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Counseling and Behavioral Interventions for Healthy Weight and Weight Gain in Pregnancy: A Systematic Review for the U.S. Preventive Services Task Force

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Structured Abstract

Background: Counseling and active behavioral interventions to limit excess gestational weight gain (GWG) during pregnancy may improve health outcomes for women and infants.

Purpose: To synthesize evidence on the effects of counseling and active behavioral interventions for healthy weight and weight gain during pregnancy for the United States Preventive Services Task Force (USPSTF).

Data Sources: Cochrane Central Register of Controlled Trials (through March 20, 2020) and Cochrane Database of Systematic Reviews (through March 20, 2020), and MEDLINE (1946 to March 20, 2020), and manually reviewed reference lists, with surveillance through February 5, 2021.

Study Selection: English-language randomized controlled trials and controlled trials of the effectiveness, benefits, and adverse effects of counseling and active behavioral interventions to limit excess GWG during pregnancy or in women planning pregnancy, including adolescents.

Data Extraction: One investigator abstracted details about study design, patient population, setting, intervention, followup, and results, reviewed by a second investigator for accuracy. Two investigators independently assessed study quality using methods developed by the USPSTF. Discrepancies were resolved through consensus.

Data Synthesis (Results): Sixty-eight studies (64 randomized clinical trials and 4 nonrandomized trials) of interventions to limit excess GWG during pregnancy were included. Sixty-seven studies evaluated interventions during pregnancy and one trial evaluated an intervention prior to pregnancy

GWG interventions were associated with small, but statistically significant reductions in risk of gestational diabetes mellitus (GDM) (43 trials; relative risk [RR], 0.87 [95% confidence interval (CI), 0.79 to 0.95]; *I*²=16.4%; absolute risk difference [ARD], -1.6% [95% CI, -2.5 to -0.7]) and emergency cesarean delivery (14 trials; RR, 0.85 [95% CI, 0.74 to 0.96]; I²=0%; ARD, -2.4% [95% CI, -4.2 to -0.3]). There was no association between GWG interventions versus controls for gestational hypertension (28 trials; RR, 0.87 [95% CI, 0.70 to 1.04]; I^2 =32.5%; ARD, -0.8% [95% CI, -1.9 to 0.2]), risk of cesarean delivery (34 trials; RR, 0.98 [95% CI, 0.91 to 1.04]; I²=10.8%; ARD, -0.7% [95% CI, -2.4 to 0.8]), preeclampsia (27 trials; RR, 0.98 [95% CI, 0.84 to 1.13], I²=0%; ARD, 0.1% [95% CI, -0.6 to 0.5]), postpartum hemorrhage (9 trials; RR, 1.00 [95% CI, 0.88 to 1.15]; I²=0%; ARD, -0.1% [95% CI, -1.3 to 1.5]), or perineal trauma (8 trials; RR, 0.86 [95% CI, 0.52 to 1.50]; I²=57.0%; ARD, -0.7% [95% CI, -3.2 to 1.7]). Stratified analyses demonstrated statistically significant interactions between effects of GWG interventions on gestational hypertension, high intensity interventions (p=0.006 for interaction) and active interventions (p<0.001 for interaction); and effects on perineal trauma and BMI category (p=0.003 for interaction) and intervention intensity (p=0.003 for interaction); but subgroup effects were not observed for other maternal health outcomes. GWG interventions were not associated with maternal death (2 trials), but data were limited by few trials and low event rates.

Data on interventions to reduce prepregnancy weight were limited. One trial showed a reduction in prepregnancy weight loss associated with a counseling intervention; however, intervention participants gained more weight versus controls during pregnancy (13.2 kg vs. 10.3 kg, p=0.03), with no effect on rates of excess GWG.

For infant health outcomes, GWG interventions were associated with decreased risk of infant macrosomia (25 trials; RR, 0.77 [95% CI, 0.65 to 0.92]; I^2 =38.3%; ARD, -1.9% [95% CI, -3.3 to -0.7]) and large for gestational age (26 trials; RR, 0.89 [95% CI, 0.80 to 0.99]; I^2 =0%; ARD, -1.3, [95% CI, -2.3 to -0.3]), but were not associated with risk of preterm birth, respiratory distress syndrome, shoulder dystocia, or neonatal intensive care unit admission. GWG interventions were not associated with neonatal death or stillbirth (11 trials); data were limited by few trials and low event rates. Stratified analyses demonstrated statistically significant interactions between effects of GWG interventions on macrosomia and high intensity interventions (p=0.03 for interaction), but subgroups effects were not observed for other infant health outcomes.

GWG interventions were associated with one kilogram lower weight gain across all prepregnancy weight categories (55 trials; pooled mean difference [MD], -1.02 kg [95% CI, -1.30 to -0.75]; I^2 =60.3%). High-intensity interventions (12 or more sessions) were associated with greater effects (28 trials; MD, -1.47 kg [95% CI, -1.78 to -1.22]; I^2 =13.0%) than moderate-(3-11 sessions) (18 trials; MD, -0.32 kg [95% CI, -0.71 to -0.04]; I^2 =17.6%) or low-intensity interventions (fewer than 2 sessions) (9 trials; MD, -0.64 kg [95% CI, -1.44 to 0.02]; I^2 =48.4%; p<0.001 for interaction). There was no interaction between intervention type (active vs. counseling only) or baseline BMI category and effects on GWG. Interventions were also associated with a lower likelihood of gaining gestational weight in excess of the Institute of Medicine (IOM) recommendations (39 trials; RR, 0.83 [95% CI, 0.77 to 0.89]; I^2 =63.8%; ARD, -7.6% [95% CI, -11.0 to -4.6]), with greater effect for active (p=0.003 for interaction) and high intensity interventions (p<0.001 for interaction); there was no interaction between BMI category and effects on likelihood of excess weight gain. GWG interventions were not associated with increased likelihood of adherence to IOM recommendations for GWG (i.e., neither gaining excessive weight nor failing to gain sufficient weight) or postpartum weight retention at less than 6 or 6 months, but were associated with reduced postpartum weight retention at 12 months (10 trials; MD, -0.63 kg [95% CI, -1.44 to -0.01]; I^2 =65.5%).

Data on harms were limited. Twelve studies of the effects of GWG interventions on maternal anxiety and depression showed mixed results. The pooled estimate of the effect of maternal GWG interventions on infants small for gestational age was not statistically significant (20 trials; RR, 0.94 [95% CI, 0.80 to 1.10]; I^2 =0%; ARD, -0.4% [95% CI, -1.7 to 1.0]). Stratified analyses demonstrated a statistically significant interaction between SGA and intervention intensity (p=0.04 for interaction), but not BMI category or intervention type.

Limitations: Restricted to English-language articles, statistical heterogeneity in pooled analyses, limited evidence on infant health outcomes and harms of interventions, and most trials had some methodological limitations. Data were lacking on effectiveness of prepregnancy interventions, and on GWG interventions in pregnant adolescents and women with advanced maternal age.

Conclusions: Counseling and active behavioral interventions to limit GWG in pregnant women are associated with a modestly decreased risk of GDM, emergency cesarean delivery, macrosomia, and large for gestational age. GWG interventions are also associated with modest reductions in weight gain and decreased likelihood of exceeding IOM recommendations for GWG. Effects of these interventions on mean GWG are slightly more pronounced for high intensity interventions.

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Chapter 1. Introduction and Background

Purpose

This report will be used by the U.S. Preventive Services Task Force (USPSTF) to inform a recommendation on counseling and behavioral interventions for women in primary care settings to prevent adverse health outcomes associated with obesity during pregnancy and excess gestational weight gain (GWG) during pregnancy. The USPSTF has not previously made a recommendation on this topic.

Condition Background

Condition Definition

The 2009 Institute of Medicine (IOM) recommendations for healthy GWG vary according to prepregnancy weight category.¹ Gestational weight gain is usually defined as change in weight measured before pregnancy (prepregnancy) or during the first trimester, to weight measured at the end of pregnancy (e.g., prior to delivery). Weight measured during the first prenatal visit is commonly accepted as a baseline measurement since many women gain little weight during the first trimester of pregnancy.¹ Prepregnancy weight categories are based on the World Health Organization categories for nonpregnant persons, defined as underweight (body mass index [BMI] less than 18.5 kg/m²), normal or healthy weight (BMI 18.5 to 24.9 kg/m²), overweight (BMI 25 to 29.9 kg/m²), and obese (BMI 30 kg/m² and greater).¹⁻³ The 2009 IOM recommendations for healthy GWG are 28-40 pounds (lbs.) for women in the prepregnancy underweight category, 25-35 lbs. for normal prepregnancy weight, 15-25 lbs. for prepregnancy overweight category, and 11-20 lbs. for prepregnancy obese category.¹ The IOM did not make recommendations about weight gain for women in different classes of obesity. The 2009 guidelines also include recommendations for weight gain by trimester and weight gain per week in the 2nd and 3rd trimester, which can be used to compare GWG among women with different lengths of gestation. Because prepregnancy BMI is an independent predictor of many adverse outcomes of pregnancy, the IOM recommends that women begin pregnancy with a normal BMI.

Prevalence and Burden of Disease/Illness

Obesity and Overweight in Pregnancy

The prevalence of overweight and obesity is increasing among women of childbearing age and pregnant women, similar to trends observed in nonpregnant populations. Based on the 2015-2016 National Health and Nutrition Examination Survey, the estimated prevalence of obesity was 36 percent among women ages 20 to 39 years.⁴ Data suggests that obesity rates during pregnancy in the United States increased from 13 percent in 1993 to 24 percent in 2015.⁵ In 2015, it was estimated that almost half of all women entered pregnancy with overweight or obesity (24% with obesity and 24% with overweight).⁶ Reported rates of overweight and obesity are generally

higher among non-Hispanic black, Alaska Native/American Indian, and Hispanic women, and lower among non-Hispanic white and Asian women.⁷

Since the IOM 2009 recommendations, observational studies have continued to report strong associations between elevated prepregnancy BMI and adverse pregnancy outcomes.⁸⁻¹⁶ A 2017 review of 156 meta-analyses of cohort studies⁸ found that elevated prepregnancy BMI was associated with increased risk of cesarean delivery, antenatal depression, gestational diabetes mellitus (GDM), large for gestational age (LGA), macrosomia, stillbirth, postpartum hemorrhage, and preterm birth, and that the association was stronger for those with increasing degrees of maternal obesity.¹⁷ Most recently, the LifeCycle Project-Maternal Obesity and Childhood Outcomes Study Group conducted an individual participant-level meta-analysis using data from over 196,000 singleton pregnancies within 25 cohort studies from Europe and North America. Prepregnancy BMI was the strongest risk factor associated with adverse maternal and infant outcomes including preeclampsia, gestational hypertension, gestational diabetes, cesarean delivery, preterm birth, and small for gestational age (SGA) or LGA, and was a stronger risk factor than GWG.¹⁸ Observational data also support associations between women with underweight BMI prior to pregnancy and increased risk of preterm birth.^{19,20} However, there are limited data to support whether change in weight before pregnancy is associated with a change in perinatal outcomes.

