurs in response to poor social functioning and consequent negative mood and focused on improving interpersonal difficulties and social deficits. Group sessions offered psychoeducation and general skill-building that could be applied to different relationships within the framework of interpersonal problem areas; episodes of overeating and loss-of-control eating were linked to interpersonal functioning.	Attention control (health education)	12 group health education sessions as attention control. Curriculum topics included: avoiding alcohol, drug, and tobacco use, identifying signs of depression and suicide, nonviolent conflict resolution, sun safety, domestic violence, and very basic information on nutrition, body image, and exercise. Information provided

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Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
					in didactic manner.
Tanofsky-Kraff, 2014[144] Fair	IG1	Interpersonal psychotherapy	One individual 1.5 hr meeting followed by 12 consecutive weekly 90-min group sessions. The program consisted of three phases: initial (providing the rationale for the approach and developing rapport among group members), middle (the work phase during which members share personal relationship experiences and develop improved communication), and termination (preparing to say goodbye and for future work on goals). The manifestation of symptoms was conceptualized in one of four problem areas: a) interpersonal deficits, b) interpersonal role disputes, c) role transitions, and d) grief. Making use of this framework for defining one or more interpersonal problem areas, IPT (Interpersonal psychotherapy) focused on identifying and changing the maladaptive interpersonal context in which the symptoms have developed and been maintained. The pre-group session focused on reviewing the adolescent's current body weight and eating patterns that placed participant at high-risk for excessive weight gain and eating disorders. In addition, important relationships that impact mood and promote LOC (loss-of-control)-eating were discussed. A timeline of the manifestation of each participant's LOC-eating patterns was developed and one to three interpersonal goals were identified for each adolescent to work on during the course of the group program. The IPT program involved psychoeducation of risk factors for excess weight gain and eating disorders and teaching communication analysis, role-playing, and social skills; and involved linking difficult relationships and associated negative affect to LOC-eating throughout the intervention. By teaching participants to identify the connections among their relationships, mood, and eating, and by guiding them to improve their interpersonal interactions both within and outside of the group milieu, the goal of IPT was to reduce the LOC-eating episodes that promoted exacerbated binge-eating and excess weight gain.	Attention control (health education)	An attention comparison to match session duration and frequency of IPT. The curriculum topics included domestic violence, alcohol, drug and tobacco, basic information on nutrition, body image, nutrition, identifying signs of depression and suicide, gang violence, non-violent conflict resolution, and sun safety. Information was provided in a didactic manner and although one session involved nutrition education, all discussion involving the topic of LOC (loss-of-control)-eating or social interactions were avoided and, if girls requested interpersonal guidance, they were encouraged to speak with a trusted adult. In order to parallel IPT, an individual pre-group meeting was held with each participant to review their current body weight and eating patterns that placed them at high-risk for excessive weight gain and exacerbated binge eating. In addition, family's health history was mapped on a genogram.
Taveras, 2011[145] Good	IG1	MI + enhanced EMR and training	Chronic Care Model-based intervention where all practice team members were trained and electronic medical record enhanced to assisst clinicians with decision support, patient tracking, follow-up, scheduling, and billing. 4 25-minute face-to-face + 3 15-min phone motivational interviewing sessions with NP which used tailored educational modules targeting TV viewing, and fast food and sugar-sweened beverage intake. Included printed and	Usual care	Current standard of care offered by the pediatric practice. This included well-child care visits and follow-up appointments for weight checks with their pediatrician

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			electronic behavior monitoring tools, lists of resources for PA, and interactive website. Focus on de-emphasizing labeling, giving the parent responsibility for identifying which behaviors are problematic, encouraging parents to clarify and resolve ambivalence about behavior change, and settings goals to initiate change process. Pediatricians trained to use brief, focused negotiation (based on motivational interviewing) in routine well-child exams to endorse family behavior change. Posters in waiting rooms highlighted targeted behaviors. Behavioral goals were		or a specialist (e.g., nutritionist). Families in the UC group visited the practice for the baseline and annual well-child appointment.
Taveras, 2015[146] Good	IG1	CDS+coaching	Modified the existing electronic health record to deploy a computerized, point-of-care clinical decision support (CDS) alert to pediatric clinicians at the time of a well-child visit for a child with a BMI at the 95th percentile or greater. Alert contained links to growth charts, evidence-based childhood obesity screening and management guidelines, and a pre-populated standardized note template specific for obesity that included options for (1) documenting and coding for BMI percentile, (2) documenting and coding for nutrition and physical activity counseling, (3) placing referrals for weight management programs, (4) placing orders for lab studies if appropriate, and (5) printing educational materials. Clinicians were trained to use brief motivational interviewing to negotiate a follow-up weight management plan with the patient and their family. A comprehensive set of educational materials were developed to be provided by pediatric clinicians to patients that focused on individual- and family-level behaviors, including (1) decreases in screen time, (2) decreases in consumption of sugar sweetened beverages, (3) increases in moderate and vigorous physical activity, and (4) improvement of sleep duration and quality. Additionally, 4 newsletters were provided throughout the intervention period that included self-guided behavior change. 4 phone motivational interview sessions (time NR) with health coach and optional text messaging program for parents (2 texts/week, one educational message about a target behavior, one self-monitoring message asking how child did with specific target behavior, with followup message after parent reply). Families were assigned a health coach who used motivational interviewing to support families by phone at 1, 3, 6, and 9 months. Parents were also invited to participate in an interactive text message program. Parents who chose not to receive texts had the option to receive the same messages by email. Texts were received 2x/week during the 1 year follow up period and provided support for behavior change for the patient and their family. The first text each week is an educational message about one of the recommended behaviors, and the second is a self-monitoring message that asks how the child did with a certain target behavior the day before. The outgoing text asks	Usual care	Received the current standard of care offered by their pediatric office. No new decision support tools for obesity were made available in the electronic health records of the 4 usual care practices. Received generic health-related materials in the mail.

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			parents to reply to these messages, and in turn they receive an automated feedback response message tailored to how they indicated they are doing meeting that behavior goal.		
Taveras, 2015[146] Good	IG2	CDS	Modified the existing electronic health record to deploy a computerized, point-of-care clinical decision support (CDS) alert to pediatric clinicians at the time of a well-child visit for a child with a BMI at the 95th percentile or greater. Alert contained links to growth charts, evidence-based childhood obesity screening and management guidelines, and a pre-populated standardized note template specific for obesity that included options for (1) documenting and coding for BMI percentile, (2) documenting and coding for nutrition and physical activity counseling, (3) placing referrals for weight management programs, (4) placing orders for lab studies if appropriate, and (5) printing educational materials. Clinicians were trained to use brief motivational interviewing to negotiate a follow-up weight management plan with the patient and their family. A comprehensive set of educational materials were developed to be provided by pediatric clinicians to patients that focused on individual- and family-level behaviors, including (1) decreases in screen time, (2) decreases in consumption of sugar sweetened beverages, (3) increases in moderate and vigorous physical activity, and (4) improvement of sleep duration and quality. Additionally, 4 newsletters were provided throughout the intervention period that included self-guided behavior change.	Usual care	Received the current standard of care offered by their pediatric office. No new decision support tools for obesity were made available in the electronic health records of the 4 usual care practices. Received generic health-related materials in the mail.
Taveras, 2017[147] Good	IG1	Enhanced primary care and coaching	All participants received from their pediatric clinician a set of evidence-supported educational materials focusing on specified behavioral targets to support self-guided behavior change. The materials focused primarily on decreases in screen time and sugar-sweetened beverages; improving diet quality; increases in moderate and vigorous physical activity; promotion of social-emotional wellness; and improvement in sleep duration and quality. Families received individualized health coaching tailored to their socio-environmental context. Four trained health coaches contacted families every other month for 1 year using telephone, videoconference (using Vidyo®), or in-person visits, according to parent preference. These contacts were approximately 15–20-minutes. Families also received twice-weekly text messages or emails, and mailings following each coaching session with educational materials to support families' behavior change goals. Health coaches used a motivational interviewing style of counseling and shared decision-making techniques to provide family-centered care in addressing childhood obesity risk factors and management. At each contact, health coaches used an online community resource map developed for the	Enhanced primary care	All participants received from their pediatric clinician a set of evidence-supported educational materials focusing on specified behavioral targets to support self-guided behavior change. The materials focused primarily on decreases in screen time and sugar-sweetened beverages; improving diet quality; increases in moderate and vigorous physical activity; promotion of social-emotional wellness; and improvement in sleep duration and quality. Participants also received

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			study to identify resources within each family's community that could support behavior change. In addition, health coaches offered families a 1-month free family membership to area YMCAs to encourage physical activity and community connections. Families were also invited to attend a healthy grocery shopping program led by Cooking Matters®. To engage parents and children in setting behavior change goals, health coaches used a behavior change decision aid tool, developed by our study team that helped families identify outcomes that mattered most to them and potential motivators for engaging in behavior change.		monthly text messages that contained links to publicly-available resources to support behavior change, e.g. links to the Let's Move! program. Participants also received a Neighborhood Resource Guide listing places that support healthy living in their community.
Taylor, 2015[148] Good	IG1	Tailored lifestyle support	One individual 1-2 hour multidisciplinary session (mentor, dietician, exercise specialist, clinical psychologist) with parents followed by regular brief contact with mentor (nutritionist or exercise trainer) tailored to family's goals and priorities, monthly for 1st year, ~ every 3 months in the 2nd year (total sessions ~14). At baseline, extensive report generated from collected data, specialists used the report to identify areas for change, but families took lead in identifying specific targets. Remaining contacts alternated between in-person visits at the university or in the home (30-40 min) and phone calls (5-10 min). Individual goals were negotiated and relevant resources, based on well-established behavioral strategies, were discussed. Resources covered parenting (talking about the study, goals, action plan, influences on child's behavior, ground rules and rewards, actions and consequences, problem solving, stress management for parents), diet ("good food guide", healthy options for fast food, food labels, feeding fussy eaters, shopping), and physical activity (getting the whole family active). Provided support and continued monitoring and adjustment to target behaviors over time. Est total intervention contact 6-7 hrs per family.	Brief feedback and advice	Met with trained researcher at baseline and 6 months. At first appt (30-45min) parents received individualized feedback about their child's diet and activity habits based on comprehensive baseline assessment. Child's results were compared with guidelines, other published data. Provided generalized advice using publicly available resources. Reviewed progress at second appt (15-30min), no new information/resources provided.
Van Grieken, 2013[149] Fair	IG1	Be Active Eat Right	Prevention protocol initiated during a well-child visit, using motivational interviewing approach; 3 additional structured healthy lifestyle counseling sessions to promote overweight-prevention behaviors could be offered (approximately 3, 6, and 12 months after well-child visit). Content of additional counseling sessions was matched to parents' stage of change as assessed during initial well-child visit. 4 behaviors targeted: play outside >1 hr/day, eat breakfast daily, ≤2 glasses sweet beverages/day, and maximum 2 hrs/day sedentary behavior). Parents together with staff chose 1-2 behaviors to target. Information materials provided, diet and activity diaries discussed, and family-oriented action plans for behavior change discussed.	Usual care	Parents were informed about the overweight status of their child but usual care was given, consisting of general information about a healthy lifestyle provided as part of a normal well-child visit.
Viner, 2020[150]	IG1	Healthy Eating and Lifestyle Program	Family-based weight management program for adolescents. Young people and at least one parent were invited to attend 12 fortnightly sessions, each lasting approximately 60 minutes, delivered over 6 months. Motivational	Standard care	Enhanced standard care consisted of 1 standardized educational session on obesity

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Fair		(HELP)	interviewing and solution-focused approaches were used to increase engagement and concordance. The program consisted of an introductory session plus modules in the following areas: where and how we eat (2 sessions), what we do (addressing sedentary and physical activity, 2 sessions), what we eat (4 sessions), and why we eat (3 session).		self-management delivered to young people by a primary care nurse within 3 months of recruitment. The session was designed to last for 40–60 minutes and incorporated standard DHSC guidance and published information on obesity. The session provided information that addressed eating behaviors, healthy activity levels and healthy eating patterns. No training in delivery style was offered. The session was delivered in the participant's general practice or an alternative community setting. Where a practice nurse was not available, a trained nurse practitioner was provided by the study team to deliver the session. Each nurse was required to return a brief questionnaire to ensure fidelity of information giving and to monitor whether or not practitioners used motivational or other techniques that were not part of the control session.
Vos, 2011[151] Fair	IG1	Family-based multidisciplinary lifestyle intervention	2 individual family screening and counseling visits with a multidisciplinary team results in contract for behavioral goals, followed by 3-month intensive phase involving 7 group meetings, 2.5 hours each (7 child-only sessions, 5 parents-only sessions, 1 parent+child session, every 2 weeks) followed by booster sessions (2-3 per year) for 2 years. Individual visits include nutritional advice (traffic light nutrition), physical activity counseling, and psychological counseling (cognitive behavioral techniques for weight loss and help child deal with/accept their own body). Child group meetings focused on nutritional information, self-control techniques, problem solving, self-reward, self-regulation, stimulus control, self-image, coping strategies, and relapse prevention. Also included physical activity at each meeting (duration NR). Parent group meetings focused on lifestyle change, nutrition,	Waitlist	Participants were given an initial physical activity and nutritional advice. After 12 months, they were offered multidisciplinary treatment.

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			and how to help child; parental role in family treatment conceived as therapeutic helper (positive feedback, positive support) and healthy lifestyle role model. Parenting style of strict rules but pleasant interactions encouraged. Booster sessions to maintain learned behavior through problem-solving and relapse prevention. More detailed description provided in study protocol.		
Wake, 2009[152] Good	IG1	LEAP-2	Four GP consultations of brief solution-focused family therapy to support healthy lifestyle goals. 16-page family folder included 5 topic sheets each targeting one area of behavioral change (sedentary time, physical activity, water consumption, eating habits and lower fat food options). Topic sheets summarized supporting evidence for the target behavior, modelled solutions to common challenges, and provided suggestions for reaching the goal. Materials included wall chart, reward stickers, and shopping tips. Parents encouraged to offer family meals, engage in shared parent-child activities, use praise and non-food rewards, and use contracting for behavior change. Before first appointment, GPs received intervention materials, summary of parent's responses from baseline questionnaire regarding nutrition, physical activity and weight status concern, and child's BMI. GP also provided brief encouragement during non-counseling visits.	Usual care	Usual care. Control families notified of control status via letter and never identified to GPs. Medical records of CG children audited to assess possible contamination (i.e., discussion of weight at a medical visit).
Wake, 2013[153] Good	IG1	HopSCOTCH	One hour-long family appointment with obesity specialist team (pediatrician and dietitian) followed by one 20-40 minute “long” GP consultation and 4-8 6-20 minute standard appointments; GP and specialist care linked by web-based software. Specialist team provided with individual patient summary about family and medical history, and daily diet, PA and sedentary activities. At this visit, clinicians and families agreed on an initial care plan and specific goals. Subsequent 20-40 minute GP session and regular 6-20 minute standard consultations every 4 to 8 weeks consisting of lifestyle and BMI progress review, problem solving, and goal setting using brief solution-focused techniques. All data entered into HopSCOTCH web-based software which was shared between specialist team and GP. 6 months after enrollment, specialist team accessed software to review participant progress and faxed a summary report to GP. Specialist team available to GP via email or phone.	Usual care	Participants were free to seek assistance from their GP or from any other service.
Weigel, 2008[154] Fair	IG1	Sea Lion Club	Twice weekly child group sessions of 45-60 minutes for 12 months consisting of PA, dietary education, and coping strategies. The first weekly session was for PA and the second for nutrition and coping strategies. Children encouraged to complete diet and PA logs (which included parent’s signature) and discuss weekly with the group. Child groups divided by age for age-appropriate training and education. Parental support provided at optional separate 2-hour monthly meetings and feedback discussions; these included	Brief advice	Two pediatrician visits with parent and child that included written therapeutic advice and explanation. Written materials included PA recommendations, dietary education, and coping

Appendix D Table 3. Detailed Intervention Characteristics of Behavioral Interventions

Author, Year and Quality	Group	Intervention	Detailed intervention description	Control	Control description
			child-parent activities and social reinforcement.		strategies (e.g., awareness of eating behavior and recommendations for habit books); materials were explained to the family by the pediatrician and followed German obesity guidelines. Children and adolescent versions of materials also provided. After 1 year, participants were offered open, fun-based lessons in the sports center where the intervention had been performed.

Abbreviations: BL = Baseline; BMI = Body mass index; CBT = Cognitive behavioral therapy; GP = General practitioner; Hr = Hours; IG = Intervention group; MI = Motivational interviewing; Min = Minutes; NR = Not reported; PA = Physical activity; PCP = Primary care physician; RD = Registered dietician

Appendix D Table 4. Population Characteristics of Trials of Medications, Sorted by Type of Medication

Author, Year and Quality	Drug	Recruitment Setting	% Female	Age range (mean)	% Race/Ethnicity	Relative weight measures
Danne, 2017[155] Fair	Liraglutide	NR	67	12-17 (15)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: 36.2 zBMI: 3.2 % >95th %ile:
Kelly, 2020[156] Good	Liraglutide	NR	59	12-17 (15)	Asian: 1 Black: 8 Latino: 22 Native Amer: 1 White: 88	BMI: 35.6 zBMI: 3.2 % >95th %ile: 100
Mastrandrea, 2019[157] Fair	Liraglutide	NR	38	7-11 (10)	Asian: NR Black: 42 Latino: 38 Native Amer: NR White: 58	BMI: NR zBMI: 3.9 % >95th %ile: 100
Chanoine, 2005[158] Fair	Orlistat	Health Care	67	12-16 (14)	Asian: NR Black: 17 Latino: NR Native Amer: NR White: 76	BMI: 35.6 zBMI: NR % >95th %ile: 100
Maahs, 2006[159] Fair	Orlistat	Primary Health Care	68	14-18 (16)	Asian: NR Black: NR Latino: 62.5 Native Amer: NR White: NR	BMI: 40.4 zBMI: NR % >95th %ile: NR

Appendix D Table 4. Population Characteristics of Trials of Medications, Sorted by Type of Medication

Author, Year and Quality	Drug	Recruitment Setting	% Female	Age range (mean)	% Race/Ethnicity	Relative weight measures
Hsia, 2019[160] Fair	PHEN/TPM	NR	NR	12-17 (NR)	Asian: NR Black: NR Latino: NR Native Amer: NR White: NR	BMI: NR zBMI: NR % >95th %ile: NR
Kelly, 2022[161] Good	PHEN/TPM	NR	54.3	12-16 (14.0)	Asian: 0.4 Black: 26.9 Latino: 32.3 Native Amer: 0.4 White: 66.8	BMI: 37.8 zBMI: NR % >95th %ile: NR
Weghuber, 2022[162] Good	Semaglutide	NR	62	12-17 (15.4)	Asian: 2 Black: 8 Latino: 11 Native Amer: NR White: 79	BMI: 37.0 zBMI: NR % >95th %ile: NR

Abbreviations: Amer = American; BMI = Body mass index; NR = Not reported; PHEN/TPM = Phentermine/Topiramate

Appendix D Table 5. Intervention Characteristics of Trials of Medications, Sorted by Type of Medication

Author, Year and Quality	Group	Intervention	Description	Dose, mg/day	Use duration, months	Schedule
Danne, 2017[155] Fair	IG1	Liraglutide	Subcutaneous liraglutide started at 0.6 mg/day, increasing by 0.6 mg/week to a maximum of 3.0 mg/day	3.0	1.25	Daily Injection
Kelly, 2020[156] Good	IG1	Liraglutide + diet and PA counseling	Subcutaneous liraglutide started at 0.6 mg/day increased weekly to 3.0 mg/day) and individualized diet and PA counseling	3.0	13	Daily injection
Mastrandrea, 2019[157] Fair	IG1	Liraglutide	Liraglutide via subcutaneous injection with a maximum dose of 3.0 mg/day	3.0	2	Daily injection
Chanoine, 2005[158] Fair	IG1	Orlistat + Diet, PA, and Behavior Therapy	Orlistat 120 mg 3 times/day + hypocaloric diet, exercise and behavioral therapy; 18 individual meetings with dietician and behavioral psychologist	360	12	120 mg 3 times/day
Maahs, 2006[159] Fair	IG1	Orlistat + dietician counseling	Orlistat 120 mg 3 times/day + 7 monthly diet and exercise counseling sessions with dietician	360	6	120 mg 3 times/day
Hsia, 2019[160] Fair	IG1	PHEN/TPM 15 mg/92 mg	Oral PHEN/TPM (15 mg/92 mg per day)	15/92	2	Daily tablet
	IG2	PHEN/TPM 7.5 mg/46 mg	Oral PHEN/TPM (7.5 mg/46 mg per day)	7.5/45	2	Daily tablet
Kelly, 2022[161] Good	IG1	PHEN/TPM 15 mg/92 mg + diet and PA training	PHEN/TPM (15 mg/92 mg per day) + hypocaloric diet and lifestyle modification program	15/92	13	Daily tablet
	IG2	PHEN/TPM 7.5 mg/46 mg + diet and PA training	PHEN/TPM (7.5 mg/46 mg per day) + hypocaloric diet and lifestyle modification program	7.5/45	13	Daily tablet
Weghuber, 2022[162] Good	IG1	Semaglutide	Subcutaneous semaglutide started at 0.25 mg once weekly, escalation every 4 weeks to 0.5, 1.0, 1.7, and 2.4 mg and individualized nutrition and PA counseling	2.4	15.6	Weekly injection

Abbreviations: IG = Intervention group; PA = Physical activity; PHEN/TPM = Phentermine/ Topiramate; Mg = Milligrams

Appendix D Table 6. Health Outcomes Results for Behavioral Interventions (Key Question 1)

Study	Group	Followup (months since tx ended)	Outcome (unit)	Directionality (Range)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
DeBar, 2012[111]	IG1	6 (1)	PedsQL, child (Total)	Higher is better (0-100)	71.1 (16.2)	68.8 (16.5)	6.5 (15.1)	104	5.1 (15.7)	102	MD in change	1.42 (-2.78 to 5.62)	0.189
		12 (7)	PedsQL, child (Total)	Higher is better (0-100)	71.1 (16.2)	68.8 (16.5)	6.7 (15.2)	85	2.9 (16.5)	76	MD in change	3.82 (-1.06 to 8.7)	0.189
		6 (1)	PHQ-A (% mood disorder)	NR	N/A	N/A	5 (4.8)	104	6 (5.9)	102	RR	0.81 (0.24 to 2.74)	0.362
		12 (7)	PHQ-A (% mood disorder)	NR	N/A	N/A	6 (7.1)	85	4 (5.3)	76	RR	1.37 (0.37 to 5.04)	0.362
Hofsteenge, 2014[116]	IG1	6 (0)	CHQ (Physical summary)	Higher is better (0-100)	78.2 (12.1)	78.3 (11.1)	2 (11.7)	44	4.2 (10.6)	33	MD in change	-2 (-6.6 to 2.5)	NSD
			CHQ (Psychosocial summary)	Higher is better (0-100)	80.9 (10.1)	81.5 (10)	1.7 (10.5)	44	2.4 (9.3)	33	MD in change	-1.5 (-5.9 to 2.8)	NSD
			PedsQL, child (Physical functioning)	Higher is better (0-100)	76.5 (14.8)	76.4 (13.2)	6.6 (13.6)	44	2.2 (12.6)	33	MD in change	3.6 (-1 to 8.2)	NSD
			PedsQL, child (Total)	Higher is better (0-100)	75.1 (12.2)	75.7 (10.7)	3.4 (11.7)	44	2.2 (10.4)	33	MD in change	-0.1 (-3.5 to 3.3)	NSD
			PedsQL, child (Psychosocial functioning)	Higher is better (0-100)	74.7 (12.6)	75.4 (11.2)	2.2 (12.3)	44	2.4 (10.7)	33	MD in change	-1 (-4.6 to 2.6)	NSD
Kalarchian, 2009[117]	IG1	6 (-6)	CHQ (General health perception)	Higher is better (0-100)	66.3 (17.5)	67.4 (15.3)	6.9 (15.2)	97	0.5 (16.7)	95	MD in change	6.42 (1.91 to 10.93)	0.006
			CHQ (Global health)	Higher is better (0-100)	71.3 (20.1)	73.4 (17.2)	6.6 (20.7)	97	-0.3 (23.3)	95	MD in change	6.84 (0.63 to 13.05)	0.032

Appendix D Table 6. Health Outcomes Results for Behavioral Interventions (Key Question 1)

Study	Group	Followup (months since tx ended)	Outcome (unit)	Directionality (Range)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		12 (0)	CHQ (Global health)	Higher is better (0-100)	71.3 (20.1)	73.4 (17.2)	4.1 (24.5)	97	0.5 (27.7)	95	MD in change	3.65 (-3.74 to 11.04)	0.33
			CHQ (General health perception)	Higher is better (0-100)	66.3 (17.5)	67.4 (15.3)	5.7 (17.8)	97	1.8 (19.1)	95	MD in change	3.87 (-1.36 to 9.1)	0.15
Kose, 2021[120]	IG1	6 (0)	PedsQL, child (Total)	Higher is better (0-100)	68.8 (8.5)	66.4 (11.1)	10.6 (6.2)	37	4 (5.6)	27	MD in change	6.64 (3.68 to 9.6)	0.002
McCallum, 2007[124]	IG1	9 (6)	PedsQL, parent/caregiver (Total)	Higher is better (0-100)	75.2 (13.7)	78.8 (12.8)	3.9 (12.4)	58	3.8 (12.6)	67	MD in change	-1.9 (-4.9 to 1.2)	0.23
		15 (12)	PedsQL, parent/caregiver (Total)	Higher is better (0-100)	75.2 (13.7)	78.8 (12.8)	2.9 (13.5)	63	0 (12.9)	69	MD in change	0.2 (-3.1 to 3.5)	0.91
		9 (6)	PedsQL, child (Total)	Higher is better (0-100)	NR	NR	NR	73	NR	80	MD in change	0.7 (-3 to 4.4)	0.70
		15 (12)	PedsQL, child (Total)	Higher is better (0-100)	NR	NR	NR	72	NR	74	MD in change	2.7 (-1.3 to 6.8)	0.19
Patrick, 2013[129]	IG1	6 (-6)	PedsQL, child (Total)	Higher is better (0-100)	80.4 (12.7)	75.9 (12.4)	5.1 (11.7)	26	3 (11.5)	24	MD in change	2.1 (-4.33 to 8.53)	NR
		12 (0)	PedsQL, child (Total)	Higher is better (0-100)	80.4 (12.7)	75.9 (12.4)	10.2 (12.1)	22	6.1 (11.7)	21	MD in change	4.1 (-3.02 to 11.22)	0.262
	IG2	6 (-6)	PedsQL, child (Total)	Higher is better (0-100)	79.4 (12.2)	75.9 (12.4)	4.3 (11.3)	22	3 (11.5)	24	MD in change	1.3 (-5.3 to 7.9)	NR
		12 (0)	PedsQL, child (Total)	Higher is better (0-100)	79.4 (12.2)	75.9 (12.4)	8.6 (11.4)	20	6.1 (11.7)	21	MD in change	2.5 (-4.57 to 9.57)	0.485

Appendix D Table 6. Health Outcomes Results for Behavioral Interventions (Key Question 1)

Study	Group	Followup (months since tx ended)	Outcome (unit)	Directionality (Range)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	IG3	6 (-6)	PedsQL, child (Total)	Higher is better (0-100)	76.8 (12.5)	75.9 (12.4)	5.2 (11.7)	26	3 (11.5)	24	MD in change	2.2 (-4.23 to 8.63)	NR
		12 (0)	PedsQL, child (Total)	Higher is better (0-100)	76.8 (12.5)	75.9 (12.4)	10.3 (12)	24	6.1 (11.7)	21	MD in change	4.2 (-2.73 to 11.13)	0.234
	IG1	6 (-6)	Center for Epidemiologic Studies depression scale (score)	NR	6 (4)	6 (3.9)	-0.5 (3.8)	26	-0.1 (3.6)	24	MD in change	-0.4 (-2.47 to 1.67)	NR
		12 (0)	Center for Epidemiologic Studies depression scale (score)	NR	6 (4)	6 (3.9)	-1 (4.1)	22	-0.3 (3.9)	21	MD in change	-0.7 (-3.11 to 1.71)	0.620
	IG2	6 (-6)	Center for Epidemiologic Studies depression scale (score)	NR	5.6 (3.8)	6 (3.9)	-0.3 (3.6)	22	-0.1 (3.6)	24	MD in change	-0.2 (-2.3 to 1.9)	NR
		12 (0)	Center for Epidemiologic Studies depression scale (score)	NR	5.6 (3.8)	6 (3.9)	-0.7 (3.8)	20	-0.3 (3.9)	21	MD in change	-0.4 (-2.78 to 1.98)	0.783
	IG3	6 (-6)	Center for Epidemiologic Studies depression scale (score)	NR	6.7 (3.9)	6 (3.9)	-1.1 (3.7)	26	-0.1 (3.6)	24	MD in change	-1 (-3.04 to 1.04)	NR

Appendix D Table 6. Health Outcomes Results for Behavioral Interventions (Key Question 1)

Study	Group	Followup (months since tx ended)	Outcome (unit)	Directionality (Range)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		12 (0)	Center for Epidemiologic Studies depression scale (score)	NR	6.7 (3.9)	6 (3.9)	-1.8 (4.1)	24	-0.3 (3.9)	21	MD in change	-1.5 (-3.84 to 0.84)	0.262
Stark, 2011[139]	IG1	6 (0)	PedsQL, parent/caregiver (Physical functioning score)	Higher is better (0-100)	76.6 (15.9)	89.4 (10)	9.5 (13)	7	-1.7 (6.5)	10	MD in change	11.2 (1.89 to 20.51)	0.042
		12 (6)	PedsQL, parent/caregiver (Physical functioning score)	Higher is better (0-100)	76.6 (15.9)	89.4 (10)	13.8 (8.6)	7	-2.7 (5.6)	9	MD in change	16.5 (9.54 to 23.46)	0.001
Tanofsky-Kraff, 2014[144]	IG1	6 (3)	Depressive symptoms (score)	NR	10.1 (6.9)	11.2 (6.3)	-5.1 (6.5)	55	-5.2 (6.3)	58	MD in change	0.1 (-2.26 to 2.46)	0.71
		12 (9)	Depressive symptoms (score)	NR	10.1 (6.9)	11.2 (6.3)	-4.7 (6.6)	55	-5.4 (6.3)	58	MD in change	0.7 (-1.67 to 3.07)	0.71
		6 (3)	Social Adjustment Scale-Self-Report (score)	NR	2.6 (0.8)	2.4 (0.8)	-0.3 (0.8)	55	0 (0.8)	58	MD in change	-0.3 (-0.6 to 0)	0.74
		12 (9)	Social Adjustment Scale-Self-Report (score)	NR	2.4 (0.8)	2.6 (0.8)	-0.1 (0.9)	55	0 (0.9)	58	MD in change	-0.1 (-0.42 to 0.22)	0.74

Appendix D Table 6. Health Outcomes Results for Behavioral Interventions (Key Question 1)

Study	Group	Followup (months since tx ended)	Outcome (unit)	Directionality (Range)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Taveras, 2017[147]	IG1	12 (0)	PedsQL, parent/caregiver (Physical functioning)	Higher is better (0-100)	89.7 (12.8)	90.3 (12.5)	0.8 (12.9)	360	-0.3 (12.8)	361	MD in change	1.04 (-0.82 to 2.91)	NSD
			PedsQL, parent/caregiver (Psychosocial functioning)	Higher is better (0-100)	83.1 (12.7)	83.7 (12.7)	1.8 (11.4)	360	1 (11.6)	361	MD in change	0.75 (-0.93 to 2.43)	NSD
			PedsQL, parent/caregiver (Total)	Higher is better (0-100)	85.3 (11.2)	86 (11.2)	1.5 (9.9)	360	0.6 (9.9)	361	MD in change	0.89 (-0.56 to 2.33)	NSD
Taylor, 2015[148]	IG1	24 (0)	PedsQL, parent/caregiver (Physical functioning)	Higher is better (0-100)	83.7 (11)	84.3 (13.7)	-1.1 (14.9)	89	-3.8 (15.9)	92	MD in change	2.8 (-1.8 to 7.4)	NSD
			PedsQL, parent/caregiver (Emotional functioning)	Higher is better (0-100)	76.6 (13.7)	75.8 (14.5)	0.1 (14.6)	89	0 (15)	92	MD in change	0.4 (-3.5 to 4.2)	NSD
			PedsQL, parent/caregiver (Social functioning)	Higher is better (0-100)	84.7 (12.6)	86.8 (14)	-1.9 (14.7)	89	-5.6 (16.7)	92	MD in change	3.2 (-1.3 to 7.7)	NSD
			PedsQL, parent/caregiver (Psychosocial functioning)	Higher is better (0-100)	81.3 (10)	82.4 (11.6)	-0.4 (11.9)	89	-2.1 (12.9)	92	MD in change	1.4 (-1.6 to 4.6)	NSD
			PedsQL, parent/caregiver	Higher is better (0-100)	82.5 (12.5)	84.4 (15.8)	0.7 (13.3)	89	-0.5 (15.3)	92	MD in change	0.3 (-3.4 to 4.1)	NSD

Appendix D Table 6. Health Outcomes Results for Behavioral Interventions (Key Question 1)

Study	Group	Followup (months since tx ended)	Outcome (unit)	Directionality (Range)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			(School functioning)										
Viner, 2020[150]	IG1	6 (0)	IWQOL (Total (parent report))	Higher is better (0-100)	70 (17)	74 (16)	3.6 ()	53	3.6 (NR)	54	MD in change	0.51 (-3.91 to 4.93)	0.8
			IWQOL (Total (youth report))	Higher is better (0-100)	77 (17)	74 (15)	2.8 ()	70	6.9 (NR)	65	MD in change	0.14 (-3.53 to 3.81)	0.9
Vos, 2011[151]	IG1	12 (-12)	DISAKIDS, child (Total)	Higher is better (0-37)	80.2 (11.4)	82.8 (13.6)	6.6 (10.7)	32	2.8 (13.1)	35	MD in change	3.8 (-1.96 to 9.56)	NR
Wake, 2009[152]	IG1	6 (3)	PedsQL, child (Psychosocial functioning)	Higher is better (0-100)	NR	NR	NR	130	NR	116	MD in change	1.8 (-1.8 to 5.5)	0.3
			PedsQL, child (Physical functioning)	Higher is better (0-100)	NR	NR	NR	130	NR	116	MD in change	0.6 (-2.4 to 3.6)	0.7
			PedsQL, child (Total)	Higher is better (0-100)	NR	NR	NR	130	NR	117	MD in change	1.3 (-1.7 to 4.4)	0.4
		12 (9)	PedsQL, child (Psychosocial functioning)	Higher is better (0-100)	NR	NR	NR	125	NR	112	MD in change	1.1 (-2.3 to 4.5)	0.5
			PedsQL, child (Physical functioning)	Higher is better (0-100)	NR	NR	NR	125	NR	112	MD in change	2.4 (-0.8 to 5.7)	0.1
			PedsQL, child (Total)	Higher is better (0-100)	NR	NR	NR	125	NR	112	MD in change	1.6 (-1.5 to 4.7)	0.3
Wake, 2013[153]	IG1	12 (0)	PedsQL, child (Total)	Higher is better (0-100)	NR	NR	NR	51	NR	45	MD in change	-1.9 (-7.8 to 4)	0.5

Appendix D Table 6. Health Outcomes Results for Behavioral Interventions (Key Question 1)

Abbreviations: BL = Baseline; CG = Control group; CHQ = Child Health Questionnaire; CI = Confidence Interval; FU = Followup; IG = Intervention group; IWQOL = Impact of Weight on Quality of Life; MD = Mean difference; N/A = Not applicable; NR = Not reported; NSD = No significant difference; PedsQL = Pediatric quality of life; PHQ-A = Patient Health Questionnaire-Adolescents; RR = Relative risk; SD = Standard deviation; Stat = Statistic; Tx = Treatment