Excess Gestational Weight Gain

Observational studies have examined the association between health outcomes as they relate to GWG above and below the 2009 IOM guidelines. Excessive GWG, defined as weight gain above that recommended by the IOM in any category, has been associated with lower risk of SGA and preterm birth, but higher risk of LGA and higher risk of cesarean delivery.^{21,22} GWG below recommended IOM guidelines has been associated with higher risk of SGA and preterm birth, but lower risk of LGA and macrosomia, and no difference in cesarean delivery.²²

In 2009, the IOM committee determined that the maternal health outcomes most closely associated with GWG were postpartum weight retention, cesarean delivery, GDM, and pregnancy-induced hypertension or preeclampsia.²³ However, there was insufficient evidence to determine a causal link between risk of preeclampsia or GDM. For infant outcomes, measures of infant size at birth (e.g., SGA and LGA), preterm birth, and childhood obesity were most strongly associated with GWG.²⁴

In 2015, GWG was within the recommended IOM guideline range for 32 percent of women in any BMI category giving birth to full-term, singleton infants; 48 percent gained more weight and 21 percent gained less weight than recommended in the IOM guidelines. Weight gain above IOM recommendations was highest among women who were overweight (61%) or had obesity (55%) before pregnancy.²⁵ The association between race and ethnicity and likelihood of adhering to IOM guidelines is not clear, although the association tends to vary by baseline BMI.^{26,27}

Etiology and Natural History

The etiologic factors that contribute to higher BMI before pregnancy are similar to factors that contribute to overweight and obesity in nonpregnant persons. The combination of individual factors (e.g., genetics, health behaviors, dietary patterns, physical activity, comorbid illnesses) and societal factors (e.g., environment, education and skills, food marketing and promotion) interact to produce weight gain, including an increase in body weight prior to pregnancy.²⁸ However, unlike the nonpregnant adult state, weight gain during pregnancy can be attributed to both the fetal compartment (fetus, placenta, amniotic fluid) and the maternal compartment, including increased maternal blood volume, uterus and breast tissue, extracellular fluid, and fat accumulation.²⁹ When maternal fat mass accrual is excessive, it may also be associated with adverse metabolic consequences during pregnancy.^{24,30,31}

Entering pregnancy at an elevated BMI or gaining excessive fat during pregnancy can be associated with metabolic dysfunction (e.g., hyperinsulinemia, inflammation, oxidative stress) and may negatively affect organogenesis, metabolic programming, maternal adipose tissue deposition and expansion, and placenta development. These effects can result in a metabolically dysregulated intrauterine environment, leading to placental and fetal dysfunction throughout pregnancy.³²⁻⁴¹ The Developmental Origins of Health and Disease hypothesizes that the events that occur during the earliest stages of human development may influence the development of diabetes, cardiovascular disease, asthma, cancers, osteoporosis, and neuropsychiatric disorders later in life.⁴²⁻⁴⁵

Interventions/Treatment

Preconception care for women with overweight or obesity may include counseling related to the risks of obesity in pregnancy and weight-loss interventions prior to conception. Given that nearly half of pregnancies in the United States are unplanned,⁴⁶ the window for preconception counseling to optimize prepregnancy BMI often is unclear. Efforts to assess pregnancy intention may provide additional opportunities to address or reduce these risks.⁴⁷ For pregnant women, interventions to reduce excess GWG may include one or more of the following: patient education and/or counseling related to potential adverse effects of excess GWG, behavioral counseling related to healthy diet or physical activity (or both), referral to nutrition services, or referral to a structured exercise program to help prevent excessive weight gain. The intensity, duration, and frequency of GWG interventions vary. Weight loss medications are not recommended for use in women planning pregnancy or during pregnancy due to safety concerns and adverse effects.⁴⁸ Although bariatric surgery may be considered treatment for weight loss in reproductive age women considering a future pregnancy, the timing of pregnancy in relation to bariatric surgery is controversial; pregnancy is generally not recommended until weight loss has stabilized in women who have undergone surgery (at least 12 to 24 months).⁴⁹⁻⁵¹

Current Clinical Practice/Recommendations of Other Groups

Current guidelines emphasize the importance of preconception counseling and weight loss for women with overweight or obesity. The American College of Obstetricians and Gynecologists recommends that primary health care providers of women of reproductive age with obesity provide specific information regarding the maternal and fetal risks of obesity in pregnancy and provide resources or encourage women to undertake a weight-reduction program before conceiving, including access to contraception to help them achieve a healthy weight prior to conception.^{1,48,52-55} Numerous organizations and clinical guidelines, including those from the IOM and National Institutes of Health (NIH), recommend counseling about healthy weight gain during pregnancy, adherence to IOM recommendations about GWG, and/or providing women at risk of excess GWG with lifestyle interventions (**Table 1**).⁵³ Guidelines also note that abnormally high or low BMI is associated with infertility and pregnancy complications. In response to these recommendations, there has been a proliferation of randomized clinical trials on the effect of interventions on GWG published in the last decade.⁵⁶⁻⁶⁰

Standard prenatal care usually includes weight monitoring to identify inadequate or excessive gestational weight. However, the degree to which women with overweight and obesity receive recommended preconception counseling or referrals to interventions is unclear.^{61,62} Women also report receiving conflicting information among different health care providers. A 2018 review of 54 articles documenting GWG discussions between women and their providers found variable prevalence and content of GWG counseling, although rates of counseling were often reported to be low and the content inaccurate. A newer systematic review reported a high percentage of women receiving advice on GWG, but the accuracy of the advice was less than optimal.⁶³ Factors associated with receipt of GWG advice include being a woman with higher socioeconomic status, older age, nulliparity, a history of dieting, low physical activity, and having overweight or obesity.⁶⁴

Chapter 2. Methods

Key Questions and Analytic Framework

Using methods developed by the USPSTF,⁶⁵ the Evidence-based Practice Center (EPC) developed the scope and Key Questions in collaboration with the USPSTF and Agency for Healthcare Research and Quality (AHRQ).⁶⁵ Investigators created an analytic framework with the key questions and the patient populations, interventions, outcomes, and adverse effects reviewed (**Figure 1**). The research plan was externally reviewed and modified prior to finalization.

Key Questions

This review addresses three Key Questions on the effects of counseling and active behavioral interventions on healthy weight and weight gain during pregnancy. The populations addressed were pregnant women with normal and high BMI and women with overweight and obesity planning a pregnancy, including adolescents.

Key Questions

- 1a. Do interventions to limit excess gestational weight gain improve health outcomes among pregnant women and their infants?
- 1b. Do interventions to reduce prepregnancy weight in women who are overweight or obese improve health outcomes among women who become pregnant and their infants?
- 1c. Does the effectiveness of these interventions differ by age, race/ethnicity, socioeconomic status, parity, smoking status, or body mass index (BMI) category?
- 2a. Do interventions to limit excess gestational weight gain reduce gestational weight gain, postpartum weight retention, or obesity-related adverse perinatal conditions among pregnant women and their infants?
- 2b. Do interventions to reduce prepregnancy weight in women who are overweight or obese improve weight outcomes or reduce obesity-related adverse perinatal conditions among women who become pregnant and their infants?
- 2c. Does the effectiveness of these interventions differ by age, race/ethnicity, socioeconomic status, parity, smoking status, or body mass index (BMI) category?
- 3a. What are the harms of interventions to limit excess gestational weight gain among pregnant women and their infants?
- 3b. What are the harms of interventions to reduce prepregnancy weight among women or who are overweight or obese?
- 3c. Do the harms of these interventions differ by age, race/ethnicity, socioeconomic status, parity, smoking status, or BMI category?

Key Question 1 focuses on the effect of interventions to limit excess gestational weight gain or reduce prepregnancy weight on health outcomes (i.e., maternal or infant morbidity and mortality). Key Question 2 evaluates the effect of interventions on weight outcomes (i.e., weight loss or gain, excessive gestational weight gain based on IOM recommendations, preconception

weight loss, and postpartum weight loss or retention). Key Question 3 examines the harms of these interventions.

Contextual Questions

Contextual Questions were also requested by the USPSTF to help inform the report. Contextual Questions are not reviewed using systematic review methodology.

- 1. What is the association between gestational weight gain and adverse maternal and infant outcomes?
- 2. What is the association between high prepregnancy BMI and risk of adverse maternal and infant outcomes?
- 3. Among women with a high prepregnancy BMI, what is the association between reduction in prepregnancy weight and risk of adverse maternal and infant outcomes?

Search Strategies

We searched the Cochrane Database of Systematic Reviews (2005 through March 20, 2020), Cochrane Central Register of Controlled Trials, PsychINFO, Ovid MEDLINE In-Process & Other Non-Indexed Citations (through March 20, 2020), and Ovid MEDLINE (1946 through March 20, 2020) for relevant English-language studies and systematic reviews. Search strategies are available in **Appendix A1.** Electronic searches were supplemented by review of reference lists of relevant articles. Ongoing surveillance was conducted to identify major studies published since March 20, 2020 that may affect the conclusions or understanding of the evidence and the related USPSTF recommendation. The last surveillance was conducted on February 5, 2021 and identified no studies affecting review conclusions. Six additional trials have recently been published, reporting similar results to this report from in-person⁶⁶⁻⁶⁸ or e-health lifestyle interventions.⁶⁹⁻⁷¹

Study Selection

Two reviewers independently evaluated each study to determine inclusion based on predetermined eligibility criteria developed for each Key Question (**Appendix A2**). After an initial dual review of citations and abstracts, investigators retrieved full-text articles of potentially relevant material. Two reviewers conducted full-text review of articles; discrepancies were resolved through consensus or with input from a third reviewer. The selection of literature is summarized in the literature flow diagram (**Appendix A3**). **Appendix A4** lists the included studies, and **Appendix A5** lists excluded studies with reasons for exclusion.

The target population was women, including adolescents, who were pregnant with normal or high BMI, or who were overweight or obese and planning pregnancy. Women with low prepregnancy BMI (underweight) were outside the scope of this review. This review focused on interventions conducted in, or recruiting from, primary care or primary care-referable settings, including routine prenatal care settings. Broader, community-based interventions were excluded. Pharmacologic interventions were excluded because they are not recommended in pregnancy. Interventions were classified as either *counseling-only* or *active* behavioral interventions. Counseling-only interventions consisted of advice provided during the course of an intervention without an active component. Active interventions consisted of a structured, physical element and could include a counseling component. Active interventions included supervised exercise programs, prescribed exercise or dietary programs, or intensive weight management. The intensity of interventions varied with regard to the number of sessions or contacts, the duration and frequency of sessions, and the length of treatment. Intervention intensity was defined by the number of participant contacts beyond usual care or the comparison group, and was categorized as low (fewer than 2 contacts during the intervention period), moderate (3-11 contacts), or high intensity (12 or more contacts). Comparisons were behavioral interventions versus a control (i.e., usual care, attention control, minimal intervention). Minimal interventions (e.g., generic print materials) and attention controls (i.e., similar format but different content than intervention) commonly consisted of initial sessions with a provider regarding general education on healthy behavior in pregnancy, group education on general health topics, or access to websites promoting healthy behaviors during pregnancy. In some trials, usual care could include nutrition or physical activity materials based on national guidelines or access to additional support (e.g., access to midwives) as needed.

Outcomes were classified as weight-related intermediate outcomes (GWG, exceeding IOM recommendations for GWG, adherence to IOM recommendations for GWG, and postpartum weight loss or retention) or health outcomes. Women were defined as exceeding IOM recommendations if they had normal BMI and gained more than 35 lbs., overweight and gained more than 25 lbs., or obesity and gained more than 20 lbs. Adherence to IOM recommendations was defined as neither gaining excessive weight nor failing to gain sufficient weight according to IOM recommendations by BMI category.

Maternal health outcomes included maternal mortality, maternal morbidity (i.e., postpartum hemorrhage, perineal trauma, depression), and health outcomes (i.e., gestational diabetes, gestational hypertension, preeclampsia, cesarean delivery). For studies of gestational diabetes, diagnostic criteria varied and included methods such as use of the International Association of Diabetes and Pregnancy Study Group (IADPSG) criteria that used the 1-step approach to diagnosis with a 75 g glucose load, country-specific guidelines as defined by national criteria, or diagnosis per chart review with no specific criteria reported. Gestational hypertension was defined as systolic blood pressure of 140 millimeters of mercury [mm Hg] or higher, or a diastolic blood pressure of 90 mm Hg or higher after 20 weeks of gestation in a woman with previously normal blood pressure. Studies reporting the standard definition of gestational hypertension (two measurements of greater than 140/90 mm Hg at least 4 hours apart) were also included.⁷² Preeclampsia was defined as gestational hypertension accompanied by one or more new-onset systemic abnormalities (i.e., new-onset proteinuria greater than 300 mg/24 hours, protein/creatinine ratio of greater than or equal to 0.3, or dipstick reading of 1+, disturbances in hematologic, liver, renal, or visual symptoms, edema).⁷² Some studies did not provide a formal definition of preeclampsia but reported the outcome categorically.

Infant health outcomes included infant mortality (including stillbirth), infant morbidity (i.e., birth trauma, shoulder dystocia, respiratory distress syndrome), and infant health outcomes (i.e., macrosomia, large for gestational age, preterm birth, growth during first year of life).

Macrosomia was defined as term infants weighing more than 4,000 g, while large for gestational age was defined as birthweight above the 90th percentile for gestational age. Preterm birth included infants born before 37 weeks gestation, before 36 weeks, or were defined categorically. Harms were those associated with interventions (e.g., anxiety, depression, maternal musculoskeletal injuries, stigma, and harms related to insufficient weight gain, including small for gestational age). Small for gestational age was defined as birthweight below the 10th percentile for gestational age. Studies reporting only behavioral changes or intermediate cardiometabolic measures were excluded.

Studies conducted in countries rated "very high" on the 2016 Human Development Index (considered applicable to U.S. populations and primary or prenatal care practice) were included.⁷³ For all Key Questions, only randomized and nonrandomized controlled clinical trials that focused on diet, exercise, and/or behavioral counseling were included; cohort or case-control studies reporting harms (Key Question 3) were also eligible for inclusion.

Inclusion was restricted to English-language articles. Other exclusion criteria were studies published only as abstracts, non-systematic literature reviews, editorials or other opinion letters, and research protocols. Studies of nonhuman subjects were excluded, and studies had to report original data. Articles reporting overall consortium results, including trials that have not yet been published individually, were excluded.

Data Abstraction and Quality Rating

For studies meeting inclusion criteria, we created data abstraction forms to summarize characteristics of each study. One investigator abstracted details about the study design, patient population, setting, interventions, analysis, followup, and results (**Appendix B Tables 1-3**). A second investigator reviewed data abstraction for accuracy. Two investigators independently applied predefined criteria developed by the USPSTF (**Appendix A6**) to assess the quality of individual controlled trials, systematic reviews, and observational studies and rate them as "good," "fair," or "poor," depending on the seriousness of the methodological shortcomings.⁶⁵ Discrepancies were resolved by consensus. Studies that were rated poor quality were excluded because results are more likely to be biased and highly unreliable.⁶⁵

Data Synthesis

To summarize evidence on the effects of GWG interventions, data were synthesized separately for each Key Question by outcome, including weight-related outcomes and health outcomes. Only randomized controlled trials were considered for meta-analysis. For both continuous and dichotomous outcomes, a random effects model based on the profile likelihood method was used to combine trials that evaluated comparable populations and interventions. Random effects meta-analyses were performed in STATA version 14 (Stata Corp, College Station, TX).

For continuous outcomes (GWG and postpartum weight retention), meta-analysis was conducted to combine the mean difference between the intervention and the control groups. If a study

reported mean difference adjusted for baseline characteristics, the adjusted mean difference was used in the meta-analysis; otherwise, the difference in weight change from baseline to followup was used as the measure for mean difference. As imbalance in baseline weight was generally not observed in studies, sensitivity analysis was not conducted using the difference in followup weights. If weight change was not reported but baseline and followup weights were reported, the weight change was calculated based on these data points, and the correlation between baseline and followup weights was assumed to be the average correlation calculated from studies that reported all standard deviations (SD) from baseline, followup weights, and weight changes. Missing SDs were imputed, if necessary, by assuming the same coefficient of variation at baseline and followup; the SDs at baseline and followup were similar in studies that reported both.

For dichotomous outcomes with at least five trials, sufficient sample size, and comparable outcomes (GDM, gestational hypertension, preeclampsia, cesarean delivery, postpartum hemorrhage, perineal trauma, macrosomia, preterm birth, LGA, SGA, respiratory distress syndrome, shoulder dystocia, neonatal intensive care unit [NICU] admission, and exceeding or adhering to IOM recommendations for GWG), risk ratios were combined across eligible studies. Data were also pooled for 14 trials that reported emergency cesarean as separate, and clinically distinct, events; the other studies of cesarean did not provide separate data or descriptions. Results from arms of comparable interventions and outcome definitions within the same study were combined so each study was represented only once in each meta-analysis.

Stratified analyses were conducted when sufficient data were available to evaluate subgroup effects based on BMI category (normal, overweight, obese, overweight or obese combined, or mixed BMI populations), weight assessment time point (28 weeks, 34-36 weeks, 36 weeks up to delivery, and at delivery), intervention type (counseling-only or active) and intensity (low, moderate, or high, as defined in the Study Selection section), and study quality (good or fair). One study could contribute data for more than one subgroup in stratified analyses. We assessed statistical heterogeneity with the Cochran Q-test and the I^2 statistic, which assesses the percentage of variation across studies that is due to heterogeneity rather than chance.⁷⁴ The p-value for subgroup interaction was calculated to test for subgroup differences.

For all Key Questions, the overall quality of evidence was determined using the approach described in the USPSTF Procedure Manual.⁶⁵ We assessed the aggregate internal validity (quality) of the overall body of evidence for each Key Question (insufficient, low, moderate, and high) using methods developed by the USPSTF, based on the number, quality, and size of studies, consistency of results between studies, and directness of evidence.⁶⁵ A summary of evidence table was developed to assess the overall quality of evidence for each Key Question using the approach described in the USPSTF Procedure Manual.⁶⁵

Expert Review and Public Comment

A draft research plan for this topic was posted on the USPSTF Web site for public comment from April 26th through May 3rd, 2018. The USPSTF received minor comments related to the included populations and outcomes. In response to these comments, the USPSTF added parity

and smoking status to the included subpopulations for Key Questions (KQ) 1c, 2c, and 3c. In addition, the USPSTF revised the list of eligible outcomes for KQ 1 to clarify that stillbirth, depression, and shoulder dystocia are included. Finally, the USPSTF revised the list of eligible outcomes for KQ 3 to clarify that harms related to insufficient weight gain among infants were included. A final version of the research plan was posted on the USPSTF website in July 2019. A draft version of this report was reviewed by content experts (**Appendix A7**), representatives of Federal partners, USPSTF members, and AHRQ Medical Officers. Reviewer comments were presented to the USPSTF during its deliberations and have been incorporated into the final report. Additionally, a draft version of this report was posted for public comment from December 8th, 2020, to January 11th, 2021 and few comments were received. In response, we revised the future research section. No other changes were necessary.

Chapter 3. Results

Included Studies

Our literature search resulted in 8,511 unique citations. Following dual title and abstract review and dual evaluation of 845 full-text articles, we identified 68 studies of interventions to limit excess GWG, reported in 87 publications that addressed Key Questions 1-3.^{56,58,59,75-158} Of the 578 articles that were excluded at the full text level, the most common reasons for exclusion were: publication type other than an original peer-reviewed study (i.e., conference abstracts or literature reviews) (161 articles), study design outside the scope of the review (i.e., not trials) (109 articles), wrong outcome (96 articles), or wrong intervention (62 articles). Eight studies¹⁵⁹⁻¹⁶⁶ were excluded at the full-text level due to poor quality.

The search and selection of articles, including reasons for exclusion (**Appendix A5**), are summarized in the literature flow diagram (**Appendix A3**).

Study Characteristics

Of the 68 included studies, 64 were randomized controlled clinical trials (RCTs, N=24,829) ${}^{56,58,59,75-90,92-96,98,100-103,105-123,125-158}$ and four were controlled clinical trials (CCTs, N=960) 91,97,104,124 (**Appendix B Table 1**). All studies included pregnant women. Sixty-seven trials evaluated interventions during pregnancy, one evaluated a prepregnancy intervention, 120 and one study included a preconception component; 141 however, no other studies evaluated the effectiveness of prepregnancy interventions to limit excessive GWG in women prior to pregnancy, limiting the number of studies to address Part B of any Key Question.

All studies conducted during pregnancy reported at least one maternal outcome: GWG (all studies), weight gain in excess of (40 studies^{59,77-79,81,83-86,88,90,92-94,96,101,103,112,114,115,117,119,122,124,126, 128,129,132,134-136,138,139,142,146-148,153,154,157) or according to IOM recommendations (19 trials), ^{59,79,85,88,93,96,103,123,127,129,130,132,135,139,142,146,147,152,154 cesarean delivery (48 studies), ^{56,58,59,76,78-80,82,84-90,93,94,96,98,102,104,105,112,114,115,118,119,123-130,132,134-136,140,142,143,145,147,152-154,158 GDM (45 studies), ^{56,58,59,76,80,82,84-90,93,94,96,101,104,105,108,112,114,115,118,119,121,123-127,128,130,132,134-136, 140-143,145,146,153,154 gestational hypertension (29 studies), ^{56,58,59,76,80,84,87-90,96,101,118,119,121,123-127,130,132,134, 135,140-142,145,152,154,158 preeclampsia (28 studies), ^{56,58,59,76,80,84,87-90,96,101,118,119,121,123-127,130,132,134, 135,140-142,145,152,158 postpartum weight retention (14 studies), ^{78,94,100,104,106,107,109,113,119,131-133,135-137,144, 155,158 postpartum weight retention (14 studies), ^{78,94,100,104,106,107,109,113,119,131-133,135-137,144, 155,158 postpartum hemorrhage (10 studies), ^{56,76,78,89,61,05,123,124,127,143,145 perineal trauma (8 trials), ^{56,80,88,96,102,123,143,145} maternal depression and anxiety (12 studies), ^{75,87,91-93,96,97,99,105,125,129, 147} or maternal mortality (2 trials), ^{88,123} Fifty studies (in 67 publications) ^{56,58,59,76,78,80,81,83-86,88-90,93-96,98,104,105,112,114,115,118,119,121,125-128,130-132,134-137,140-143,145-147,151-154 also reported at least one infant outcome, including pretern birth (34 studies), ^{56,58,59,76,80,81,83,84,86,88,89,95,96,101,102,104,116-119, 121,128,131,132,134,135,142,145,147,151-155 macrosomia (26 studies), ^{56,58,59,78,80,81,83,84,86,88,89,95,96,101,102,104,116-119, 121,125,127,136,137,140,143,145,147,151-155 SGA and low birth weight (30 studies), ^{76,80,89,09,49,69,8,105,111,112,117,119,121,125,127,136,137,140,143,145,146,152-155 NICU admission (14}}}}}}}}}}}}}

trials), ^{56,59,76,88-90,93-96,101,102,105,125,127,143-145,149,150,154-156} infant respiratory distress syndrome (8 trials), ^{80,88-90,118,140,141,145,154,155} shoulder dystocia (8 trials), ^{56,80,88,93,96,123,127,143} and neonatal mortality (11 trials) ^{59,76,88-90,93,96,125,143-145,149,150,156} (**Appendix B Table 3**).

Across all studies, sample sizes ranged from 50 to 2,261 (N=25,789; median n=230), and studies enrolled women aged 18 years and older; reported sample mean ages ranged from 18.6 years to 33.8 years (median 30.4 years, SD 2.8), with enrolled study participants ranging in age from 14 to 49 years depending on study inclusion criteria (**Appendix B Table 1**). There were no studies exclusively of pregnant adolescents or women with advanced maternal age. Thirty-four trials ^{58, 59,75,76,78,80,82-87,89,91-94,100-102,106,113,116-119,121,124,128-130,136,137,139-144,146,149,150,156,158 were conducted in Europe, 22 trials^{77,79,90,97,98,103,104,107,110-112,114,115,122,126,127,131-135,138,148,151-155} in the United States and Canada, 10 trials^{56,88,95,96,105,108,109,123,125,145,147,157} in Australia and New Zealand, and 1 trial⁸¹ in Argentina. Studies did not report outcomes by age, race and ethnicity, socioeconomic status, parity, or smoking status.}

Studies included women in three prepregnancy BMI categories: mixed (all BMI categories), overweight and obesity only, and obesity only. One study enrolled pregnant women with normal weight only⁹⁶; 34 studies^{75,76,78-86,88,93,103-106,113-115,119,122,126,128,131,132,135-137,139,142,143,147,148,151,152} enrolled pregnant women of mixed weight categories (including 1 trial⁹² enrolling women with normal weight and overweight only); 19 studies^{56,77,89,90,95,97,98,100-102,107-112,117,121,123,127,129,130,133, 134,138,145,153,157} enrolled women with overweight or obesity only; and 13 studies ^{58,59,87,91,94,118, 124,125,140,141,146,149,150,154-156,158} enrolled women with obesity only (**Appendix B Table 1**). The majority of trials recruited women directly from the primary care setting, including obstetric and prenatal care settings, at the initial prenatal visit or through electronic health records. Eight studies recruited participants more widely via newspaper or online advertisements, referrals from social services, health fairs, or flyers posted in community spaces.^{101,103,106,115,118,126,148,152}

Sixty-seven trials evaluated interventions during pregnancy; six included interventions continuing into postpartum period.^{78,97,107,119,126,151} Forty-five studies (in 56 publications)^{56,58,76-80,87-90,92,93,95-98,104,107-113,116-119,121-127,130-132,135-141,146-148,151-155,157,158} evaluated counseling-only interventions, where providers either offered advice or specific recommendations on behavior change (e.g., weight monitoring, dietary changes, physical activity); 22 studies (in 29 publications)^{59,75,81-86,91,94,100-103,105,106,114,115,128,129,133,134,142-145,149,150,156} were considered active interventions where providers implemented a structured, physical element such as medically supervised exercise or meal replacement (**Appendix B Tables 1-2**; see **Appendix E Table 2** for examples of implementation). Interventions addressed advice about nutrition (5 studies), ^{76,80,123, 127,158} physical activity (16 studies), ^{75,81,82,84-86,94,100-102,105,106,129,139,142,145,148} lifestyle and behavioral change (6 studies), ^{97,108-112,122,125} or serial weight measurement (3 studies), ^{88,92,93} with the remainder addressing multiple components (**Appendix B Table 2**).