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Boutelle, 2014[106]	IG1	All	8 (4)	BMI, kg/m2	28 (5)	26.5 (4.5)	-0.1 (4.7)	21	0.6 (4.7)	18	MD in change	-0.7 (-3.66 to 2.26)	0.229
Broccoli, 2016[107]	IG1	All	12 (9)	BMI, kg/m2	18.3 (0.8)	18.2 (0.8)	0.5 (1.3)	186	0.8 (1.2)	185	MD in change	-0.32 (-0.57 to -0.06)	0.005
			24 (21)	BMI, kg/m2	18.3 (0.8)	18.2 (0.8)	1.5 (1.6)	186	1.6 (1.6)	185	MD in change	-0.04 (-0.36 to 0.28)	0.986
		< 6 years	12 (9)	BMI, kg/m2	NR	NR	0.5 (NR)	NR	0.7 (NR)	NR	MD in change	-0.31 (-0.78 to 1.15)	NR
			24 (21)	BMI, kg/m2	NR	NR	1.7 (NR)	NR	1.5 (NR)	NR	MD in change	0.19 (NR)	NR
		≥ 6 years	12 (9)	BMI, kg/m2	NR	NR	0.5 (NR)	NR	0.8 (NR)	NR	MD in change	-0.3 (-0.62 to 0.02)	NR
			24 (21)	BMI, kg/m2	NR	NR	1.4 (NR)	NR	1.6 (NR)	NR	MD in change	-0.14 (NR)	NR
		Female	12 (9)	BMI, kg/m2	NR	NR	0.2 (1.2)	112	0.8 (1.2)	117	MD in change	-0.51 (-0.83 to -0.19)	NR
			24 (21)	BMI, kg/m2	NR	NR	1.4 (NR)	NR	1.6 (NR)	NR	MD in change	-0.18 (NR)	NR
		Male	12 (9)	BMI, kg/m2	NR	NR	0.8 (1.3)	75	0.8 (1.4)	68	MD in change	-0.01 (-0.45 to 0.44)	NR
			24 (21)	BMI, kg/m2	NR	NR	1.7 (NR)	NR	1.5 (NR)	NR	MD in change	0.16 (NR)	NR
		Mother's education	12 (9)	BMI, kg/m2	NR	NR	0.9 (1.5)	63	0.6 (1.1)	58	MD in change	0.21 (-0.28 to 0.69)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		< 13 years	24 (21)	BMI, kg/m2	NR	NR	2 (NR)	NR	1.4 (NR)	NR	MD in change	0.66 (NR)	NR
		Mother's education > 13 years	12 (9)	BMI, kg/m2	NR	NR	-0.2 (1.2)	24	0.8 (1.2)	23	MD in change	-1.04 (-1.75 to -0.33)	NR
			24 (21)	BMI, kg/m2	NR	NR	0.8 (NR)	NR	1.5 (NR)	NR	MD in change	-0.73 (NR)	NR
		Mother's education 13 years	12 (9)	BMI, kg/m2	NR	NR	0.3 (1.1)	97	0.9 (1.3)	98	MD in change	-0.52 (-0.84 to -0.19)	NR
			24 (21)	BMI, kg/m2	NR	NR	1.4 (NR)	NR	1.6 (NR)	NR	MD in change	-0.3 (NR)	NR
Croker, 2012[109]	IG1	All	6 (0)	BMI, kg/m2	30.6 (5.1)	30.6 (5.7)	-0.4 (1.1)	31	0 (1.1)	27	MD in change	-0.33 (-0.87 to 0.21)	0.17
Derwig, 2022[112]	IG1	All	12 (7.5)	BMI, kg/m2	18 (0.4)	18.1 (0.5)	-0.2 (1)	238	0 (1)	237	MD in change	-0.21 (-0.44 to 0.01)	0.065
		Female	12 (7.5)	BMI, kg/m2	NR	NR	-0.2 (1)	129	0.1 (1.1)	128	MD in change	-0.29 (-0.59 to 0.05)	0.053
		High SES	12 (7.5)	BMI, kg/m2	NR	NR	-0.3 (0.9)	117	0 (1)	111	MD in change	-0.3 (-0.55 to -0.05)	0.02
		Low SES	12 (7.5)	BMI, kg/m2	NR	NR	-0.1 (1.1)	121	0 (1)	126	MD in change	-0.15 (-0.54 to 0.24)	0.40
		Male	12 (7.5)	BMI, kg/m2	NR	NR	-0.2 (1)	109	-0.1 (1)	109	MD in change	-0.13 (-0.5 to 0.24)	0.47
Ho, 2016[115]	IG1	All	6 (0)	BMI, kg/m2	29.8 (5.6)	28.5 (5.7)	0 (1.6)	37	0.1 (1.5)	36	MD in change	-0.12 (-0.85 to 0.61)	0.74

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Hofsteenge, 2014 [116]	IG1	All	6 (0)	BMI, kg/m2	33.3 (4.6)	33.6 (5.1)	-0.5 (4.7)	53	0.6 (5.2)	44	MD in change	-0.76 (-1.74 to 0.22)	NR
Kalarchian, 2009[117]	IG1	All	6 (-6)	BMI, kg/m2	31.7 (5.2)	32.5 (4.7)	-0.7 (2.9)	97	0.5 (2)	95	MD in change	-1.22 (-1.93 to -0.51)	0.0007
			12 (0)	BMI, kg/m2	31.7 (5.2)	32.5 (4.7)	0.5 (3)	97	1.1 (2.2)	95	MD in change	-0.61 (-1.35 to 0.13)	0.11
			18 (6)	BMI, kg/m2	31.7 (5.2)	32.5 (4.7)	1.5 (3)	97	1.7 (2)	95	MD in change	-0.21 (-0.92 to 0.5)	0.56
Kalavainen, 2007[118]	IG1	All	12 (6)	BMI, kg/m2	23.4 (2.6)	22.9 (2.5)	-0.8 (0.9)	35	0 (1)	35	MD in change	-0.8 (-1.24 to -0.36)	0.003
			24 (18)	BMI, kg/m2	23.4 (2.6)	22.9 (2.5)	1.3 (1.6)	34	1.5 (1.6)	35	MD in change	-0.2 (-0.95 to 0.55)	0.624
			36 (30)	BMI, kg/m2	23.4 (2.6)	22.9 (2.5)	2.1 (1.9)	34	2.3 (2.6)	34	MD in change	-0.2 (-1.27 to 0.87)	0.700
Kose, 2021[120]	IG1	All	6 (0)	BMI, kg/m2	29.9 (3.4)	30.8 (3.4)	-2.3 (1.2)	37	-0.5 (1.2)	27	MD in change	-1.81 (-2.39 to -1.23)	0.001
Lison, 2012[121]	IG1	All	6 (0)	BMI, kg/m2	29.7 (NR)	29.2 (3.9)	-0.4 (NR)	32	1.6 (NR)	20	MD in change	-2 (NR)	<0.0001
	IG2			BMI, kg/m2	28.5 (NR)	29.2 (3.9)	-1.2 (NR)	32	1.6 (NR)	20	MD in change	-2.8 (NR)	NR
McCallum, 2007[124]	IG1	All	9 (6)	BMI, kg/m2	20.5 (2.2)	20 (1.8)	0.5 (2.4)	73	0.8 (2)	80	MD in change	-0.2 (-0.6 to 0.1)	0.25
			15 (12)	BMI, kg/m2	20.5 (2.2)	20 (1.8)	1.2 (2.8)	70	1.2 (2.2)	76	MD in change	0 (-0.5 to 0.5)	1.00

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Nemet, 2005[126]	IG1	All	12 (9)	BMI, kg/m2	27.7 (3.6)	28 (5.2)	-1.6 (4.3)	20	0.6 (5.5)	20	MD in change	-2.2 (-5.26 to 0.86)	<0.05
Norman, 2016[127]	IG1	All	8 (-4)	BMI, kg/m2	29.6 (4)	28.9 (3.9)	0.2 (4.1)	53	0.3 (3.9)	53	MD in change	-0.1 (-1.62 to 1.42)	NR
			12 (0)	BMI, kg/m2	29.6 (4)	28.9 (3.9)	0.2 (4.2)	53	0.4 (4.1)	53	MD in change	-0.2 (-1.79 to 1.39)	NR
		Female	8 (-4)	BMI, kg/m2	29.8 (3.8)	28.9 (3.6)	0.6 (3.9)	29	0.2 (3.6)	25	MD in change	0.4 (-1.62 to 2.42)	NR
			12 (0)	BMI, kg/m2	29.8 (3.8)	28.9 (3.6)	0.9 (4.1)	29	0.2 (4)	25	MD in change	0.7 (-1.46 to 2.86)	0.15
		Male	8 (-4)	BMI, kg/m2	29.4 (3.8)	28.9 (3.9)	-0.4 (3.8)	24	0.4 (3.9)	28	MD in change	-0.8 (-2.9 to 1.3)	NR
			12 (0)	BMI, kg/m2	29.4 (3.8)	28.9 (3.9)	-0.7 (3.8)	24	0.6 (3.9)	28	MD in change	-1.3 (-3.42 to 0.82)	0.003
Reinehr, 2010[131]	IG1	All	6 (0)	BMI, kg/m2	24.2 (1.5)	23.3 (1.7)	-0.9 (1)	34	0.8 (1)	32	MD in change	-1.61 (-2.1 to -1.12)	0.001
Sacher, 2010[133]	IG1	All	6 (3.75)	BMI, kg/m2	27.2 (3.7)	27.1 (4.9)	-1.5 (3.5)	37	0.6 (5.1)	45	MD in change	-1.2 (-1.8 to -0.6)	<0.0001
Saelens, 2002[134]	IG1	All	7 (3)	BMI, kg/m2	31 (3.5)	30.7 (3.1)	0.1 (4.1)	18	1.4 (3.5)	19	MD in change	-1.3 (-3.75 to 1.15)	NR
Savoye, 2007[135]	IG1	All	6 (-6)	BMI, kg/m2	35.8 (7.6)	36.2 (6.2)	-2.1 (2.9)	105	1.1 (3)	69	MD in change	-3.1 (-4.2 to -2.1)	<0.001
			6 (0)	BMI, kg/m2	32.1 (5.2)	34.6 (6.8)	-0.4 (1)	31	0.7 (1.4)	27	MD in change	-1.05 (-1.78 to -0.32)	0.005

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (0)	BMI, kg/m2	35.8 (7.6)	36.2 (6.2)	-1.7 (3.1)	105	1.6 (3.2)	69	MD in change	-3.3 (-4.3 to -2.1)	<0.001
		Female	6 (0)	BMI, kg/m2	NR	NR	NR	NR	NR	NR	MD in change	-0.8 (-1.7 to 0.1)	0.08
		Male	6 (0)	BMI, kg/m2	NR	NR	NR	NR	NR	NR	MD in change	-1.7 (-3 to -0.5)	0.01
Smith, 2021[138]	IG1	All	6 (0)	BMI, kg/m2	25.8 (5)	25.3 (5.4)	1.1 (5.4)	141	0.5 (5.2)	99	MD in change	0.63 (-0.74 to 2)	0.242
			12 (6)	BMI, kg/m2	25.8 (5)	25.3 (5.4)	1.1 (5.3)	141	1.4 (5.6)	99	MD in change	-0.26 (-1.66 to 1.14)	0.833
Stettler, 2014[142]	IG1	All	12 (0)	BMI, kg/m2	21.4 (2.6)	22 (2.9)	0.6 (2.7)	46	1.7 (3.3)	24	MD in change	-0.45 (-1.02 to 0.12)	0.12
	IG2	All	12 (0)	BMI, kg/m2	21.5 (2.6)	22 (2.9)	0.7 (2.8)	97	1.7 (3.3)	24	MD in change	-0.48 (-1.04 to 0.08)	0.10
	IG3	All	12 (0)	BMI, kg/m2	21.5 (2.7)	22 (2.9)	0.9 (2.9)	51	1.7 (3.3)	24	MD in change	-0.39 (-1 to 0.23)	0.22
Tanofsky-Kraff, 2010[143]	IG1	All	6 (3)	BMI, kg/m2	25.1 (2.8)	25.6 (3.1)	0.9 (0.5)	19	0.3 (1.6)	19	MD in change	0.56 (-0.19 to 1.31)	NSD
			12 (9)	BMI, kg/m2	25.1 (2.8)	25.6 (3.1)	0.8 (1.2)	19	0.7 (2.1)	19	MD in change	0.13 (-0.98 to 1.24)	NR
Tanofsky-Kraff, 2014[144]	IG1	All	6 (3)	BMI, kg/m2	26.9 (2.6)	27.1 (2.4)	NR	NR	NR	NR	MD in change	NR	>0.49
			12 (9)	BMI, kg/m2	26.9 (2.6)	27.1 (2.4)	NR	NR	NR	NR	MD in change	NR	>0.49

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Taveras, 2011[145]	IG1	All	12 (0)	BMI, kg/m2	19.2 (3.2)	19.1 (1.4)	0.3 (1.4)	253	0.5 (1.4)	192	MD in change	-0.21 (-0.5 to 0.07)	0.15
		All	24 (12)	BMI, kg/m2	19.2 (2.6)	19.1 (2)	1.1 (2)	253	1.2 (1.8)	192	MD in change	-0.08 (-0.53 to 0.36)	NSD
		Female	12 (0)	BMI, kg/m2	19.2 (2.2)	19.3 (1.9)	0.3 (1.3)	121	0.6 (1.4)	94	MD in change	-0.38 (-0.73 to -0.03)	0.03
		Male	12 (0)	BMI, kg/m2	19.2 (2.3)	19 (2)	0.3 (1.6)	132	0.4 (1.4)	98	MD in change	0.04 (-0.55 to 0.63)	0.89
		White	12 (0)	BMI, kg/m2	19 (2.2)	18.9 (2.3)	0.2 (1.3)	118	0.4 (1.3)	134	MD in change	-0.19 (-0.54 to 0.16)	0.30
		Black	12 (0)	BMI, kg/m2	19.6 (2.5)	19.5 (1.9)	0.5 (1.6)	70	1.1 (1.6)	14	MD in change	-0.64 (-1.61 to 0.32)	0.20
		Latino	12 (0)	BMI, kg/m2	19.3 (2.8)	19.8 (2.5)	0.5 (1.5)	48	0.4 (1.6)	26	MD in change	0.09 (-0.72 to 0.9)	0.82
		Other Race	12 (0)	BMI, kg/m2	18.6 (1.2)	19.5 (2.1)	0 (1.5)	17	0.6 (1.3)	18	MD in change	-0.48 (-1.58 to 0.63)	0.41
		Age < 5 years	12 (0)	BMI, kg/m2	19 (NR)	18.9 (NR)	0 (NR)	NR	0.2 (NR)	NR	MD in change	-0.29 (-0.75 to 0.17)	0.22
		Age ≥ 5 years	12 (0)	BMI, kg/m2	19.4 (NR)	19.3 (NR)	0.6 (NR)	NR	0.6 (NR)	NR	MD in change	-0.13 (-0.48 to 0.22)	0.46
		Income > $50k	12 (0)	BMI, kg/m2	19 (2.5)	19 (2.5)	0.3 (1.4)	160	0.3 (1.1)	153	MD in change	0.02 (-0.3 to 0.33)	0.92
		Income ≤ $50k	12 (0)	BMI, kg/m2	19.6 (2.8)	19.9 (2.5)	0.4 (1.6)	88	1.4 (1.8)	38	MD in change	-0.93 (-1.6 to -0.25)	0.01

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		Parent: College Graduate	12 (0)	BMI, kg/m2	18.9 (2.4)	19.1 (2.3)	0.2 (1.3)	147	0.3 (1.1)	127	MD in change	-0.14 (-0.44 to 0.16)	0.37
		Parent: Some College	12 (0)	BMI, kg/m2	19.6 (3.1)	19.1 (1.6)	0.5 (1.6)	106	0.9 (1.6)	65	MD in change	-0.36 (-0.92 to 0.19)	0.20
Taveras, 2015[146]	IG1	All	12 (0)	BMI, kg/m2	26 (4.2)	25.7 (4.2)	0.9 (4.4)	164	1.2 (4.4)	171	MD in change	-0.34 (-0.75 to 0.07)	NR
	IG2	All	12 (0)	BMI, kg/m2	25.6 (4.5)	25.7 (4.2)	0.7 (4.6)	183	1.2 (4.4)	171	MD in change	-0.51 (-0.91 to -0.11)	NR
Taylor, 2015[148]	IG1	All	12 (-12)	BMI, kg/m2	19.8 (2.5)	19 (2)	0.1 (2.7)	91	0.4 (2.1)	90	MD in change	-0.3 (-1 to 0.4)	NR
			24 (0)	BMI, kg/m2	19.8 (2.5)	19 (2)	0.8 (3)	89	1.2 (2.3)	92	MD in change	-0.34 (-0.65 to -0.03)	NR,
Van Grieken, 2013[149]	IG1	All	24 (12)	BMI, kg/m2	18.2 (0.6)	18.1 (0.6)	1.4 (1.5)	277	1.4 (1.7)	230	MD in change	-0.16 (-0.6 to 0.27)	0.46
Viner, 2020[150]	IG1	All	6 (0)	BMI, kg/m2	32 (4.6)	32 (4.1)	0.2 (NR)	74	0.2 (NR)	71	MD in change	-0.11 (-0.62 to 0.4)	0.7
			12 (6)	BMI, kg/m2	32 (4.6)	32 (4.1)	0.5 (NR)	60	0.8 (NR)	55	MD in change	-0.22 (-1.05 to 0.61)	0.6
Wake, 2009[152]	IG1	All	6 (3)	BMI, kg/m2	20.2 (2.3)	20.3 (1.9)	0.3 (2.5)	132	0.3 (2.1)	118	MD in change	-0.12 (-0.4 to 0.15)	0.4
			12 (9)	BMI, kg/m2	20.2 (2.3)	20.3 (1.9)	0.6 (2.6)	127	0.7 (2.2)	115	MD in change	-0.11 (-0.45 to 0.22)	0.5
			12 (0)	BMI, kg/m2	22.3	22.8	0.9 (3.4)	56	0.8 (4.2)	49	MD in	-0.1 (-0.7 to	0.7

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
					(2.7)	(3.6)					change	0.5)	
Weigel, 2008[154]	IG1	All	6 (-6)	BMI, kg/m2	27.3 (3.3)	30 (3.7)	-0.1 (3.8)	36	1.7 (3.9)	34	MD in change	-1.8 (-3.6 to 0)	<0.01
			12 (0)	BMI, kg/m2	27.3 (3.3)	30 (3.7)	-1.5 (3)	36	2.8 (3.9)	30	MD in change	-4.3 (-5.97 to -2.63)	<0.001
Broccoli, 2016[107]	IG1	All	12 (9)	BMI percentile, %	91 (3)	90.9 (2.9)	-3.6 (8.4)	186	-1.5 (6.7)	185	MD in change	-2.02 (-3.57 to -0.47)	NR
			24 (21)	BMI percentile, %	91 (3)	90.9 (2.9)	-3 (9.3)	186	-2.5 (8.3)	185	MD in change	-0.5 (-2.29 to 1.29)	NR
DeBar, 2012[111]	IG1	All	6 (1)	BMI percentile, %	97.1 (2.3)	97.1 (2.3)	-1.3 (3.7)	100	-0.6 (2.7)	95	MD in change	-0.69 (-1.59 to 0.21)	0.067
			12 (7)	BMI percentile, %	97.1 (2.3)	97.1 (2.3)	-1.9 (6)	90	-0.8 (2.9)	83	MD in change	-1.08 (-2.5 to 0.34)	0.067
Kong, 2013[119]	IG1	All	6 (-3)	BMI percentile, %	NR	NR	-0.3 (NR)	28	0.2 (NR)	23	MD in change	-0.6 (-1.2 to 0.1)	0.04
Nemet, 2005[126]	IG1	All	12 (9)	BMI percentile, %	98.2 (0.3)	97.2 (0.7)	-5.9 (2.9)	20	-1.1 (1.2)	20	MD in change	-4.8 (-6.16 to -3.44)	<0.05
Patrick, 2013[129]	IG1	All	6 (-6)	BMI percentile, %	97.8 (0.1)	98.1 (0)	-0.3 (0.1)	26	-0.5 (0)	24	MD in change	0.2 (0.16 to 0.24)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (0)	BMI percentile, %	97.8 (0.1)	98.1 (0)	-0.3 (0)	22	-0.9 (0)	21	MD in change	0.6 (0.57 to 0.63)	0.614
	IG2		6 (-6)	BMI percentile, %	97.9 (0)	98.1 (0)	-0.4 (0)	22	-0.5 (0)	24	MD in change	0.1 (0.07 to 0.13)	NR
			12 (0)	BMI percentile, %	97.9 (0)	98.1 (0)	-0.8 (0)	20	-0.9 (0)	21	MD in change	0.1 (0.07 to 0.13)	0.985
	IG3		6 (-6)	BMI percentile, %	98.1 (0.1)	98.1 (0)	-0.4 (0.1)	26	-0.5 (0)	24	MD in change	0.1 (0.07 to 0.13)	NR
			12 (0)	BMI percentile, %	98.1 (0.1)	98.1 (0)	-0.9 (0.1)	24	-0.9 (0)	21	MD in change	0 (-0.03 to 0.03)	0.953
Resnicow, 2015[132]	IG1	All	24 (0)	BMI percentile, %	92.1 (3.4)	91.5 (3.3)	-4.9 (15.2)	154	-1.8 (13.8)	158	MD in change	-3.1 (-6.32 to 0.12)	0.02
	IG2	All	24 (0)	BMI percentile, %	92.2 (3.3)	91.5 (3.3)	-3.8 (14)	145	-1.8 (13.8)	158	MD in change	-2 (-5.13 to 1.13)	NSD
Sherwood, 2019[137]	IG1	All	12 (0)	BMI percentile, %	84.7 (6.9)	85 (7)	-3.3 (9.2)	181	-2.7 (9.4)	183	MD in change	-0.6 (-2.52 to 1.32)	NR
			24 (12)	BMI percentile, %	84.7 (6.9)	85 (7)	-4.1 (10.3)	180	-3.7 (11)	187	MD in change	-0.48 (-1.94 to 0.98)	0.72

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Stark, 2011[139]	IG1	All	6 (0)	BMI percentile, %	99 (0.9)	97.7 (2.5)	-2.1 (1.9)	7	0.3 (2)	10	MD in change	-2.4 (-4.4 to -0.3)	0.030
			12 (6)	BMI percentile, %	99 (0.9)	97.7 (2.5)	-1.1 (1.9)	7	1.6 (2.7)	9	MD in change	-2.7 (-5.3 to -0.2)	0.040
Stark, 2014[140]	IG1	All	6 (0)	BMI percentile, %	NR	NR	-0.8 (1.2)	11	-0.1 (0.7)	12	MD in change	-0.7 (-1.6 to 0.1)	0.09
			12 (6)	BMI percentile, %	NR	NR	-5.1 (11.3)	11	0.2 (1.1)	12	MD in change	-5.4 (-12.3 to 1.5)	0.12
Stark, 2018[141]	IG1	All	6 (0)	BMI percentile, %	98.6 (1.2)	98.6 (1.3)	-2 (2.9)	47	-0.8 (1.9)	54	MD in change	-1.24 (-2.2 to -0.28)	0.003
			12 (6)	BMI percentile, %	98.6 (1.2)	98.6 (1.3)	-1.6 (3)	47	-0.7 (2.3)	54	MD in change	-0.97 (-2.02 to 0.08)	0.057
			18 (12)	BMI percentile, %	98.6 (1.2)	98.6 (1.3)	-1.8 (3.5)	47	-0.8 (2.5)	54	MD in change	-0.95 (-2.13 to 0.23)	0.083
	IG2	All	6 (0)	BMI percentile, %	98.5 (1.3)	98.6 (1.3)	-0.2 (1.2)	50	-0.8 (1.9)	54	MD in change	0.56 (-0.07 to 1.19)	NR
			12 (6)	BMI percentile, %	98.5 (1.3)	98.6 (1.3)	-0.7 (1.9)	50	-0.7 (2.3)	54	MD in change	0.01 (-0.82 to 0.84)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			18 (12)	BMI percentile, %	98.5 (1.3)	98.6 (1.3)	-0.9 (2)	46	-0.8 (2.5)	54	MD in change	-0.05 (-0.96 to 0.86)	NR
Tanofsky-Kraff, 2014[144]	IG1	All	6 (3)	BMI percentile, %	92.4 (4.6)	92.2 (4.4)	-0.4 (6.5)	55	-0.2 (6.6)	58	MD in change	-0.2 (-2.61 to 2.21)	>0.49
			12 (9)	BMI percentile, %	92.4 (4.6)	92.2 (4.4)	-1.4 (6.5)	55	-1.2 (6.6)	58	MD in change	-0.2 (-2.61 to 2.21)	0.96
Boutelle, 2014[106]	IG1	All	8 (4)	zBMI (BMI SDS), z-score	2.1 (0.4)	2.1 (0.4)	-0.1 (0.4)	21	0 (0.4)	18	MD in change	-0.05 (-0.31 to 0.21)	0.158
Broccoli, 2016[107]	IG1	All	12 (9)	zBMI (BMI SDS), z-score	1.4 (0.2)	1.4 (0.2)	-0.1 (0.4)	186	0 (0.3)	185	MD in change	-0.11 (-0.18 to -0.03)	NR
			24 (21)	zBMI (BMI SDS), z-score	1.4 (0.2)	1.4 (0.2)	-0.1 (0.5)	186	0 (0.4)	185	MD in change	-0.02 (-0.11 to 0.07)	NSD
Bryant, 2011[108]	IG1	All	12 (0)	zBMI (BMI SDS), z-score	2.9 (0.4)	3.1 (0.5)	0 (0.2)	35	0 (0.3)	35	MD in change	0.06 (-0.06 to 0.18)	NR
Croker, 2012[109]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	3.1 (0.6)	3.3 (0.6)	-0.1 (0.2)	31	-0.1 (0.2)	27	MD in change	-0.01 (-0.09 to 0.07)	NSD
Davis, 2012[110]	IG1	All	8 (0)	zBMI (BMI SDS), z-score	2.2 (0.5)	2.2 (0.5)	NR	NR	NR	NR	MD in change	NR	NSD

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
DeBar, 2012[111]	IG1	All	6 (1)	zBMI (BMI SDS), z-score	2 (0.3)	2 (0.3)	-0.1 (0.4)	100	-0.1 (0.4)	95	MD in change	-0.06 (-0.16 to 0.04)	0.012
			12 (7)	zBMI (BMI SDS), z-score	2 (0.3)	2 (0.3)	-0.1 (0.4)	90	-0.1 (0.4)	83	MD in change	-0.07 (-0.19 to 0.05)	0.012
Derwig, 2022[112]	IG1	All	12 (7.5)	zBMI (BMI SDS), z-score	1.6 (0.2)	1.6 (0.3)	-0.1 (0.5)	238	0 (0.5)	237	MD in change	-0.11 (-0.24 to 0.01)	0.069
		Female	12 (7.5)	zBMI (BMI SDS), z-score	NR	NR	-0.1 (0.5)	129	0.1 (0.5)	128	MD in change	-0.14 (-0.27 to 0)	0.058
		Male	12 (7.5)	zBMI (BMI SDS), z-score	NR	NR	-0.1 (0.5)	109	0 (0.5)	109	MD in change	-0.06 (-0.25 to 0.13)	0.5
		High SES	12 (7.5)	zBMI (BMI SDS), z-score	NR	NR	-0.1 (0.5)	117	0 (0.5)	111	MD in change	-0.14 (-0.31 to 0.03)	0.09
		Low SES	12 (7.5)	zBMI (BMI SDS), z-score	NR	NR	0 (0.6)	121	0 (0.5)	126	MD in change	-0.09 (-0.3 to 0.12)	0.34
Gerards, 2015[113]	IG1	All	12 (8.5)	zBMI (BMI SDS), z-score	1.8 (0.8)	1.9 (0.7)	0.1 (0.3)	35	-0.1 (0.3)	32	MD in change	0.13 (0 to 0.26)	NR
Golley, 2007[114]	IG1	All	6 (1)	zBMI (BMI SDS), z-score	2.7 (0.6)	2.8 (0.4)	-0.2 (0.6)	29	NR	NR	MD in change	NR	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (7)	zBMI (BMI SDS), z-score	2.7 (0.6)	2.8 (0.4)	-0.2 (0.4)	31	-0.1 (0.4)	31	MD in change	-0.11 (-0.32 to 0.1)	0.76
	IG2	All	6 (1)	zBMI (BMI SDS), z-score	2.8 (0.6)	2.8 (0.4)	-0.1 (0.6)	28	NR	NR	MD in change	NR	NR
			12 (7)	zBMI (BMI SDS), z-score	2.8 (0.6)	2.8 (0.4)	-0.2 (0.5)	29	-0.1 (0.4)	31	MD in change	-0.02 (-0.24 to 0.2)	NR
	IG1	Female	6 (1)	zBMI (BMI SDS), z-score	2.6 (NR)	2.8 (NR)	-0.1 (NR)	20	NR	NR	MD in change	NR	NR
			12 (7)	zBMI (BMI SDS), z-score	2.6 (NR)	2.8 (NR)	-0.1 (NR)	22	-0.3 (NR)	19	MD in change	0.12 (NR)	NR
	IG2	Female	6 (1)	zBMI (BMI SDS), z-score	2.7 (NR)	2.8 (NR)	-0.1 (NR)	17	NR	NR	MD in change	NR	NR
			12 (7)	zBMI (BMI SDS), z-score	2.7 (NR)	2.8 (NR)	-0.1 (NR)	17	-0.3 (NR)	19	MD in change	0.15 (NR)	NR
	IG1	Male	6 (1)	zBMI (BMI SDS), z-score	2.9 (NR)	2.8 (NR)	-0.4 (NR)	9	NR	NR	MD in change	NR	NR
			12 (7)	zBMI (BMI SDS), z-score	2.9 (NR)	2.8 (NR)	-0.6 (NR)	9	0 (NR)	12	MD in change	-0.66 (NR)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	IG2	Male	6 (1)	zBMI (BMI SDS), z-score	2.8 (NR)	2.8 (NR)	-0.2 (NR)	11	NR	NR	MD in change	NR	NR
			12 (7)	zBMI (BMI SDS), z-score	2.8 (NR)	2.8 (NR)	-0.3 (NR)	12	0 (NR)	12	MD in change	-0.38 (NR)	NR
Ho, 2016[115]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.7 (0.4)	2.7 (0.3)	-0.2 (0.3)	37	-0.1 (0.2)	36	MD in change	-0.05 (-0.17 to 0.07)	0.42
Hofsteenge, 2014 [116]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.9 (0.4)	2.9 (0.5)	-0.1 (0.5)	53	0 (0.5)	44	MD in change	-0.1 (-0.23 to 0.04)	NR
Kalavainen, 2007[118]	IG1	All	12 (6)	zBMI (BMI SDS), z-score	2.6 (0.6)	2.5 (0.6)	-0.3 (0.1)	35	-0.2 (0.3)	35	MD in change	-0.1 (-0.21 to 0.01)	0.022
			24 (18)	zBMI (BMI SDS), z-score	2.6 (0.6)	2.5 (0.6)	-0.2 (0.4)	34	-0.2 (0.3)	35	MD in change	0 (-0.17 to 0.17)	0.840
			36 (30)	zBMI (BMI SDS), z-score	2.6 (0.6)	2.5 (0.6)	-0.3 (0.4)	34	-0.3 (0.6)	34	MD in change	0 (-0.24 to 0.24)	0.916
Lison, 2012[121]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.1 (NR)	2.2 (0.2)	-0.2 (NR)	32	0 (NR)	20	MD in change	-0.15 (NR)	0.002
	IG2	All	6 (0)	zBMI (BMI SDS), z-score	2.1 (NR)	2.2 (0.2)	-0.2 (NR)	32	0 (NR)	20	MD in change	-0.22 (NR)	0.004

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Looney, 2014[122]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.5 (0.4)	2.2 (0.7)	-0.2 (0.5)	7	-0.1 (0.6)	8	MD in change	-0.09 (-0.65 to 0.47)	NSD
	IG2	All	6 (0)	zBMI (BMI SDS), z-score	2.4 (0.3)	2.2 (0.7)	-0.1 (0.3)	7	-0.1 (0.6)	8	MD in change	-0.01 (-0.51 to 0.49)	NR
Love-Osborne, 2014[123]	IG1	BL BMI >99%	8 (0)	zBMI (BMI SDS), z-score	NR	NR	0 (NR)	17	0 (NR)	14	MD in change	0 (NR)	0.36
		BL BMI 85-95%	8 (0)	zBMI (BMI SDS), z-score	NR	NR	0.1 (NR)	20	0 (NR)	23	MD in change	0.14 (NR)	0.65
		BL BMI 95-99%	8 (0)	zBMI (BMI SDS), z-score	NR	NR	0 (NR)	40	-0.1 (NR)	35	MD in change	0.09 (NR)	0.81
McCallum, 2007[124]	IG1	All	9 (6)	zBMI (BMI SDS), z-score	2 (0.5)	1.9 (0.5)	0 (0.6)	73	0 (0.5)	80	MD in change	-0.09 (-0.2 to 0.02)	0.12
			15 (12)	zBMI (BMI SDS), z-score	2 (0.5)	1.9 (0.5)	0 (0.6)	70	0 (0.6)	76	MD in change	-0.03 (-0.17 to 0.1)	0.62
Norman, 2016[127]	IG1	All	8 (-4)	zBMI (BMI SDS), z-score	2.1 (0.3)	2.1 (0.3)	-0.1 (0.4)	53	-0.1 (0.3)	53	MD in change	0 (-0.13 to 0.13)	NR
			12 (0)	zBMI (BMI SDS), z-score	2.1 (0.3)	2.1 (0.3)	-0.1 (0.4)	53	-0.1 (0.4)	53	MD in change	0 (-0.15 to 0.15)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		Female	8 (-4)	zBMI (BMI SDS), z-score	2.1 (0.3)	2 (0.4)	-0.1 (0.3)	29	-0.1 (0.4)	25	MD in change	0 (-0.19 to 0.19)	NR
			12 (0)	zBMI (BMI SDS), z-score	2.1 (0.3)	2 (0.4)	-0.1 (0.3)	29	-0.1 (0.4)	25	MD in change	0 (-0.21 to 0.21)	0.42
		Male	8 (-4)	zBMI (BMI SDS), z-score	2.1 (0.4)	2.1 (0.3)	-0.1 (0.4)	24	0 (0.3)	28	MD in change	-0.1 (-0.27 to 0.07)	NR
			12 (0)	zBMI (BMI SDS), z-score	2.1 (0.4)	2.1 (0.3)	-0.1 (0.4)	24	0 (0.3)	28	MD in change	-0.1 (-0.29 to 0.09)	0.008
O'Connor, 2013[128]	IG1	All	7 (0)	zBMI (BMI SDS), z-score	NR	NR	NR	20	NR	20	MD in change	NR	0.86
Patrick, 2013[129]	IG1	All	6 (-6)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.2 (0.3)	0 (0.4)	26	0 (0.4)	24	MD in change	0 (-0.21 to 0.21)	NR
		All	12 (0)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.2 (0.3)	-0.2 (0.4)	22	0 (0.4)	21	MD in change	-0.2 (-0.43 to 0.03)	0.824
	IG2	All	6 (-6)	zBMI (BMI SDS), z-score	2.2 (0.3)	2.2 (0.3)	-0.1 (0.4)	22	0 (0.4)	24	MD in change	-0.1 (-0.31 to 0.11)	NR
		All	12 (0)	zBMI (BMI SDS), z-score	2.2 (0.3)	2.2 (0.3)	-0.1 (0.4)	20	0 (0.4)	21	MD in change	-0.1 (-0.33 to 0.13)	0.934

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	IG3	All	6 (-6)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.2 (0.3)	-0.1 (0.4)	26	0 (0.4)	24	MD in change	-0.1 (-0.31 to 0.11)	NR
		All	12 (0)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.2 (0.3)	-0.1 (0.4)	24	0 (0.4)	21	MD in change	-0.1 (-0.33 to 0.13)	0.876
Raynor, 2012a[130]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.5 (0.9)	-0.1 (NR)	35	-0.1 (NR)	33	MD in change	0.03 (NR)	NSD
		All	12 (6)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.5 (0.9)	-0.1 (NR)	35	-0.1 (NR)	33	MD in change	0.03 (NR)	NSD
	IG2	All	6 (0)	zBMI (BMI SDS), z-score	2.3 (0.5)	2.5 (0.9)	-0.1 (NR)	33	-0.1 (NR)	33	MD in change	0.03 (NR)	NSD
		All	12 (6)	zBMI (BMI SDS), z-score	2.3 (0.5)	2.5 (0.9)	-0.1 (NR)	33	-0.1 (NR)	33	MD in change	0.02 (NR)	NSD
Raynor, 2012b[130]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.3 (0.7)	-0.2 (NR)	26	-0.1 (NR)	29	MD in change	-0.03 (NR)	NSD
		All	12 (6)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.3 (0.7)	-0.2 (NR)	26	-0.2 (NR)	29	MD in change	0 (NR)	NSD
	IG2	All	6 (0)	zBMI (BMI SDS), z-score	2.3 (0.7)	2.3 (0.7)	-0.1 (NR)	26	-0.1 (NR)	29	MD in change	0.05 (NR)	NSD

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		All	12 (6)	zBMI (BMI SDS), z-score	2.3 (0.7)	2.3 (0.7)	-0.1 (NR)	26	-0.2 (NR)	29	MD in change	0.11 (NR)	NSD
Reinehr, 2010[131]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	1.7 (0.2)	1.6 (0.2)	-0.3 (0.2)	34	0.1 (0.2)	32	MD in change	-0.31 (-0.41 to -0.21)	<0.001
Sacher, 2010[133]	IG1	All	6 (3.75)	zBMI (BMI SDS), z-score	2.8 (0.5)	2.8 (0.6)	-0.3 (0.5)	37	0 (0.6)	45	MD in change	-0.24 (-0.34 to -0.13)	<0.0001
Saelens, 2002[134]	IG1	All	7 (3)	zBMI (BMI SDS), z-score	2.1 (0.2)	2.1 (0.1)	0 (0.2)	18	0.1 (0.2)	19	MD in change	-0.11 (-0.23 to 0.01)	<0.04
Savoye, 2014[136]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.3 (0.4)	-0.1 (0.1)	31	0 (0.1)	27	MD in change	-0.09 (-0.14 to -0.04)	<0.001
		Female	6 (0)	zBMI (BMI SDS), z-score	NR	NR	NR	NR	NR	NR	MD in change	-0.1 (-0.14 to -0.01)	0.01
		Male	6 (0)	zBMI (BMI SDS), z-score	NR	NR	NR	NR	NR	NR	MD in change	-0.13 (-0.22 to -0.03)	0.01
Sherwood, 2019[137]	IG1	All	12 (0)	zBMI (BMI SDS), z-score	1.1 (0.3)	1.1 (0.3)	-0.1 (0.4)	181	-0.1 (0.4)	183	MD in change	-0.02 (-0.1 to 0.06)	NR
			24 (12)	zBMI (BMI SDS), z-score	1.1 (0.3)	1.1 (0.3)	-0.1 (0.4)	180	-0.1 (0.4)	187	MD in change	-0.02 (-0.07 to 0.04)	0.71

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Smith, 2021[138]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.3 (1.5)	2 (1.3)	-0.1 (1.5)	141	0 (1.2)	99	MD in change	-0.06 (-0.42 to 0.3)	0.318
			12 (6)	zBMI (BMI SDS), z-score	2.3 (1.5)	2 (1.3)	-0.1 (1.5)	141	-0.1 (1.6)	99	MD in change	-0.01 (-0.4 to 0.38)	0.288
Stark, 2011[139]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	NR	NR	-0.5 (0.4)	7	0.1 (0.3)	10	MD in change	-0.59 (-0.94 to -0.24)	0.003
			12 (6)	zBMI (BMI SDS), z-score	NR	NR	-0.4 (0.4)	7	0.4 (0.5)	9	MD in change	-0.77 (-1.26 to -0.27)	0.005
Stark, 2014[140]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.5 (0.8)	2.4 (0.4)	-0.2 (0.2)	11	-0.1 (0.2)	12	MD in change	-0.16 (-0.34 to 0.02)	0.08
			12 (6)	zBMI (BMI SDS), z-score	2.5 (0.8)	2.4 (0.4)	-0.6 (0.8)	11	0 (0.4)	12	MD in change	-0.5 (-0.98 to -0.03)	0.04
Stark, 2018[141]	IG1	All	6 (0)	zBMI (BMI SDS), z-score	2.4 (0.5)	2.4 (0.6)	-0.3 (0.3)	43	-0.1 (0.3)	50	MD in change	-0.19 (-0.32 to -0.06)	<0.004
		All	12 (6)	zBMI (BMI SDS), z-score	2.4 (0.5)	2.4 (0.6)	-0.2 (0.5)	47	-0.1 (0.4)	54	MD in change	-0.07 (-0.25 to 0.11)	0.217
		All	18 (12)	zBMI (BMI SDS), z-score	2.4 (0.5)	2.4 (0.6)	-0.2 (0.6)	47	-0.2 (0.4)	54	MD in change	-0.03 (-0.24 to 0.18)	0.359

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	IG2	All	6 (0)	zBMI (BMI SDS), z-score	2.4 (0.6)	2.4 (0.6)	-0.1 (0.3)	46	-0.1 (0.3)	50	MD in change	0.08 (-0.04 to 0.2)	NR
		All	12 (6)	zBMI (BMI SDS), z-score	2.4 (0.6)	2.4 (0.6)	-0.1 (0.3)	50	-0.1 (0.4)	54	MD in change	0.01 (-0.13 to 0.15)	NR
		All	18 (12)	zBMI (BMI SDS), z-score	2.4 (0.6)	2.4 (0.6)	-0.2 (0.3)	50	-0.2 (0.4)	54	MD in change	0.01 (-0.14 to 0.16)	NR
Stettler, 2014[142]	IG1	All	12 (0)	zBMI (BMI SDS), z-score	1.2 (0.5)	1.3 (0.4)	-0.1 (0.5)	46	0 (0.4)	24	MD in change	-0.08 (-0.17 to 0)	0.05
	IG2	All	12 (0)	zBMI (BMI SDS), z-score	1.2 (0.5)	1.3 (0.4)	-0.1 (0.5)	97	NR	24	MD in change	-0.09 (-0.17 to -0.01)	0.03
	IG3	All	12 (0)	zBMI (BMI SDS), z-score	1.2 (0.5)	1.3 (0.4)	-0.1 (0.6)	51	0 (0.4)	24	MD in change	-0.08 (-0.17 to 0.02)	0.11
Tanofsky-Kraff, 2010[143]	IG1	All	6 (3)	zBMI (BMI SDS), z-score	1.3 (0.4)	1.3 (0.4)	0.1 (0.4)	19	-0.1 (0.4)	19	MD in change	0.12 (-0.15 to 0.39)	NSD
			12 (9)	zBMI (BMI SDS), z-score	1.3 (0.4)	1.3 (0.4)	-0.1 (0.5)	19	-0.1 (0.5)	19	MD in change	0 (-0.29 to 0.29)	NR
Tanofsky-Kraff, 2014[144]	IG1	All	6 (3)	zBMI (BMI SDS), z-score	1.5 (0.3)	1.5 (0.3)	0 (0.4)	55	0 (0.4)	58	MD in change	0 (-0.13 to 0.13)	>0.49

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (9)	zBMI (BMI SDS), z-score	1.5 (0.3)	1.5 (0.3)	0 (0.4)	55	0 (0.4)	58	MD in change	0 (-0.13 to 0.13)	0.91
Taveras, 2011[145]	IG1	All	12 (0)	zBMI (BMI SDS), z-score	1.9 (0.7)	1.8 (0.6)	NR	253	NR	192	MD in change	-0.05 (-0.14 to 0.04)	0.28
			24 (12)	zBMI (BMI SDS), z-score	1.9 (0.7)	1.8 (0.6)	-0.2 (0.5)	253	-0.2 (0.5)	192	MD in change	-0.04 (-0.14 to 0.06)	NSD
Taveras, 2015[146]	IG1	All	12 (0)	zBMI (BMI SDS), z-score	2.1 (0.3)	2 (0.3)	-0.1 (0.3)	164	0 (0.3)	171	MD in change	-0.05 (-0.09 to 0)	NR
	IG2	All	12 (0)	zBMI (BMI SDS), z-score	2 (0.3)	2 (0.3)	-0.1 (0.4)	183	0 (0.3)	171	MD in change	-0.06 (-0.11 to -0.02)	NR
Taveras, 2017[147]	IG1	All	12 (0)	zBMI (BMI SDS), z-score	1.9 (0.6)	1.9 (0.6)	-0.1 (0.4)	360	-0.1 (0.4)	361	MD in change	-0.02 (-0.8 to 0.03)	0.39
Taylor, 2015[148]	IG1	All	12 (-12)	zBMI (BMI SDS), z-score	1.7 (0.5)	1.5 (0.4)	-0.2 (0.5)	91	-0.1 (0.4)	90	MD in change	-0.11 (-0.25 to 0.03)	NR
			24 (0)	zBMI (BMI SDS), z-score	1.7 (0.5)	1.5 (0.4)	-0.3 (0.5)	89	-0.1 (0.4)	92	MD in change	-0.12 (-0.2 to -0.04)	NR, significant
Van Grieken, 2013[149]	IG1	All	24 (12)	zBMI (BMI SDS), z-score	NR	NR	NR	NR	NR	NR	MD in change	NR	0.07

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Vos, 2011[151]	IG1	All	12 (-12)	zBMI (BMI SDS), z-score	4.2 (0.6)	4.3 (0.6)	-0.4 (1.1)	32	-0.1 (1)	35	MD in change	-0.2 (0.03 to 0.42)	0.02
Wake, 2013[153]	IG1	All	12 (0)	zBMI (BMI SDS), z-score	2.2 (0.5)	2.1 (0.3)	-0.2 (0.5)	56	-0.1 (0.4)	49	MD in change	-0.05 (-0.14 to 0.03)	0.2
Weigel, 2008[154]	IG1	All	6 (-6)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.5 (0.6)	-0.1 (0.5)	36	0.2 (0.6)	34	MD in change	-0.32 (-0.57 to -0.07)	<0.05
			12 (0)	zBMI (BMI SDS), z-score	2.2 (0.4)	2.5 (0.6)	-0.3 (0.5)	36	0.3 (0.6)	30	MD in change	-0.6 (-0.85 to -0.35)	<0.01
Croker, 2012[109]	IG1	All	6 (0)	Weight, kg	70.8 (17.8)	65.5 (18.8)	0.8 (2.8)	31	2.8 (2.8)	27	MD in change	-1.99 (-3.44 to -0.54)	0.002
DeBar, 2012[111]	IG1	All	6 (1)	Weight, kg	86 (15.2)	84.6 (15.6)	0.2 (15.7)	100	1.6 (16.3)	95	MD in change	-1.46 (-5.94 to 3.03)	0.015
			12 (7)	Weight, kg	86 (15.2)	84.6 (15.6)	2.2 (16.4)	90	3.2 (16.3)	83	MD in change	-0.99 (-5.87 to 3.88)	0.015
Ho, 2016[115]	IG1	All	6 (0)	Weight, kg	NR	NR	2.5 (5.2)	37	2.7 (5)	36	MD in change	-0.12 (-2.45 to 2.21)	0.92
Hofsteenge, 2014[116]	IG1	All	6 (0)	Weight, kg	94.7 (18.4)	92.2 (18.5)	1.2 (18.1)	53	2.9 (18.7)	44	MD in change	-2.05 (-4.98 to 0.88)	NR
Kalarchian, 2009[117]	IG1	All	6 (-6)	Weight, kg	70.2 (18.4)	72.7 (16.6)	1.6 (6.7)	97	4.8 (5.6)	95	MD in change	-3.2 (-4.94 to -1.46)	0.0003
			12 (0)	Weight, kg	70.2 (18.4)	72.7 (16.6)	6.9 (7.1)	97	9.2 (5.8)	95	MD in change	-2.3 (-4.14 to -0.46)	0.014

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			18 (6)	Weight, kg	70.2 (18.4)	72.7 (16.6)	11.8 (6.9)	97	13.4 (5.4)	95	MD in change	-1.58 (-3.32 to 0.16)	0.077
Kalavainen, 2007[118]	IG1	All	12 (6)	Weight, kg	43.1 (8.7)	40.4 (6.7)	0.5 (1.8)	35	1.8 (2.2)	35	MD in change	-1.3 (-2.24 to -0.36)	NR
			24 (18)	Weight, kg	43.1 (8.7)	40.4 (6.7)	10.7 (3.9)	34	10.7 (4.1)	35	MD in change	0 (-1.89 to 1.89)	NR
			36 (30)	Weight, kg	43.1 (8.7)	40.4 (6.7)	17.3 (5.2)	34	17.1 (7.4)	34	MD in change	0.2 (-2.84 to 3.24)	NR
Kong, 2013[119]	IG1	All	6 (-3)	Weight, kg	78.5 (12.5)	78.1 (18)	1.7 (3.9)	28	2.5 (4)	23	MD in change	-0.8 (-3.1 to 1.4)	0.12
Kose, 2021[120]	IG1	All	6 (0)	Weight, kg	79.5 (14)	80.5 (12.3)	-4.7 (3.5)	37	0.5 (3.6)	27	MD in change	-5.16 (-6.9 to -3.42)	0.001
Lison, 2012[121]	IG1	All	6 (0)	Weight, kg	74 (NR)	69.2 (18.3)	1.2 (NR)	32	7.8 (NR)	20	MD in change	-6.6 (NR)	<0.0001
	IG2	All	6 (0)	Weight, kg	67.2 (NR)	69.2 (18.3)	-0.3 (NR)	32	7.8 (NR)	20	MD in change	-8.1 (NR)	NR
Mellin, 1987[125]	IG1	All	6 (3)	Weight, kg	79.2 (NR)	76.9 (NR)	-1.4 (NR)	34	-1 (NR)	29	MD in change	-0.35 (NR)	NSD
Nemet, 2005[126]	IG1	All	12 (9)	Weight, kg	59.1 (15.4)	63.4 (23.6)	0.6 (16.7)	20	5.2 (24.2)	20	MD in change	-4.6 (-17.49 to 8.29)	<0.05
Saelens, 2002[134]	IG1	All	7 (3)	Weight, kg	85.5 (13.9)	80.5 (13.5)	2 (15.1)	18	5.3 (14.1)	19	MD in change	-3.3 (-12.69 to 6.09)	NR
Savoye, 2007[135]	IG1	All	6 (-6)	Weight, kg	87 (25.1)	91.2 (23.3)	-2.6 (8.6)	105	5 (9.1)	69	MD in change	-7.6 (-10.8 to -4.3)	<0.001

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (0)	Weight, kg	87 (25.1)	91.2 (25.1)	0.3 (8.9)	105	7.7 (10)	69	MD in change	-7.4 (-10.6 to -4.2)	<0.001
Savoye, 2014[136]	IG1	All	6 (0)	Weight, kg	83.7 (19)	92 (24)	0.6 (4.1)	31	3.7 (3.9)	27	MD in change	-3.1 (-5.3 to -0.9)	0.006
		Female	6 (0)	Weight, kg	NR	NR	NR	NR	NR	NR	MD in change	-1.9 (-4.5 to 0.7)	0.15
		Male	6 (0)	Weight, kg	NR	NR	NR	NR	NR	NR	MD in change	-5.9 (-9.9 to -1.9)	0.004
Stark, 2011[139]	IG1	All	6 (0)	Weight, kg	NR	NR	-0.9 (2.3)	7	1.8 (0.9)	10	MD in change	-2.7 (-4.4 to -1)	0.004
			12 (6)	Weight, kg	NR	NR	0.6 (3.5)	7	4.8 (1.5)	9	MD in change	-4.3 (-7 to -1.5)	0.005
Stark, 2014[140]	IG1	All	6 (0)	Weight, kg	26.6 (8.9)	26.1 (5.7)	1.1 (2.4)	11	1.9 (0.9)	12	MD in change	-0.7 (-2.2 to 0.9)	0.37
			12 (6)	Weight, kg	26.6 (8.9)	26.1 (5.7)	2.3 (3.1)	11	5.2 (2.6)	12	MD in change	-3 (-5.5 to -0.4)	0.03
Stark, 2018[141]	IG1	All	6 (0)	Weight, kg	26.1 (6.2)	26 (5.5)	0.7 (1.9)	43	2 (1.8)	50	MD in change	-1.36 (-2.09 to -0.63)	<0.001
			12 (6)	Weight, kg	26.1 (6.2)	26 (5.5)	3.4 (2.7)	47	4.5 (2.3)	54	MD in change	-1.1 (-2.08 to -0.12)	0.021
			18 (12)	Weight, kg	26.1 (6.2)	26 (5.5)	5.8 (3.4)	47	7.1 (3.1)	54	MD in change	-1.29 (-2.56 to -0.02)	0.054
	IG2	All	6 (0)	Weight, kg	25.9 (5)	26 (5.5)	2.2 (1.4)	46	2 (1.8)	50	MD in change	0.18 (-0.45 to 0.81)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (6)	Weight, kg	25.9 (5)	26 (5.5)	4.5 (2.5)	50	4.5 (2.3)	54	MD in change	-0.06 (-0.99 to 0.87)	NR
			18 (12)	Weight, kg	25.9 (5)	26 (5.5)	7.3 (3.8)	50	7.1 (3.1)	54	MD in change	0.13 (-1.2 to 1.46)	NR
Stettler, 2014[142]	IG1	All	12 (0)	Weight, kg	46.8 (10.2)	49.2 (12.2)	5.5 (10)	46	8.6 (13.8)	24	MD in change	-1.1 (-2.58 to 0.37)	0.14
	IG2	All	12 (0)	Weight, kg	46.8 (11.1)	49.2 (12.2)	5.5 (11.2)	97	8.6 (13.8)	24	MD in change	-1.44 (-2.98 to 0.1)	0.07
	IG3	All	12 (0)	Weight, kg	46.8 (11.9)	49.2 (12.2)	5.6 (12.2)	51	8.6 (13.8)	24	MD in change	-1.55 (-3.34 to 0.25)	0.09
Taylor, 2015[148]	IG1	All	12 (-12)	Weight, kg	30.4 (8.8)	27.4 (6.9)	2.9 (9.3)	91	3.5 (7.5)	90	MD in change	-0.6 (-3.06 to 1.86)	NR
			24 (0)	Weight, kg	30.4 (8.8)	27.4 (6.9)	7.5 (10.4)	89	8.1 (8)	92	MD in change	-0.6 (-3.3 to 2.1)	NR
Viner, 2020[150]	IG1	All	6 (0)	Weight, kg	84.4 (14.9)	88.9 (14.6)	2 (NR)	74	1.8 (NR)	71	MD in change	0.07 (-1.51 to 1.65)	0.9
Bryant, 2011[108]	IG1	All	12 (0)	WC, cm	NR	NR	-0.1 (0.5)	35	0 (0.4)	35	MD in change	-0.05 (-0.25 to 0.15)	NR
Croker, 2012[109]	IG1	All	6 (0)	WC, cm	91.2 (9.8)	88.7 (11)	-0.5 (3.2)	31	0.2 (3.2)	27	MD in change	-0.69 (-2.36 to 0.98)	0.33
Gerards, 2015[113]	IG1	All	12 (8.5)	WC, cm	67.2 (8.4)	68.8 (8.7)	3.9 (3)	35	3.4 (3.5)	32	MD in change	0.44 (-1.1 to 1.98)	NR
Golley, 2007[114]	IG1	All	6 (1)	WC, z-score	3.3 (0.7)	3.1 (0.6)	-0.3 (0.7)	29	NR	NR	MD in change	NR	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (7)	WC, z-score	3.3 (0.7)	3.1 (0.6)	-0.3 (0.5)	31	0 (0.6)	31	MD in change	-0.29 (-0.57 to -0.01)	0.03
	IG2	All	6 (1)	WC, z-score	3.2 (0.7)	3.1 (0.6)	-0.1 (0.6)	28	NR	NR	MD in change	NR	NR
			12 (7)	WC, z-score	3.2 (0.7)	3.1 (0.6)	-0.2 (0.5)	29	0 (0.6)	31	MD in change	-0.15 (-0.42 to 0.12)	NR
Ho, 2016[115]	IG1	All	6 (0)	WC, cm	95.6 (14.2)	93.4 (14.1)	-3.1 (19.2)	36	1.9 (18.4)	36	MD in change	-5.03 (-13.72 to 3.66)	0.26
Hofsteenge, 2014[116]	IG1	All	6 (0)	WC, cm	108.1 (12.4)	108.6 (11.2)	0.3 (12.3)	53	3.3 (12.3)	44	MD in change	-3.02 (-6.33 to 0.29)	NR
Kalarchian, 2009[117]	IG1	All	6 (-6)	WC, cm	70.2 (18.4)	72.6 (16.8)	1.1 (8.1)	97	4.9 (6.3)	95	MD in change	-3.83 (-5.87 to -1.79)	0.0003
			12 (0)	WC, cm	70.2 (18.4)	72.6 (16.8)	6.2 (10.3)	97	9.6 (8.5)	95	MD in change	-3.41 (-6.08 to -0.74)	0.014
Kalavainen, 2007[118]	IG1	All	12 (6)	WC, cm	77.3 (7.4)	75.3 (6.1)	-0.7 (3.1)	35	0.8 (3.5)	35	MD in change	-1.5 (-3.04 to 0.04)	0.062
Kong, 2013[119]	IG1	All	6 (-3)	WC, cm	89.9 (8.5)	89.9 (11.4)	0 (3.6)	28	1.7 (2.9)	23	MD in change	-1.7 (-3.6 to 0.2)	0.04
Lison, 2012[121]	IG1	All	6 (0)	WC, cm	95.5 (NR)	94.7 (10.3)	-0.7 (NR)	32	2.7 (NR)	20	MD in change	-3.4 (NR)	0.012
	IG2	All	6 (0)	WC, cm	94.7 (NR)	94.7 (10.3)	-4.4 (NR)	32	2.7 (NR)	20	MD in change	-7.1 (NR)	NR
Norman, 2016[127]	IG1	All	12 (0)	WC, cm	98.8 (10.6)	97.9 (10.5)	-0.1 (11.5)	53	-0.1 (11.2)	53	MD in change	0 (-4.32 to 4.32)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		Female	12 (0)	WC, cm	99.3 (10.6)	98.7 (10.5)	0.3 (11.4)	29	-1.1 (11)	25	MD in change	1.4 (-4.61 to 7.41)	0.55
		Male	12 (0)	WC, cm	98.1 (9.6)	97.1 (9.5)	-0.4 (10.4)	24	0.9 (10.6)	28	MD in change	-1.3 (-7.03 to 4.43)	0.48
Reinehr, 2010[131]	IG1	All	6 (0)	WC, cm	83 (8)	81 (5)	-6 (8)	34	0 (1)	32	MD in change	-6 (-8.79 to -3.21)	0.008
Sacher, 2010[133]	IG1	All	6 (3.75)	WC, cm	81.8 (8.3)	80.3 (8.6)	-4.1 (7.8)	37	1.7 (8.6)	45	MD in change	-4.1 (-5.6 to -2.7)	<0.0001
			6 (3.75)	WC, z-score	2.9 (0.5)	2.7 (0.6)	-0.4 (0.6)	37	0.1 (0.6)	45	MD in change	-0.37 (-0.49 to -0.25)	<0.0001
Taylor, 2015[148]	IG1	All	12 (-12)	WC, cm	66.5 (9.5)	63.1 (7.2)	1.4 (10.2)	91	2.9 (7.9)	90	MD in change	-1.5 (-4.15 to 1.15)	NR
			24 (0)	WC, cm	66.5 (9.5)	63.1 (7.2)	4.9 (11)	89	6.5 (8.2)	92	MD in change	-1.5 (-2.5 to -0.5)	NR, significant
Van Grieken, 2013[149]	IG1	All	24 (12)	WC, cm	NR	NR	7.2 (5.5)	262	7.3 (5.3)	222	MD in change	-0.46 (-1.82 to 0.9)	0.506
Viner, 2020[150]	IG1	All	6 (0)	WC, cm	98 (12)	99 (11)	-0.1 ()	64	0.2 (NR)	61	MD in change	-0.72 (-3.28 to 1.84)	0.6
Wake, 2009[152]	IG1	All	6 (3)	WC, cm	NR	NR	NR	131	NR	117	MD in change	0.12 (-0.98 to 1.22)	0.8
			12 (9)	WC, cm	NR	NR	NR	125	NR	114	MD in change	0.12 (-1.12 to 1.37)	0.8
Wake, 2013[153]	IG1	All	12 (0)	WC, cm	NR	NR	NR	56	NR	49	MD in change	-1.7 (-4.1 to 0.6)	0.1

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Broccoli, 2016[107]	IG1	All	12 (9)	% Above weight cut-off, >=85th percentile	N/A	N/A	137 (73.3)	187	143 (77.3)	185	RR	0.8 (0.5 to 1.29)	0.169
Derwig, 2022[112]	IG1	All	12 (7.5)	% Above weight cut-off, obesity (IOTF)	N/A	N/A	23 (9.7)	238	35 (14.8)	237	RR	0.63 (0.3 to 1.29)	NR
			12 (7.5)	% Above weight cut-off, severe obesity (IOTF)	N/A	N/A	3 (1.3)	238	5 (2.1)	237	RR	0.66 (0.11 to 4.02)	NR
Stark, 2011[139]	IG1	All	12 (6)	% Above weight cut-off, ≥99th percentile	N/A	N/A	1 (14.3)	7	5 (55.6)	9	RR	0.13 (0.01 to 1.61)	NR
Stettler, 2014[142]	IG1	All	12 (0)	% Above weight cut-off, ≥95th percentile	N/A	N/A	7 (15.2)	46	9 (37.5)	24	RR	0.3 (0.02 to 1.08)	0.06
	IG2	All	12 (0)	% Above weight cut-off, ≥95th percentile	N/A	N/A	15 (15.5)	97	9 (37.5)	24	RR	0.3 (0.01 to 0.65)	0.02
	IG3	All	12 (0)	% Above weight cut-off, ≥95th percentile	N/A	N/A	8 (15.7)	51	9 (37.5)	24	RR	0.31 (0.1 to 0.95)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Taveras, 2017[147]	IG1	All	12 (0)	% Above weight cut-off, >=95th percentile	N/A	N/A	216 (60)	360	225 (62.3)	361	RR	0.91 (0.67 to 1.22)	NR
			12 (0)	% Above weight cut-off, >=85th percentile	N/A	N/A	318 (88.3)	360	327 (90.6)	361	RR	0.79 (0.49 to 1.27)	NR
Van Grieken, 2013[149]	IG1	All	24 (12)	% Above weight cut-off, overweight or obesity (IOTF)	N/A	N/A	209 (75.5)	277	170 (73.9)	230	RR	1.08 (0.73 to 1.62)	NR
			24 (12)	% Above weight cut-off, obesity (IOTF)	N/A	N/A	40 (14.4)	277	25 (10.9)	230	RR	1.38 (0.81 to 2.36)	NR
Mellin, 1987[125]	IG1	All	6 (3)	% excess of 50th %ile, % relative weight	136.5 (NR)	129.5 (NR)	-6.2 (NR)	34	-5.2 (NR)	29	MD in change	-1 (NR)	NSD
Saelens, 2002[134]	IG1	All	7 (3)	% excess of 50th %ile, percentage	62 (20.5)	62.3 (17.4)	-2.4 (22.8)	18	4.1 (18.9)	19	MD in change	-6.5 (-19.97 to 6.97)	NSD
Bryant, 2011[108]	IG1	All	12 (0)	Body fat %, %	NR	NR	1.4 (3)	35	0.2 (4.6)	35	MD in change	1.2 (-0.61 to 3.01)	NR

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Nemet, 2005[126]	IG1	All	12 (9)	Body fat %, %	40.6 (6.7)	40.9 (9.5)	-2.3 (10.8)	20	3.5 (9.6)	20	MD in change	-5.8 (-12.14 to 0.54)	<0.05
Patrick, 2013[129]	IG1	All	6 (-6)	Body fat %, %	46 (6.2)	46.1 (6)	-0.3 (6.6)	26	-0.5 (6.5)	24	MD in change	0.2 (-3.43 to 3.83)	NR
			12 (0)	Body fat %, %	46 (6.2)	46.1 (6)	-0.7 (7.1)	22	-0.5 (6.3)	21	MD in change	-0.2 (-4.24 to 3.84)	0.771
	IG2	All	6 (-6)	Body fat %, %	44.6 (5.9)	46.1 (6)	-1 (6.3)	22	-0.5 (6.5)	24	MD in change	-0.5 (-4.18 to 3.18)	NR
			12 (0)	Body fat %, %	44.6 (5.9)	46.1 (6)	-2 (6.8)	20	-0.5 (6.3)	21	MD in change	-1.5 (-5.51 to 2.51)	0.448
	IG3	All	6 (-6)	Body fat %, %	46.2 (6.2)	46.1 (6)	-1.3 (6.6)	26	-0.5 (6.5)	24	MD in change	-0.8 (-4.41 to 2.81)	NR
			12 (0)	Body fat %, %	46.2 (6.2)	46.1 (6)	-2.7 (7.2)	24	-0.5 (6.3)	21	MD in change	-2.2 (-6.18 to 1.78)	0.185
Reinehr, 2010[131]	IG1	All	6 (0)	Body fat %, %	32 (4)	30 (1)	-2.7 (4.9)	34	1.8 (2)	32	MD in change	-4.5 (-6.33 to -2.67)	0.004
Sacher, 2010[133]	IG1	All	6 (3.75)	Body fat %, %	39.6 (6.2)	39.4 (7)	-1.7 (5.6)	23	-0.8 (7.4)	22	MD in change	-1.6 (-5 to 1.9)	0.7
Savoye, 2007[135]	IG1	All	6 (-6)	Body fat %, %	47 (8.7)	45.8 (7.2)	-3.2 (5.8)	105	2 (6.1)	69	MD in change	-5.2 (-7 to -3.5)	<0.001
			12 (0)	Body fat %, %	47 (8.7)	45.8 (7.2)	-4 (6.3)	105	2 (6.4)	69	MD in change	-6 (-7.8 to -4.2)	<0.001
Smith, 2021[138]	IG1	All	6 (0)	Body fat %, % body fat	36.6 (8.4)	34.7 (7.7)	1 (8.7)	141	0.2 (7.8)	99	MD in change	0.8 (-1.35 to 2.95)	0.060

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (6)	Body fat %, % body fat	36.6 (8.4)	34.7 (7.7)	0.1 (8.8)	141	0.4 (8.5)	99	MD in change	-0.35 (-2.57 to 1.87)	0.278
Tanofsky-Kraff, 2014[144]	IG1	All	12 (9)	Body fat %, %	36.5 (5)	36.4 (5.3)	-0.3 (5.4)	55	-0.3 (5.6)	58	MD in change	0 (-2.03 to 2.03)	0.85
Taylor, 2015[148]	IG1	All	12 (-12)	Body fat %, %	26.9 (5.1)	25.7 (4.5)	0 (5.4)	91	0.5 (4.5)	90	MD in change	-0.5 (-1.94 to 0.94)	NR
			24 (0)	Body fat %, %	26.9 (5.1)	25.7 (4.5)	1 (5.9)	89	1.5 (4.8)	92	MD in change	-0.6 (-1.2 to 0.1)	NSD
Viner, 2020[150]	IG1	All	6 (0)	Body fat %, %	43 (8)	44 (8)	0.7 (NR)	62	1.2 (NR)	55	MD in change	-0.21 (-1.57 to 1.14)	0.8
Wake, 2013[153]	IG1	All	12 (0)	Body fat %, %	NR	NR	NR	56	NR	48	MD in change	-0.9 (-2.6 to 0.8)	0.3
Smith, 2021[138]	IG1	All	6 (0)	% excess of 95th %tile, %	115.6 (22)	111.6 (22.1)	-0.3 (22.8)	141	-0.3 (21.2)	99	MD in change	-0.03 (-5.72 to 5.66)	0.304
			12 (6)	% excess of 95th %tile, %	115.6 (22)	111.6 (22.1)	-0.7 (22.8)	141	0.2 (24.2)	99	MD in change	-0.92 (-6.93 to 5.09)	0.457
Stark, 2018[141]	IG1	All	6 (0)	% excess of 95th %tile, %	114.7 (13.3)	115.3 (14.4)	-4.9 (6.5)	47	0 (6.1)	54	MD in change	-4.88 (-7.34 to -2.42)	<0.001
			12 (6)	% excess of 95th %tile, %	114.7 (13.3)	115.3 (14.4)	-1.7 (8.6)	47	2.1 (8.4)	54	MD in change	-3.79 (-7.11 to -0.47)	0.025
			18 (12)	% excess of 95th	114.7 (13.3)	115.3 (14.4)	-0.6 (9.9)	47	2.8 (8.8)	54	MD in change	-3.43 (-7.08 to 0.22)	0.094

Appendix D Table 7. Weight-Related Outcomes Results for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
				%tile, %									
	IG2	All	6 (0)	% excess of 95th %tile, %	113.8 (13.1)	115.3 (14.4)	0.8 (4.9)	50	0 (6.1)	54	MD in change	0.76 (-1.38 to 2.9)	NR
			12 (6)	% excess of 95th %tile, %	113.8 (13.1)	115.3 (14.4)	1.1 (7.5)	50	2.1 (8.4)	54	MD in change	-0.91 (-3.98 to 2.16)	NR
			18 (12)	% excess of 95th %tile, %	113.8 (13.1)	115.3 (14.4)	3.2 (10.5)	50	2.8 (8.8)	54	MD in change	0.38 (-3.32 to 4.08)	NR

*Interaction p-value report for only 1 study Tanofsky-Kraff, 2014

Abbreviations: BL = Baseline; BMI = Body mass index; CG = Control group; CI = Confidence Interval; Cm = centimeter; FU = Followup; IG = Intervention group; IOTF = International Obesity Task Force; Kg/m2 = Kilograms per meters squared; MD = Mean difference; N/A = Not applicable; NR = Not reported; NSD = No significant difference; RR = Relative risk; SD = Standard deviation; SDS = Standardized; SES = Socioeconomic status; Stat = Statistic; Tx = Treatment; WC = Waist circumference