The interventions were highly variable in intensity (number of sessions or contacts) and modes of delivery (**Appendix B Table 1**). Ten trials^{79,80,88,92,93,123,130,135-137,139} were considered low intensity (fewer than 2 contacts during the intervention period); 23 trials^{56,76,78,87,89,95,96,104,108-110, 113,116-119,121,122,124,126,127,131,132,140,141,146-148,158} evaluated moderate-intensity interventions (3-11 contacts); and 34 trials^{58,59,75,77,81-86,90,91,94,97,98,100-103,105-107,111,112,114,115,125,128,129,133,134,138,142-145,149-157} evaluated high-intensity interventions (12 or more contacts). Moderate and high-intensity

interventions included the potential to refer participants to external providers (e.g., registered dieticians, qualified fitness specialists, physiotherapists, health coaches, etc., not embedded in the research team) and/or settings (e.g., local community fitness center). Interventions evaluated in the nine low-intensity trials included healthy behavior counseling at an initial session with a dietician, midwife, or other provider, followed by tailored counseling on iterative weight gain during regularly scheduled visits. In five trials, research team and external providers also made specific recommendations for supervised physical activity based on ACOG guidelines.^{79,80,135-137,139} The 57 moderate-^{56,76,78,87,89,95,96,104,108-110,113,116-119,121,122,124,126,127,131,132,140,141,146-148,158} or high-^{58,59,75,77,81-86,90,91,94,97,98,100-103,105-107,111,112,114,115,125,128,129,133,134,138,142-145,149-157} intensity trials included interactions with participants in person, by telephone, or both, and generally included individual or group education or counseling for those characterized as active interventions. The mode of delivery for the interventions was primarily face-to-face in 59 studies and by computer, internet, or telephone in 5 trials^{111,112,126,148,153,157}; 3 trials^{58,77,138} compared a face-to-face arm and a telehealth arm with a control group (**Appendix B Tables 1-2**).

The comparison, or control intervention, consisted of usual care in 56 trials and minimal intervention in 11 trials (**Appendix B Table 2**).^{59,89,90,98,103,108,126,148,152,153} Minimal intervention or attention controls typically included general education sessions on healthy behaviors in pregnancy; in three trials^{90,125,152} evaluating a peer-educator program, control participants received home visits and group education. Usual care involved routine antenatal care with obstetricians, midwives, or other providers and included information on healthy pregnancy behaviors delivered by clinic staff or via printed information; the intensity, frequency, and content of usual care varied according to standards in the country where the intervention occurred.

The timing of initiation and study duration varied across trials, with the initial intervention generally occurring at the end of the first trimester or the beginning of the second trimester, and generally ending prior to delivery. For the outcome of total GWG, the timing and evaluation of weight gain assessments differed across trials, with one trial assessing final weight at 28 weeks, 18 trials at 34-36 weeks, 27 trials at 36 weeks up to delivery, 19 trials at delivery, one trial at 2 weeks postpartum, and one trial did not report timing (**Appendix B Table 3**). The followup period for the majority of studies ended at the time of the final weight measurement; however, 14 studies followed participants postpartum and reported the outcome of postpartum weight retention at various timepoints, specifically within 6 months of delivery^{100,104,106,109,111,113,116,132, 135,136,156,158} and at 12 months postpartum^{78,107,111,113,116,131,133,137,144,155} (**Appendix B Table 3**).

Given the overlap of studies included for more than one Key Question and the limited trials on prepregnancy weight loss interventions, results are organized by outcome into the following sections: maternal health outcomes, infant health outcomes, prepregnancy weight loss, maternal weight outcomes, and harms (**Appendix B Table 3**). Data regarding subgroup effects were primarily available for BMI categories and are reported within the results for each outcome.

Study Quality

Among the 68 included studies, 15 RCTs^{56,58,78,80,90,95,96,108,109,117,120,121,125,129,143,145,146,154,155} and 1 CCT⁹⁷ were rated good-quality, and 49 RCTs and 3 CCTs^{59,75-77,79,81-89,91-94,98,101,103-107,110-116,118, 119,122-124,126-128,130-142,147-153,156-158} were rated fair-quality (**Appendix C Tables 1-2**). Methodological limitations in the fair-quality trials included lack of reporting details about blinding of care providers^{56,58,59,78-85,87-93,95,96,98,101-104,106,110-112,114-118,121-124,126-132,134-139,142-144,146-150,152,154-158 or outcome assessors or analysts, ^{58,59,79,81-85,87,88,91,92,104,110-112,114-118,121,124,126-130,135-137, 139,148-150,152,156-158 relatively higher (i.e., greater than 20%) and differential attrition, ^{81,89,91,94,106, 114,122,126,139,147,158} lack of or unclear reporting of allocation concealment, ^{96,110,114,115,126,128,135,142, 152,158} no attempt to or did not report on intention-to-treat analyses, ^{59,114,123,128,148-150,156} and significant differences in groups at baseline. ^{92,124,136,137,157} The main limitations for the eight poor-quality intervention studies were multiple or very serious flaws in the domains of attrition, ¹⁵⁹⁻¹⁶⁶ lack of reporting details of blinding of outcome assessors or analysts, ¹⁵⁹⁻¹⁶⁵ significant differences between groups at baseline, ¹⁶⁰⁻¹⁶⁵ or lack of reporting methods of randomization. ¹⁶⁰⁻¹⁶²}}

Effects of Interventions to Limit Excess Gestational Weight Gain on Maternal Health Outcomes

Summary

- GWG interventions were associated with decreased risk of GDM versus controls (43 trials; RR, 0.87 [95% CI, 0.79 to 0.95]; *I*²=16.4%; ARD, -1.6% [95% CI, -2.5 to -0.7]); there were no statistically significant interactions between effects of GWG intervention on rates of GDM and BMI category (p=0.14 for interaction), intervention type (p=0.68 for interaction), or intervention intensity (p=0.92 for interaction).
- GWG interventions were associated with decreased risk of emergency cesarean delivery, but indications were rarely reported (14 trials; RR, 0.85 [95% CI, 0.74 to 0.96]; *I*²=0.0%; ARD, -2.4% [95% CI, -4.2 to -0.3]).
- GWG interventions were not associated with risk of gestational hypertension (28 trials; RR, 0.87 [95% CI, 0.70 to 1.04]; *I*²=32.5%; ARD, -0.8% [95% CI, -1.9 to 0.2]); cesarean delivery (34 trials; RR, 0.98 [95% CI, 0.91 to 1.04], *I*²=10.8%; ARD, -0.7%, [95% CI, -2.4 to 0.8]), preeclampsia (27 trials; RR, 0.98 [95% CI, 0.84 to 1.13]; *I*²=0.0%; ARD, 0.1% [95% CI, -0.6 to 0.5]), postpartum hemorrhage (9 trials; RR, 1.00 [95% CI, 0.88 to 1.15]; *I*²=0.0%; ARD, -0.1% [95% CI, -1.3 to 1.5]) or perineal trauma (third- or fourth-degree perineal tear, 8 trials; RR, 0.86 [95% CI, 0.52 to 1.50]; *I*²=57.0%; ARD, -0.7% [95% CI, -3.2 to 1.7]) versus controls.
- Statistically significant interactions between effects of GWG interventions on perineal trauma and BMI category and intervention intensity were present, and between effects of GWG interventions on gestational hypertension and intervention intensity and active interventions.
- Evidence was too limited to determine effects of GWG interventions on maternal mortality.

Evidence

Gestational Diabetes Mellitus

Forty-five studies (43 RCTs, N=19,752 and 2 CCTs, N=397) of counseling-only and active interventions versus controls reported on the outcome of GDM (**Appendix B Tables 1-3**).^{56,58,59,76,80,82,84-90,93,94,96,101,104,105,108,112,114,115,118,119,121,123-125,127,128,130,132,134-136,140-143,145,146,153,154, ¹⁵⁸ Twelve trials were rated good quality^{56,58,80,90,96,108,121,125,143,145,146,154} and 33 studies were rated fair quality (**Appendix C Tables 1-2**). The criteria used to define GDM varied among studies and included criteria based on country-specific guidelines (16 studies); ^{56,58,59,85,87,104,105,114,115,118, ^{121,123,128,136,143,158} IADPSG criteria using the 1-step approach to diagnosis with a 75 g glucose load (18 trials), ^{76,80,86,89,90,94,96,101,108,119,125,130,134,140,141,145,146,153} and review of medical records (9 studies)^{84,93,124,126,127,132,135,142,154}; two trials used unclear criteria to define GDM.^{82,88} Forty-two trials reported timing of screening, which occurred between 24 to 28 weeks' gestation in all trials; one trial¹⁴¹ also screened for GDM at 12 to 16 weeks.}}

One trial⁹⁶ enrolled women with normal BMI, 20 trials enrolled women in mixed prepregnancy BMI categories, $^{76,80,82,84-86,88,93,105,114,115,118,119,121,126,128,135,136,142,143}$ 12 studies included women categorized only as obese (BMI greater than $29^{87,146}$ or greater than or equal to $30^{58,59,94,124,125,140,141,154,158}$ kg/m²), and 12 studies included women in overweight or obese categories. 56,89,90,101,104,108,112,123,127,130,132,134,145,153 There were 29 studies of counseling-only interventions, $^{56,58,76,87-90,93,96,104,108,112,118,119,121,123-125,127,130,132,135,136,140,141,146,153,154,158}$ and 16 trials that included an active component. $^{59,80,82,84-86,94,102,105,114,115,128,134,142,143,145}$ Intervention intensity was low in 7 trials, 80,88,93,123,130,135,136 moderate in 17 studies, 56,76,87,89,96,104,108,118,119,121,124,127,132,140,141,146,158 and high in 21 trials. $^{58,59,82,84-86,90,94,101,105,112,114,115,125,128,134,142,143,145,153,154}$

GWG interventions were associated with decreased risk of GDM versus control (43 trials; RR, 0.87 [95% CI, 0.79 to 0.95]; I^2 =16.4%; ARD, -1.6% [95% CI, -2.5 to -0.7]) (**Table 2, Figure 2**). In the stratified analyses, there were no subgroup interactions between rates of GDM and BMI category (p=0.14 for interaction), intervention type (p=0.68 for interaction), or intervention intensity (p=0.92 for interaction; **Table 2**).

Gestational Hypertension

Twenty-eight RCTs (N=14,875) and one CCT¹²⁴ (N=178) reported rates of gestational hypertension (**Appendix B Tables 1-3**). $^{56,58,59,80,84,87-90,96,101,118,119,123-127,130,132,134,135,140-142,145,152,154,158}$ Eight RCTs were rated good quality 56,58,80,90,96,125,145,154 and 20 RCTs and one CCT¹²⁴ fair quality $^{59,84,87-89,101,118,119,123,126,127,130,132,134,135,140-142,152,158}$ (**Appendix C Tables 1-2**). Gestational hypertension was defined as persistent or repeated measures of blood pressure greater than or equal to 140/90 mmHg after 20 weeks' gestation, and was generally consistent with the U.S. guideline defined by two measurements of elevated blood pressure (greater than or equal to 140/90 mmHg) at least 4 hours apart. 72

There was 1 trial⁹⁶ enrolling women with normal prepregnancy weight, 9 trials enrolling women with mixed prepregnancy weight,^{80,84,88,119,126,132,135,142,152} 9 trials with prepregnancy overweight

or obesity, ^{56,89,90,101,123,127,130,134,145} and 10 studies of women with obesity. ^{58,59,87,118,124,125,140,141, 154,158} Six trials reported the effects of interventions in women with normal prepregnancy BMI.^{84,96,126,132,135,142} Seven trials evaluated active exercise interventions^{59,84,101,127,134,142,145} while the remaining studies evaluated counseling-only interventions. The intensity of interventions was low in 5 trials, ^{80,88,123,130,135} moderate in 13 studies, ^{56,87,89,96,118,119,124,126,127,132,140,141,158} and high in 11 trials. ^{58,59,84,90,101,125,134,142,145,152,154}

GWG interventions were not associated with reduced likelihood of gestational hypertension compared to controls (28 trials; RR, 0.87 [95% CI, 0.70 to 1.04]; I^2 =32.5%; ARD, -0.8%, [95% CI, -1.9 to 0.2]) (**Table 3, Figure 3**).^{56,58,59,80,84,87-90,101,118,119,123,125-127,130,132,134,135,140-142,145,154,158} However, stratified analysis demonstrated statistically significant interactions between effects of GWG interventions on gestational hypertension and active interventions (p<0.001 for interaction) and high intensity interventions (p=0.006 for interaction), but not BMI category (p=0.08 for interaction; **Table 3**).