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Golley, 2007[114]	IG1	All	12 (7)	SBP, mm Hg	NR	NR	NR	NR	NR	NR	MD in change	NR	0.49
Ho, 2016[115]	IG1	All	6 (0)	SBP, percentile	80.6 (19.9)	82.6 (19.7)	-6.2 (23.1)	36	-8.9 (23.8)	36	MD in change	2.72 (-8.1 to 13.54)	0.62
Hofsteenge, 2014[116]	IG1	All	6 (0)	SBP, mm Hg	113 (13)	112 (13)	-1 (13.5)	53	-2 (12.5)	44	MD in change	1.54 (-2.8 to 5.89)	NR
Kalarchian, 2009[117]	IG1	All	6 (-6)	SBP, mm Hg	111.2 (9.4)	113.1 (9.9)	-4.5 (13.2)	97	-0.6 (13.9)	95	MD in change	-3.87 (-7.71 to -0.03)	0.049
			12 (0)	SBP, mm Hg	111.2 (9.4)	113.1 (9.9)	-4.9 (17.6)	97	0.4 (18.8)	95	MD in change	-2.96 (-13.35 to 7.43)	0.045
Kalavainen, 2007[118]	IG1	All	12 (6)	SBP, mm Hg	110.8 (8.3)	108.1 (6.8)	-0.9 (6.4)	34	0 (4.8)	35	MD in change	-0.9 (-3.58 to 1.78)	0.503
Norman, 2016[127]	IG1	All	12 (0)	SBP, mm Hg	117.9 (11.8)	120.1 (11.7)	2.4 (11.8)	53	-1.2 (11.6)	53	MD in change	3.6 (-0.84 to 8.04)	NR
		Female	12 (0)	SBP, mm Hg	117 (11.6)	119 (11.5)	1.1 (11.1)	29	-1.7 (10.8)	25	MD in change	2.8 (-3.05 to 8.65)	0.35
		Male	12 (0)	SBP, mm Hg	118.9 (10.9)	121.1 (11)	4 (11.3)	24	-0.7 (11.4)	28	MD in change	4.7 (-1.47 to 10.87)	0.15
Reinehr, 2010[131]	IG1	All	6 (0)	SBP, mm Hg	113 (7)	110 (10)	-7 (4)	34	-1 (5)	32	MD in change	-6 (-8.18 to -3.82)	<0.001
Sacher, 2010[133]	IG1	All	6 (3.75)	SBP, mm Hg	120.7 (13.4)	120.7 (11.7)	-9.6 (12.1)	36	-8.2 (10.6)	45	MD in change	-1 (-6.4 to 4.4)	0.7
Savoye, 2007[135]	IG1	All	6 (-6)	SBP, mm Hg	123 (13.6)	122 (14)	-2.2 (12.8)	105	0.3 (12.5)	69	MD in change	-2.4 (-6.6 to 1.8)	0.25
			12 (0)	SBP, mm Hg	123 (13.6)	122 (14)	-2 (12.3)	105	-0.4 (14)	69	MD in change	-1.6 (-5.8 to 2.6)	0.45
Savoye,	IG1	All	6 (0)	SBP, mm Hg	118.5 (10.3)	123.3 (11.7)	-6.2 (8)	31	-0.7 (7)	27	MD in	-5.5 (-9.3	0.005

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
2014[136]											change	to -1.7)	
		Female	6 (0)	SBP, mm Hg	NR	NR	NR	NR	NR	NR	MD in change	-5.1 (-9.9 to -0.3)	0.04
		Male	6 (0)	SBP, mm Hg	NR	NR	NR	NR	NR	NR	MD in change	-5.5 (-12.4 to 1.4)	0.12
Viner, 2020[150]	IG1	All	6 (0)	SBP, mm Hg	NR	NR	3 (NR)	73	2.2 (NR)	68	MD in change	0.01 (-3.24 to 3.26)	>0.9
Vos, 2011[151]	IG1	All	12 (-12)	SBP, mm Hg	125 (12.5)	126 (12.3)	-6.6 (15.5)	32	-4.3 (17.3)	35	MD in change	-2.8 (-7 to 1.5)	NSD
Weigel, 2008[154]	IG1	All	6 (-6)	SBP, mm Hg	115 (11)	118 (10)	0 (11)	36	4 (11.1)	34	MD in change	-4 (-9.19 to 1.19)	NSD
			12 (0)	SBP, mm Hg	115 (11)	118 (10)	-2 (10.5)	36	5 (9.2)	30	MD in change	-7 (-11.82 to -2.18)	<0.01
Golley, 2007[114]	IG1	All	12 (7)	DBP, mm Hg	NR	NR	NR	NR	NR	NR	MD in change	NR	0.82
Ho, 2016[115]	IG1	All	6 (0)	DBP, percentile	64.8 (18.6)	62.8 (16.4)	-3.4 (24.7)	37	-6.3 (21.6)	36	MD in change	2.85 (-7.81 to 13.51)	0.60
Hofsteenge, 2014[116]	IG1	All	6 (0)	DBP, mm Hg	63 (8)	62 (8)	-1 (8)	53	0 (7.5)	44	MD in change	-0.41 (-3.46 to 2.63)	NR
Kalarchian, 2009[117]	IG1	All	6 (-6)	DBP, mm Hg	69.2 (7.6)	69.7 (8.7)	-3.5 (10.6)	97	-0.4 (13.1)	95	MD in change	-3.12 (-6.49 to 0.25)	0.072
			12 (0)	DBP, mm Hg	69.2 (7.6)	69.7 (8.7)	-3 (14.2)	97	0 (17.5)	95	MD in change	-2.96 (-7.47 to 1.55)	0.20
Kalavainen,	IG1	All	12 (6)	DBP, mm Hg	55.2 (6.5)	55.2 (6.5)	0.2 (4.2)	34	-0.7 (6.3)	35	MD in	0.9 (-1.61	0.489

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
2007[118]											change	to 3.41)	
Norman, 2016[127]	IG1	All	12 (0)	DBP, mm Hg	68.4 (11.5)	68 (11.3)	-1.7 (10.5)	53	-0.2 (10.4)	53	MD in change	-1.5 (-5.48 to 2.48)	NR
		Female	12 (0)	DBP, mm Hg	68.8 (12.4)	69.8 (12.2)	-1.3 (10.7)	29	-2.4 (10.6)	25	MD in change	1.1 (-4.6 to 6.8)	0.74
		Male	12 (0)	DBP, mm Hg	67.9 (9.2)	66.3 (9.3)	-2.1 (10)	24	1.8 (10.1)	28	MD in change	-3.9 (-9.36 to 1.56)	0.23
Reinehr, 2010[131]	IG1	All	6 (0)	DBP, mm Hg	60 (8)	57 (9)	-6 (4)	34	-2 (7)	32	MD in change	-4 (-6.73 to -1.27)	0.003
Sacher, 2010[133]	IG1	All	6 (3.75)	DBP, mm Hg	65.8 (7.8)	66.7 (7.7)	-5.1 (7.9)	36	-2.2 (7.8)	45	MD in change	-3.9 (-8.1 to 0.4)	0.07
Savoye, 2007[135]	IG1	All	6 (-6)	DBP, mm Hg	66 (9.5)	67 (11.1)	-1.7 (11)	105	1.9 (11.7)	69	MD in change	-3.6 (-7.5 to 0.3)	0.07
Savoye, 2007[135]	IG1	All	12 (0)	DBP, mm Hg	66 (9.5)	67 (11.1)	1.4 (11.5)	105	2.8 (13.6)	69	MD in change	-1.4 (-5.3 to 2.5)	0.47
Savoye, 2014[136]	IG1	All	6 (0)	DBP, mm Hg	67.3 (8.3)	67.8 (7.4)	-0.9 (20.4)	31	8.3 (21.4)	27	MD in change	-9.2 (-19.9 to 1.5)	0.09
		Female	6 (0)	DBP, mm Hg	NR	NR	NR	NR	NR	NR	MD in change	-11.2 (-24.1 to 1.6)	0.09
		Male	6 (0)	DBP, mm Hg	NR	NR	NR	NR	NR	NR	MD in change	-5.6 (-24.2 to 12.9)	0.55
Viner, 2020[150]	IG1	All	6 (0)	DBP, mm Hg	NR	NR	2.1 (NR)	73	3.4 (NR)	68	MD in change	-1.21 (-4.63 to 2.2)	0.5
Vos, 2011[151]	IG1	All	12 (-12)	DBP, mm Hg	65 (7.8)	65 (7.7)	-7.3 (11.6)	32	-5.7 (12.7)	35	MD in change	-3.2 (-6.7 to 0.4)	NSD
Weigel,	IG1	All	6 (-6)	DBP, mm Hg	65 (10)	64 (7)	-3 (9.2)	36	-1 (6.6)	34	MD in change	-2 (-5.75 to 1.75)	NSD

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
2008[154]			12 (0)	DBP, mm Hg	65 (10)	64 (7)	-4 (9.2)	36	3 (9.6)	30	MD in change	-7 (-11.55 to -2.45)	NSD
Golley, 2007[114]	IG1	All	12 (7)	LDL-C, NR	NR	NR	NR	NR	NR	NR	MD in change	NR	0.42
Ho, 2016[115]	IG1	All	6 (0)	LDL-C, mg/dL	104.6 (27.8)	91.1 (25.5)	-8.1 (16.2)	31	6.6 (17)	32	MD in change	-14.67 (-22.88 to -6.47)	0.71
Kalavainen, 2007[118]	IG1	All	12 (6)	LDL-C, mg/dL	103.9 (21.2)	106.9 (26.6)	1.2 (12.7)	34	0.4 (19.7)	35	MD in change	0.77 (-7.07 to 8.61)	0.500
Kose, 2021[120]	IG1	All	6 (0)	LDL-C, mg/dL	96.1 (29.4)	94.5 (26.9)	-4.1 (23.9)	37	2.4 (16)	27	MD in change	-6.49 (-16.9 to 3.92)	NR
Norman, 2016[127]	IG1	All	12 (0)	LDL-C, mg/dL	96.7 (22.3)	102.3 (23.4)	-13.5 (24.8)	53	-14.9 (26.8)	53	MD in change	1.4 (-8.44 to 11.24)	NR
		Female	12 (0)	LDL-C, mg/dL	94.1 (18.4)	99.4 (18.8)	-8 (25)	29	-18.5 (20)	25	MD in change	10.5 (-1.72 to 22.72)	0.04
		Male	12 (0)	LDL-C, mg/dL	99.8 (24.3)	104.8 (25.1)	-20 (23)	24	-11.6 (29.4)	28	MD in change	-8.4 (-22.93 to 6.13)	0.20
Savoye, 2007[135]	IG1	All	6 (-6)	LDL-C, mg/dL	98 (33.4)	92 (27.9)	-3.3 (20.7)	105	2 (19.9)	69	MD in change	-5.3 (-12.2 to 1.6)	0.13
			12 (0)	LDL-C, mg/dL	98 (33.4)	92 (27.9)	-2.4 (23.8)	105	1.5 (26.9)	69	MD in change	-3.9 (-10.8 to 3)	0.26
Savoye, 2014[136]	IG1	All	6 (0)	LDL-C, mg/dL	88.3 (27.1)	92.5 (31)	-1.3 (22.4)	31	3.5 (18.5)	27	MD in change	-4.8 (-15.2 to 5.6)	0.37
		Female	6 (0)	LDL-C, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-1.8 (-14.2 to 10.5)	0.77

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		Male	6 (0)	LDL-C, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-11.3 (-29.6 to 6.9)	0.22
Viner, 2020[150]	IG1	All	6 (0)	LDL-C, mg/dL	104.2 (30.9)	96.5 (30.9)	-5 (NR)	61	-7.7 (NR)	55	MD in change	3.47 (-2.7 to 10.04)	0.3
Davis, 2012[110]	IG1	All	8 (0)	HDL-C, mg/dL	36.4 (6.8)	37.3 (8.2)	1.7 (8)	30	0.7 (8.2)	23	MD in change	1 (-3.38 to 5.38)	NSD
Golley, 2007[114]	IG1	All	12 (7)	HDL-C, NR	NR	NR	NR	NR	NR	NR	MD in change	NR	0.96
Ho, 2016[115]	IG1	All	6 (0)	HDL-C, mg/dL	44.4 (10.8)	49 (14.3)	1.3 (6.9)	31	1.1 (6.6)	32	MD in change	0.23 (-3.11 to 3.57)	0.90
Hofsteenge, 2014[116]	IG1	All	6 (0)	HDL-C, mg/dL	44.4 (9.7)	45.9 (8.5)	-1.2 (9.1)	53	-2.3 (8)	44	MD in change	0.77 (-1.54 to 3.09)	NR
Kalavainen, 2007[118]	IG1	All	12 (6)	HDL-C, mg/dL	45.6 (10.4)	43.2 (10.4)	4.6 (6.1)	34	2.7 (8.4)	35	MD in change	1.93 (-1.55 to 5.41)	0.317
Kong, 2013[119]	IG1	All	6 (-3)	HDL-C, mg/dL	41.3 (9)	40.9 (8.5)	0 (9)	28	-1.5 (4.9)	23	MD in change	1.54 (-2.7 to 5.41)	0.50
Kose, 2021[120]	IG1	All	6 (0)	HDL-C, mg/dL	50.3 (10.8)	46.4 (12.4)	0.3 (9.6)	37	1.8 (5.8)	27	MD in change	-1.48 (-5.58 to 2.62)	NR
Norman, 2016[127]	IG1	All	12 (0)	HDL-C, mg/dL	40.5 (9.9)	42.2 (10)	4.5 (10.2)	53	3.6 (10.1)	53	MD in change	0.9 (-2.95 to 4.75)	NR
		Female	12 (0)	HDL-C, mg/dL	41.1 (10.3)	41.6 (10.5)	4.4 (10.4)	29	4.1 (10.4)	25	MD in change	0.3 (-5.25 to 5.85)	0.90
		Male	12 (0)	HDL-C, mg/dL	39.7 (8.5)	42.8 (8.6)	4.8 (9)	24	3 (9)	28	MD in change	1.8 (-3.09 to 6.69)	0.30

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Savoye, 2007[135]	IG1	All	6 (-6)	HDL-C, mg/dL	44 (10.8)	43 (16.5)	2.2 (10.2)	105	0 (10.4)	69	MD in change	2.2 (-1.4 to 5.8)	0.23
			12 (0)	HDL-C, mg/dL	44 (10.8)	43 (16.5)	3.2 (10.2)	105	1.4 (11.9)	69	MD in change	1.8 (-1.8 to 5.4)	0.32
Savoye, 2014[136]	IG1	All	6 (0)	HDL-C, mg/dL	40.1 (9.6)	39.8 (8.1)	-2.8 (8.3)	31	-3.9 (7.6)	27	MD in change	1.1 (-3.1 to 5.3)	0.60
		Female	6 (0)	HDL-C, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	1.9 (-2.9 to 6.6)	0.44
		Male	6 (0)	HDL-C, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-0.1 (-8.7 to 8.5)	0.98
Viner, 2020[150]	IG1	All	6 (0)	HDL-C, mg/dL	42.5 (11.6)	42.5 (11.6)	-1.5 ()	61	-3.1 (NR)	55	MD in change	0.77 (-2.32 to 3.47)	0.7
Vos, 2011[151]	IG1	All	12 (-12)	HDL-C, mg/dL	42.5 (6)	42.5 (6)	0 (16.1)	32	0 (16.9)	35	MD in change	-1.16 (-4.25 to 2.32)	NSD
Weigel, 2008[154]	IG1	All	6 (-6)	HDL-C, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
			12 (0)	HDL-C, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
Golley, 2007[114]	IG1	All	12 (7)	TC, NR	NR	NR	NR	NR	NR	NR	MD in change	NR	0.47
Ho, 2016[115]	IG1	All	6 (0)	TC, mg/dL	169.9 (29.7)	161.8 (30.5)	-6.2 (18.5)	31	-7.3 (18.5)	32	MD in change	1.16 (-8 to 10.31)	0.83
Kalavainen, 2007[118]	IG1	All	12 (6)	TC, mg/dL	166 (23.2)	162.2 (27)	7.7 (22.1)	34	3.9 (22.5)	35	MD in change	3.86 (-6.67 to 14.39)	0.493
Kose, 2021[120]	IG1	All	6 (0)	TC, mg/dL	167.8 (38.9)	158.8 (26.9)	-11.9 (33.7)	37	0.1 (14.2)	27	MD in change	-12.06 (-25.58 to 1.46)	NR

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Norman, 2016[127]	IG1	All	12 (0)	TC, mg/dL	160.8 (26.6)	166.7 (27.3)	-12.2 (28.3)	53	-12.1 (28.2)	53	MD in change	-0.1 (-10.87 to 10.67)	NR
		Female	12 (0)	TC, mg/dL	157.5 (22.9)	163.6 (23.1)	-4.9 (26.7)	29	-13.6 (26.1)	25	MD in change	8.7 (-5.42 to 22.82)	0.19
		Male	12 (0)	TC, mg/dL	164.7 (27.9)	169.5 (28.5)	-21 (27.5)	24	-10.8 (27.8)	28	MD in change	-10.2 (-25.3 to 4.9)	0.17
Savoye, 2007[135]	IG1	All	6 (-6)	TC, mg/dL	167 (34.5)	158 (35.5)	-7.5 (25.1)	105	1.5 (26.1)	69	MD in change	-9 (-18 to 0.09)	0.05
			12 (0)	TC, mg/dL	167 (34.5)	158 (35.5)	-9.2 (29.5)	105	3.7 (32.2)	69	MD in change	-12.8 (-21.9 to -3.8)	0.005
Savoye, 2014[136]	IG1	All	6 (0)	TC, mg/dL	151.1 (34)	159.2 (35.9)	-10.8 (30.5)	31	-2.1 (23.6)	27	MD in change	-8.7 (-23.1 to 5.7)	0.24
		Female	6 (0)	TC, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-3.4 (-19.3 to 12.5)	0.68
		Male	6 (0)	TC, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-19 (-46 to 8)	0.16
Weigel, 2008[154]	IG1	All	6 (-6)	TC, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
			12 (0)	TC, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
Golley, 2007[114]	IG1	All	12 (7)	Triglycerides, NR	NR	NR	NR	NR	NR	NR	MD in change	NR	0.98
Ho, 2016[115]	IG1	All	6 (0)	Triglycerides, mg/dL	105.3 (46.9)	108 (52.2)	2.5 (43.4)	31	-8.7 (45.1)	32	MD in change	11.15 (-10.72 to 33.02)	0.32
Hofsteenge, 2014[116]	IG1	All	6 (0)	Triglycerides, mg/dL	NR	NR	NR	53	NR	44	MD in change	5.31 (-7.97 to	NR

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
												18.58)	
Kalavainen, 2007[118]	IG1	All	12 (6)	Triglycerides, mg/dL	80.5 (49.6)	75.2 (35.4)	-20.4 (39.9)	33	-1.8 (32.2)	35	MD in change	-18.58 (-35.78 to -1.39)	0.093
Kong, 2013[119]	IG1	All	6 (-3)	Triglycerides, mg/dL	123.9 (57.1)	115.1 (51.2)	8.9 (79.9)	28	8.9 (40.9)	23	MD in change	0 (-35.4 to 35.4)	0.95
Kose, 2021[120]	IG1	All	6 (0)	Triglycerides, mg/dL	NR	NR	0 (NR)	37	4 (NR)	27	MD in change	-4 (NR)	NR
Norman, 2016[127]	IG1	All	12 (0)	Triglycerides, mg/dL	105.5 (68.9)	108.1 (55.3)	-14.9 (62.2)	53	-13.6 (54)	53	MD in change	-1.3 (-23.48 to 20.88)	NR
		Female	12 (0)	Triglycerides, mg/dL	100.7 (46)	120.2 (47.2)	-7.4 (49.3)	29	-20.9 (50.3)	25	MD in change	13.5 (-13.13 to 40.13)	0.67
		Male	12 (0)	Triglycerides, mg/dL	111.2 (84)	97.3 (56)	-23.9 (72.9)	24	-7.1 (52.5)	28	MD in change	-16.8 (-50.99 to 17.39)	0.26
Savoye, 2007[135]	IG1	All	6 (-6)	Triglycerides, mg/dL	104 (1.8)	101 (1.6)	-17.9 (40.3)	105	-4.2 (51.9)	69	MD in change	-13.7 (-33.9 to 3.6)	0.12
			12 (0)	Triglycerides, mg/dL	104 (1.8)	101 (1.6)	-21.3 (38.7)	105	-8.1 (60)	69	MD in change	-13.2 (-33.4 to 2.3)	0.11
Savoye, 2014[136]	IG1	All	6 (0)	Triglycerides, mg/dL	102.3 (1.6)	116.9 (1.8)	-28.4 (30.7)	31	-4.6 (34.4)	27	MD in change	-23.9 (-37.2 to -7.9)	0.005
		Female	6 (0)	Triglycerides, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-18.8 (-34.9 to 1.3)	0.07
		Male	6 (0)	Triglycerides,	NR	NR	NR	NR	NR	NR	MD in	-31.9 (-54.4 to -	0.05

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
				mg/dL							change	0.8)	
Viner, 2020[150]	IG1	All	6 (0)	Triglycerides, mg/dL	88.5 (62)	88.5 (35.4)	-6.2 (NR)	61	-0.9 (NR)	56	MD in change	7.08 (-7.08 to 21.24)	0.3
Vos, 2011[151]	IG1	All	12 (-12)	Triglycerides, mg/dL	106.2 (96.9)	79.7 (41)	-8.9 (110.5)	32	8.9 (77.3)	35	MD in change	-3.54 (-26.55 to 17.7)	NSD
Weigel, 2008[154]	IG1	All	6 (-6)	Triglycerides, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
			12 (0)	Triglycerides, mg/dL	NR	NR	-26.5 (NR)	NR	NR	NR	MD in change	NR	NSD
Love-Osborne, 2014[123]	IG1	All	8 (0)	Dyslipidemia, %	N/A	N/A	1 (1.2)	82	1 (1.2)	83	RR	1.01 (0.06 to 16.46)	NSD
Golley, 2007[114]	IG1	All	12 (7)	FPG, NR	NR	NR	NR	NR	NR	NR	MD in change	NR	0.88
Ho, 2016[115]	IG1	All	6 (0)	FPG, mg/dL	93.7 (6.8)	91.4 (5.4)	0.1 (5.6)	31	0.9 (12.8)	34	MD in change	-0.85 (-5.73 to 4.03)	0.74
Hofsteenge, 2014[116]	IG1	All	6 (0)	FPG, mg/dL	90.1 (7.2)	90.1 (7.2)	0 (7.2)	53	1.8 (7.2)	44	MD in change	-1.26 (-8.47 to 5.77)	NR
Kalavainen, 2007[118]	IG1	All	12 (6)	FPG, mg/dL	93.7 (5.4)	93.7 (5.4)	0 (5.2)	34	1.8 (5.2)	34	MD in change	-1.8 (-4.26 to 0.65)	0.145
Kong, 2013[119]	IG1	All	6 (-3)	FPG, mg/dL	81.1 (7)	84.7 (4.2)	5.4 (7)	28	1.8 (6.3)	23	MD in change	3.6 (0.54 to 7.21)	0.04
Kose, 2021[120]	IG1	All	6 (0)	FPG, mg/dL	91.8 (7.9)	94.1 (8.2)	-0.2 (7.7)	37	0.2 (8.9)	27	MD in change	-0.31 (-4.39 to 3.77)	NR

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Norman, 2016[127]	IG1	All	12 (0)	FPG, NR	88.4 (7.4)	90.3 (7.5)	-2.1 (7.4)	53	-2.9 (7.5)	53	MD in change	0.8 (-2.02 to 3.62)	NR
		Female	12 (0)	FPG, mg/dL	87.7 (6.6)	88.9 (6.5)	-2.3 (6.8)	29	-3.8 (6.7)	25	MD in change	1.5 (-2.1 to 5.1)	0.43
		Male	12 (0)	FPG, mg/dL	89.3 (7.7)	91.5 (7.6)	-1.9 (7.4)	24	-2.1 (7.3)	28	MD in change	0.2 (-3.78 to 4.18)	0.95
Savoye, 2007[135]	IG1	All	6 (-6)	FPG, mg/dL	92 (8.3)	90 (8.5)	-2.2 (8.6)	105	-1.3 (9.3)	69	MD in change	-0.9 (-4.1 to 2.3)	0.57
			12 (0)	FPG, mg/dL	92 (8.3)	90 (8.5)	-3.4 (8.9)	105	-1.8 (10.8)	69	MD in change	-1.7 (-4.9 to 1.5)	0.30
Savoye, 2014[136]	IG1	All	6 (0)	FPG, mg/dL	92.9 (7)	92.4 (8)	-0.5 (7)	31	2.5 (8.1)	27	MD in change	-3 (-7.3 to 1.2)	0.16
		Female	6 (0)	FPG, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-0.6 (-5.5 to 4.3)	0.8
		Male	6 (0)	FPG, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-6.9 (-13.8 to 0)	0.05
Vos, 2011[151]	IG1	All	12 (-12)	FPG, mg/dL	95.5 (8.5)	93.7 (5.6)	-3.6 (7.5)	32	0 (13.1)	35	MD in change	-1.8 (-5.41 to 1.8)	NSD
Ho, 2016[115]	IG1	All	6 (0)	Two-hr OGTT, mg/dL	102.2 (21.3)	101.6 (14.4)	0.4 (21.8)	30	-1.3 (30.5)	33	MD in change	1.68 (-11.52 to 14.87)	0.79
Savoye, 2014[136]	IG1	All	6 (0)	Two-hr OGTT, mg/dL	153.6 (18.2)	148.6 (14.8)	-27.2 (21.9)	31	-10.1 (21)	27	MD in change	-17.1 (-29 to -5.1)	0.005
		Female	6 (0)	Two-hr OGTT, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-20.5 (-36.4 to -4.6)	0.01
		Male	6 (0)	Two-hr OGTT, mg/dL	NR	NR	NR	NR	NR	NR	MD in change	-12.1 (-32.3 to 8.1)	0.24

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Hofsteenge, 2014[116]	IG1	All	6 (0)	HOMA, IU/mL	4.7 (2.6)	5 (3)	0.1 (2.5)	53	0 (2.7)	44	MD in change	-0.08 (-0.98 to 0.82)	NR
Kalavainen, 2007[118]	IG1	All	12 (6)	HOMA, IU/mL	2.4 (1.4)	2 (1)	-0.4 (1)	34	0.1 (1.1)	34	MD in change	-0.44 (-0.96 to 0.08)	0.113
Kong, 2013[119]	IG1	All	6 (-3)	HOMA, IU/mL	NR	NR	0 (NR)	28	0.7 (NR)	23	MD in change	-0.1 (-0.6 to 0.9)	1.00
Kose, 2021[120]	IG1	All	6 (0)	HOMA, IU/mL	NR	NR	-0.7 ()	37	0 (NR)	27	MD in change	-0.74 (NR)	NR
Savoye, 2007[135]	IG1	All	6 (-6)	HOMA, IU/mL	5.1 (1.9)	5.2 (1.7)	-1.5 (7.8)	105	0.3 (3.5)	69	MD in change	-1.84 (-3.1 to -0.85)	<0.001
			12 (0)	HOMA, IU/mL	5.1 (1.9)	5.2 (1.7)	-1.5 (2.4)	105	0.9 (4.5)	69	MD in change	-2.42 (-3.76 to -1.29)	<0.001
Savoye, 2014[136]	IG1	All	6 (0)	HOMA, IU/mL	8.7 (1.7)	9.3 (1.6)	-1.2 (3.7)	31	1.4 (4.7)	27	MD in change	-2.6 (-4.3 to -0.4)	0.03
		Female	6 (0)	HOMA, IU/mL	NR	NR	NR	NR	NR	NR	MD in change	-1.7 (-3.8 to 1.1)	0.20
		Male	6 (0)	HOMA, IU/mL	NR	NR	NR	NR	NR	NR	MD in change	-4.1 (-6.7 to -0.3)	0.04
Davis, 2012[110]	IG1	All	8 (0)	Insulin, mcIU/mL	19.1 (10.4)	24.4 (12)	-4.6 (9.9)	30	-6.6 (11.3)	23	MD in change	2 (-3.73 to 7.73)	NSD
Golley, 2007[114]	IG1	All	12 (7)	Insulin, NR	NR	NR	NR	NR	NR	NR	MD in change	NR	0.84
Ho, 2016[115]	IG1	All	6 (0)	Insulin, pmol/L	148 (121.5)	105.6 (71.2)	4.4 (104.2)	32	44.5 (132.2)	32	MD in change	-40.12 (-98.45 to 18.21)	0.18
Hofsteenge, 2014[116]	IG1	All	6 (0)	Insulin, pmol/L	125 (63)	133 (75)	2 (59)	53	-1 (69.4)	44	MD in change	-0.3 (-22 to 21)	NR

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Kalavainen, 2007[118]	IG1	All	12 (6)	Insulin, mIU/L	10.2 (5.8)	8.5 (4.4)	-1.6 (4.3)	34	0 (4.4)	34	MD in change	-1.6 (-3.68 to 0.48)	0.142
Kong, 2013[119]	IG1	All	6 (-3)	Insulin, pmol/L	NR	NR	-10.1 (NR)	28	1.4 (NR)	23	MD in change	-5.7 (-39.6 to 40.3)	0.59
Kose, 2021[120]	IG1	All	6 (0)	Insulin, IU/mL	NR	NR	3.6 (NR)	37	0 (NR)	27	MD in change	3.56 (NR)	NR
Savoye, 2007[135]	IG1	All	6 (-6)	Insulin, mcIU/mL	23 (1.8)	24 (1.7)	-6.5 (33.2)	105	1.7 (15.5)	69	MD in change	-8.2 (-10 to -3.9)	<0.001
			12 (0)	Insulin, mcIU/mL	23 (1.8)	24 (1.7)	-6.1 (31.6)	105	4.5 (19.9)	69	MD in change	-10.6 (-12.1 to -5.7)	<0.001
Savoye, 2014[136]	IG1	All	6 (0)	Insulin, mcIU/mL	38 (1.6)	40.7 (1.6)	-4.9 (15.1)	31	5.2 (17.9)	27	MD in change	-10.1 (-17.1 to -1.4)	0.03
		Female	6 (0)	Insulin, mcIU/mL	NR	NR	NR	NR	NR	NR	MD in change	-7.7 (-15.9 to 3)	0.14
		Male	6 (0)	Insulin, mcIU/mL	NR	NR	NR	NR	NR	NR	MD in change	-14.1 (-24.7 to 1.2)	0.07
Viner, 2020[150]	IG1	All	6 (0)	Insulin, IU/l	14.2 (13)	11.7 (8)	3.9 (NR)	61	4.3 (NR)	56	MD in change	1.51 (-1.46 to 4.48)	0.3
Vos, 2011[151]	IG1	All	12 (-12)	Insulin, mIU/L	19.5 (12.2)	14.9 (8)	1 (17.2)	32	3.9 (14.6)	35	MD in change	-4 (0 to 8)	0.05
Love-Osborne, 2014[123]	IG1	All	8 (0)	Diabetes, %	N/A	N/A	0 (0)	82	2 (2.4)	83	RR	0.2 (0.01 to 4.18)	NR
Savoye, 2014[136]	IG1	All	6 (0)	Diabetes, % incidence	N/A	N/A	0 (0)	38	0 (0)	37	RR	0.97 (0.02 to 50.37)	NR

Appendix D Table 8. Other Intermediate Outcomes for Behavioral Interventions (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Vos, 2011[151]	IG1	All	12 (-12)	Cardiorespiratory fitness, z-score	1.7 (1.6)	2.2 (1.5)	0 (2.1)	32	-1.1 (2)	35	MD in change	0.7 (-1.1 to -0.3)	<0.01

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence Interval; DBP = Diastolic blood pressure; FPG = Fasting plasma glucose; FU = Followup; HDL-C = High-density lipoprotein cholesterol; Hr = Hour; HOMA = homeostatic model assessment; IG = Intervention group; IU = Microunit; LDL-C = low-density lipoprotein cholesterol; MD = Mean difference; Mg/dL = Milligrams per deciliter; mmHg = Milligrams mercury; NR = Not reported; NSD = No significant difference; OGTT = Oral glucose tolerance test; RR = Relative risk; SBP = Systolic blood pressure; SD = Standard deviation; Stat = Statistic; TC = Total cholesterol; Tx = Treatment

Appendix D Table 9. Stratified Analyses of Change in Body Mass Index (kg/m^2) in Behavioral Interventions Compared With Controls

Subgroups	K (N)	I^2, %	BMI Mean Diff in Change (95% CI)	P-value* of group difference
Estimated contact hours				
< 26 hours	17 (3,407)	62.1	-0.3 (-0.5 to -0.1)	0.004
≥ 26 hours	11 (1,087)	87.8	-1.4 (-2.2 to -0.6)	
Est. contact hours category				
≥ 52 hours	5 (604)	90.6	-2.0 (-4.0 to -0.1)	
26 to 51 hours	6 (483)	24.5	-0.8 (-1.2 to -0.4)	0.001
6 to 25 hours	6 (601)	68.2	-0.6 (-1.4 to 0.2)	
0 to 5 hours	11 (2,806)	0.0	-0.2 (-0.3 to -0.1)	
Limited to participants with BMI ≥95th percentile				
No	19 (3,261)	78.9	-0.5 (-0.8 to -0.2)	0.15
Yes	9 (1,233)	91.8	-1.2 (-2.3 to -0.1)	
Limited to participants with BMI between 85th to 95th percentile				
No	23 (3,005)	85.2	-0.7 (-1.2 to -0.3)	0.541
Yes	5 (1,489)	90.5	-0.5 (-1.3 to 0.2)	
Offered PA sessions				
No	21 (3,938)	51.7	-0.3 (-0.5 to -0.2)	0.001
Yes	7 (556)	90.1	-1.9 (-3.1 to -0.7)	
Followup timing				
At the end of tx	15 (2,092)	90.6	-0.9 (-1.6 to -0.23)	0.041
≥ 1 mo after tx ended	13 (2,402)	50.4	-0.3 (-0.6 to -0.1)	
Age group				
Preschool	4 (1,798)	0.0	-0.2 (-0.3 to -0.1)	
Elementary	11 (1,657)	43.1	-0.4 (- 0.7 to -0.2)	0.043
Adolescent	5 (351)	69.2	-0.8 (-1.8 to 0.2)	
Wide range	8 (688)	91.4	-1.5 (-2.8 to -0.2)	
Age group (Outcome, zBMI)				
Preschool	6 (1,432)	0.0	-0.1 (-0.2 to 0.0)	
Elementary	13 (1,731)	61.0	-0.1 (-0.1 to -0.0)	0.58
Adolescent	6 (501)	0.0	-0.1 (-0.1 to -0.0)	
Wide range	9 (1,332)	89.1	-0.1 (-0.3 to 0.0)	
Trial conducted in USA				
No	17 (2,760)	88.6	-0.7 (-1.1 to -0.2)	0.900
Yes	11 (1,734)	82.1	-0.7 (-0.3 to -0.1)	
Low SES population				
No	26 (4,196)	88.4	-0.7 (-1.0 to -0.3)	0.578
Yes	2 (298)	0.0	-0.9 (-5.0 to 3.2)	
Trial included 50% or more Black or Latino participants				
No	23 (3,878)	82.8	-0.6 (-0.9 to -0.3)	0.549
Yes	5 (616)	83.4	-1.0 (-2.7 to 0.8)	
Study quality rating				
Fair	21 (2,669)	86.3	-0.9 (-1.4 to -0.4)	0.002
Good	7 (1,825)	0.0	-0.2 (-0.3 to -0.1)	
Where study implemented				
Primary care setting	14 (3,258)	71.1	-0.3 (-0.6 to -0.1)	0.017
Other setting	14 (1,236)	86.3	-1.1 (-1.8 to -0.4)	
Study required parental obesity				
No	28 (4,494)	86.8	-0.7 (-1.0 to -0.3)	NA

Abbreviations: BMI = Body mass index; CI = Confidence interval; Diff. = Difference; Est. = Estimated; I^2 = Heterogeneity statistics; K= Number of studies; Kg/m2 = kilograms per meters squared; N = Number of participants; NA = Not applicable; PA = Physical activity; SES = Socioeconomic status; USA = United States of America

*P-values derived from Q test of between-subgroups heterogeneity (based on random effects model)

Appendix D Table 10. Weight-Related Outcomes Results for Glucagon-Like Peptide 1 Agonists (Key Question 2)

Study (Medication)	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Kelly, 2020[156] (Liraglutide)	IG1	All	13 (0)	BMI, kg/m2	35.3 (5.1)	35.8 (5.7)	-1.4 (3.5)	125	0.2 (3.7)	126	MD in change	1.58 (-2.47 to -0.69)	NR
			19 (6)	BMI, kg/m2	35.3 (5.1)	35.8 (5.7)	-0.2 (3.5)	112	0.8 (4)	102	MD in change	-1 (-2.01 to 0.01)	NR
			13 (0)	zBMI (BMI SDS), score	3.1 (0.6)	3.2 (0.8)	-0.2 (0.6)	125	0 (0.6)	126	MD in change	-0.22 (-0.37 to -0.08)	NR
			19 (6)	zBMI (BMI SDS), score	3.1 (0.6)	3.2 (0.8)	-0.1 (0.5)	112	0.1 (0.7)	102	MD in change	-0.13 (-0.29 to 0.03)	NR
			13 (0)	Weight, kg	99.3 (19.7)	102.2 (21.6)	-2.3 (10.5)	125	2.2 (11)	126	MD in change	-4.5 (-7.17 to -1.84)	NR
			19 (6)	Weight, kg	99.3 (19.7)	102.2 (21.6)	1.7 (10.1)	112	4.4 (11.7)	102	MD in change	-2.7 (-5.62 to 0.22)	NR
			13 (0)	WC, cm	104.9 (12.7)	107 (13.6)	-4.3 (9.5)	125	-1.4 (9.9)	126	MD in change	-2.93 (-5.24 to -0.63)	NR
			13 (0)	≥5% BMI loss, %	N/A	N/A	51 (45.1)	113	20 (19)	105	RR	3.5 (1.78 to 6.16)	NR
			13 (0)	≥10% BMI loss, %	N/A	N/A	33 (29.2)	113	9 (8.6)	105	RR	4.4 (1.81 to 8.83)	NR
			13 (0)	% excess of 95th %tile, %	137.7 (18)	139.6 (21.4)	-5.5 (13.6)	125	0.8 (14.3)	126	MD in change	-6.24 (-9.7 to -2.79)	NR
Weghuber, 2022 [162] (Semaglutide)	IG1	All	16 (0)	BMI, kg/m^2	37.7 (6.7)	35.7 (5.4)	-5.8 ()	134	0.1 ()	67	MD in change	-6 (-7.3 to -4.6)	NR
			16 (0)	BMI, % change	--	--	-16.1 (NR)	134	0.6 (NR)	67	MD in change	-16.7 (-20.3 to -13.2)	<0.001

Appendix D Table 10. Weight-Related Outcomes Results for Glucagon-Like Peptide 1 Agonists (Key Question 2)

Study (Medication)	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			17 (0)	BMI, % change	--	--	-13.2 (NR)	134	1.2 (NR)	67	MD in change	-14.4 (-17.8 to -11)	<0.001
			16 (0)	zBMI (BMI SDS), z-score	--	--	-1.1 (NR)	134	-0.1 (NR)	67	MD in change	-1 (-1.3 to -0.8)	NR
			16 (0)	Weight, kg	109.9 (25.2)	102.6 (22.3)	15.3 (NR)	134	2.4 (NR)	67	MD in change	-17.7 (-21.8 to -13.7)	NR
			16 (0)	WC, cm	111.9 (16.9)	107.3 (13.4)	-12.7 (NR)	134	-0.6 (NR)	67	MD in change	-12.1 (-15.6 to -8.7)	NR
			16 (0)	≥5% weight loss, %	N/A	N/A	95 (72.5)	131	11 (17.7)	62	RR	12.23 (6.3 to 31)	<0.001
			16 (0)	≥10% weight loss, %	N/A	N/A	81 (61.8)	131	5 (8.1)	62	RR	18.5 (8.3 to 63.7)	NR
			16 (0)	Achieving normal weight, %	N/A	N/A	30 (25.4)	118	1 (1.7)	58	RR	19.43 (2.58 to 146.49)	NR

Abbreviations: BL = Baseline; BMI = Body mass index; BMI SDS = Standardized BMI; CG = Control group; CI = Confidence interval; Cm = centimeter; FU = Followup; IG = Intervention group; Kg = kilograms; Kg/m2 = kilograms/meters^2; MD = Mean difference; NR = Not reported; RR = Relative risk; SD = Standard deviation; Stat = Statistic; Tx = Treatment; WC = Waist circumference

Appendix D Table 11. Other Intermediate Outcome Results for Glucagon-Like Peptide 1 Agonists (Key Question 2)

Study (Medication)	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Kelly, 2020[156] (Liraglutide)	IG1	All	13 (0)	LDL-C, mg/dL	88.6 (24)	86.6 (25.2)	1 (0.2)	125	1 (0.2)	126	MD in change	1 (0.94 to 1.05)	NR
				HDL-C, mg/dL	43.8 (10)	43.8 (10.3)	1 (0.2)	125	1 (0.2)	126	MD in change	1.02 (0.97 to 1.07)	NR
				TC, mg/dL	156.4 (27)	154.9 (29.6)	1 (0.1)	125	1 (0.1)	126	MD in change	1.01 (0.97 to 1.04)	NR
				Triglycerides, mg/dL	121 (59.4)	124.5 (62.5)	0.9 (0.4)	125	0.9 (0.4)	126	MD in change	0.98 (0.89 to 1.08)	NR
				FPG, mg/dL	94.1 (7.6)	94.5 (11.1)	-2 (9.5)	125	-0.2 (9.7)	126	MD in change	-1.82 (-4.14 to 0.51)	NR
				SBP, mmHg	116 (10)	117 (12)	-1.2 (10.1)	125	0.8 (10.1)	126	MD in change	-2.05 (-4.53 to 0.43)	NR
				DBP, mmHg	72 (8)	73 (8)	0.8 (7.7)	125	-0.5 (7.7)	126	MD in change	1.24 (-0.66 to 3.14)	NR
				HbA1c, %	5.3 (0.4)	5.3 (0.4)	-0.1 (0.3)	125	0 (0.3)	126	MD in change	-0.06 (-0.14 to 0.01)	NR
				Insulin resistance on HOMA, ratio	NR	NR	1 (NR)	125	1.1 (NR)	126	MD in change	0.91 (0.77 to 1.08)	NR
Weghuber, 2022 [162] (Semagludtide)	IG1	All	16 (0)	LDL-C, % change	89.8 (29.8)	91.7 (26.9)	-10.2 ()	134	-3.4 (NR)	67	MD in change	-7 (-11.9 to -1.8)	NR
			16 (0)	HDL-C, % change	43.7 (NR)	43.3 (NR)	8 (NR)	134	3.2 (NR)	67	MD in change	4.7 (-1 to 10.7)	NR
			16 (0)	TC, %	159.4	160.1	-8.3	134	-1.3	67	MD in	-7.1 (-10.5 to -3.5)	NR

Appendix D Table 11. Other Intermediate Outcome Results for Glucagon-Like Peptide 1 Agonists (Key Question 2)

Study (Medication)	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
				change	(19.3)	(18.9)	(NR)		(NR)		change		
			16 (0)	Triglycerides, % change	111.3 (NR)	108.1 (NR)	-28.4 (NR)	134	(NR)	NR	MD in change	-30.2 (-38 to -21.5)	NR
			16 (0)	SBP, mm Hg	120 (11)	120 (12)	-2.7 (NR)	134	-0.8 (NR)	67	MD in change	-1.9 (-5 to 1.1)	NR
			16 (0)	DBP, mm Hg	73 (9)	73 (9)	-1.4 (NR)	134	-0.8 (NR)	67	MD in change	-0.6 (NR)	NR
			16 (0)	HbA1c, %	5.5 (0.4)	5.5 (0.4)	-0.4 (NR)	134	-0.1 (NR)	67	MD in change	-0.3 (NR)	NR

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence interval; DBP = Diastolic blood pressure; FPG = Fasting plasma glucose; FU = Followup; HDL-C = High-density lipoprotein cholesterol; HOMA = Homeostatic model assessment; IG = Intervention group; LDL-C = low-density lipoprotein cholesterol; MD = Mean difference; Mg/dL = milligrams per deciliter; mmHg = millimeters of mercury; NR = Not reported; RR = Relative risk; SBP = Systolic blood pressure; SD = Standard deviation; Stat = Statistic; TC = total cholesterol; Tx = Treatment

Appendix D Table 12. Weight-Related Outcomes for Orlistat (Key Question 2), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Chanoine, 2005[158]	IG1	All	12 (0)	BMI, kg/m2	35.7 (4.2)	35.4 (4.1)	-0.6 (NR)	352	0.3 (NR)	181	MD in change	-0.86 (NR)	0.001
Maahs, 2006[159]	IG1	All	6 (0)	BMI, kg/m2	39.2 (5.3)	41.7 (11.7)	-1.3 (7.2)	16	-0.8 (13.4)	18	MD in change	-0.5 (-7.87 to 6.87)	0.70
Chanoine, 2005[158]	IG1	All	12 (0)	Weight, kg	97.7 (15)	95.1 (14.2)	0.5 (NR)	352	3.1 (NR)	181	MD in change	-2.61 (NR)	<0.001
Maahs, 2006[159]	IG1	All	6 (0)	Weight, kg	111.1 (22.9)	114.3 (38.4)	-5.5 (23.9)	16	-1.6 (39.4)	18	MD in change	-3.9 (-26.15 to 18.35)	0.76
Chanoine, 2005[158]	IG1	All	12 (0)	WC, cm	106.4 (11.2)	104.5 (10.6)	-1.3 (NR)	352	0.1 (NR)	181	MD in change	-1.45 (NR)	<0.05
				≥5% BMI loss, %	N/A	N/A	93 (26.4)	352	29 (16)	181	RR	1.88 (1.19 to 2.99)	0.005
				≥10% BMI loss, %	N/A	N/A	46 (13.1)	352	8 (4.4)	181	RR	3.25 (1.5 to 7.05)	0.002
				≥5% weight loss, %	N/A	N/A	67 (19)	352	21 (11.6)	181	RR	1.79 (1.06 to 3.03)	0.03
				≥10% weight loss, %	N/A	N/A	34 (9.7)	352	6 (3.3)	181	RR	3.12 (1.28 to 7.57)	0.01
Maahs, 2006[159]	IG1	All	6 (0)	Body fat %, %	43.7 (2.7)	44.2 (4.9)	-2.7 (4.9)	16	-1.9 (5.8)	18	MD in change	-0.8 (-4.41 to 2.81)	0.45

Abbreviations: BL = Baseline; BMI = Body mass index; CG = Control group; CI = Confidence interval; Cm = centimeter; FU = Followup; IG = Intervention group; Kg = kilograms; Kg/m2 = kilograms/meters^2; MD = Mean difference; Mg/dL = milligrams per deciliter; N/A = Not applicable; NR = Not reported; RR = Relative risk; SD = Standard deviation; Stat = Statistic; Tx = Treatment; WC = Waist circumference

Appendix D Table 13. Other Intermediate Outcomes for Orlistat, Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Chanoine, 2005[158]	IG1	All	12 (0)	LDL-C, mg/dL	97 (28)	97 (27)	-1 (NR)	322	0.9 (NR)	162	MD in change	-1.87 (NR)	0.29
Maahs, 2006[159]	IG1	All	6 (0)	LDL-C, mg/dL	87.1 (34.9)	89.6 (20.6)	1.4 (31.6)	16	-4 (25.7)	18	MD in change	5.4 (-13.89 to 24.69)	0.13
Chanoine, 2005[158]	IG1	All	12 (0)	HDL-C, mg/dL	42 (10)	42 (8)	0.1 (NR)	323	-0.3 (NR)	163	MD in change	0.38 (NR)	0.62
Maahs, 2006[159]	IG1	All	6 (0)	HDL-C, mg/dL	42.2 (8.9)	40 (7.6)	-0.2 (8.7)	16	0.9 (8.6)	18	MD in change	-1.1 (-6.92 to 4.72)	0.47
Chanoine, 2005[158]	IG1	All	12 (0)	TC, mg/dL	161 (32)	163 (33)	2.3 (NR)	323	3.4 (NR)	163	MD in change	-1.13 (NR)	0.59
Maahs, 2006[159]	IG1	All	6 (0)	TC, mg/dL	155.8 (43.8)	159.3 (29.1)	-1.1 (39.7)	16	-3 (35.4)	18	MD in change	1.9 (-23.35 to 27.15)	0.49
Chanoine, 2005[158]	IG1	All	12 (0)	Triglycerides, mg/dL	116 (55)	121 (72)	17.9 (NR)	323	11.7 (NR)	163	MD in change	6.22 (NR)	0.30
Maahs, 2006[159]	IG1	All	6 (0)	Triglycerides, mg/dL	132.7 (72.9)	148.3 (46.5)	-12.4 (75.4)	16	0.6 (56.1)	18	MD in change	-13 (-57.35 to 31.35)	0.52
Chanoine, 2005[158]	IG1	All	12 (0)	FPG, mg/dL	90 (11)	92 (12)	-2.4 (NR)	282	-5.2 (NR)	136	MD in change	2.84 (NR)	0.06
Maahs, 2006[159]	IG1	All	6 (0)	FPG, mg/dL	87 (8.5)	87.4 (8.9)	2.8 (7.8)	16	4.8 (8.2)	18	MD in change	-2 (-7.4 to 3.4)	0.12
Chanoine, 2005[158]	IG1	All	12 (0)	Two-hr OGTT, mg/dL	109 (22)	108 (20)	-11.2 (NR)	283	-10.1 (NR)	136	MD in change	-1.09 (NR)	0.68
				SBP, mm Hg	114 (12)	114 (12)	1.1 (NR)	347	1.3 (NR)	180	MD in change	-0.22 (NR)	0.84

Appendix D Table 13. Other Intermediate Outcomes for Orlistat, Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
				DBP, mm Hg	68 (10)	67 (10)	-0.5 (NR)	347	1.3 (NR)	180	MD in change	-1.81 (NR)	0.04
				Insulin, micro IU/mL	20 (20)	22 (33)	-2.8 (NR)	271	-5.4 (NR)	132	MD in change	2.6 (NR)	0.41
Maahs, 2006[159]	IG1	All	6 (0)	Insulin, micro IU/mL	24.2 (14.3)	23.3 (10.3)	-0.7 (15)	16	1.4 (12.3)	18	MD in change	-2.1 (-11.27 to 7.07)	0.43
Chanoine, 2005[158]	IG1	All	12 (0)	Two-hr insulin, micro IU	82 (86)	75 (64)	-25.7 (NR)	276	-20.6 (NR)	133	MD in change	-5.1 (NR)	0.44

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence interval; Cm = centimeter; FU = Followup; Hr = Hour; IG = Intervention group; MD = Mean difference; Mg/dL = milligrams per deciliter; N/A = Not applicable; NR = Not reported; RR = Relative risk; SD = Standard deviation; Stat = Statistic; Tx = Treatment

Appendix D Table 14. Diet, Physical Activity, and Sedentary Behavior Outcomes Results for Behavioral Interventions (Key Question 3), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Vos, 2011[151]	IG1	All	12 (-12)	Cardiorespiratory fitness (z-score)	1.7 (1.6)	2.2 (1.5)	0 (2.1)	32	-1.1 (2)	35	MD in change	0.7 (-1.1 to -0.3)	<0.01
McCallum, 2007[124]	IG1	All	9 (6)	Dietary pattern score (Score (0-28))	16.3 (2.9)	16.2 (2.8)	2.7 (2.8)	43	0.3 (2.7)	54	MD in change	2.1 (1.3 to 2.9)	<0.001
			15 (12)	Dietary pattern score (Score (0-28))	16.3 (2.9)	16.2 (2.8)	2.4 (2.6)	48	-0.1 (2.8)	55	MD in change	1.6 (0.9 to 2.3)	<0.001
Smith, 2021[138]	IG1	All	12 (6)	Dietary pattern score (NHANES DSQ (0-8))	3.2 (1)	3.1 (0.8)	0 (1)	141	-0.2 (0.8)	99	MD in change	0.17 (-0.06 to 0.4)	0.008
Stark, 2018[141]	IG1	All	6 (0)	Dietary pattern score (HEI (0-100))	56.2 (11)	57.9 (11.4)	6.6 (12.6)	43	-2.1 (11.5)	48	MD in change	8.7 (3.75 to 13.65)	0.007
	IG2	All	6 (0)	Dietary pattern score (HEI (0-100))	55.6 (9.7)	57.9 (11.4)	-0.9 (12)	44	-2.1 (11.5)	48	MD in change	1.2 (-3.6 to 6)	NR
Wake, 2009[152]	IG1	All	6 (3)	Dietary pattern score (Score (0-5))	3.7 (1.1)	3.5 (1.2)	0.2 (1.1)	125	0.1 (1.2)	114	MD in change	0.2 (-0.03 to 0.4)	0.1
			12 (9)	Dietary pattern score (Score (0-5))	3.7 (1.1)	3.5 (1.2)	0.2 (1.1)	119	0.2 (1.2)	104	MD in change	0.1 (-0.1 to 0.4)	0.2
Wake, 2013[153]	IG1	All	12 (0)	Dietary pattern score (Score (0-5))	NR	NR	NR	56	NR	47	MD in change	0.3 (0 to 0.6)	0.05
DeBar, 2012[111]	IG1	All	6 (1)	MVPA (min/day)	55.3 (51.8)	49.7 (39.5)	9.4 (61.3)	104	6.7 (47.8)	102	MD in change	2.71 (-12.31 to 17.73)	0.705
Gerards, 2015[113]	IG1	All	12 (8.5)	MVPA (min/day)	49.9 (16.6)	51.2 (18.4)	0.1 (11.6)	28	-4.2 (18.5)	28	MD in change	4.31 (-3.76 to 12.38)	NR

Appendix D Table 14. Diet, Physical Activity, and Sedentary Behavior Outcomes Results for Behavioral Interventions (Key Question 3), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Golley, 2007[114]	IG1	All	6 (1)	MVPA (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
			12 (7)	MVPA (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
	IG2	All	6 (1)	MVPA (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
			12 (7)	MVPA (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
Kong, 2013[119]	IG1	All	6 (-3)	MVPA (30 min blocks/day)	1.4 (3.8)	2 (2.5)	0 (3.4)	27	-0.9 (1.8)	20	MD in change	0.6 (-1.6 to 2)	0.63
Looney, 2014[122]	IG1	All	6 (0)	MVPA (min/day)	NR	NR	NR	7	NR	7	MD in change	NR	NSD
O'Connor, 2013[128]	IG1	All	7 (0)	MVPA (min/day)	24.8 (11.7)	28.3 (14.9)	0.5 (11.7)	16	-3.8 (13.6)	16	MD in change	4.3 (-4.46 to 13.06)	0.86
Patrick, 2013 [129]	IG1	All	6 (-6)	MVPA (min/day)	46.6 (1.5)	54.1 (1.6)	1 (1.3)	26	-8.5 (2.4)	24	MD in change	9.47 (8.39 to 10.55)	NR
			12 (0)	MVPA (min/day)	46.6 (1.5)	54.1 (1.6)	3.2 (1.7)	22	-16.4 (1.6)	21	MD in change	19.63 (18.63 to 20.63)	0.339
	IG2	All	6 (-6)	MVPA (min/day)	44.6 (1.7)	54.1 (1.6)	-0.8 (1.5)	22	-8.5 (2.4)	24	MD in change	7.7 (6.53 to 8.87)	NR
			12 (0)	MVPA (min/day)	44.6 (1.7)	54.1 (1.6)	-1.6 (1.6)	20	-16.4 (1.6)	21	MD in change	14.86 (13.88 to 15.83)	0.544
	IG3	All	6 (-6)	MVPA (min/day)	45.8 (1.5)	54.1 (1.6)	0.3 (1.3)	26	-8.5 (2.4)	24	MD in	8.84 (7.77	NR

Appendix D Table 14. Diet, Physical Activity, and Sedentary Behavior Outcomes Results for Behavioral Interventions (Key Question 3), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
											change	to 9.92)	
			12 (0)	MVPA (min/day)	45.8 (1.5)	54.1 (1.6)	-2 (1.5)	24	-16.4 (1.6)	21	MD in change	14.37 (13.45 to 15.29)	0.509
Sacher, 2010[133]	IG1	All	6 (3.75)	MVPA (min/day)	180 (90)	179.1 (75.4)	-58.3 (81.9)	37	-84.9 (71.5)	45	MD in change	33.43 (0.86 to 66.86)	0.04
Sherwood, 2019[137]	IG1	All	12 (0)	MVPA (min/day)	51.6 (30.2)	52.4 (29.8)	-13.2 (26.6)	181	-10.9 (26.7)	183	MD in change	-2.3 (-7.78 to 3.18)	NR
			24 (12)	MVPA (min/day)	51.6 (30.2)	52.4 (29.8)	-12.5 (26.9)	180	-16.4 (26.6)	187	MD in change	0.37 (-4.31 to 5.04)	0.13
Stark, 2011[139]	IG1	All	6 (0)	MVPA (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
			12 (6)	MVPA (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
Stark, 2018[141]	IG1	All	6 (0)	MVPA (min/day)	90.6 (33.1)	92.7 (31)	-17.8 (28.7)	47	5 (24.8)	54	MD in change	-22.8 (-33.23 to -12.37)	<0.001
			12 (6)	MVPA (min/day)	90.6 (33.1)	92.7 (31)	-8.4 (30)	47	-5.8 (28.4)	54	MD in change	-2.6 (-14 to 8.8)	0.680
			18 (12)	MVPA (min/day)	90.6 (33.1)	92.7 (31)	-6.8 (27.5)	47	-7 (27.6)	54	MD in change	0.2 (-10.57 to 10.97)	0.767
	IG2	All	6 (0)	MVPA (min/day)	94.6 (31.8)	92.7 (31)	-5.9 (30.1)	50	5 (24.8)	54	MD in change	-10.9 (-21.47 to -	NR

Appendix D Table 14. Diet, Physical Activity, and Sedentary Behavior Outcomes Results for Behavioral Interventions (Key Question 3), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
												0.33)	
			12 (6)	MVPA (min/day)	94.6 (31.8)	92.7 (31)	-5.5 (28.6)	50	-5.8 (28.4)	54	MD in change	0.3 (-10.66 to 11.26)	NR
			18 (12)	MVPA (min/day)	94.6 (31.8)	92.7 (31)	-12.5 (26.5)	50	-7 (27.6)	54	MD in change	-5.5 (-15.92 to 4.92)	NR
Taveras, 2011[145]	IG1	All	12 (0)	MVPA (min/day)	112.8 (85.9)	124.8 (83.1)	3.6 (95.4)	253	12 (108.1)	192	MD in change	-14.4 (-34.2 to 5.4)	0.16
Taylor, 2015[148]	IG1	All	24 (0)	MVPA (min/day)	30 (15)	32 (14)	6 (20.2)	89	2 (17.1)	92	MD in change	4 (-2 to 9)	0.141
Wake, 2009[152]	IG1	All	6 (3)	MVPA (% of time spent)	NR	NR	NR	122	NR	109	MD in change	0.7 (-0.5 to 2)	NR
			12 (9)	MVPA (% of time spent)	NR	NR	NR	110	NR	91	MD in change	0.6 (-1 to 2.2)	0.5
Smith, 2021[138]	IG1	All	12 (6)	Physical activity (Family Health Behaviors scale)	2.2 (0.8)	2.2 (0.8)	0.3 (0.8)	141	0.1 (0.9)	99	MD in change	0.28 (0.06 to 0.5)	0.122
Wake, 2013[153]	IG1	All	12 (0)	Physical activity (% time moderate/vigorous)	NR	NR	NR	48	NR	44	MD in change	0.4 (-1.6 to 2.4)	0.7
Reinehr, 2010[131]	IG1	All	6 (0)	Computer time (min/day)	78.9 (59.1)	73.7 (47.1)	-7.7 (56)	34	1.7 (49.9)	32	MD in change	-9.43 (-35.09 to 16.23)	NSD
Stark,	IG1	All	6 (0)	Moderate PA	NR	NR	4 (12)	11	-6 (10)	12	MD in	1.5 (-5.1	0.64

Appendix D Table 14. Diet, Physical Activity, and Sedentary Behavior Outcomes Results for Behavioral Interventions (Key Question 3), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
2014[140]				(min/day)							change	to 8.1)	
			12 (6)	Moderate PA (min/day)	NR	NR	6 (16)	11	-15 (16)	12	MD in change	10.2 (-1.5 to 22)	0.08
DeBar, 2012[111]	IG1	All	6 (1)	MET (min/day)	256.8 (238.2)	228 (187.8)	33.6 (278.8)	104	40.2 (254.2)	102	MD in change	-6.6 (-79.49 to 66.29)	0.889
Raynor, 2012b[130]	IG1	All	6 (0)	MET (ratio/day)	1.6 (0.3)	1.7 (0.5)	0.4 (0.8)	17	0.1 (0.5)	24	MD in change	0.3 (-0.08 to 0.68)	NR
			12 (6)	MET (ratio/day)	1.6 (0.3)	1.7 (0.5)	0.1 (0.4)	17	0.1 (0.6)	24	MD in change	0 (-0.3 to 0.3)	NR
	IG2	All	6 (0)	MET (ratio/day)	1.6 (0.3)	1.7 (0.5)	0 (0.3)	19	0.1 (0.5)	24	MD in change	-0.1 (-0.33 to 0.13)	NR
			12 (6)	MET (ratio/day)	1.6 (0.3)	1.7 (0.5)	0 (0.4)	19	0.1 (0.6)	24	MD in change	-0.1 (-0.39 to 0.19)	NR
Gerards, 2015[113]	IG1	All	12 (8.5)	Sedentary behavior (min/day)	405.7 (63.7)	425.6 (71.4)	26.4 (57.7)	28	46.9 (66.3)	28	MD in change	-20.45 (-53.02 to 12.12)	NR
McCallum, 2007[124]	IG1	All	9 (6)	Sedentary behavior (score)	3.3 (0.7)	3.3 (0.6)	0 (0.6)	45	-0.1 (0.6)	61	MD in change	0.2 (0 to 0.4)	0.08
			15 (12)	Sedentary behavior (score)	3.3 (0.7)	3.3 (0.6)	0 (0.6)	49	-0.1 (0.6)	58	MD in change	0.2 (0 to 0.3)	0.08
O'Connor, 2013[128]	IG1	All	7 (0)	Sedentary behavior (min/day)	562.2 (94)	551.7 (81)	6.9 (85.6)	16	44.4 (78.4)	16	MD in change	-37.5 (-94.41 to 19.41)	0.33
Patrick,	IG1	All	6 (-6)	Sedentary behavior	276	324	-18 (341.1)	26	-6 (332.2)	24	MD in	-12 (-198.9 to	NR

Appendix D Table 14. Diet, Physical Activity, and Sedentary Behavior Outcomes Results for Behavioral Interventions (Key Question 3), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
2013 [129]				(min/day)	(342.7)	(329.2)					change	174.9)	
			12 (0)	Sedentary behavior (min/day)	276 (342.7)	324 (329.2)	-48 (334.8)	22	-6 (322.9)	21	MD in change	-42 (-238.77 to 154.77)	0.221
	IG2	All	6 (-6)	Sedentary behavior (min/day)	234 (318)	324 (329.2)	-6 (315.2)	22	-6 (332.2)	24	MD in change	0 (-187.56 to 187.56)	NR
			12 (0)	Sedentary behavior (min/day)	234 (318)	324 (329.2)	-18 (312.1)	20	-6 (322.9)	21	MD in change	-12 (-206.55 to 182.55)	0.458
	IG3	All	6 (-6)	Sedentary behavior (min/day)	294 (342.7)	324 (329.2)	-108 (341.1)	26	-6 (332.2)	24	MD in change	-102 (-288.9 to 84.9)	NR
			12 (0)	Sedentary behavior (min/day)	294 (342.7)	324 (329.2)	-126 (338.9)	24	-6 (322.9)	21	MD in change	-120 (-314.19 to 74.19)	0.006
Sacher, 2010[133]	IG1	All	6 (3.75)	Sedentary behavior (min/day)	61.7 (39.4)	66.9 (39.4)	74.6 (54.1)	37	119.1 (68.3)	45	MD in change	-43.71 (-77.14 to -9.43)	0.01
Saelens, 2002[134]	IG1	All	7 (3)	Sedentary behavior (min/day)	260 (260)	240 (136)	21 (252.8)	18	27 (127.6)	18	MD in change	-6 (-136.83 to 124.83)	NSD
Taylor, 2015[148]	IG1	All	24 (0)	Sedentary behavior (min/day)	616 (57)	602 (52)	15 (60.8)	89	26 (55.2)	92	MD in change	-3 (-19 to 12)	0.684
Wake, 2013[153]	IG1	All	12 (0)	Sedentary behavior (% time sedentary)	NR	NR	NR	48	NR	44	MD in change	-0.7 (-3.8 to 2.4)	0.7
Broccoli,	IG1	All	12 (9)	Screen time (Parent	NR	NR	NR	NR	NR	NR	MD in	NR	NR

Appendix D Table 14. Diet, Physical Activity, and Sedentary Behavior Outcomes Results for Behavioral Interventions (Key Question 3), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
2016[107]				report of change)							change		
DeBar, 2012[111]	IG1	All	6 (1)	Screen time (min/day)	261.8 (127.8)	276.3 (132.3)	-43.7 (119.9)	104	-33.7 (127.8)	102	MD in change	-10.03 (-43.87 to 23.81)	0.343
			12 (7)	Screen time (min/day)	261.8 (127.8)	276.3 (132.3)	-35.9 (124.2)	85	-50.7 (127.4)	76	MD in change	14.83 (-24.08 to 53.74)	0.343
Golley, 2007[114]	IG1	All	6 (1)	Screen time (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
			12 (7)	Screen time (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
	IG2	All	6 (1)	Screen time (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
			12 (7)	Screen time (min/day)	NR	NR	NR	NR	NR	NR	MD in change	NR	NSD
Kong, 2013[119]	IG1	All	6 (-3)	Screen time (Weekend (hrs/day))	NR	NR	-0.1 (NR)	28	0.5 (NR)	23	MD in change	-0.6 (-1.9 to 1.3)	0.17
			6 (-3)	Screen time (Weekday (hrs/day))	NR	NR	-0.4 (NR)	28	0.2 (NR)	23	MD in change	-0.7 (-1.6 to 0)	0.03
Looney, 2014[122]	IG1	All	6 (0)	Screen time (min/day)	NR	NR	NR	7	NR	7	MD in change	NR	NSD
Nemet, 2005[126]	IG1	All	12 (9)	Screen time (min/day)	276 (102)	282 (102)	-78 (90.8)	20	-78 (102)	20	MD in change	0 (-59.85 to 59.85)	NSD
O'Connor, 2013[128]	IG1	All	7 (0)	Screen time (min/day)	20.1 (12.3)	21.5 (10.6)	-5.2 (11.1)	16	1.8 (10.1)	16	MD in change	-7 (-14.36 to 0.36)	0.02

Appendix D Table 14. Diet, Physical Activity, and Sedentary Behavior Outcomes Results for Behavioral Interventions (Key Question 3), Sorted by Outcome

Study	Group	Analyzed	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Raynor, 2012b[130]	IG1	All	6 (0)	Screen time (min/day)	120 (54)	96 (90)	-18 (88.4)	17	-6 (78.5)	24	MD in change	-12 (-63.37 to 39.37)	NR
			12 (6)	Screen time (min/day)	120 (54)	96 (90)	-42 (93.5)	17	6 (80.7)	24	MD in change	-48 (-101.56 to 5.56)	NR
	IG2	All	6 (0)	Screen time (min/day)	108 (54)	96 (90)	0 (64.9)	19	-6 (78.5)	24	MD in change	6 (-37.83 to 49.83)	NR
			12 (6)	Screen time (min/day)	108 (54)	96 (90)	0 (64.9)	19	6 (80.7)	24	MD in change	-6 (-50.65 to 38.65)	NR
Reinehr, 2010[131]	IG1	All	6 (0)	Screen time (min/day)	85.7 (54)	80.6 (42)	-7.7 (56.3)	34	-5.1 (40)	32	MD in change	-2.57 (-26.26 to 21.12)	NSD
Sherwood, 2019[137]	IG1	All	12 (0)	Screen time (min/day)	138 (72)	144 (78)	-12 (72)	181	-18 (75.2)	183	MD in change	6 (-9.13 to 21.13)	NR
			24 (12)	Screen time (min/day)	138 (72)	144 (78)	0 (69.2)	180	-6 (75.2)	187	MD in change	4.2 (-6 to 14.4)	0.61
Taveras, 2011[145]	IG1	All	12 (0)	Screen time (min/day)	160.2 (95.4)	146.4 (83.1)	-31.8 (85.9)	253	-4.2 (74.8)	192	MD in change	-21.6 (-38.4 to -5.4)	0.01
			24 (12)	Screen time (min/day)	160.2 (94.8)	146.4 (79.8)	-30 (92.4)	253	-13.8 (73.2)	192	MD in change	-12 (-29.4 to 5.4)	NSD

Abbreviations: BL = Baseline; CG = Control group; CI = Confidence Interval; FU = Followup; HEI = Healthy Eating Index; IG = Intervention group; MD = Mean difference; MET = Metabolic equivalent of task; Min = Minutes; MVPA = Moderate- to vigorous physical activity; NHANES DSQ = National Health and Nutrition Examination Survey Dietary Screener Questionnaire; NR = Not reported; NSD = No significant difference; PA = Physical activity; SD = Standard deviation; Stat = Statistic; Tx = Treatment

Appendix D Table 15. Harms Outcomes Results for Behavioral Interventions, Sorted by Outcome (Key Question 4)

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Ho, 2016[115]	IG1	All	6 (0)	Participants with any AE (n)	N/A	N/A	0 (0)	48	0 (0)	51	RR	1.06 (0.02 to 54.57)	NR
Reinehr, 2010[131]	IG1	All	6 (0)	Participants with any AE (number)	N/A	N/A	0 (0)	34	0 (0)	32	RR	0.94 (0.02 to 48.88)	NR
Raynor, 2012a[130]	IG1	All	12 (6)	Participants with serious AE (n)	N/A	N/A	0 (0)	35	0 (0)	33	RR	0.94 (0.02 to 48.92)	NR
	IG2	All	12 (6)	Participants with serious AE (n)	N/A	N/A	0 (0)	33	0 (0)	33	RR	1 (0.02 to 51.89)	NR
Raynor, 2012b[130]	IG1	All	12 (6)	Participants with serious AE (n)	N/A	N/A	0 (0)	26	0 (0)	29	RR	1.11 (0.02 to 58.1)	NR
	IG2	All	12 (6)	Participants with serious AE (n)	N/A	N/A	0 (0)	26	0 (0)	29	RR	1.11 (0.02 to 58.1)	NR
Stark, 2018[141]	IG1	All	6 (0)	Participants with serious AE (Number)	N/A	N/A	0 (0)	43	0 (0)	50	RR	1.16 (0.02 to 59.74)	NR
	IG2	All	6 (0)	Participants with serious AE (Number)	N/A	N/A	0 (0)	46	0 (0)	50	RR	1.09 (0.02 to 55.85)	NR
Viner, 2020[150]	IG1	All	12 (6)	Participants with serious AE (N)	N/A	N/A	0 (0)	60	0 (0)	55	RR	0.92 (0.02 to 47.02)	NR
Croker, 2012[109]	IG1	All	6 (0)	AE related to treatment (probable) (Number)	N/A	N/A	0 (0)	31	1 (3.7)	27	RR	0.28 (0.01 to 7.17)	NR
Stark, 2018[141]	IG1	All	6 (0)	AE related to treatment (probable) (Number of adverse events)	N/A	N/A	1 (2.3)	43	0 (0)	50	RR	3.56 (0.14 to 89.8)	NR

Appendix D Table 15. Harms Outcomes Results for Behavioral Interventions, Sorted by Outcome (Key Question 4)