Cesarean Delivery

Forty-eight studies reported effects of GWG interventions on rates of cesarean delivery (**Appendix B Tables 1-3**).^{56,58,59,76,78-80,82,84-90,93,94,96,98,102,104,105,114,115,118,119,123-129,132,134-136,140,142, 143,145,147,152-154,158 These included 46 RCTs (N=19,573),^{56,58,59,76,78-80,82,84-90,93,94,96,98,102,105,114,115, 118,119,123,125-129,132,134-136,140,142,143,145,147,152-154,158 of which 11 met criteria for good quality^{56,58,78,80, 90,96,125,129,143,145,154} and 33 were fair quality^{59,76,79,82,84-89,93,94,98,102,105,114,115,118,119,123,126-128,132,134-136,140,142,147,152-154,158} (**Appendix C Table 1**). The remaining two studies were fair-quality CCTs (N=397) (**Appendix C Table 2**).^{104,124}}}

One trial enrolled women with normal BMI at baseline, ⁹⁶ 24 studies enrolled women in mixed BMI categories, ^{76,78-80,82,84-86,88,93,104,105,114,115,119,126,128,132,135,136,142,143,147,152} 10 were studies of women in the obese category only, ^{58,59,87,94,118,124,125,140,154,158} and 13 were trials of women in overweight or obese categories. ^{56,89,90,98,101,123,127,129,134,145,153} There were 32 studies of counseling-only interventions and 16 trials of active interventions, 7 of which also included counseling plus an active component. The intensity of interventions was low in 8 trials, ^{79,80,88,93,123,130,135,136} moderate in 16 studies, ^{56,76,78,87,89,96,104,118,119,124,126,127,132,140,147,158} and high in 24 trials. ^{58,59,82,84-86,90,94,98,101,105,114,115,125,128,129,142,143,145,152-154} Thirty-four trials reported on the outcome of cesarean delivery, ^{56,58,76,78,82,84-86,89,90,93,96,98,101,105,114,115,118,119,125-129,132,134-136,140,142,145,153,154,158} not specified as emergency or elective (N=15,908), while 12 trials ^{59,80,87,88,94,105,119,123,123,125,143,147,152} reported separate rates of emergency cesarean (N=7,520); one trial¹⁵³ reported indications for emergency cesarean.

GWG interventions were not associated with decreased likelihood of cesarean delivery, not specified as emergency or elective, versus controls (34 trials; RR, 0.98 [95% CI, 0.91 to 1.04]; I^2 =10.8%; ARD, -0.7% [95% CI, -2.4 to 0.8]) (**Table 4, Figure 4**). However, when pooled separately, GWG interventions were associated with a reduced risk of emergency cesarean (14 trials; RR, 0.85 [95% CI, 0.74 to 0.96]; I^2 =0%; ARD, -2.4% [95% CI, -4.2 to -0.3]). Indications for emergency cesarean were rarely reported. Based on stratified analysis, there was no statistically significant interactions between effects of GWG interventions on likelihood of

cesarean delivery and BMI category (p=0.70 for interaction), intervention type (p=0.37 for interaction), or intensity (p=0.37 for interaction; **Table 4**).

Preeclampsia

Twenty-eight studies reported effects of GWG interventions on rates of preeclampsia (**Appendix B Tables 1-3**).^{56,58,59,76,80,84,87,93,96,105,118,119,121,123,124,126,127,132,134,135,140,141,143,145,152,154,158} Of 27 included RCTs (N=17,538), 8 were rated good quality^{56,58,80,96,121,143,145,154} and 19 were rated fair quality^{59,84,87,93,118,123,126,127,132,134,135,152,158} (**Appendix C Table 1**). The remaining trial was a fair-quality CCT (N=178) (**Appendix C Table 2**).¹²⁴ Most studies defined preeclampsia as gestational hypertension accompanied by proteinuria (greater than 300 mg/24 hours). The remaining trials reported preeclampsia as a clinically distinct event from gestational hypertension but did not provide a formal definition.

There was one trial of women in normal BMI category,⁹⁶ 12 trials of women with mixed prepregnancy BMI categories,^{76,80,84,93,105,119,121,126,132,135,143,152} 6 trials of women in overweight or obese category,^{56,123,127,134,145} and 9 studies of women categorized as obese only. ^{58,59,87,118,124,140, 141,154,158} Some trials included multiple discrete populations. Six trials assessed active exercise interventions, ^{59,84,105,134,143,145} while the remaining 22 studies evaluated counseling-only interventions. ^{56,58,76,80,87,93,96,118,119,121,123,124,126,127,132,135,140,141,152,154,158} Intensity of the intervention was rated low in 5 trials, ^{80,88,93,123,135} moderate in 14 studies, ^{56,76,87,96,118,119,121,124,126,127,132,140,141,158} and high in 9 trials. ^{58,59,84,105,134,143,145,152,154}

Interventions for GWG were not associated with a risk of preeclampsia versus controls (27 trials; RR, 0.98 [95% CI, 0.84 to 1.13]; I^2 =0%; ARD, 0.1% [95% CI, -0.6 to 0.5]; **Table 5, Figure 5**). Based on stratified analysis, there were no statistically significant interactions between effects of GWG interventions on risk of preeclampsia and BMI category (p=0.86 for interaction), intervention type (p=0.25 for interaction), or intensity (p=0.29 for interaction; **Table 5**).

Postpartum Hemorrhage

Ten studies reported the association between GWG interventions and risk of postpartum hemorrhage during or immediately following delivery (**Appendix B Tables 1-3**). ^{56,76,88,96,105,123, 124,127,144,145} Of the nine trials (N=6,306), four were rated good quality and five fair quality; one CCT (N=178) was fair quality (**Appendix C Tables 1-2**). There was one trial of women with normal BMI, four trials of women with mixed prepregnancy BMI categories, four trials of women in the overweight or obese BMI category, and one study of women in the obesity only category.¹²⁴ Three trials^{105,143,145} assessed active exercise interventions, while the remaining seven studies evaluated counseling-only interventions. Interventions were of low (2 trials),^{88,123} moderate (5 studies),^{56,76,96,124,127} or high intensity (3 trials).^{105,143,145} Hemorrhage was defined as greater than 500 milliliters (mL)¹⁴⁴ in one trial, 600 mL^{56,96} in or 1,000 mL^{123,145} in two trials each, and was not formally defined in five studiess.^{76,88,105,124,127}

Pooled results of nine trials demonstrated no effect of interventions on likelihood of postpartum hemorrhage (RR, 1.00 [95% CI, 0.88 to 1.15]; $I^2=0\%$; ARD, -0.1% [95% CI, -1.3 to 1.5]) (**Table**

6, **Figure 6**). Based on stratified analysis, there were no statistically significant interactions between effects of GWG interventions on likelihood of postpartum hemorrhage and BMI category (p=0.65 for interaction), intervention type (p=1.00 for interaction), or intensity (p=0.99 for interaction; **Table 6**).

Perineal Trauma

Eight RCTs (N=5,707) reported the association between GWG interventions and risk of perineal trauma during delivery (**Appendix B Tables 1-3**).^{56,80,88,96,102,123,144,145} Five trials were good quality^{56,80,96,143,145} and three trials were fair quality (**Appendix C Tables 1-2**).^{88,101,123} There was one trial of women with normal BMI,⁹⁶ three trials of women with mixed categories of prepregnancy BMI, and four trials of women with prepregnancy BMI categories of overweight or obese. Three trials^{101,143,145} assessed active exercise interventions, while the other five trials^{56,80,88,96,123} evaluated counseling-only interventions. The intensity of interventions was low in three trials,^{80,88,123} moderate in two trials,^{56,96} and high in three trials.^{101,143,145} Perineal trauma was defined as third- or fourth-degree perineal tear in five trials^{56,80,88,102,123,144} and tear of any degree in two trials^{80,145}; one trial reported both definitions.⁹⁶

Pooled analysis from eight trials showed no effect of interventions on risk of perineal trauma (RR, 0.86 [95% CI, 0.52 to 1.50]; I^2 =57.0%; ARD, -0.7% [95% CI, -3.2 to 1.7]) (**Table 7**, **Figure 7**). Based on stratified analysis, there was a statistically significant interaction between effects of GWG intervention on risk of perineal trauma and mixed BMI category (p=0.003 for interaction) and low or high intervention intensity (p=0.003 for interaction), but not intervention type (p=0.73 for interaction; **Table 7**).

Maternal Mortality

One good-quality, moderate-intensity and one fair-quality, low-intensity counseling-only RCT (reported in three publications; N=2,994) reported rates of maternal death (**Appendix B Tables 1-3**). 56,88,95 Three maternal deaths total were reported in two trials, with two in the control group and one in the intervention group. None of the deaths reported were related to the interventions.

Effects of Interventions to Reduce Prepregnancy Weight on Weight and Health Outcomes in Women Who Are Overweight or Obese and Their Infants

One trial evaluated a prepregnancy intervention.¹²⁰ One trial, aimed at preventing GDM in high risk pregnant women, included a prepregnancy arm.¹⁴¹ A good quality counseling RCT (N=326) evaluated the effect of intentional weight loss for women with overweight or obese BMI before pregnancy on gestational weight gain and other pregnancy outcomes.¹²⁰ The high intensity behavioral weight loss intervention consisted of weekly health-coaching phone sessions that included information on weight loss, healthy diet, and exercise aimed at women planning pregnancy within two years. Phone coaching continued monthly throughout pregnancy. There was a significant difference in prepregnancy weight loss for the intervention participants versus

controls (mean kg per week [SD]: -0.25 (0.51) vs. -0.03 (0.21), p<0.001). However, intervention participants gained more weight than controls during pregnancy (mean kg [SD]: 13.2 (8.2) vs. 10.3 (7.41); p=0.03), with no difference in rates of exceeding GWG guidelines at any time point.

A fair quality counseling RCT (N=128) had an arm that enrolled high-risk women with obesity or with a history of GDM planning a pregnancy.¹⁴¹ Women planning pregnancy received lifestyle counseling every 3 months and those with BMI \geq 25 were also encouraged to lose 5-10% of their weight before pregnancy. The number of women who were given weight loss advice and the weight change in the groups prior to pregnancy were not reported. GDM was defined as one or more pathological glucose values in a 75 g 2-hour oral glucose tolerance test, performed between 12 and 16 weeks of gestation, inconsistent with current definitions of GDM. For those testing negative, the test was repeated between 24-28 weeks gestation. The incidence of GDM as traditionally defined (24-28 weeks) was high in both the intervention and the control groups (21.5% vs 23.8%, respectively), but the difference was not statistically significant.

Effects of Interventions to Limit Excess Gestational Weight Gain on Infant Health Outcomes

Summary

- GWG interventions were associated with decreased risk of infant macrosomia (25 trials; RR, 0.77 [95% CI, 0.65 to 0.92]; *I*²=38.3%; ARD, -1.9% [95% CI, -3.3 to -0.7]) and large for gestational age (26 trials; RR, 0.89 [95% CI, 0.80 to 0.99]; *I*²=0%; ARD, -1.3% [95% CI, -2.3 to -0.3]) versus controls.
- GWG interventions were not associated with risk of preterm birth (33 trials; RR, 0.93 [95% CI, 0.81 to 1.07]; *I*²=2.2%; ARD, -0.2% [95% CI, -1.1 to 0.7]); respiratory distress syndrome (8 trials; RR, 1.00 [95% CI, 0.67 to 1.42]; *I*²=0%; ARD, -0.3% [95% CI, -1.3 to 0.7]), shoulder dystocia (8 trials; RR, 1.05 [95% CI, 0.63 to 1.47]; *I*²=0%; ARD, 0.0% [95% CI, -0.4 to 0.5]), or NICU admissions (14 trials; RR, 0.98 [95% CI, 0.86 to 1.08]; *I*²=0%; ARD, -0.7% [95% CI, -1.9 to 0.5]).
- GWG interventions were not associated with effects on infant growth during first year of life, or with neonatal death/stillbirth.

Evidence

Macrosomia

Twenty-five trials (N=13,990) and one CCT (N=219) evaluated effects of GWG interventions on risk of macrosomia; 9 were good quality^{56,58,78,80,96,121,143,145,154} and 18 fair quality^{59,81,83,84,86,89,94, 102,104,118,119,126,128,132,134,135,142,152} (Appendix B Tables 1-3 and Appendix C Tables 1-2).

Macrosomia was defined as term infants weighing more than 4 kg (21 RCTs, 58,59,78,81,83,84,86,89,96,121,126,128,132,134,135,142,143,145,152,154,167 1 CCT¹⁰⁴) or 4.5 kg (6 RCTs), 80,94,96,118,119,121 with two

trials^{96,121} reporting outcomes for both definitions. There was one trial with women with normal BMI,⁹⁶ 15 studies with women with mixed BMI categories,^{78,80,81,83,84,86,104,119,121,126,128,132,135,142},

^{143,152} 5 of women with prepregnancy BMI categories of overweight or obese, ^{56,89,102,134,145} and 5 of women with BMI category of obesity only. ^{58,59,94,118,154} Twelve interventions were active ^{59,81, 83,84,86,94,128,134,142,143,145} and 14 were counseling-only; intensity was rated low in 2 trials, ^{80,135} moderate in 10 studies, ^{78,89,95,96,104,118,119,121,126,132} and high in 14 trials. ^{58,59,81,83,84,86,94,128,134,142,143,145}

GWG interventions were associated with decreased risk of macrosomia versus controls (25 trials; RR, 0.77 [95% CI, 0.65 to 0.92]; I^2 =38.3%; ARD, -1.9% [95% CI, -3.3 to -0.7]) (**Table 8, Figure 8**). When stratified by definition, GWG interventions were associated with decreased risk of macrosomia in trials using the definition of greater than 4 kg (21 trials; RR, 0.75 [95% CI, 0.62 to 0.89]; I^2 =39.0%), but not using the definition of greater than 4.5 kg (4 trials; RR, 1.47 [95% CI, 0.53 to 3.14]; I^2 =0%). Stratified analysis demonstrated interactions between effects of GWG interventions on risk of macrosomia and higher intervention intensity (p=0.03 for interaction), but not BMI category (p=0.24 for interaction) or intervention type (p=1.00 for interaction; **Table 8**).

Large for Gestational Age (LGA)

Twenty-six RCTs (N=13,000) reported the outcome of LGA infants, defined as birthweight greater than the 90th percentile for gestational age.^{56,58,59,76,80,88-90,94,96,98,105,114,115,119,121,125,127,136, 140,143,145,146,152-154} Ten were rated good quality^{56,58,80,90,121,125,143,145,146,154} and 16 were fair-quality trials (**Appendix B Tables 1-3 and Appendix C Tables 1-2**). ^{59,76,88,89,94,96,98,105,114,115,119,127,136, 140,152,153} There was one trial with women with normal BMI,⁹⁶ 10 trials with women with mixed BMI categories,^{76,80,88,105,114,115,119,136,143,152} 8 of women with prepregnancy BMI categories of overweight or obese, ^{56,89,90,98,121,127,145,153} and 7 of women with prepregnancy BMI category of obese.^{58,59,94,125,140,146,154} Seven trials were active, ^{59,94,105,114,115,114,115,143,145} and the remainder were counseling-only interventions. Intervention intensity was rated low in 3 trials,^{80,88,136} moderate in 9,^{56,76,89,96,119,121,127,140,146} and high in 14 trials.^{58,59,90,94,98,105,114,115,125,143,152-154}

Pooled estimates demonstrated a statistically significant effect of GWG interventions on LGA (26 trials; RR, 0.89 [95% CI, 0.80 to 0.99]; $I^2=0\%$; ARD, -1.3% [95% CI, -2.3 to -0.3]) (**Table 9**, **Figure 9**). Stratified analysis demonstrated no interactions between effects of GWG interventions on risk of LGA and BMI category (p=0.98 for interaction), intervention type (p=0.18 for interaction), or intensity (p=0.22 for interaction; **Table 9**).

Preterm Birth

Thirty-three RCTs (N=16,974) and one CCT¹²⁴ (N=178) reported on the outcome of preterm birth.^{56,58,76,78,80,81,83-86,89,90,93,94,96,98,105,119,125,126,130,132,134-136,140,142,144,145,147,152-154} Ten were rated good quality^{56,58,78,80,90,96,125,143,145,154} and 24 were fair quality (**Appendix B Tables 1-3 and Appendix C Tables 1-2**). There was 1 trial with women with normal BMI,⁹⁶ 19 studies with women with mixed BMI categories,^{76,78,80,81,83-86,93,105,119,124,126,132,136,142,143,147,152} 8 trials in women with prepregnancy BMI categories of overweight or obese,^{56,89,90,98,130,134,145,153} and 6 in women with prepregnancy BMI category of obese.^{58,94,124,125,140,154} Eleven were active,^{81,83-86,94, ^{105,134,142,143,145} and 23 were counseling-only interventions. Intervention intensity was rated low in} 5 trials, ^{80,93,130,135,136} moderate in 11 studies, ^{56,76,78,89,96,119,124,126,132,140,147} and high in 18 trials. ^{58,81, 83-86,90,94,98,105,125,134,142,143,145,152-154} Preterm birth was defined as delivery at less than 37 weeks in 25 studies, ^{56,58,76,78,80,81,83-86,90,93,94,96,98,119,124-126,140,144,145,152-154} less than 36 weeks in 4 trials, ^{132, 134,135,142} and 5 trials did not report a definition. ^{89,105,130,136,147} GWG interventions were not associated with a lower risk of preterm birth (33 trials; RR, 0.93 [95% CI, 0.81 to 1.07]; l^2 =2.2%; ARD, -0.2% [95% CI, -1.1 to 0.7]) (**Table 10, Figure 10**).

When stratified by definition, GWG interventions were not associated with risk of preterm birth before 37 weeks' gestation (24 trials; RR, 0.94 [95% CI, 0.81 to 1.10]; I^2 =3.5%), birth before 36 weeks' gestation (4 trials; RR, 1.04 [95% CI, 0.61 to 2.08]; I^2 =0%) or undefined preterm birth (5 trials; RR, 0.50 [95% CI, 0.10 to 1.33]; I^2 =7.1%). There were no statistically significant interactions between effects of GWG interventions on risk of preterm birth and BMI category (p=0.10 for interaction), intervention type (p=0.56 for interaction), or intensity (p=0.42 for interaction; **Table 10**).

Respiratory Distress Syndrome

Eight counseling-only RCTs (N=3,155; 4 good and 4 fair quality) of women with mixed (2 trials), overweight or obese (2 trials), or obese only (4 trials) prepregnancy BMI categories evaluated effects of GWG interventions on risk of respiratory distress syndrome (**Appendix B Tables 1-3 and Appendix C Tables 1-2**).^{80,88,90,118,140,141,145,154} Intervention intensity was low in two trials, moderate in three trials, and high in three trials. Pooled estimates demonstrated no effect of GWG interventions on risk of respiratory distress syndrome (8 trials; RR, 1.00 [95% CI, 0.67 to 1.42]; I^2 =0%; ARD, -0.3% [95% CI, -1.3 to 0.7]) (**Table 11, Figure 11**). There were no statistically significant interactions between effects of GWG interventions on risk of respiratory distress of respiratory distress syndrome and BMI category (p=0.19 for interaction), intervention type (p=0.25 for interaction), or intensity (p=0.42 for interaction; **Table 11**).

Shoulder Dystocia

Eight counseling RCTs (N=6,467; 4 good quality and 4 fair quality) found no difference in rates of shoulder dystocia for normal (1 trial), mixed (4 studies), or overweight or obese (3 studies) prepregnancy BMI categories for one active and seven counseling-only interventions compared to controls (**Appendix B Tables 1-3 and Appendix C Tables 1-2**).^{56,80,88,93,96,123,127,143} Intervention intensity was low in four trials, moderate in three trials, and high in one trial. There was no effect of GWG interventions on rates of shoulder dystocia based on pooled estimates (8 trials; RR, 1.05 [95% CI, 0.63 to 1.47]; I^2 =0%; ARD, 0.0% [95% CI, -0.4 to 0.5]; **Table 12**, **Figure 12**). There were no statistically significant interactions between effects of GWG intervention, interventions on risk of shoulder dystocia and BMI category (p=0.55 for interaction), intervention type (p=0.61 for interaction), or intensity (p=0.89 for interaction; **Table 12**).

NICU Admission

Fourteen RCTs (N=8,426) of women (7 of good quality, 7 fair quality) with normal (1 trial), mixed (6 trials), overweight or obese (4 trials), or obese (3 trials) prepregnancy BMI categories

reported on rates of NICU or special care nursery admission, with no reported differences in rates between intervention and control groups in five active or 9 counseling-only intervention trials (**Appendix B Tables 1-3 and Appendix C Tables 1-2**).^{56,59,76,80,88,90,93,94,96,105,125,127,143,145} Intensity was rated low in three trials, moderate in four, and high in 7 trials. Pooled estimates demonstrated no effect of GWG interventions on rates of NICU admission (14 trials; RR, 0.98 [95% CI, 0.86 to 1.08]; I^2 =0%; ARD, -0.7% [95% CI, -1.9 to 0.5]; **Table 13, Figure 13**). There were no statistically significant interactions between effects of GWG interventions on risk of NICU admission and BMI category (p=0.38 for interaction), intervention type (p=0.47 for interaction), or intensity (p=0.82 for interaction; **Table 13**).

Neonatal Death

Eleven RCTs (N=7,090) of women with normal (1 trial), mixed (4 trials), overweight or obese (4 trials), or obese (2 trials) prepregnancy BMI categories reported rates of neonatal death or stillbirth, with no significant differences reported between intervention versus control groups (**Appendix B Tables 1-3**).^{56,59,76,88-90,93,96,125,143,145} In the six good-quality^{56,90,125,143,145} and five fair-quality trials,^{59,76,88,89} three interventions were considered active and eight were counseling-only, and intervention intensity was rated low in two studies, moderate in four, and high in five studies. Data were not pooled for this outcome given heterogeneity in outcome categorization and low event rates.

Growth During the First Year of Life

Three counseling-only RCTs (N=2,516) of low, moderate, or high intensity found no differences between interventions during pregnancy versus usual care on infant growth during the first year of life (**Appendix B Tables 1-3**).^{95,137,151} One good-quality RCT⁹⁵ of women with overweight or obese prepregnancy BMI categories reported the incidence of infant BMI z-score greater than or equal to both 85 percent and 90 percent at 6 months of age, and found no differences between groups. Two fair-quality RCTs of women with mixed BMI categories reported infant weight at 12 months postpartum following a counseling-only intervention during pregnancy and reported no difference between intervention and controls.^{137,151}

Effects of Interventions to Limit Excess Gestational Weight Gain on Gestational Weight Outcomes

Summary

Interventions were associated with decreased mean GWG versus controls (55 trials; MD, -1.02 kg [95% CI, -1.30 to -0.75]; *I*²=60.3%). Statistically significant interactions were present between effects of GWG intervention on mean GWG and high intensity interventions (p<0.001 for interaction), but not for BMI category (p=0.06 for interaction), intervention type (p=0.07 for interaction), study quality (p=0.30 for interaction), or weight assessment timepoint (p=0.26 for interaction).

- Interventions were associated with decreased likelihood of exceeding IOM recommendations for GWG (39 trials; RR, 0.83 [95% CI, 0.77 to 0.89]; *I*²=63.8%; ARD, -7.6% [95% CI, -11.0 to -4.6]); stratified analysis demonstrated statistically significant interactions between effects of GWG interventions on likelihood of GWG and active interventions (p=0.003 for interaction) and high intensity interventions (p<0.001 for interaction), but not BMI category (p=0.60 for interaction).
- GWG interventions were not associated with improved adherence to IOM recommendations for GWG, defined by neither gaining excessive weight nor failing to gain sufficient weight (19 trials; RR, 1.10 [95% CI, 0.89 to 1.35]; *I*²=84.3%; ARD, 4.2% [95% CI, -1.2 to 10.0]). There were no interactions between effects of GWG interventions on adherence to GWG recommendations and BMI category (p=0.09 for interaction), intervention type (p=1.00 for interaction), or intensity (p=1.00 for interaction).
- GWG interventions were associated with decreased postpartum weight retention (PPWR) at the followup time point of 12 months (10 trials; MD, -0.63 kg [95% CI, -1.44 to -0.01]; *I*²=65.5%), but not less than 6 months (6 trials; MD, -0.81 kg [95% CI, -2.40 to 0.55]; *I*²=84.4%) or 6 months (3 trials; MD, -0.85 kg [95% CI, -3.67 to 0.81]; *I*²=70.6%). There were no interactions between effects of GWG interventions on PPWR and BMI category at up to 6 months (p=0.41) or 12 months (p=0.75) postpartum; however, the number of trials was small and estimates were imprecise.