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	IG2	All	6 (0)	AE related to treatment (probable) (Number of adverse events)	N/A	N/A	0 (0)	46	0 (0)	50	RR	1.09 (0.02 to 55.85)	NR
Sacher, 2010 [133]	IG1	All	6 (3.75)	AE related to treatment (possible) (Number of events)	N/A	N/A	0 (0)	23	0 (0)	22	RR	0.96 (0.02 to 50.34)	NR
Derwig, 2022[112]	IG1	All	12 (7.5)	Underweight (%)	N/A	N/A	0 (0)	238	0 (0)	237	RR	1 (0.02 to 50.74)	NR
McCallum, 2007[124]	IG1	All	9 (6)	Harter Scale (total score)	NR	NR	NR	73	NR	80	MD in change	0 (-0.1 to 0.2)	0.65
			15 (12)	Harter Scale (total score)	NR	NR	NR	72	NR	74	MD in change	0 (-0.2 to 0.1)	0.64
Sacher, 2010[133]	IG1	All	6 (3.75)	Harter Scale (total score)	2.8 (0.6)	2.8 (0.6)	0.4 (0.7)	37	0.1 (0.7)	44	MD in change	0.3 (0 to 0.7)	0.04
Wake, 2013[153]	IG1	All	12 (0)	Harter Scale (total score)	N/A	N/A	NR	NR	NR	NR	RR	(0.6 to 1.7)	>0.9
DeBar, 2012[111]	IG1	All	6 (1)	Rosenburg Self-Esteem Scale (total score)	2.4 (0.3)	2.4 (0.3)	0 (0.3)	104	0 (0.3)	102	MD in change	0.03 (-0.04 to 0.1)	0.275
			12 (7)	Rosenburg Self-Esteem Scale (total score)	2.4 (0.3)	2.4 (0.3)	0.1 (0.3)	85	0 (0.3)	76	MD in change	0.07 (-0.01 to 0.15)	0.275
Patrick, 2013[129]	IG1	All	6 (-6)	Rosenburg Self-Esteem Scale (score)	31.5 (4.9)	30.7 (4.8)	0.3 (4.8)	26	1.2 (4.6)	24	MD in change	-0.9 (-3.53 to 1.73)	NR

Appendix D Table 15. Harms Outcomes Results for Behavioral Interventions, Sorted by Outcome (Key Question 4)

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			12 (0)	Rosenburg Self-Esteem Scale (score)	31.5 (4.9)	30.7 (4.8)	0.5 (5.3)	22	2.3 (5)	21	MD in change	-1.8 (-4.87 to 1.27)	0.258
	IG2	All	6 (-6)	Rosenburg Self-Esteem Scale (score)	32.8 (5.2)	30.7 (4.8)	0.7 (4.8)	22	1.2 (4.6)	24	MD in change	-0.5 (-3.24 to 2.24)	NR
			12 (0)	Rosenburg Self-Esteem Scale (score)	32.8 (5.2)	30.7 (4.8)	1.4 (5.1)	20	2.3 (5)	21	MD in change	-0.9 (-4 to 2.2)	0.527
	IG3	All	6 (-6)	Rosenburg Self-Esteem Scale (score)	30.2 (4.8)	30.7 (4.8)	0.5 (4.7)	26	1.2 (4.6)	24	MD in change	-0.7 (-3.3 to 1.9)	NR
			12 (0)	Rosenburg Self-Esteem Scale (score)	30.2 (4.8)	30.7 (4.8)	1 (5.2)	24	2.3 (5)	21	MD in change	-1.3 (-4.28 to 1.68)	0.354
Viner, 2020[150]	IG1	All	6 (0)	Rosenburg Self-Esteem Scale (score)	18 (6)	18 (5)	1.5 (NR)	66	1.8 (NR)	64	MD in change	-0.25 (-1.7 to 1.2)	0.7
Wake, 2009[152]	IG1	All	6 (3)	Positive vs negative appearance/self-worth (number of participants)	N/A	N/A	91 (70)	130	80 (69.6)	115	RR	1.02 (0.79 to 1.58)	0.5
			12 (9)	Positive vs negative appearance/self-worth (number of participants)	N/A	N/A	96 (76.8)	125	83 (74.1)	112	RR	1.16 (0.79 to 1.77)	0.4

Appendix D Table 15. Harms Outcomes Results for Behavioral Interventions, Sorted by Outcome (Key Question 4)

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Hofsteenge, 2014[116]	IG1	All	6 (0)	Body Esteem Scale (weight satisfaction)	1.6 (0.7)	1.7 (0.6)	0.1 (0.7)	44	0.1 (0.7)	33	MD in change	0 (-0.2 to 0.2)	NSD
DeBar, 2012[111]	IG1	All	6 (1)	Body Satisfaction Scale (total score)	2.5 (0.6)	2.5 (0.7)	0.3 (0.7)	104	0.2 (0.7)	102	MD in change	0.12 (-0.07 to 0.31)	0.026
			12 (7)	Body Satisfaction Scale (total score)	2.5 (0.6)	2.5 (0.7)	0.4 (0.7)	85	0.2 (0.7)	76	MD in change	0.23 (0.02 to 0.44)	0.026
McCallum, 2007[124]	IG1	All	9 (6)	Collins Body Figure Perception Scale (total score)	NR	NR	NR	73	NR	80	MD in change	0.1 (-0.3 to 0.5)	0.58
			15 (12)	Collins Body Figure Perception Scale (total score)	NR	NR	NR	72	NR	74	MD in change	0.2 (-1 to 0.5)	0.30
Wake, 2009[152]	IG1	All	6 (3)	Collins Body Figure Perception Scale (NR)	NR	NR	NR	130	NR	115	MD in change	0.09 (-0.17 to 0.34)	0.5
			12 (9)	Collins Body Figure Perception Scale (NR)	NR	NR	NR	125	NR	112	MD in change	-0.07 (-0.33 to 0.19)	0.6
Wake, 2013[153]	IG1	All	12 (0)	Collins Body Figure Perception Scale (total score)	NR	NR	NR	NR	NR	NR	MD in change	-0.3 (-0.8 to 0.2)	0.3
DeBar, 2012[111]	IG1	All	6 (1)	Disordered eating (number of participants)	N/A	N/A	2 (1.9)	104	5 (4.9)	102	RR	0.38 (0.07 to 2.01)	0.280
			12 (7)	Disordered eating (number of	N/A	N/A	0 (0)	85	1 (1.3)	76	RR	0.29 (0.01 to 7.33)	0.280

Appendix D Table 15. Harms Outcomes Results for Behavioral Interventions, Sorted by Outcome (Key Question 4)

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
				participants)									
Tanofsky-Kraff, 2010[143]	IG1	All	6 (3)	Disordered eating (episodes)	3.5 (5.4)	1.2 (1.9)	-0.5 (0.9)	NR	-0.2 (0.5)	9	MD in change	-0.32 (NR)	0.036
Viner, 2020[150]	IG1	All	6 (0)	EAT-26 Eating attitude score (score)	10 (8)	11 (8)	-0.8 (NR)	70	-0.7 (NR)	65	MD in change	0.15 (-1.24 to 1.54)	0.8
				EAT-26 Dieting scale score (score)	7 (6)	7 (5)	-1.3 (NR)	70	-1 (NR)	65	MD in change	-0.09 (-2.32 to 2.14)	0.9
Tanofsky-Kraff, 2014[144]	IG1	All	6 (3)	Loss-of-control eating (score)	4.7 (2.4)	8 (4.4)	-3.8 (2.1)	55	-6.2 (3.8)	58	MD in change	2.4 (1.25 to 3.55)	0.35
		All	12 (9)	Loss-of-control eating (score)	8 (4.3)	4.7 (2.5)	-7.3 (3.9)	55	-3.6 (2.2)	58	MD in change	-3.7 (-4.85 to -2.55)	0.35
		Racial-ethnic minority	12 (9)	Loss-of-control eating (score)	NR	NR	NR	26	NR	19	MD in change	NR	NR
		White	12 (9)	Loss-of-control eating (score)	NR	NR	NR	29	NR	39	MD in change	NR	NR
		All	6 (3)	Binge eating (# episodes)	0.4 (0.4)	0.8 (1)	-0.3 (0.4)	55	-0.4 (0.8)	58	MD in change	0.1 (-0.14 to 0.34)	0.26
			12 (9)	Binge eating (# episodes)	0.4 (0.4)	0.8 (1)	-0.4 (0.3)	55	-0.6 (0.9)	58	MD in change	0.28 (0.03 to 0.53)	0.03
		All	12 (9)	Binge eating (%)	N/A	N/A	NR	NR	NR	NR	RR	(0.03 to 0.64)	0.01

Appendix D Table 15. Harms Outcomes Results for Behavioral Interventions, Sorted by Outcome (Key Question 4)

Study	Group	Analyzed*	Followup (months since tx ended)	Outcome (unit)	IG BL mean (SD)	CG BL mean (SD)	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
		All	12 (9)	Eating Disorder Examination Version 14 OD/C.2 (%)	N/A	N/A	1 (1.8)	55	5 (8.6)	58	RR	0.2 (0.46 to 39.6)	0.20
Saelens, 2002[134]	IG1	All	7 (3)	TFEQ - restraint (score)	10.3 (4.8)	8.8 (4.1)	2.1 (5.2)	18	0.8 (4)	18	MD in change	1.3 (-1.73 to 4.33)	NSD
				TFEQ - disinhibition (score)	6.6 (2.8)	6.4 (3.1)	-2 (2.8)	18	-0.3 (3.4)	18	MD in change	-1.7 (-3.73 to 0.33)	NSD
				CHEAT (total score)	13.4 (6.7)	10.7 (6.5)	-2.1 (7.3)	18	0.3 (7.8)	18	MD in change	-2.4 (-7.33 to 2.53)	NSD
				Killen Weight Concerns Scale (score)	49.1 (18.2)	42.7 (21.3)	3.1 (20.2)	18	7.2 (20.6)	18	MD in change	-4.1 (-17.43 to 9.23)	NSD

*Interaction p-value report for only 1 study Tanofsky-Kraff, 2014

Abbreviations: AE = Adverse events; BL = Baseline; CHEAT = Children's Eating Attitude Test; CG = Control group; EAT = Eating Attitudes Test; FU = Followup; IG = Intervention group; MD = Mean difference; N/A = Not applicable; NR = Not reported; NSD = No significant difference; RR = Relative risk; SD = Standard deviation; Stat = Statistic; TFEQ = Three-Factor Eating Questionnaire; Tx = Treatment

Appendix D Table 16. Harms Outcomes Results for Glucagon-Like-Peptide-1 Agonists (Key Question 4)

Drug	Study	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Liraglutide	Danne, 2017[155]	1 (NR)	Participants with any AE, %	14 (100)	14	4 (57.1)	7	RR	22.56 (0.97 to 524.4)	NR
	Kelly, 2020[156]	13 (0)	Participants with any AE, %	111 (88.8)	125	107 (84.9)	126	RR	1.41 (0.67 to 2.95)	0.07
	Kelly, 2020[156]	19 (6)	Participants with any AE, %	113 (90.4)	125	108 (85.7)	126	RR	1.57 (0.72 to 3.41)	0.20
	Mastrandrea, 2019[157]	2 (NR)	Participants with any AE, %	9 (56.3)	16	5 (62.5)	8	RR	0.77 (0.14 to 4.39)	NR
	Danne, 2017[155]	1 (NR)	Participants with serious AE, %	0 (0)	14	0 (0)	7	RR	0.52 (0.01 to 28.75)	NR
	Kelly, 2020[156]	13 (0)	Participants with serious AE, %	3 (2.4)	125	5 (4)	126	RR	0.6 (0.14 to 2.55)	0.72
	Kelly, 2020[156]	19 (6)	Participants with serious AE, %	4 (3.2)	125	9 (7.1)	126	RR	0.43 (0.13 to 1.43)	0.25
	Mastrandrea, 2019[157]	2 (NR)	Participants with serious AE, %	0 (0)	16	0 (0)	8	RR	0.52 (0.01 to 28.3)	NR
	Danne, 2017[155]	1 (NR)	Participants discontinued due to AE, %	0 (0)	14	0 (0)	7	RR	0.52 (0.01 to 28.75)	NR
	Kelly, 2020 [156]	13 (0)	Participants discontinued due to AE, %	13 (10.4)	125	0 (0)	126	RR	30.36 (1.78 to 516.57)	<0.001
	Mastrandrea, 2019[157]	2 (NR)	Participants discontinued due to AE, %	0 (0)	16	0 (0)	8	RR	0.52 (0.01 to 28.3)	NR
	Danne, 2017[155]	1 (NR)	AE related to treatment (probable), %	2 (14.3)	14	0 (0)	7	RR	3 (0.13 to 71.31)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE related to treatment (probable), %	5 (31.3)	16	1 (12.5)	8	RR	3.18 (0.3 to 33.26)	NR
	Danne, 2017[155]	1 (NR)	AE related to treatment (possible), %	13 (92.9)	14	0 (0)	7	RR	135 (4.87 to 3744.42)	NR

Appendix D Table 16. Harms Outcomes Results for Glucagon-Like-Peptide-1 Agonists (Key Question 4)

Drug	Study	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	Mastrandrea, 2019[157]	2 (NR)	AE related to treatment (possible), %	3 (18.8)	16	1 (12.5)	8	RR	1.62 (0.14 to 18.58)	NR
	Danne, 2017[155]	1 (NR)	AE: GI disorders, %	12 (85.7)	14	2 (28.6)	7	RR	15 (1.63 to 138.16)	NR
	Kelly, 2020[156]	13 (0)	AE: GI disorders, %	81 (64.8)	125	46 (36.5)	126	RR	3.2 (1.91 to 5.36)	0.001
	Kelly, 2020[156]	19 (6)	AE: GI disorders, %	83 (66.4)	125	48 (38.1)	126	RR	3.21 (1.92 to 5.38)	0.004
	Mastrandrea, 2019[157]	2 (NR)	AE: GI disorders, %	6 (37.5)	16	1 (12.5)	8	RR	4.2 (0.41 to 43.04)	NR
	Danne, 2017[155]	1 (NR)	AE: Nervous system disorders, %	7 (50)	14	1 (14.3)	7	RR	6 (0.57 to 63.68)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: Nervous system disorders, %	3 (18.8)	16	4 (50)	8	RR	0.23 (0.04 to 1.5)	NR
	Danne, 2017[155]	1 (NR)	AE: Infections and infestations, %	6 (42.9)	14	2 (28.6)	7	RR	1.88 (0.27 to 13.2)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: Infections and infestations, %	2 (12.5)	16	1 (12.5)	8	RR	1 (0.08 to 13.02)	NR
	Danne, 2017[155]	1 (NR)	AE: General and administration site conditions, %	5 (35.7)	14	0 (0)	7	RR	8.68 (0.41 to 183.23)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: General and administration site conditions, %	3 (18.8)	16	1 (12.5)	8	RR	1.62 (0.14 to 18.58)	NR
	Danne, 2017[155]	1 (NR)	AE: Musculoskeletal and connective tissue disorders, %	3 (21.4)	14	0 (0)	7	RR	4.57 (0.21 to 101.61)	NR

Appendix D Table 16. Harms Outcomes Results for Glucagon-Like-Peptide-1 Agonists (Key Question 4)

Drug	Study	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	Mastrandrea, 2019[157]	2 (NR)	AE: Musculoskeletal and connective tissue disorders, %	1 (6.3)	16	1 (12.5)	8	RR	0.47 (0.03 to 8.6)	NR
	Danne, 2017[155]	1 (NR)	AE: Reproductive system and breast disorders, %	3 (21.4)	14	0 (0)	7	RR	4.57 (0.21 to 101.61)	NR
	Danne, 2017[155]	1 (NR)	AE: Respiratory, thoracic and mediastinal disorders, %	2 (14.3)	14	1 (14.3)	7	RR	1 (0.07 to 13.37)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: Respiratory, thoracic and mediastinal disorders, %	2 (12.5)	16	0 (0)	8	RR	2.93 (0.13 to 68.55)	NR
	Danne, 2017[155]	1 (NR)	AE: Skin and subcutaneous tissue disorders, %	2 (14.3)	14	0 (0)	7	RR	3 (0.13 to 71.31)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: Skin and subcutaneous tissue disorders, %	1 (6.3)	16	0 (0)	8	RR	1.65 (0.06 to 44.97)	NR
	Danne, 2017[155]	1 (NR)	AE: Injury, poisoning and procedural complications, %	1 (7.1)	14	0 (0)	7	RR	1.67 (0.06 to 46.23)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: Injury, poisoning and procedural complications, %	0 (0)	16	1 (12.5)	8	RR	0.15 (0.01 to 4.17)	NR
	Danne, 2017[155]	1 (NR)	AE: Vascular disorders, %	1 (7.1)	14	0 (0)	7	RR	1.67 (0.06 to 46.23)	NR
	Danne, 2017[155]	1 (NR)	Hypoglycemic episodes, %	2 (14.3)	14	0 (0)	7	RR	3 (0.13 to 71.31)	NR
	Kelly, 2020[156]	13 (0)	Hypoglycemic episodes, %	26 (20.8)	125	18 (14.3)	126	RR	1.58 (0.81 to 3.05)	NR

Appendix D Table 16. Harms Outcomes Results for Glucagon-Like-Peptide-1 Agonists (Key Question 4)

Drug	Study	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	Mastrandrea, 2019[157]	2 (NR)	Hypoglycemic episodes, %	4 (25)	16	1 (12.5)	8	RR	2.33 (0.22 to 25.24)	NR
	Kelly, 2020[156]	13 (0)	Bulimia nervosa, %	1 (.8)	125	0 (0)	126	RR	3.05 (0.12 to 75.54)	NR
	Kelly, 2020[156]	13 (0)	Eating disorder (unspecified), %	1 (.8)	125	0 (0)	126	RR	3.05 (0.12 to 75.54)	NR
	Kelly, 2020[156]	13 (0)	AE: Psychiatric Events, %	13 (10.4)	125	18 (14.3)	126	RR	0.7 (0.33 to 1.49)	NR
	Kelly, 2020[156]	13 (0)	Suicidal ideation, %	1 (.8)	125	1 (.8)	126	RR	1.01 (0.06 to 16.3)	NR
	Kelly, 2020[156]	13 (0)	Suicide (completed), %	1 (.8)	125	0 (0)	126	RR	3.05 (0.12 to 75.54)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: Ear and labyrinth disorders, %	1 (6.3)	16	0 (0)	8	RR	1.65 (0.06 to 44.97)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: Eye disorders, %	1 (6.3)	16	0 (0)	8	RR	1.65 (0.06 to 44.97)	NR
	Mastrandrea, 2019[157]	2 (NR)	AE: Investigations, %	0 (0)	16	1 (12.5)	8	RR	0.15 (0.01 to 4.17)	NR
Semaglutide	Weghuber, 2022 [162]	17 (0)	Participants with any AE, Number	105 (78.9)	133	55 (82.1)	67	RR	0.82 (0.39 to 1.73)	NR
			Participants with serious AE, Number	15 (11.3)	133	6 (9)	67	RR	1.29 (0.48 to 3.5)	NR
			Participants discontinued due to AE, Number	6 (4.5)	133	3 (4.5)	67	RR	1.01 (0.24 to 4.16)	NR
			AE: GI disorders, Number	82 (61.7)	133	28 (41.8)	67	RR	2.24 (1.23 to 4.07)	NR
			AE: General and administration site conditions, Number	4 (3)	133	3 (4.5)	67	RR	0.66 (0.14 to 3.04)	NR

Appendix D Table 16. Harms Outcomes Results for Glucagon-Like-Peptide-1 Agonists (Key Question 4)

Drug	Study	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
			AE: Psychiatric Events, Number	9 (6.8)	133	10 (14.9)	67	RR	0.41 (0.16 to 1.07)	NR
			AE: Acute gallbladder disease, Number	5 (3.8)	133	0 (0)	67	RR	5.78 (0.31 to 106.07)	NR
			AE: Hepatic disorders, Number	10 (7.5)	133	1 (1.5)	67	RR	5.37 (0.67 to 42.83)	NR
			AE: Cardiovascular disorders, Number	10 (7.5)	133	7 (10.4)	67	RR	0.7 (0.25 to 1.92)	NR
			AE: Allergic reactions, Number	12 (9)	133	4 (6)	67	RR	1.56 (0.48 to 5.04)	NR

Abbreviations: AE = Adverse events; CG = Control group; CI = Confidence Interval; FU = Followup; GI = Gastrointestinal; IG = Intervention group; NR = Not reported; RR = Relative risk; Stat = Statistic; Tx = Treatment

Appendix D Table 17. Harms Outcomes Results for Orlistat (Key Question 4), Sorted by Outcome

Study	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Chanoine, 2005[158]	12 (0)	Participants with any AE, %	341 (96.9)	352	170 (93.9)	181	RR	2.01 (0.85 to 4.72)	NR
Chanoine, 2005[158]	12 (0)	Participants with serious AE, %	11 (3.1)	352	5 (2.8)	181	RR	1.14 (0.39 to 3.32)	NR
Chanoine, 2005[158]	12 (0)	Participants discontinued due to AE, %	12 (3.4)	352	3 (1.7)	181	RR	2.09 (0.58 to 7.52)	NR
Maahs, 2006[159]	6 (0)	Participants discontinued due to AE, Number	2 (10)	20	0 (0)	20	RR	5.54 (0.25 to 123.08)	NR
Chanoine, 2005[158]	12 (0)	AE: GI disorders, %	23 (6.5)	352	8 (4.4)	181	RR	1.51 (0.66 to 3.45)	NR
Chanoine, 2005[158]	12 (0)	AE: Injury, poisoning and procedural complications, %	18 (5.1)	352	5 (2.8)	181	RR	1.9 (0.69 to 5.2)	NR
Chanoine, 2005[158]	12 (0)	AE: Flatus with discharge, %	70 (19.9)	352	5 (2.8)	181	RR	8.74 (3.46 to 22.07)	NR
Maahs, 2006[159]	6 (0)	AE: Flatus with discharge, %	4 (25)	16	0 (0)	18	RR	13.32 (0.66 to 269.84)	<0.001
Chanoine, 2005[158]	12 (0)	AE: Fecal incontinence, %	31 (8.8)	352	1 (.6)	181	RR	17.38 (2.35 to 128.4)	NR
Maahs, 2006[159]	6 (0)	AE: Fecal incontinence, %	1 (6.3)	16	0 (0)	18	RR	3.58 (0.14 to 94.3)	<0.001
Chanoine, 2005[158]	12 (0)	AE: Excess flatus, %	32 (9.1)	352	8 (4.4)	181	RR	2.16 (0.98 to 4.8)	NR
Maahs, 2006[159]	6 (0)	AE: Excess flatus, %	3 (18.8)	16	2 (11.1)	18	RR	1.85 (0.27 to 12.76)	0.50
Maahs, 2006[159]	6 (0)	AE: Cramps, %	2 (12.5)	16	4 (22.2)	18	RR	0.5 (0.08 to 3.19)	0.02
Chanoine,	12 (0)	AE: Fecal urgency, %	73 (20.7)	352	20 (11)	181	RR	2.11 (1.24 to 3.58)	NR

Appendix D Table 17. Harms Outcomes Results for Orlistat (Key Question 4), Sorted by Outcome

Study	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
2005[158]									
Maahs, 2006[159]	6 (0)	AE: Fecal urgency, %	3 (18.8)	16	2 (11.1)	18	RR	1.85 (0.27 to 12.76)	0.38
Chanoine, 2005[158]	12 (0)	AE: Back pain, %	28 (8)	352	11 (6.1)	181	RR	1.34 (0.65 to 2.75)	NR
Chanoine, 2005[158]	12 (0)	AE: Headache, %	134 (38.1)	352	56 (30.9)	181	RR	1.37 (0.94 to 2.01)	NR
Chanoine, 2005[158]	12 (0)	AE: Gallstones, %	6 (1.7)	352	1 (.6)	181	RR	3.12 (0.37 to 26.13)	NR
Chanoine, 2005[158]	12 (0)	AE: Abdominal Pain, %	77 (21.9)	352	20 (11)	181	RR	2.25 (1.33 to 3.83)	NR

Abbreviations: AE = Adverse events; CG = Control group; CI = Confidence Interval; FU = Followup; GI = Gastrointestinal; IG = Intervention group; NR = Not reported; RR = Relative risk; Stat = Statistic; Tx = Treatment

Appendix D Table 18. Harms Outcomes Results for Phentermine/Topiramate (Key Question 4)

Study	Intervention Name	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	Participants with any AE, %	10 (76.9)	13	7 (50)	14	RR	3.33 (0.63 to 17.57)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	Participants with any AE, %	6 (40)	15	7 (50)	14	RR	0.67 (0.15 to 2.9)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	Participants with any AE, %	59 (52.2)	113	29 (51.8)	56	RR	1.02 (0.54 to 1.93)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	Participants with any AE, %	20 (37)	54	29 (51.8)	56	RR	0.55 (0.26 to 1.17)	NR
	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	Participants with serious AE, %	2 (1.8)	113	0 (0)	56	RR	2.53 (0.12 to 53.67)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	Participants with serious AE, %	0 (0)	54	0 (0)	56	RR	1.04 (0.02 to 53.18)	NR
Hsia, 2019 [160]	PHEN/TPM 15 mg/92 mg	2 (NR)	Participants discontinued due to AE, %	2 (15.4)	13	0 (0)	14	RR	6.3 (0.27 to 144.7)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	Participants discontinued due to AE, %	0 (0)	15	0 (0)	14	RR	0.94 (0.02 to 50.31)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	Participants discontinued due to AE, %	1 (.9)	113	2 (3.6)	56	RR	0.24 (0.02 to 2.72)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	Participants discontinued due to AE, %	0 (0)	54	2 (3.6)	56	RR	0.2 (0.01 to 4.26)	NR
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	AE: GI disorders, %	1 (7.7)	13	0 (0)	14	RR	3.48 (0.13 to 93.3)	NR

Appendix D Table 18. Harms Outcomes Results for Phentermine/Topiramate (Key Question 4)

Study	Intervention Name	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	AE: GI disorders, %	3 (20)	15	0 (0)	14	RR	8.12 (0.38 to 172.87)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: GI disorders, %	12 (10.6)	113	8 (14.3)	56	RR	0.71 (0.27 to 1.86)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: GI disorders, %	7 (13)	54	8 (14.3)	56	RR	0.89 (0.3 to 2.66)	NR
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	AE: Nervous system disorders, %	7 (53.8)	13	4 (28.6)	14	RR	2.92 (0.59 to 14.33)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	AE: Nervous system disorders, %	2 (13.3)	15	4 (28.6)	14	RR	0.38 (0.06 to 2.54)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: Nervous system disorders, %	16 (14.2)	113	7 (12.5)	56	RR	1.15 (0.45 to 2.99)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: Nervous system disorders, %	5 (9.3)	54	7 (12.5)	56	RR	0.71 (0.21 to 2.41)	NR
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	AE: Infections and infestations, %	0 (0)	13	1 (7.1)	14	RR	0.33 (0.01 to 8.93)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	AE: Infections and infestations, %	2 (13.3)	15	1 (7.1)	14	RR	2 (0.16 to 24.87)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: Infections and infestations, %	25 (22.1)	113	15 (26.8)	56	RR	0.78 (0.37 to 1.63)	NR

Appendix D Table 18. Harms Outcomes Results for Phentermine/Topiramate (Key Question 4)

Study	Intervention Name	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: Infections and infestations, %	9 (16.7)	54	15 (26.8)	56	RR	0.55 (0.22 to 1.38)	NR
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	AE: General and administration site conditions, %	2 (15.4)	13	0 (0)	14	RR	6.3 (0.27 to 144.7)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	AE: General and administration site conditions, %	0 (0)	15	0 (0)	14	RR	0.94 (0.02 to 50.31)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: General and administration site conditions, %	13 (11.5)	113	3 (5.4)	56	RR	2.3 (0.63 to 8.42)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: General and administration site conditions, %	2 (3.7)	54	3 (5.4)	56	RR	0.68 (0.11 to 4.23)	NR
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	AE: Musculoskeletal and connective tissue disorders, %	1 (7.7)	13	0 (0)	14	RR	3.48 (0.13 to 93.3)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	AE: Musculoskeletal and connective tissue disorders, %	1 (6.7)	15	0 (0)	14	RR	3 (0.11 to 79.91)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: Musculoskeletal and connective tissue disorders, %	10 (8.8)	113	1 (1.8)	56	RR	5.34 (0.67 to 42.81)	NR

Appendix D Table 18. Harms Outcomes Results for Phentermine/Topiramate (Key Question 4)

Study	Intervention Name	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: Musculoskeletal and connective tissue disorders, %	4 (7.4)	54	1 (1.8)	56	RR	4.4 (0.48 to 40.7)	NR
	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: Respiratory, thoracic and mediastinal disorders, %	13 (11.5)	113	7 (12.5)	56	RR	0.91 (0.34 to 2.43)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: Respiratory, thoracic and mediastinal disorders, %	4 (7.4)	54	7 (12.5)	56	RR	0.56 (0.15 to 2.03)	NR
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	AE: Skin and subcutaneous tissue disorders, %	2 (15.4)	13	0 (0)	14	RR	6.3 (0.27 to 144.7)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	AE: Skin and subcutaneous tissue disorders, %	0 (0)	15	0 (0)	14	RR	0.94 (0.02 to 50.31)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: Injury, poisoning and procedural complications, %	7 (6.2)	113	5 (8.9)	56	RR	0.67 (0.2 to 2.23)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: Injury, poisoning and procedural complications, %	5 (9.3)	54	5 (8.9)	56	RR	1.04 (0.28 to 3.82)	NR

Appendix D Table 18. Harms Outcomes Results for Phentermine/Topiramate (Key Question 4)

Study	Intervention Name	Followup (months since tx ended)	Outcome	IG FU change mean (SD) or n events (%)	IG N	CG FU change mean (SD) or n events (%)	CG N	Stat	Between-group difference (95% CI)	Study-reported p-value
	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: Vascular disorders, %	2 (1.8)	113	2 (3.6)	56	RR	0.49 (0.07 to 3.55)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: Vascular disorders, %	0 (0)	54	2 (3.6)	56	RR	0.2 (0.01 to 4.26)	NR
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	AE: Psychiatric Events, %	1 (7.7)	13	1 (7.1)	14	RR	1.08 (0.06 to 19.31)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	AE: Psychiatric Events, %	1 (6.7)	15	1 (7.1)	14	RR	0.93 (0.05 to 16.42)	NR
Kelly, 2022[161]	PHEN/TPM 15 mg/92 mg + diet and PA training	13 (NR)	AE: Psychiatric Events, %	10 (8.8)	113	1 (1.8)	56	RR	5.34 (0.67 to 42.81)	NR
	PHEN/TPM 7.5 mg/46 mg + diet and PA training	13 (NR)	AE: Psychiatric Events, %	4 (7.4)	54	1 (1.8)	56	RR	4.4 (0.48 to 40.7)	NR
Hsia, 2019[160]	PHEN/TPM 15 mg/92 mg	2 (NR)	AE: Metabolism & nutritional disorders, %	2 (15.4)	13	1 (7.1)	14	RR	2.36 (0.19 to 29.71)	NR
	PHEN/TPM 7.5 mg/46 mg	2 (NR)	AE: Metabolism & nutritional disorders, %	0 (0)	15	1 (7.1)	14	RR	0.29 (0.01 to 7.74)	NR

Abbreviations: AE = Adverse events; CG = Control group; CI = Confidence Interval; FU = Followup; GI = Gastrointestinal; IG = Intervention group; Mg = milligrams; NR = Not reported; PA = Physical activity; PHEN/TPM = Phentermine/ Topiramate; RR = Relative risk; Stat = Statistic; Tx = Treatment

Appendix D Table 19. Associations of Childhood BMI With Outcomes in Adulthood in the International Childhood Cardiovascular Cohort (i3c) Consortium

	CVD Mortality[23]	Cancer Mortality[24]	Diabetes[25]	Dyslipidemia[26]
N	38,589	21,012	6,738	5,195
Time Horizon	35 mean y F/U Mean age at childhood visits: 12 y Mean age at death: 47 y	29-42 mean y F/U, varying by cohort Mean age at childhood visits: 10 y Mean age at death: 45 y	Mean years F/U NR Mean age at childhood visits: NR, range 3-19 Mean age at F/U: 44 y	Mean years F/U 27 Mean age at childhood visits: 10 y Mean age at F/U: 38 y
Continuous HR (95% CI) per 1.0 zBMI increase	1.44 (1.33-1.57)	1.24 (1.03–1.49) +ethnicity adjustment: 1.21 (1.01-1.45) +adult BMI adjustment: 1.35 (1.12-1.63)	1.44 (1.31-1.59)	1.22 (1.15-1.29) Adult BMI: 1.85 (1.74 to 1.97)
Categorical HR (95% CI)	<50%tile: 1 50-<80%tile: 1.01 (0.77-1.33) 85 to <95%tile: 1.61 (1.14-2.27) ≥95%tile: 3.34 (2.42-4.60)	Reference: 1 Overweight (IOTF): 1.49 (1.17–1.90) BMI ≤95%tile: 1 BMI >95%tile: 1.72 (1.15–2.56)	Participants in 4 lowest z-score categories (z-scores <0.5) of childhood BMI showed similar risk of DM, while those with BMI z-scores of 0.5 to <1 and scores ≥1 had incrementally increased risk beginning at age 30 years zBMI 0.5 ~ BMI 75-90%tile zBMI 1 ~ BMI 85-95%tile	NR
Adjustments	Sex, Black race, cohort, mean age, and parental education	Age, sex, cohort; childhood fasting glucose, total cholesterol, triglycerides, and systolic blood pressure	Age, year, sex, race, country, cohort, glucose, insulin	Age, race, sex, cohort
Limitations	Not adjusted for other cardiometabolic risk factors, behavior, adult BMI; cohort enrollment in 1970s-1990s; with mean age at death 47, HRs are for	Not adjusted for smoking, other behaviors; cohort enrollment in 1970s-1990s; with mean age at death 45, HRs are for early cancer	Self-report DM; not adjusted for smoking, other behaviors; cohort enrollment in 1970s-1990s	Not adjusted for other cardiometabolic risk factors, behavior, adult BMI; cohort enrollment in 1970s-1990s

Appendix D Table 19. Associations of Childhood BMI With Outcomes in Adulthood in the International Childhood Cardiovascular Cohort (i3c) Consortium

	premature CVD death	mortality		
Findings by race and ethnicity	Black: 15% Hispanic: NR, reported as very limited representation No significant interactions by race	Black: 13% Hispanic: NR No interactions reported, results remained the same after adjustments	Black: 29% Only White and Black participants analyzed Per zBMI (adjustments as above) Black: 1.31 (1.12, 1.53) White: 1.54 (1.36, 1.74)	80% White, other NR Generally consistent patterns by race but statistically significantly larger association between adult BMI in White participants than Black participants

Abbreviations: BMI=body mass index; DM; diabetes mellitus; F/U=followup; IOTF; International Obesity Task Force; NR=not reported; y= years

Appendix D Table 20. Behavioral Intervention Implementation Table: Summary and Examples of Included Interventions