Evidence

All 67 included trials (reported in 86 publications) conducted during pregnancy evaluated effects of GWG interventions on mean GWG (**Appendix B Tables 1-3**).^{56,58,59,75-119,121-158} Fifteen studies were rated good quality^{56,58,78,80,90,95-97,100,108,109,117,121,125,129,143,145,146,154,155} and 52 were rated fair quality.^{59,75-77,79,81-89,91-94,98,101,103-107,110-116,118,119,122-124,126-128,130-142,147-153,156-158} Sample sizes ranged from 50 to 2,261 (N=25,789, median=230), and reported sample mean ages ranged from 18.6 years to 33.8 years. One trial reported outcomes in women with normal prepregnancy BMI category,⁹⁶ 34 studies^{75,76,78-86,88,93,103-106,113-115,119,122,126,128,131,132,135-137,139,142,143,147,148,151,152} reported outcomes in women with mixed prepregnancy BMI categories (including one⁹² with women whose prepregnancy BMI was normal or overweight only); 19 with women with overweight or obese categories^{56,77,89,90,95,97,98,100-102,107-112,117,121,123,127,129,130,133,134,138,145,153,157}; and 13 with women with prepregnancy BMI category of obesity

13 with women with prepregnancy BMI category of obesity only. 58,59,87,91,94,118,124,125,140,141,146,149,150,154-156,158

Mean Gestational Weight Gain

GWG interventions were associated with reduced gestational weight gain during pregnancy of approximately one kilogram versus controls (55 trials; N=20,090; MD, -1.02 kg [95% CI, -1.30 to -0.75]; I^2 =60.3%) (**Table 14, Figure 14**). Fourteen trials were rated good quality, and 41 were fair quality (**Appendix C Table 1**). High-intensity interventions were associated with greater effects (28 trials; MD, -1.47 kg [95% CI, -1.78 to -1.22]; I^2 =13.0%) than moderate (18 trials; MD, -0.32 kg [95% CI, -0.71 to -0.04]; I^2 =17.6%) or low-intensity interventions (9 trials; MD, -0.64 kg [94% CI, -1.44 to 0.02]; I^2 =48.4%; p<0.001 for intensity subgroup interaction) (**Table**

14, Appendix D Figure 1).

There was no association between effects of GWG interventions and prepregnancy BMI category (p=0.06 for BMI category interaction). Subgroup analyses demonstrated a greater effect of GWG interventions for women in the obesity category (18 trials; MD, -1.63 [95% CI, -2.45 to -0.91]; I^2 =63.0%) than in the overweight category (10 trials; MD, -0.89 [95% CI, -1.54 to -0.32]; I^2 =15.5%), overweight and obesity weight categories combined (20 trials; MD, -0.90 [95% CI, -1.38 to -0.46]; I^2 =31.1%), mixed weight categories (28 trials; MD, -0.81 [95% CI, -1.16 to -0.46]; I^2 =60.7%); or normal weight category (8 trials; MD, -0.48 [95% CI, -96 to -0.21]; I^2 =0.0%; **Table 14, Appendix D Figure 2**).

Additional subgroup analyses did not show any statistically significant interactions between effects of GWG interventions on weight gain and the intervention type (counseling-only vs. active; p=0.07), study quality (p=0.30), or timing of assessment of weight gain (p=0.26) (**Table 14, Appendix D Figures 3-5**).

Subgroup analyses based on demographic characteristics or socioeconomic status could not be conducted due to sparse data (**Appendix B Table 3**). Two trials enrolled low-income African American women exclusively,^{90,112} two enrolled low-income Latina women (one study exclusively of Latina women),^{103,110} and one enrolled low-income White (61%) and Black (39%) women.¹³⁵ Results in these trials generally were consistent with overall findings, although the estimates of mean GWG in the two studies of African American women were slightly higher (MDs of -1.59 and -3.10 kg) than the studies of Latina women, which reported more inconsistent effects (MDs of -0.14 and -1.32 kg). One trial found no interaction between BMI category, income level, and effects of GWG interventions on mean GWG (p=0.16).¹²⁶

Exceeding IOM Recommendations for Gestational Weight Gain

Thirty-nine RCTs^{59,77-79,81,83-86,88,90,92-94,96,101,103,112,114,115,117,119,122,126,128,129,132,134-136,138,139,142,146-^{148,153,154,157} (N=14,271) and one CCT¹²⁴ (N=178) reported GWG in excess of the IOM recommendations as a dichotomous outcome (**Appendix B Tables 1-3**). Seven trials were rated good quality, and 33 studies fair quality (**Appendix C Tables 1-2**); 15 were active interventions^{59,81,83-86,94,101,103,114,115,128,129,134,142} and the remainder were counseling-only (**Appendix B Table 1**). GWG interventions were associated with decreased likelihood of gaining weight in excess of IOM recommendations (39 trials; RR, 0.83 [95% CI, 0.77 to 0.89]; I^2 =63.8%; ARD, -7.6% [95% CI, -11.0 to -4.6]) (**Table 15, Figure 15**).}

Stratified analysis demonstrated statistically significant interactions between effects of GWG interventions on likelihood of exceeding GWG recommendations and active interventions (p=0.003 for interaction) and high intensity interventions (p<0.001 for interaction), but not BMI category (p=0.60) (**Table 15**).

Adherence to IOM Recommendations for Gestational Weight Gain

Nineteen trials^{59,79,85,88,103,123,127,129,130,132,135,139,142,146,147,152,154} (N=5,835) reported on the outcome

of rates of adherence to GWG guidelines according to ranges recommended by the IOM (i.e., neither gaining excessive weight nor failing to gain sufficient weight) by prepregnancy BMI category (**Appendix B Tables 1-3**).^{59,79,85,88,93,96,103,123,127,129,130,132,135,139,142,146,147,152,154} Four trials were rated good quality and 15 fair quality (**Appendix C Table 1**). There were five active trials,^{59,85,103,129,142} and the remainder included counseling-only interventions (**Appendix B Table 1**). There was no difference between GWG interventions and controls in likelihood of adherence to IOM recommendations for GWG (19 trials; RR, 1.10 [95% CI, 0.89 to 1.35]; *I*²=84.3%; ARD, 4.2% [95% CI, -1.2 to 10.0]), although statistical heterogeneity was substantial (**Table 16**, **Figure 16**).

There was no statistically significant interaction between effects of GWG interventions on adherence to IOM recommendations for GWG and BMI category (p=0.09 for interaction), intervention type (p=1.00 for interaction), or intensity (p=1.00 for interaction) (**Table 16**).

Postpartum Weight Retention

Fourteen studies in 26 publications evaluated the effects of GWG interventions on postpartum weight retention (**Appendix B Tables 1-3**).^{59,78,100,104,106-109,111-113,116,118,119,131-133,135-137,143,144,154-156,158} There were 13 RCTs (N=4,841; 4 rated good quality^{78,108,109,143,144,154,155} and 9 rated fair quality)^{59,106,111-113,116,118,131,132,135-137,156,158} and one fair-quality CCT¹⁰⁴ (N=219) (**Appendix C Tables 1-2**). Two trials enrolled women with prepregnancy BMI categories of overweight or obese,^{109,111} four enrolled women categorized as obese only,^{116,155,156,158} and eight studies enrolled women with mixed BMI categories.^{78,104,106,113,131,132,135-137,144} Three trials^{59,106,143} evaluated active exercise interventions, while 11 studies assessed counseling-only interventions. Intensity was rated as low in two trials,¹³⁵⁻¹³⁷ moderate in seven studies,^{78,104,109,113,116,132,158} and high in five trials.^{106,111,143,155,156} Weight gain was reported from less than 6 months to 12 months postpartum.

GWG interventions were associated with statistically significant effects on postpartum weight retention at 12 months (10 trials; MD, -0.63 kg [95% CI, -1.44 to -0.01]; I^2 =65.5%),^{78,107,111,113,116,131,133,137,144,155} but not at less than 6 months (9 trials; MD, -0.81 kg [95% CI, -2.40 to 0.55]; I^2 =84.4%)^{100,109,113,114,116,135,136,158} or 6 months postpartum (3 trials; MD, -0.85 kg [95% CI, -3.67 to 0.81]; I^2 =70.6%)^{111,132,156} (**Table 17, Figure 17**). There were no statistically significant interactions between effects of GWG interventions on postpartum weight retention and BMI category at followup time of up to 6 months (p=0.41) or 12 months (p=0.75) (**Table 17; Appendix D Figures 6-8**).

Harms of Interventions to Limit Excess Gestational Weight Gain Among Pregnant Women and Their Infants

Summary

• Evidence was mixed on the effect of GWG interventions on maternal anxiety and depression based on various validated symptom scales in twelve studies.

• Interventions were not associated with SGA infants based on pooled analysis (20 trials; RR, 0.94 [95% CI, 0.80 to 1.10]; *I*²=0.0%; ARD, -0.4% [95% CI, -1.7 to 1.0]). There was a statistically significant interaction between effects of GWG interventions on risk of SGA and intervention intensity (p=0.04 for interaction), but not BMI category (p=0.91 for interaction) or intervention type (p=0.77 for interaction).

Evidence

Evidence on harms associated with GWG interventions was very limited, with most studies not reporting harms related to the intervention (**Appendix B Table 3**). Limited data were available on effects of GWG interventions on psychological symptoms related to GWG interventions and risk of SGA infants. No study reported effects of GWG interventions on the outcomes of stigma, maternal musculoskeletal injuries, or other harms.

Depression and Anxiety

Twelve studies of GWG interventions reported effects on maternal depression and anxiety (**Appendix B Tables 1-3**).^{75,87,91-93,96,97,99,105,125,129,147} Ten were randomized trials (N=2,553; three good quality and seven fair quality), and two were controlled prospective cohort studies (N=563); one good quality, one fair quality)^{91,97} (**Appendix C Tables 1- 2**). Different validated scales were used to measure anxiety and depression symptoms in these studies; therefore, pooling was not possible. Eight trials evaluated symptoms with the Edinburgh Postnatal Depression Scale (EPDS) scale at various time points or postpartum,^{75,87,91,96,99,105,125,147} but three trials did not report scores^{87,91,125}; two trials reported scores based on the Hospital Anxiety Depression Scale (HADS)^{92,93}; and a number of trials used different validated scales for measuring anxiety or depression.^{87,91,96,97,99,105,125,129} One trial enrolled women with normal BMI category,⁹⁶ five trials enrolled women in mixed BMI categories,^{75,92,93,105,147} three studies enrolled women in the obese only prepregnancy BMI category.^{87,91,125} There were five active^{75,91,99,105,129} and seven counseling-only^{87,92,93,697,125,147} interventions. Intervention intensity was low in two trials,^{92,93} moderate in three trials,^{87,96,147} and high in seven trials.^{75,91,97,99,105,125,129}

Effects of GWG interventions on maternal depression and anxiety were mixed. A fair quality trial $(N=140)^{75}$ evaluating a high intensity, active intervention found that scores on the Edinburgh Postnatal Depression Scale (EPDS) were lower in women in a water exercise group than in controls (EPDS score, mean (SD): 6.41 (3.7) vs. 10.2 (2.4), p<0.001). An additional fair quality trial $(N=172)^{105}$ evaluating a high intensity, active exercise intervention did not report differences between groups in EPDS scores over time, but reported a significant difference in psychological distress using the 21-item Depression Anxiety Stress Scale (DASS-21), used to evaluate general psychological distress (DASS-21 score, median (IQR): 6 (2-10) vs. 7 (4-11), p<0.05). A good quality, high intensity counseling intervention (N=230)¹²⁵ found that dietary education was not associated with differences in anxiety or depression based on the State and Trait Anxiety Inventory (STAI) or EPDS. Another good quality trial (N=215)⁹⁷ evaluating a high intensity counseling intervention effects on changes in psychological outcomes. There were significant decreases in depressive symptoms

from baseline to the post-intervention period in the intervention group versus controls (4.5 (3.7) vs. 6.1 (4.5); -1.95, 95% CI, -3.35 to -0.55, p=0.007), but no difference between groups in pregnancy-related anxiety using the pregnancy-related anxiety scale. A fair quality trial (N=261)¹⁴⁷ evaluating a moderate intensity counseling intervention demonstrated no difference in psychological variables between intervention and control groups as measured by the EPDS and the DASS-21 at 15 weeks and 33 weeks gestation. A good quality counseling trial (N=633) in women with normal weight used three different scales to measure maternal quality of life and emotional well-being.⁹⁶ There were no differences between intervention and control groups for the EPDS, SF-12, or STAI scores at any of the three measured time points (trial entry, 28, and 36 weeks).