Primary Population	Children and adolescents with high BMI, such as BMI ≥ 95th percentile for age and sex
Primary Outcomes	Change in BMI
Study Findings	Behavioral weight management interventions were associated with small reductions in BMI and other weight-related outcomes after 6 to 12 months (mean difference in change between groups [MD], -0.7 kg/m2 [95% CI, -1.0 to -0.3]; 28 RCTs [n=4,494]; I^2=86.8%). Larger effects were seen in interventions with higher contact hours and that offered physical activity sessions.
Behavior change goals and techniques	Interventions covered healthy diet, physical activity, and behavior change techniques. Behavior change techniques commonly included goal setting, monitoring diet and activity behaviors, use of positive reinforcement (e.g., sticker charts), stimulus control (e.g., limiting access to tempting foods and limiting screen time), and problem-solving. Other components may include attention to satiety and hunger cues, promoting self-esteem and body satisfaction, dealing with weight-based teasing, and positive parenting. Hands-on activities may include physical activity sessions, cooking and food preparation demonstrations, and understanding food labels.
Interventions contact time and duration	The number of sessions with a live interventionist (over the phone or in-person) ranged from zero to 122 over a time period ranging from 2.25 to 24 months. The median number of sessions was 12 (IQR, 6 to 16), involving an estimated 16.2 hours of contact with an interventionist (IQR, 4 to 37.5 hours) over 6 months (IQR, 5 to 12 months). Interventions including at least 26 hours of contact showed larger effects than those offering fewer than 26 hours of contact.
Settings of Studies	Some were conducted in or initiated from primary care; the interventions with higher contact hours often involved specialty or health education settings for most of the sessions.
To Whom is Intervention Targeted?	Parents were almost always included, and interventions in young children primarily target the parent, with or without activities for the children (e.g., physical games and exercise, food tastings). For elementary-aged children and older, most of the interventions showing greater weight loss actively involved both the parent and child.
Mode and intensity of delivery	Higher-contact trials typically included in-person group sessions, often separate parent-only, child-only, and whole-family sessions, and frequently included some individual family sessions as well. Lower-contact trials typically involved only individual family or parent-only sessions, and may include some phone-based sessions as well as in-person sessions.
Example interventions (age range, BMI criterion, estimated contact hours)*	• Resnicow 2015[132] (2-8, 85-97th percentile, NR [est. <26]) • LAUNCH[139,140,141] (2-5, ≥95th percentile, 30-38) • Kalarchian, 2009[117] (8-12, ≥ 97th percentile, 44) • Stettler, 2014[142] (8-12, 75th-95th percentile, 12) • Bright Bodies[135,136] (8-16, >95th percentile, 78-82) • DeBar, 2012[111] (Girls,12-17, ≥90th percentile, 36) • Kong, 2013[119] (9th - 11th grade, ≥85th percentile, 4)
Materials Provided for Practice†	Bright Bodies: https://www.blueprintsprograms.org/programs/626999999/bright-bodies-weight-management-program/print/ Family-based behavioral treatment: https://familybasedbehavioraltreatment.wustl.edu/ (Free, publicly available manuals and training guides were not found; websites listed here provide information about cost of training and materials)
Evidence of effect modification	Larger effect sizes were found with interventions that had more contact hours (e.g., 26 or more estimated hours) and that provided physical activity sessions (e.g., 1-3 times/week for the duration of the intervention). These features were correlated, however, and their independent effects could not be disentangled.
Comparison group	Usual care or minimal intervention (e.g., designed to be roughly equivalent to what would be received in a reasonably well-resourced usual primary care setting)
Interventionist and	A wide variety of professionals served as interventionists, even within the same study, such as dieticians, health educators, nurses, clinical

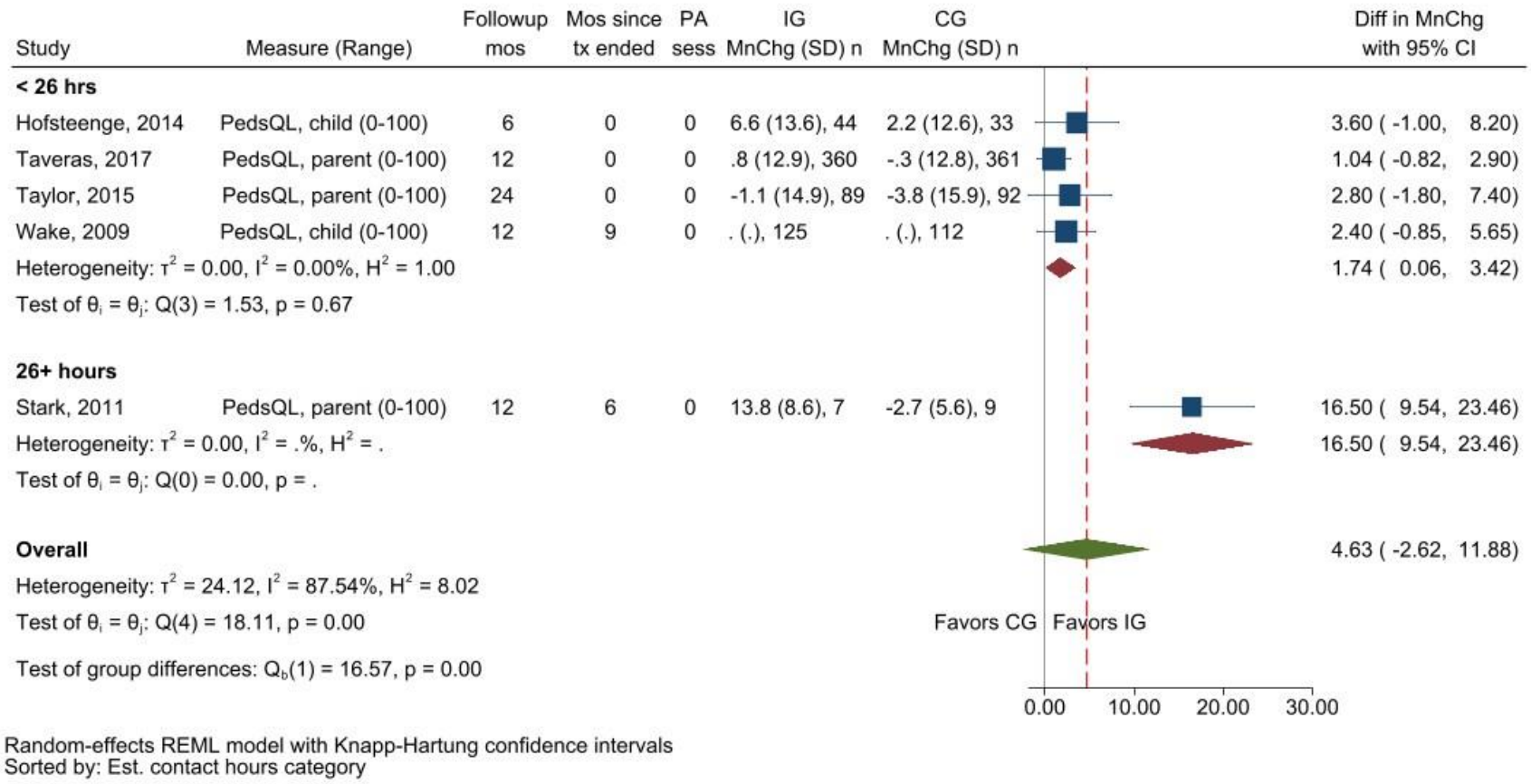
Appendix D Table 20. Behavioral Intervention Implementation Table: Summary and Examples of Included Interventions

Training Required	psychologists, personal trainers, lifestyle coaches, exercise physiologists, and social workers. Primary care clinicians often delivered supportive messages. Some interventions involved multiple clinicians from different disciplines.
Reported Intervention Adherence	Where reported, the average percent of sessions completed generally ranged from the mid-60s to low 80s. The percentage of participants who attended all planned sessions ranged from 31 to 93 in nine trials that reported this outcome.

*List only includes studies conducted in the US with a statistically significant reduction in at least one weight outcome at 6- to 12-month followup. Inclusion of studies is for example purposes only and does not indicate endorsement by the USPSTF
†Materials for practice were not specifically referenced in the included studies, but identified from internet searches of the named interventions in the listed studies.

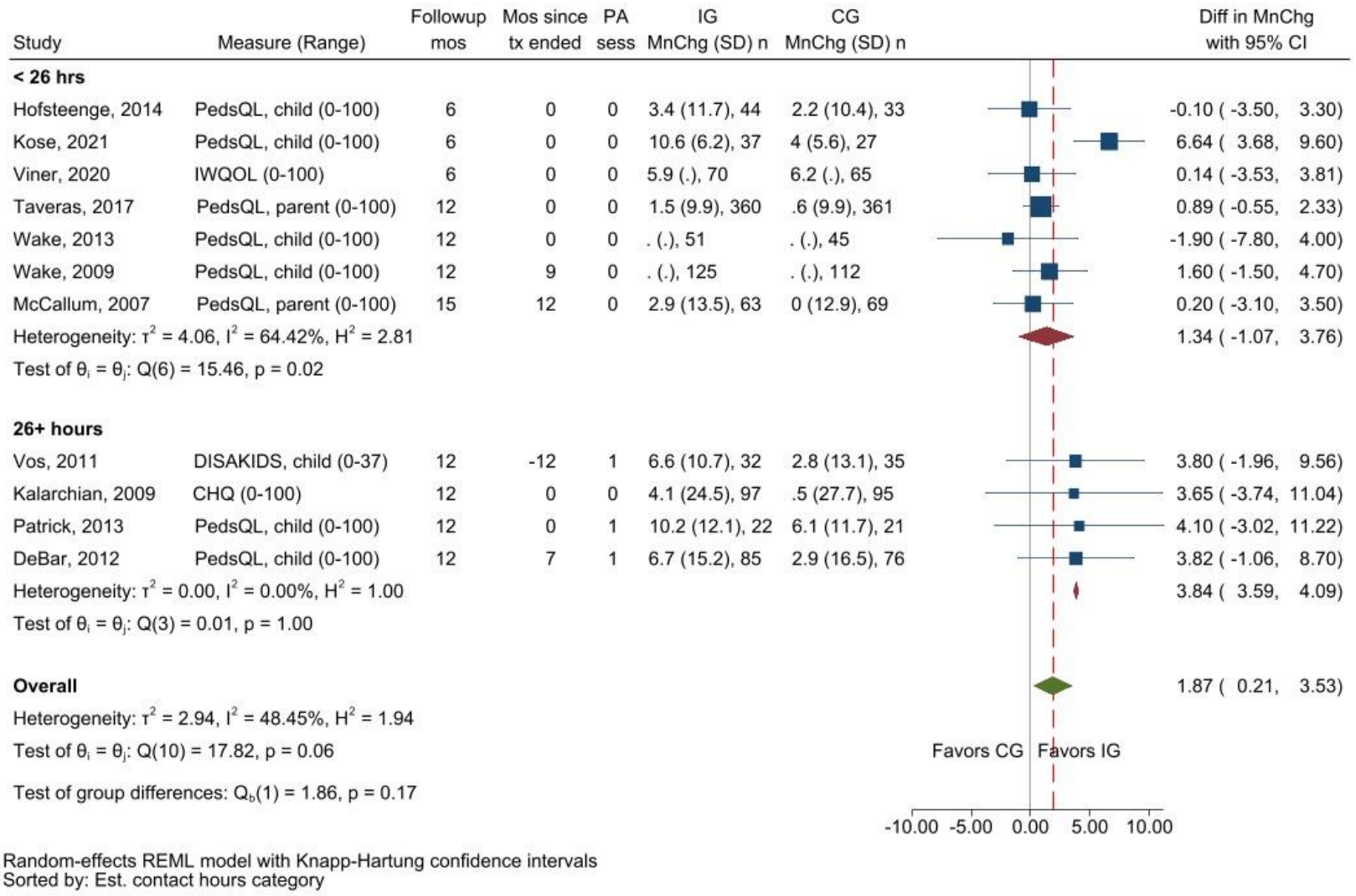
Abbreviations: BMI = Body mass index; Est = estimated; IQR = Interquartile range; Kg/m2 = Kilograms per meters squared; MD = Mean difference; NR = Not reported; RCTs = Randomized controlled trials

Appendix E Figure 1. Pooled Analysis of Change in Physical Quality of Life in Behavioral Interventions Compared With Controls, by Estimated Hours of Contact



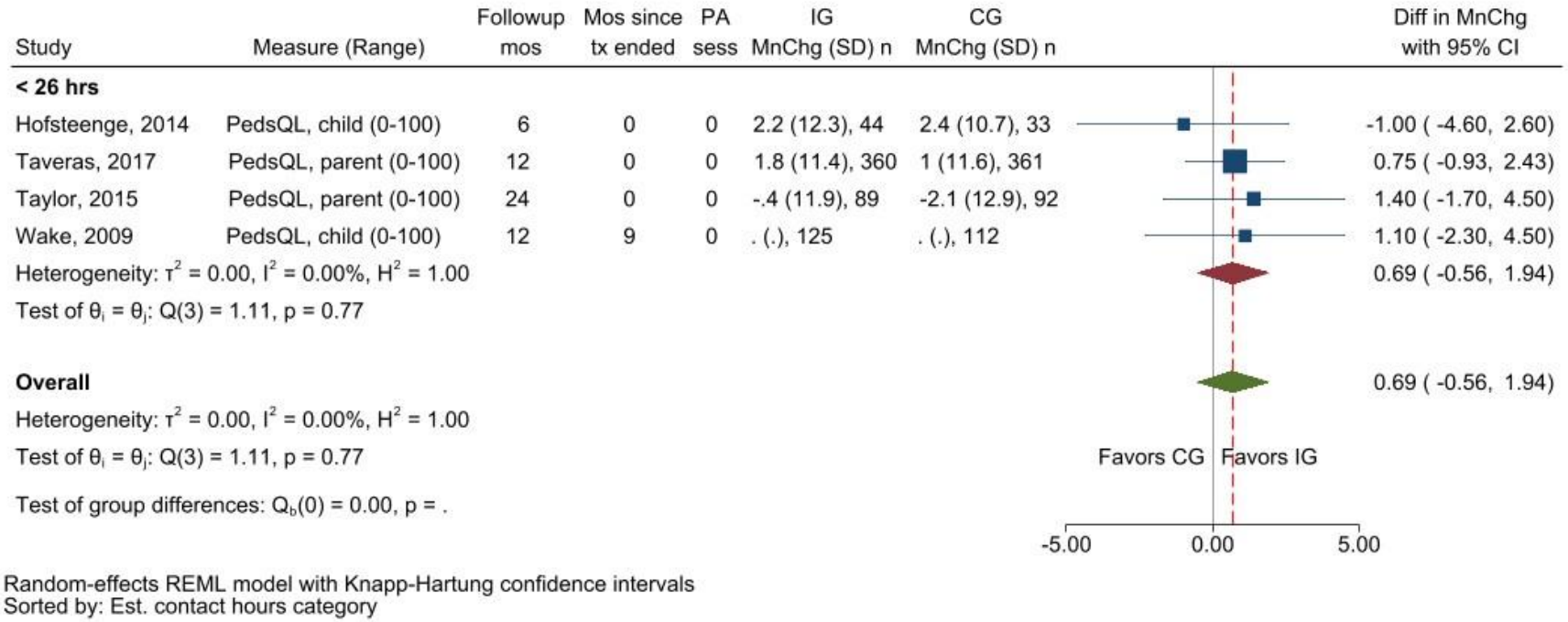
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; PedsQL = Pediatric Quality of Life Inventory; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 2. Pooled Analysis of Change in Total or Global Quality of Life (Standardized Mean Difference) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



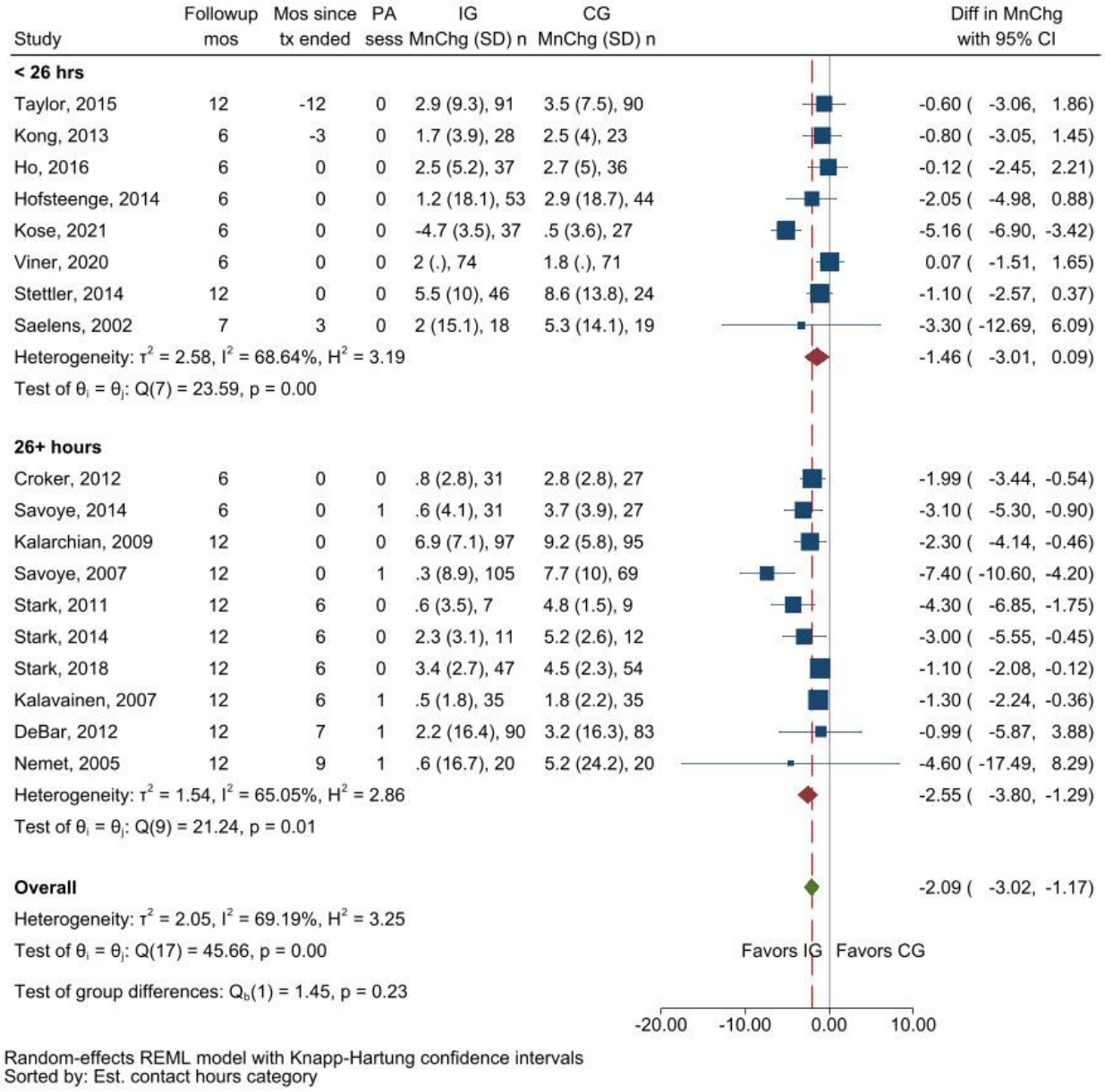
Abbreviations: CG= Control group; CHQ = Child Health Questionnaire; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; PedsQL = Pediatric Quality of Life Inventory; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 3. Pooled Analysis of Change in Psychosocial Quality of Life in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



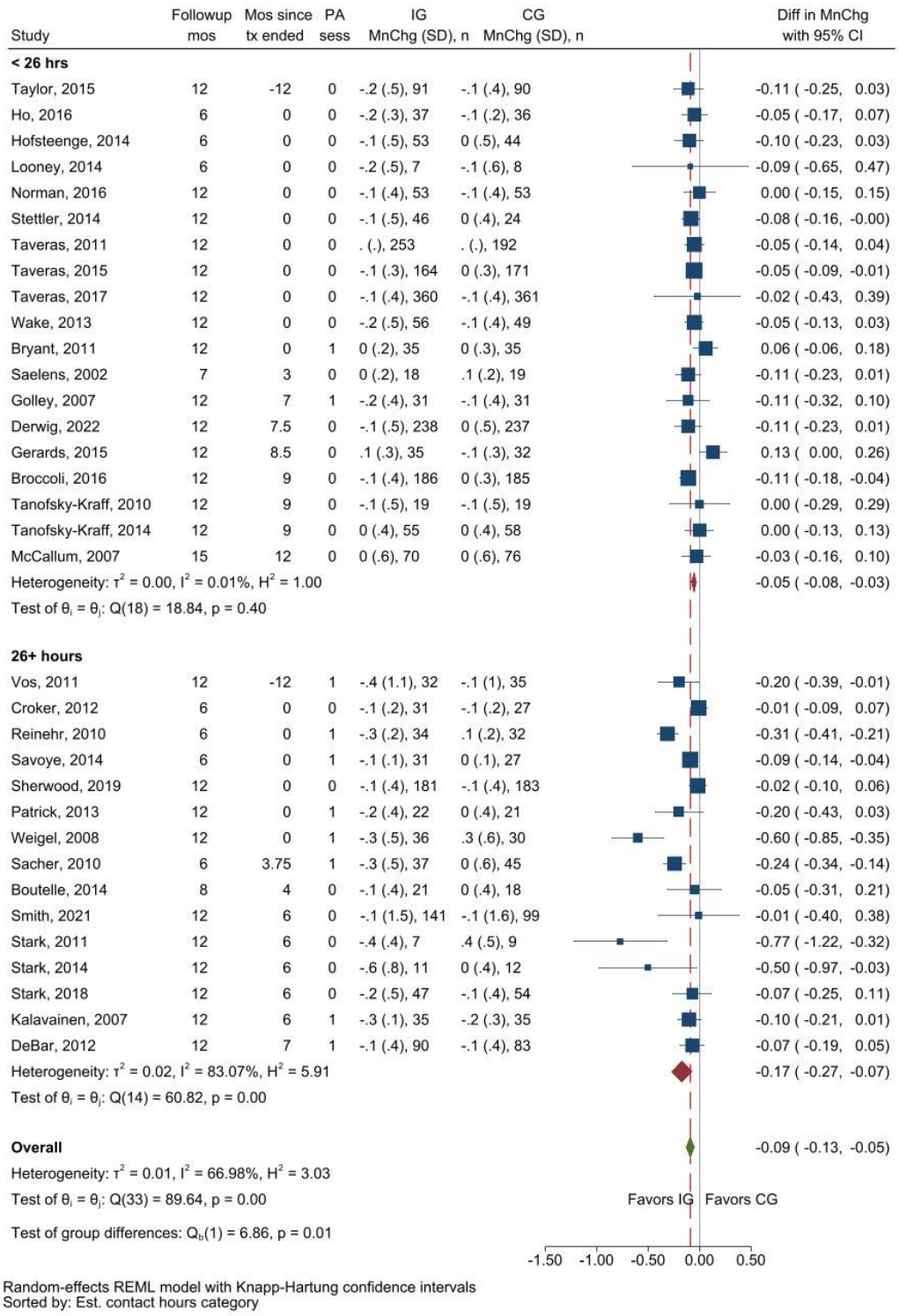
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; PedsQL = Pediatric Quality of Life Inventory; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 4. Pooled Analysis of Change in Weight (kg) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



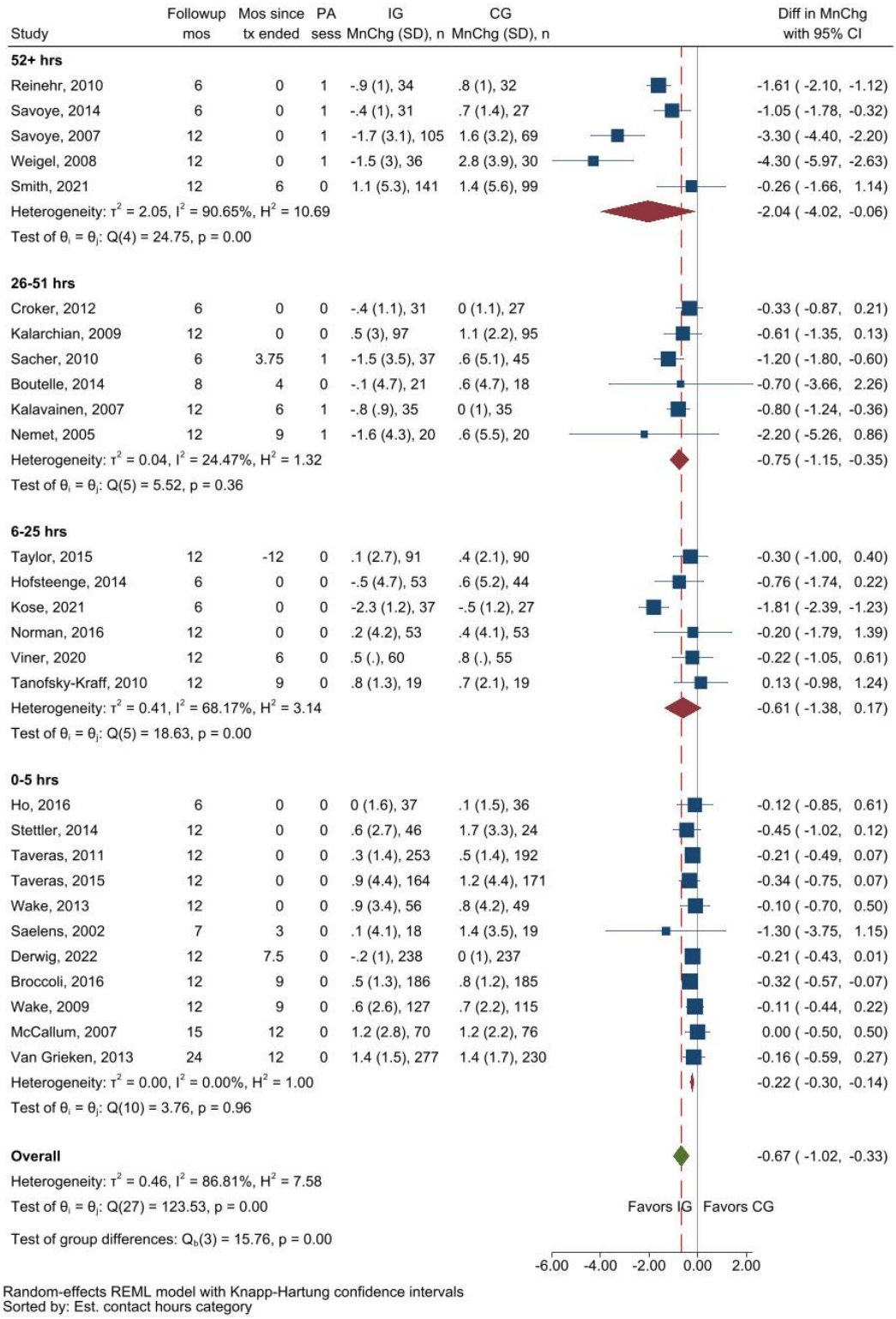
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Kg = Kilograms; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 5. Pooled Analysis of Change in zBMI (z-score) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



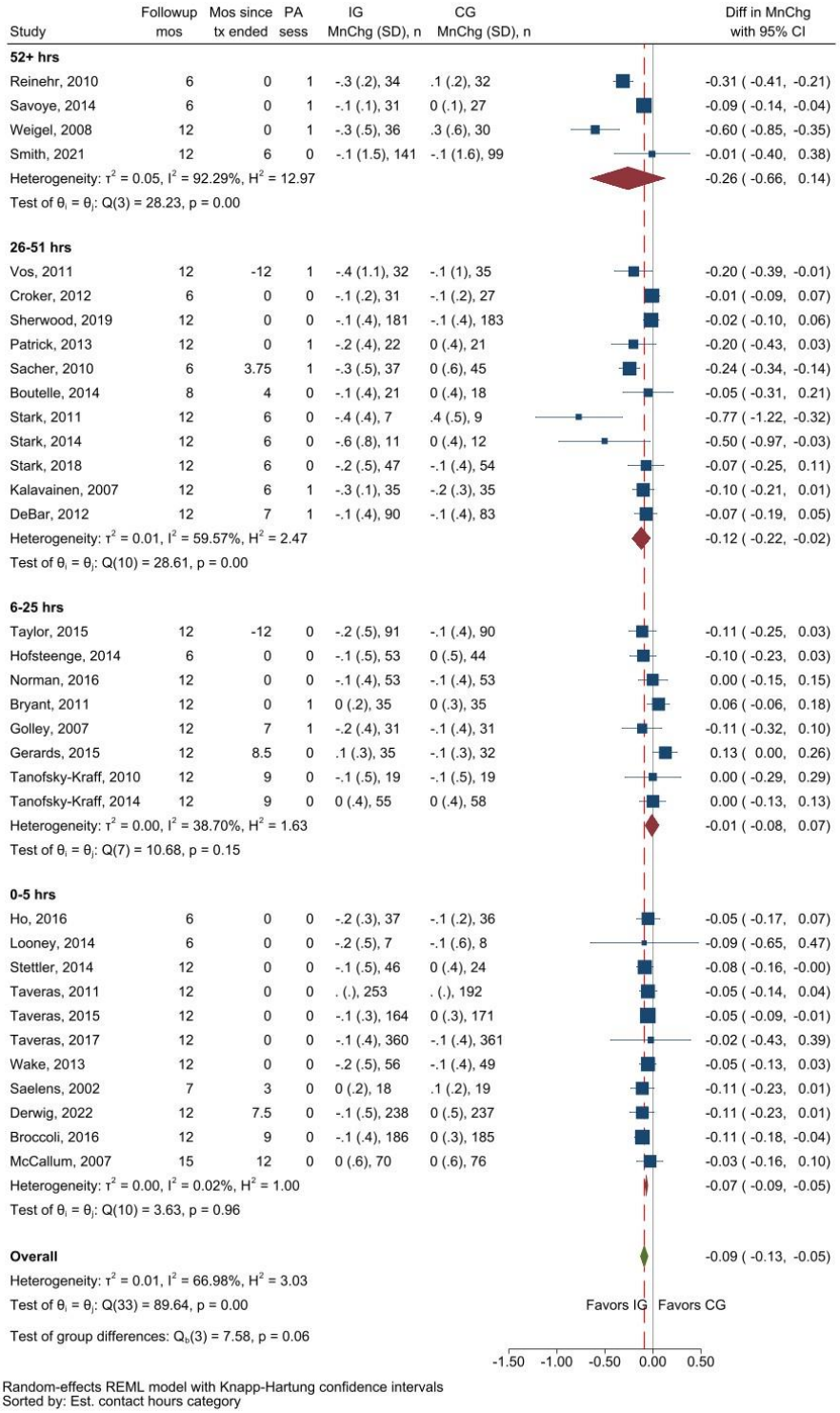
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment; zBMI = Standardized body mass index

Appendix E Figure 6. Pooled Analysis of Change in Body Mass Index (kg/m^2) in Behavioral Interventions Compared With Controls, by Four Levels of Estimated Contact Hours



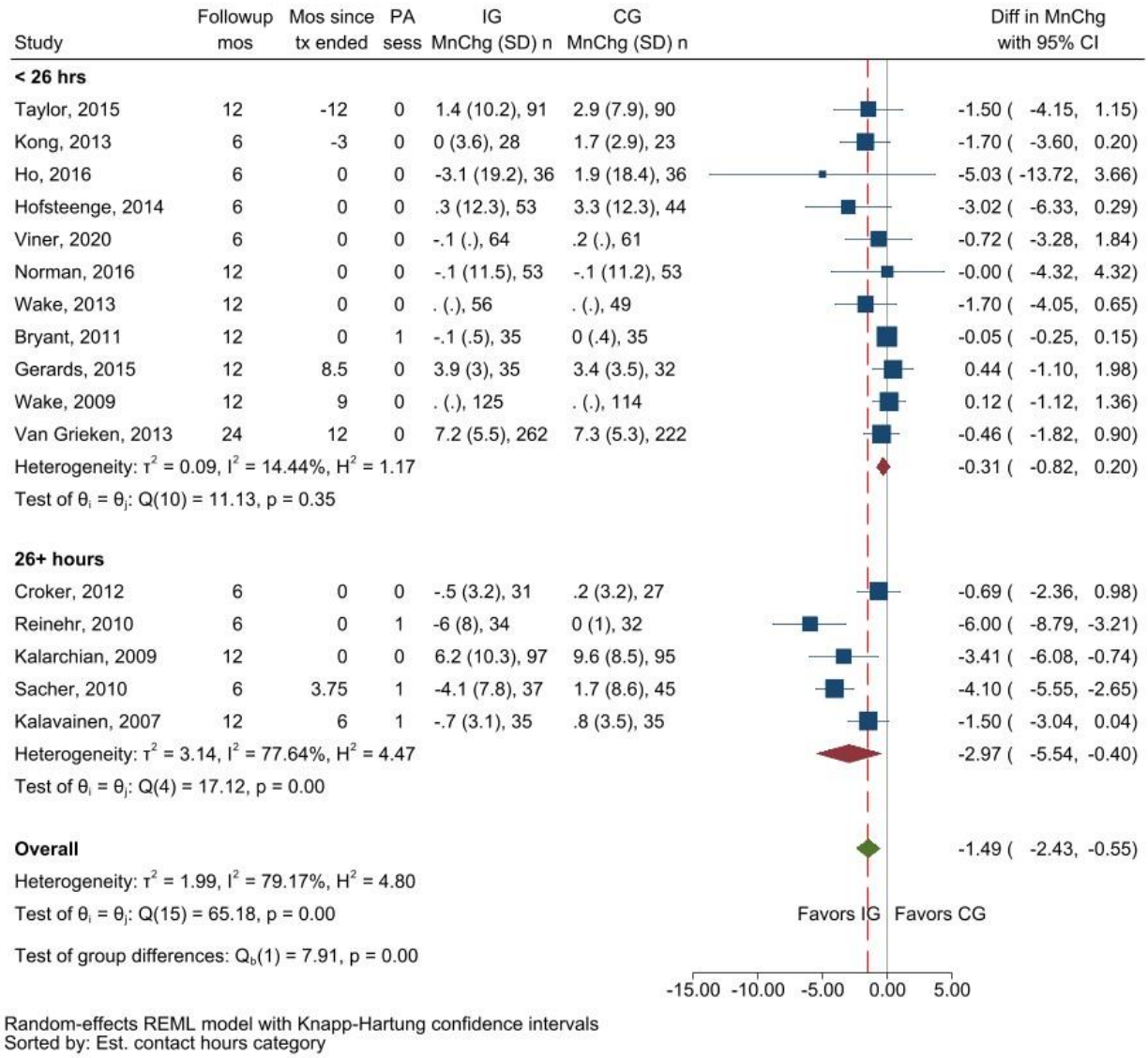
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Kg/m^2 = Kilograms per meters squared; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 7. Pooled Analysis of Change in zBMI (z-score) in Behavioral Interventions Compared With Controls, by Four Levels of Estimated Contact Hours



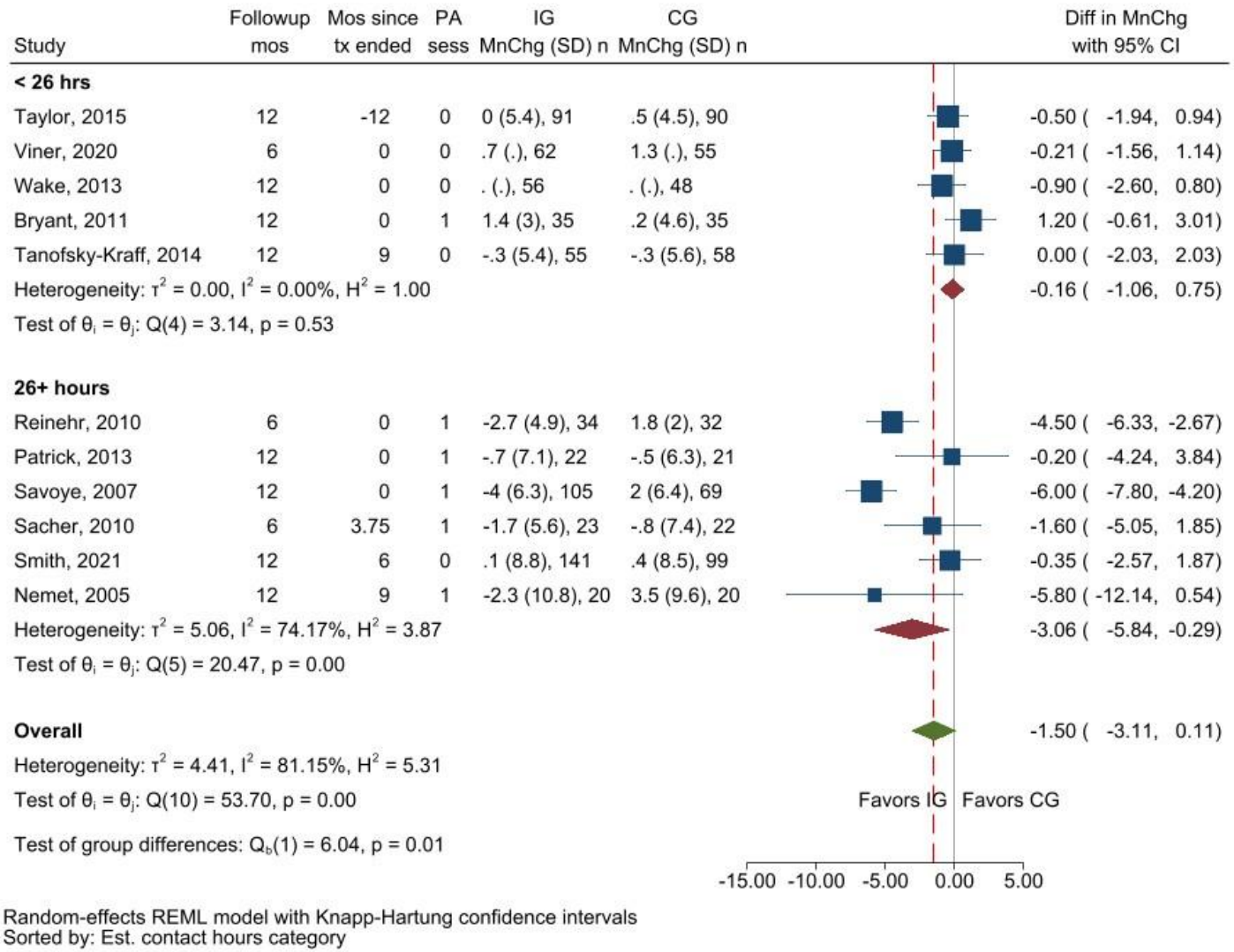
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment; zBMI = Standardized body mass index

Appendix E Figure 8. Pooled Analysis of Change in Waist Circumference (cm) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



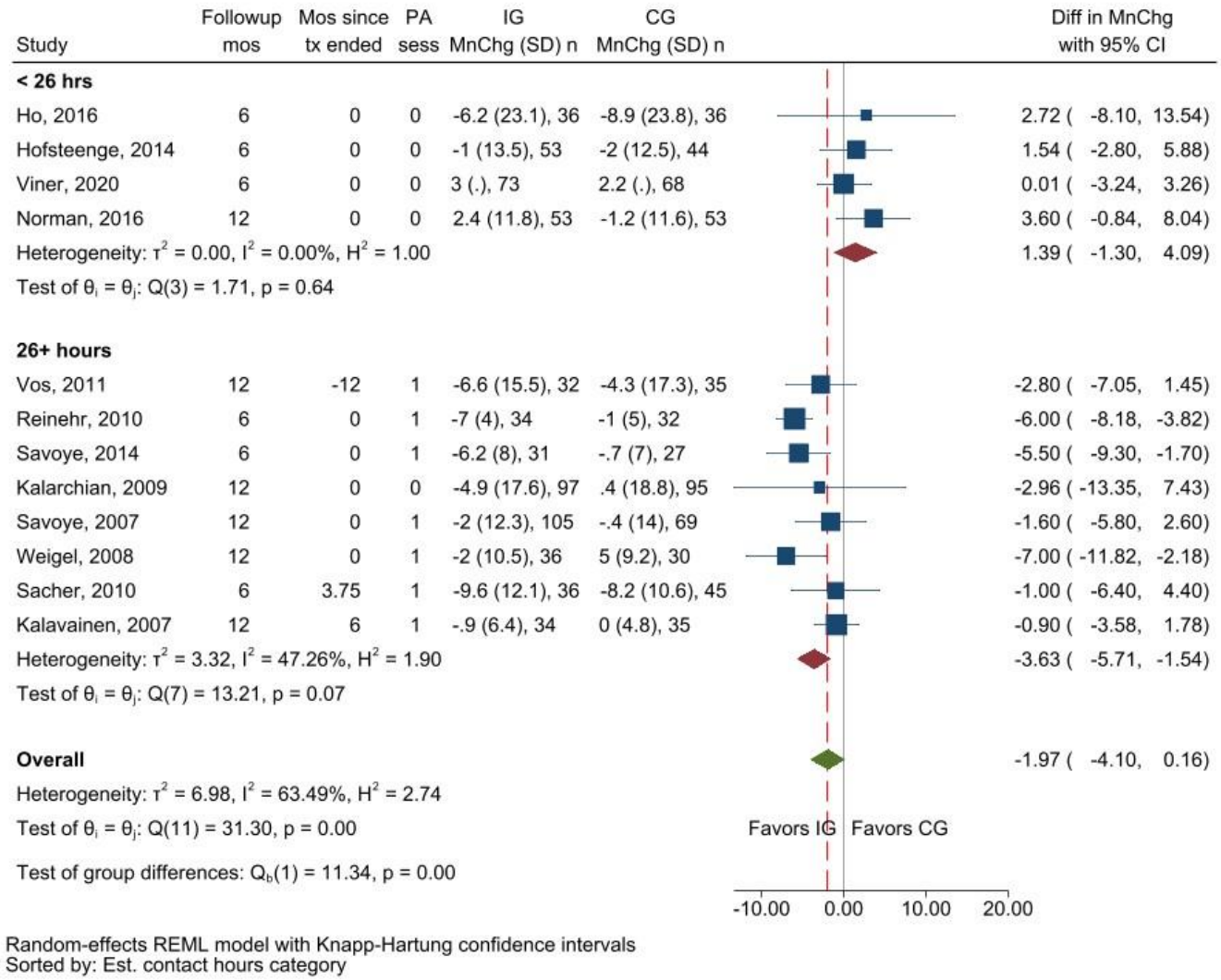
Abbreviations: CG= Control group; CI = Confidence interval; cm = cemtimeters; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 9. Pooled Analysis of Change in Percent Body Fat in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



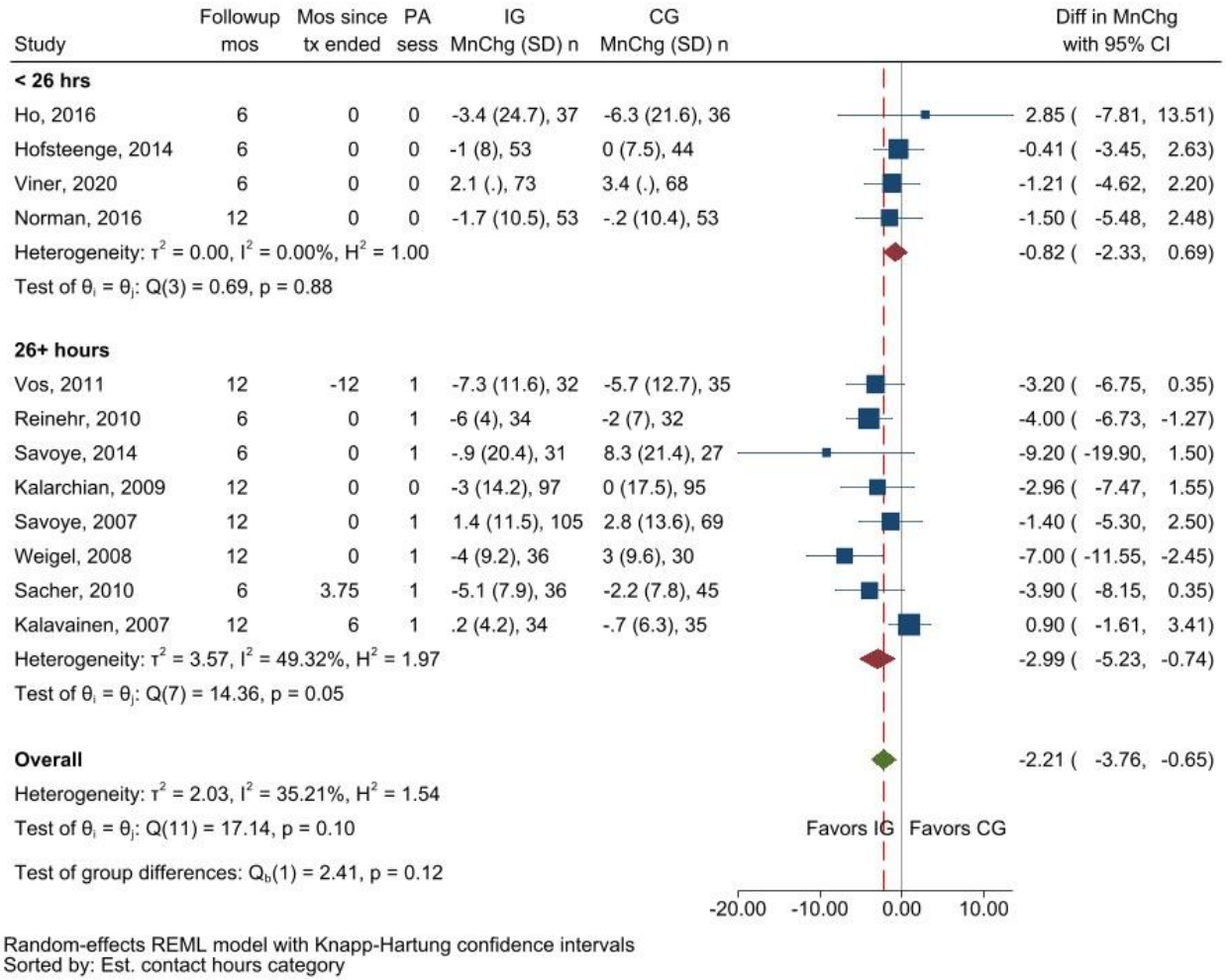
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 10. Pooled Analysis of Change in Systolic Blood Pressure (mm Hg) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



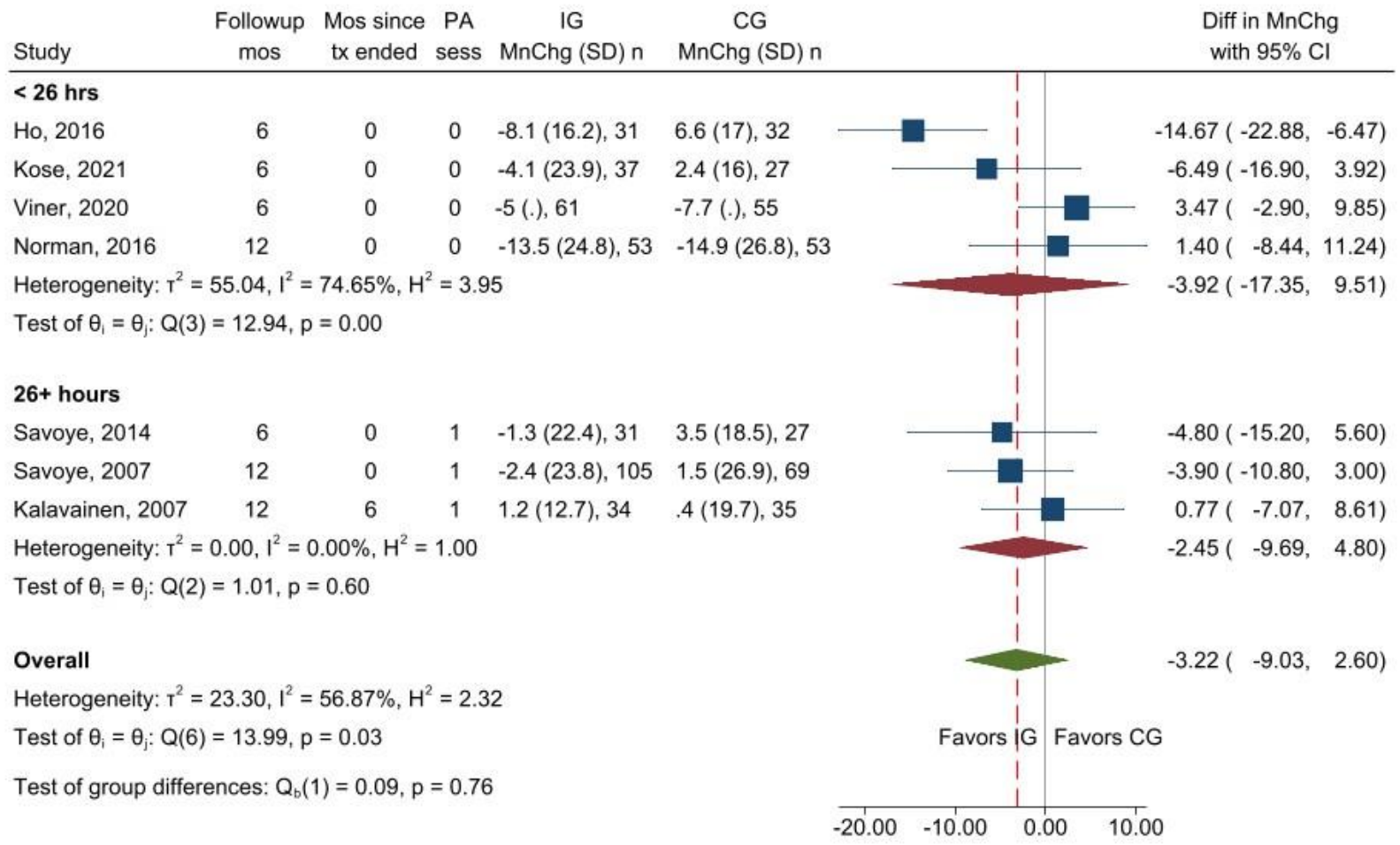
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Mm Hg = Millimeters of mercury; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 11. Pooled Analysis of Change in Diastolic Blood Pressure (mm Hg) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



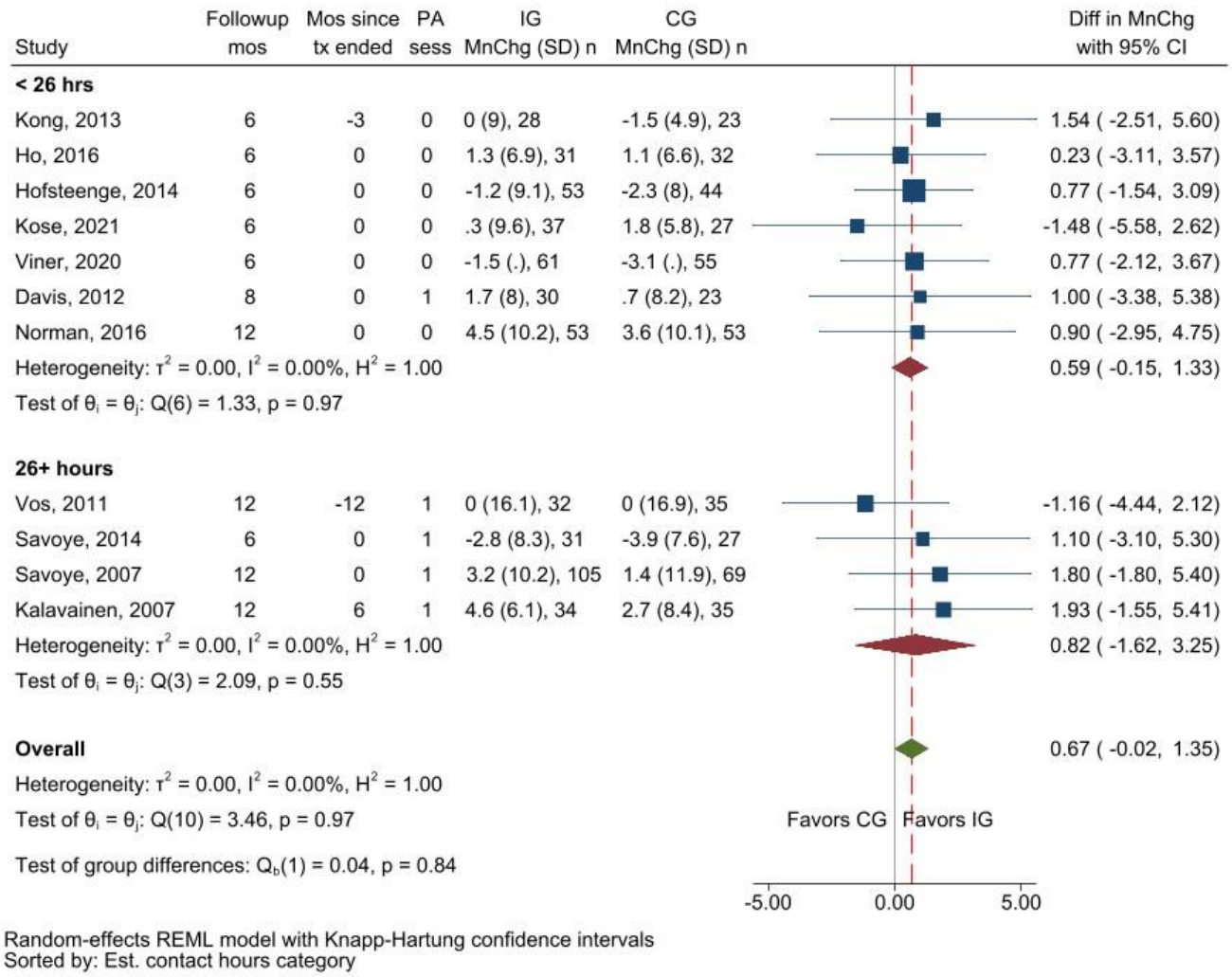
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Mm Hg = Millimeters of mercury; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 12. Pooled Analysis of Change in Low-Density Lipoprotein Cholesterol (mg/dL) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



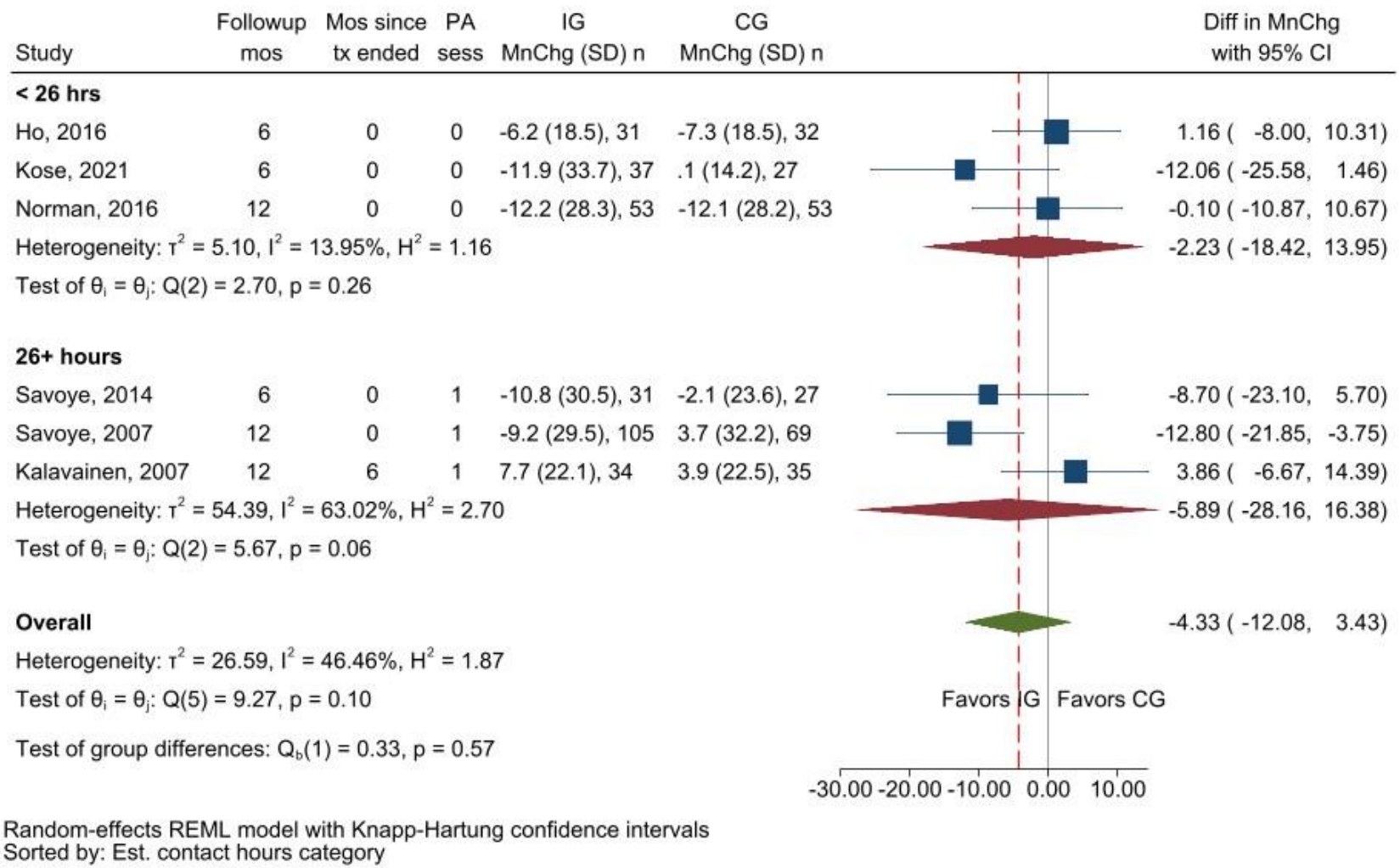
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Mg/dL = Milligrams per deciliter; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 13. Pooled Analysis of Change in High-Density Lipoprotein Cholesterol (mg/dL) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



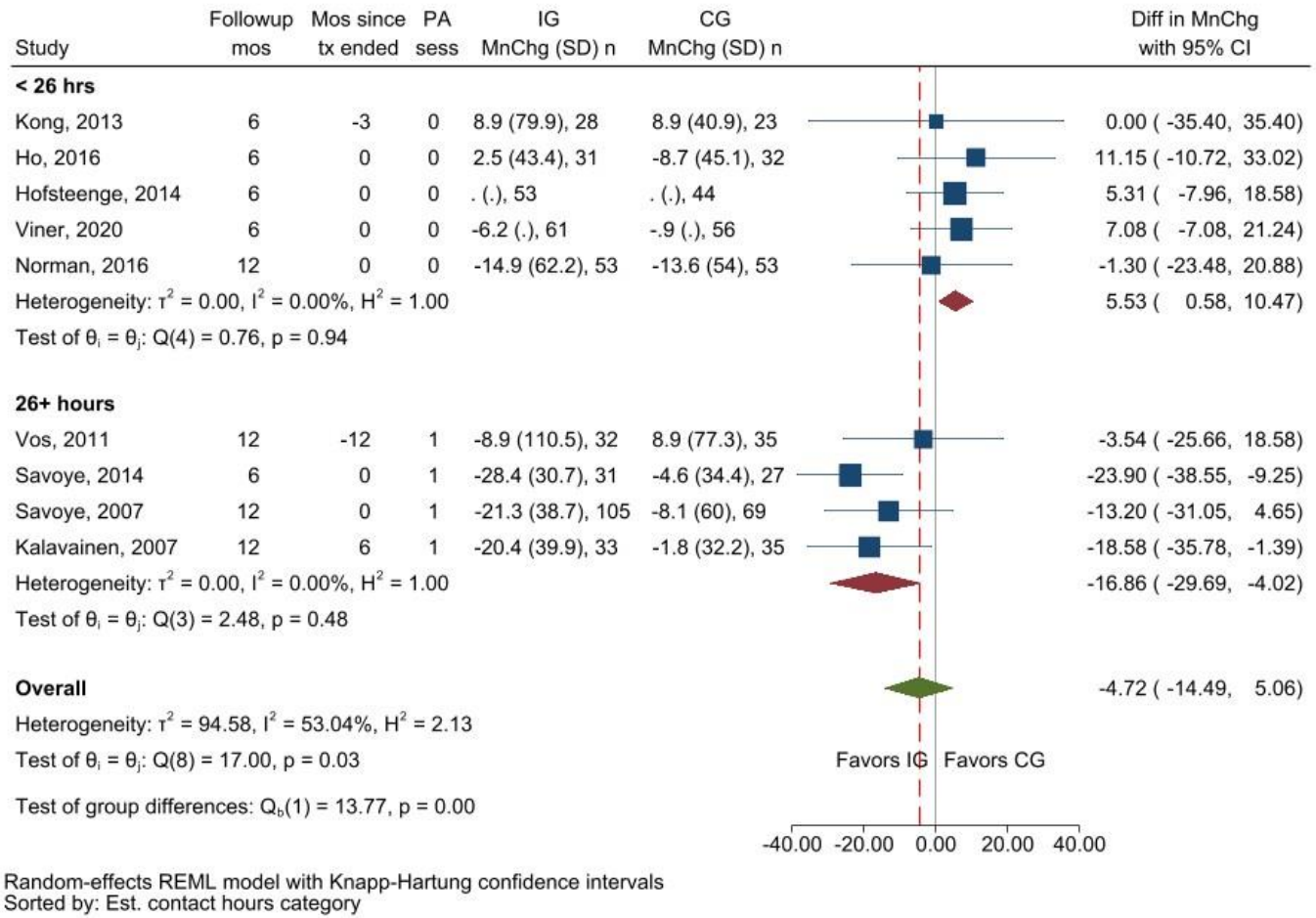
Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Mg/dL = Milligrams per deciliter; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 14. Pooled Analysis of Change in Total Cholesterol (mg/dL) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Mg/dL = Milligrams per deciliter; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix E Figure 15. Pooled Analysis of Change in Triglycerides (mg/dL) in Behavioral Interventions Compared With Controls, by Estimated Contact Hours



Abbreviations: CG= Control group; CI = Confidence interval; Diff = Difference; Est. = Estimated; Hrs = Hours; IG = Intervention group; Mg/dL = Milligrams per deciliter; MnChg = Mean change; Mos = Months; n = number of participants; PA = Physical activity; REML = Restricted maximum likelihood; SD = Standard deviation; Sess = Session; Tx = Treatment

Appendix F. Ongoing Studies

Trial	Location	N	Duration (Months)	Intervention	Relevant outcomes	Trial registry no.	Est. completion date
Behavioral Studies							
Dyad Plus Effectiveness	US	90	6	A coordinated program (Dyad Plus) that aims to facilitate self-monitoring, positive communication, joint problem solving, and social support to increase physical activity, healthy eating, and weight loss. Participants of the Brenner FIT (Families In Training) pediatric weight management program and their parent/guardian will co-enroll in weight loss programs. Parents/guardians will receive the components of By Design Essentials. Youth 2-18 years old are referred by a physician for overweight or obesity.	zBMI, PA, FBG, fasting insulin, TC	NCT04036331	June 2023
Guided self-help Obesity Treatment in the primary care setting (GOTDoc)	US	200	12	Parent-child dyads will be randomized to receive health coaching focused on healthy diet and PA behaviors or usual care. The overall goal of this program is to help children improve their weight status by losing ½ to 1 lb per week. Parents interested in losing weight are also encouraged to do so since parent weight loss is highly correlated with child weight loss.	zBMI, PA, diet scores	NR	NR
Executive Function Training in Childhood Obesity: Food Choice, Quality of Life, and Brain Connectivity (TOuCH)	Spain	46	12	This study aims to explore the impact of executive function training on food-related choices, cognitive and neuroimaging outcomes, but also on the psychological and physical status and quality of life measures. Obese children in the intervention group will complete home-based executive function training by iPad. At the same time, they will be asked to learn basic psychoeducational contents and send pictures of their daily meals. Education around learning healthy habits will also be a part of the program.	BMI, WC, food choices, PedsQL, PA	NCT03615274	January 2021

Appendix F. Ongoing Studies

Trial	Location	N	Duration (Months)	Intervention	Relevant outcomes	Trial registry no.	Est. completion date
TEXT message Behavioral Intervention for Teens on Eating, physical activity, and Social wellbeing (TEXTBITES)	Australia	150	12	An RCT comparing a two-way text message intervention, with optional telephone health counseling, to usual care in adolescents (13-18 years old) who are overweight (recruited from a pediatric weight management clinic and the broader community in Sydney, Australia).	zBMI, dietary intake, PA, sedentary behavior, QoL, eating disorder symptoms, depression symptoms	ACTRN12619000389101	December 2021
Adaptando Dieta y Acción Para Todos (ADAPT+)	US	48 – 60 dyads	2	Focus groups targeting Latino families, followed by a small quasi-RCT. The RCT will include an 8-session, culturally sensitive multi-family behavioral obesity intervention targeting families with pre-adolescents, to increase healthy eating and physical activity lifestyle behaviors in both parents and their children.	zBMI, BP, PA, dietary intake	NR	NR
FITLINE	US	501	12	Two practice-based interventions on improving diet and physical activity and reducing BMI among overweight and obese 8-12 year olds seen in pediatric practice: (1) Fitline-Coaching, consisting of a pediatric practice-based component plus Fitline counseling and workbook, or (2) Fitline-Workbook, consisting of the same practice-based component, but only the family workbook materials mailed over 8 weeks, with no referral to Fitline coaching	BMI, zBMI, dietary intake, PA	NCT03143660	January 2022
eatNplay	US	44 families	6	A RCT pilot trial of a rural, family-based, telehealth intervention that aims to improve weight-related behaviors among children, compared to monthly newsletter	BMI, zBMI, QoL, dietary intake, sedentary behavior, PA	NR	NR
Primary care pediatrics, Learning, Activity, and	US	528 families	24	Family-based behavioral treatment that targets diet, activity, behavioral skills, parenting, and social facilitation in children and their parents. The treatment includes: 1)	BMI, zBMI, PA, sedentary behavior	NR	NR

Appendix F. Ongoing Studies

Trial	Location	N	Duration (Months)	Intervention	Relevant outcomes	Trial registry no.	Est. completion date
Nutrition (PLAN) with Families study				the Traffic Light Eating Plan, which utilizes RED, YELLOW, and GREEN labels for food to guide families toward the goal of consuming healthy low energy dense, high nutrient dense foods; 2) the Traffic Light Activity Program, also utilizes RED, YELLOW, and GREEN labels for different levels of caloric expenditure to increase physical activity and reduce sedentary behaviors; 3) a variety of behavioral techniques, including stimulus control, self-monitoring, goal setting, problem solving, finding behavioral substitutes for highly reinforcing food, improving positive parenting, providing reinforcers for behavior change and weight loss; and 4) facilitation of support in the family and peer environments to optimize the durability and generalizability of improved eating and activity habits across multiple social and environmental contexts (e.g., home, school, with friends).			
Hearts & Parks	US	327	12	A two-arm, randomized crossover controlled trial comparing routine primary care management of childhood obesity versus a novel clinic/family/community partnership program to treat childhood obesity. The goal is to evaluate how different types of physical activity and nutrition education and support (in addition to normal clinical care) through attendance and participation in the Duke Healthy Lifestyles/Bull City Fit clinic/community program, affect children's health.	zBMI, PA, QOL, FPG, Lipids	NCT03339440	June 2021
Population Effects of MI on Pediatric	US	329	24	A cluster randomized effectiveness trial, pediatric primary care practices will be recruited (18 in total). Intervention arm	BMI, % distance from the sex-age-specific 95%	NCT03177148	August 2021

Appendix F. Ongoing Studies

Trial	Location	N	Duration (Months)	Intervention	Relevant outcomes	Trial registry no.	Est. completion date
Obesity in Primary Care (BMI2+)				practices will select 1-2 pediatric clinicians, including pediatricians (PED) and nurse practitioners (NP), to receive in-person training in Motivational Interviewing (MI), behavioral therapy, billing and coding, and study procedures. Over 24 months, parents in the IG may receive up to 4 in-person, MI-based counseling sessions with a trained pediatric clinician and up to 6 telephone counseling sessions with an MI-trained Registered Dietician (RD).	percentile		
Implementation and effectiveness of a network approach (de Laat, et. al)	The Netherlands	180	12	An integrated network approach of preventive care for children with overweight and obesity in designated neighborhoods, in which nurses fulfil the role of central care providers. The theory behind the integrated network approach is supporting overweight children and their families is based on patient and family empowerment and self-management.	BMI, PedsQL, IWQOL, dietary behaviors, PA	NTR6813	January 2020
The More and Less Study Europe	Multisite (Romania, Spain, Sweden)	300	9	A 10 week parent training group session (More and Less Program) followed by a 6-month mobile phone based intervention. Both components aim to develop healthy lifestyle behaviors regarding dietary habits and physical activity in 2-6 year olds. The intervention is delivered towards the parents.	zBMI, WC, CEBQ, PA, sedentary behavior	NCT03800823	December 2023
Gamification-based smartphone application for weight loss in overweight and obese adolescents (Timpel, et. al)	US	108	6	A gamification-based smartphone application for weight loss in overweight and obese adolescents. The application combines tracking (monitoring) and gamification to develop a healthy lifestyle and can be a tool in the management of obesity in children and teenagers.	zBMI, WC, BP, Lipids, FPG, IWQOL, PA	NR	NR

Appendix F. Ongoing Studies

Trial	Location	N	Duration (Months)	Intervention	Relevant outcomes	Trial registry no.	Est. completion date
Family-based behavioral treatment of childhood obesity (FABO) study	Norway	120	24	Seventeen weekly family-based treatment sessions at the hospital obesity clinic followed by monthly follow-up sessions with their local nurse and follow-up sessions at the hospital every third month for 2 years. The treatment targets both child and parent life-style; eating habits, physical activity, sedentary activity and sleep habits. Behavior modification techniques are systematically employed; such as self-monitoring, goal setting, reward systems, problem solving and stimulus control. In addition, FBSFT focuses on facilitating lifestyle change across different settings (family, friends, school and community) and harnessing social support for healthy habits, which is considered important for long-term weight control.	BMI, BMI SDS, % above the IOTF cut-off for OW, WC, % body fat, BP, dietary intake, PA	NCT02687516	May 2021
Study for using Technology to Reach Individual Excellence (STRIVE)	US	68	6	An RCT that will test the feasibility of using mHealth to reduce cardiometabolic risk in children by collecting longitudinal patient generated health behavior data and providing clinical recommendations in a closed-loop feedback system	zBMI, dietary intake, PA, sedentary behavior	NCT 02659163	October 2018
Pharmacology studies							
Lifestyle Counseling and Medication for Adolescent Weight Management (QUEST)	US	120	12	1 year of semaglutide plus relatively low-intensity behavioral counseling (12 contact hours) compared to 1 year of intensive (52 contact hours) behavioral counseling in adolescents with severe obesity	BMI	NCT04873245	January 2025
Brain Activation and Satiety in Children 2	US	64	6	24 weekly sessions of family-based behavioral treatment with weekly injections of 2 mg exenatide (IG) or matching placebo	zBMI, body composition assessed with	NCT04520490	August 2024

Appendix F. Ongoing Studies

Trial	Location	N	Duration (Months)	Intervention	Relevant outcomes	Trial registry no.	Est. completion date
(BASIC2)				(CG).	bioelectrical impedance, insulin resistance		
SMART Use of Medication for the Treatment of Adolescent Severe Obesity (SMART)	US	150	11	Individual lifestyle counseling for 12 or 24 weeks with stepped therapy to phentermine and topiramate; groups are randomized to timing and sequence of adding pharmacotherapy as an adjunct to lifestyle counseling in adolescents with BMI ≥1.2 times the 95th percentile or ≥35 kg/m^2 who do not achieve 5% BMI loss with lifestyle counseling alone.	BMI	NCT04007393	August 2025