A fair quality active trial (N=91), designed as a secondary analysis to evaluate the outcome of psychological well-being among women with overweight and obese BMI, used the Psychological General Well-Being Index to measure outcomes during pregnancy and the EPDS for assessing postpartum depression.⁹⁹ There were no differences in either set of scores between intervention and control groups, demonstrating no effect of a supervised exercise program during pregnancy on psychological well-being. One good quality RCT $(N=106)^{129}$ found an active GWG intervention associated with decreased likelihood of third trimester depression based on Center for Epidemiological Studies Depression Scale score (with depression indicated by scores greater than or equal to 16). Scores in the intervention group were significantly lower in the third trimester compared to the first trimester for the entire group (γ^2 =16.36, p=0.00) and in all BMI categories. One fair quality trial $(N=205)^{87}$ found a high intensity counseling intervention was associated with small differences in anxiety symptom scores using the STAI, but no difference in depressed mood based on the EPDS. There was a statistically significant decrease in levels of anxiety in the intervention group and a statistically significant increase in anxiety among controls based on a multivariate model of state of anxiety by group (β-estimate [standard error], 1.04 [1.42] vs. 1.90 [1.52] vs. controls, p=0.02). One fair quality prospective intervention trial (N=348)⁹¹ found no effects on depression or anxiety symptoms using the Beck Anxiety Inventory and the EPDS.⁹¹ One fair quality RCT (N=78),⁹² designed as a feasibility RCT to test the acceptability of a counseling intervention with community midwives, used the Hospital Anxiety and Depression Scale to evaluate symptoms of anxiety and depression. In this trial, and the follow up fair quality RCT (N=616) evaluating the same intervention, there were no significant differences in scores for anxiety or depression between intervention and control groups (anxiety, adjusted mean -0.58, 95% CI: -1.25 to -0.8; depression, adjusted mean -0.60, 95% CI: -1.24 to -0.05).⁹³

Small for Gestational Age

Thirty studies reported effects of GWG interventions on risk of infants small for gestational age (SGA); 29 were RCTs^{58,76,80,81,84,88-90,94,96,98,104,105,112,119,121,125-127,132,134-136,142,143,145,146,152-154} (N=13,820) and 1 was a CCT⁹¹ (N=348) (**Appendix B Tables 1-3**). SGA was defined as birthweight less than the 10th percentile for gestational age (21 studies),^{58,76,80,89-91,94,96,98,105,119,121,125,127,136,143,145,146,152-154} low birth weight less than 2,500 g (12 studies),^{81,84,94,96,104,126,132,134,135,142,145,152} or intrauterine growth restriction (1 study)⁸⁸; three RCTs^{96,145,152} reported both SGA and low birth weight. SGA, low birth weight, and intrauterine growth restriction were reported as secondary outcomes rather than as harms of GWG

interventions. Ten RCTs trials met criteria for good quality,^{58,80,90,96,121,125,143,145,146,154} and the remaining 20 studies (19 RCTs and 1 CCT) were rated fair quality (**Appendix Table C Tables 1-2**); eight were active interventions^{81,84,94,105,134,142,143,145} and the remainder were counseling-only (**Appendix B Table 1**). One trial enrolled women with normal weight, 14 trials enrolled women with mixed weight categories, 10 with women with overweight or obesity, and 5 with women with obesity; intensity was rated low in 4 trials, moderate in 10, and high in 16 (**Appendix B Table 1**).

In the 20 SGA trials (N=8,981), there was one trial in women with normal BMI,⁹⁶ eight trials in women with mixed BMI categories,^{76,80,104,105,119,136,143,152} seven of women in the overweight or obese category,^{89,90,98,121,127,145,153} and four of women in the obese category only.^{58,125,146,154} Intensity was low in two trials,^{80,136} moderate in seven trials,^{76,89,96,119,121,127,146} and high in 11 trials^{58,90,94,98,105,125,143,145,152-154}; four were active interventions^{94,105,143,145} and the remainder were counseling-only.

GWG interventions were not associated with increased risk of SGA in 20 trials (RR, 0.94 [95% CI, 0.80 to 1.10]; I^2 =0.0%; ARD, -0.4% [95% CI, -1.7 to 1.0]) (**Table 18, Figure 18**). ^{76,78,105,111,112,116,118,119,125,131,132,136,137,143-145,153,155} There was a statistically significant interaction between effects of GWG interventions on SGA and intervention intensity (p=0.04 for interaction), but not BMI category (p=0.91 for interaction) or intervention type (p=0.77 for interaction; **Table 18**).

Contextual Questions

Contextual Question 1. What Is the Association Between Gestational Weight Gain and Adverse Maternal and Infant Outcomes?

A 2008 systematic evidence review commissioned by AHRQ evaluated the association between GWG and infant and maternal outcomes.²³ Nearly all of the studies in the review were observational. Of 11 maternal and intrapartum outcomes reported, cesarean delivery was the only maternal outcome with evidence showing a moderate association with GWG; the association was stronger among women with overweight or obesity (OR, 1.3 [95% CI, 1.2 to 1.3]).²² The review described the evidence on the association between GWG and other maternal outcomes (hypertensive disorders, abnormal glucose metabolism) as weak. For infant health outcomes (i.e., birth outcomes) there was moderate to strong evidence for an association between low GWG and preterm birth, low birth weight, and SGA, and strong evidence for the association between high GWG and high birthweight, macrosomia, and LGA. This systematic evidence review was used to inform the revised 2009 IOM GWG guidelines.

Systematic evidence reviews and meta-analyses of observational data conducted since the 2008 AHRQ review report similar findings.²³ GWG above 2009 guidelines was associated with higher risk of LGA, macrosomia, and cesarean section. Weight gain below guidelines was associated with higher risk of SGA and preterm birth. Most recently, the LifeCycle Project-Maternal Obesity and Childhood Outcomes Study Group conducted an individual participant-level meta-analysis using data from over 196,000 singleton pregnancies within 25 cohort studies from
Europe and North America.¹⁸ Excessive GWG in each prepregnancy weight category (including different obesity classes) was associated with adverse perinatal outcomes (e.g., the presence of one or more of the following outcomes: preeclampsia, gestational hypertension, gestational diabetes, cesarean delivery, preterm birth, SGA, or LGA). However, the predictive power of GWG for the different adverse pregnancy outcomes was either low or moderate. In fact, the study group concluded that while optimal GWG may inform prenatal counseling, the optimal GWG ranges had limited predictive value for the adverse outcomes assessed.

Contextual Question 2. What Is the Association Between High Prepregnancy BMI and Risk of Adverse Maternal and Infant Outcomes?

A key result of the LifeCycle Project-Maternal Obesity and Childhood Outcomes Study was that prepregnancy BMI was more strongly associated with adverse maternal and infant outcomes than GWG.¹⁸ Numerous observational studies have demonstrated an association between elevated BMI at pregnancy onset and adverse perinatal outcomes.^{11,13,15,168-170} A 2017 umbrella review of 156 meta-analyses of cohort studies⁸ evaluated the association between adiposity and multiple obstetric and gynecological outcomes; evidence was strongest for elevated prepregnancy BMI and increased risk of cesarean delivery (BMI less than 25 vs. greater than 30; OR, 2.00 [95% CI, 1.87 to 2.15]), preeclampsia (BMI less than 25 vs. 25-30; OR, 1.70 [95% CI, 1.60 to 1.81]), and antenatal depression (BMI less than 25 vs. greater than 30; OR, 1.48 [95% CI, 1.32 to 1.66]; p<0.001 for all comparisons). The evidence was highly suggestive for associations between elevated prepregnancy BMI and GDM, LGA, macrosomia, stillbirth, postpartum hemorrhage, and preterm birth. There was a dose-dependent association between increasing degree of maternal obesity and increased maternal morbidity.¹⁷

A large (N=226,958) population-based cohort study from Canada¹⁷¹ examined the relationship between prepregnancy BMI and adverse pregnancy outcomes. The study estimated a 10 percent reduction in prepregnancy BMI would be associated with at least a 10 percent lower risk of preeclampsia, gestational diabetes, preterm delivery, macrosomia, and stillbirth. For example, women with a BMI of 36 kg/m² would have a 10 percent lower risk of these complications than women with a BMI of 40 kg/m². Larger declines in prepregnancy BMI (20% to 30%) were necessary to reduce risks of cesarean, shoulder dystocia, NICU stay 48 hours or longer, and inhospital newborn mortality. Prepregnancy BMI was not associated with risk of postpartum hemorrhage requiring intervention, severe maternal morbidity or maternal mortality, or spontaneous preterm delivery before 32 weeks of gestation.

Contextual Question 3. Among Women With a High Prepregnancy BMI, What Is the Association Between Reduction in Prepregnancy Weight and Risk of Adverse Maternal and Infant Outcomes?

A 2018 systematic evidence review and meta-analysis found an interpregnancy BMI decrease (greater than 1 BMI unit) was associated with decreased risk of LGA (3 trials; adjusted odds ratio [aOR], 0.7 [95% CI, 0.6 to 0.9]), macrosomia (3 trials; aOR, 0.5 [95% CI, 0.4 to 0.7]), and GDM (3 trials; aOR, 0.3 [95% CI, 0.6 to 1.0]), but increased risk of SGA (3 trials; aOR, 1.3 [95% CI, 1.1 to 1.6]) and low birth weight (less than 2,500 g) (3 trials; aOR, 2.2 [95% CI, 1.4 to

3.5]).¹⁷² One study that stratified women by BMI category found that those with normal BMI who lost weight had a similar risk for SGA as those who were overweight/obese and lost weight.¹⁷³

Increases in BMI between pregnancies among women with prepregnancy BMI greater than 25 kg/m² were associated with adverse pregnancy outcomes. A moderate increase in BMI was associated with increased risk of cesarean delivery and GDM; there was also an association with increased risk of LGA but this was not statistically significant.¹⁷² A substantial increase in BMI (greater than 3 BMI units) was associated with significantly increased risk of LGA and GDM, and an increased risk of cesarean delivery that was not statistically significant.¹⁷² However, the time between pregnancies was variable in these studies and could be quite long (years), which might not directly reflect the consequences of intentional weight loss prior to pregnancy.

A recent observational study of 16,395 women from the ELFE French national birth cohort examined the association between self-reported weight loss in the year prior to pregnancy and infant birthweight.¹⁷⁴ For women with normal or high BMI, GWG was higher for women with weight loss before pregnancy, compared with women with stable or moderate weight variation. For women with prepregnancy BMI <25 kg/m², infants of mothers with prepregnancy weight loss had higher mean birth weight compared to those from mothers with stable weight. For women with prepregnancy BMI >25 kg/m², weight loss before pregnancy was not associated with infant birth weight. Prepregnancy weight loss was not significantly associated with the risk of SGA and LGA for any group. In mediation analyses, the authors concluded that the increased GWG among those with prepregnancy weight loss.¹⁷⁴

Chapter 4. Discussion

Summary of Review Findings

This report synthesizes evidence on the effect of healthy weight and weight gain interventions during pregnancy on maternal and infant health outcomes, maternal weight outcomes, and harms. **Table 19** summarizes the evidence for this review; **Appendix E** summarizes the study characteristics of the included trials (**Appendix E Table 1**) and provides examples for potential implementation (**Appendix E Table 2**).

Evidence on effects of GWG interventions on maternal outcomes was most robust for gestational diabetes, gestational hypertension, preeclampsia, and cesarean delivery. Counseling-only and active GWG interventions were associated with decreased risk of GDM and emergency cesarean delivery. The absolute risk difference (ARD) for GDM was 1.6 percent; with a number needed to treat (NNT) to prevent one case of GDM of approximately 63. There were no statistically significant interactions between BMI categories, intervention type or intensity and effects on GDM. While the point estimate favored GWG interventions and was nearly statistically significant, there was no overall effect of GWG interventions on rates of gestational hypertension. Effects were observed in some stratified analyses for gestational hypertension, specifically decreased rates for high intensity interventions and active interventions, which may be related to a more direct relationship between these factors and effects on blood pressure. Interactions were also observed between effects of GWG interventions on perineal trauma and BMI category (p=0.003 for interaction) and intervention intensity (p=0.003 for interaction), but not for other maternal health outcomes. There was also no effect of GWG interventions on preeclampsia, a multisystem syndrome with less clear associations with BMI.¹⁷⁵ Importantly. studies included for this review that reported rates of hypertensive diseases of pregnancy distinguished between gestational hypertension and preeclampsia based on predefined diagnostic criteria.

Evidence on effects of GWG interventions on infant outcomes was most robust for macrosomia, LGA, and preterm birth. GWG interventions were associated with decreased risk of macrosomia and LGA, with ARD between 1 and 2 percent for both outcomes, resulting in a NNT of approximately 53 (95% CI, 31 to 250) to prevent one case of macrosomia and approximately 77 (95% CI, 42 to 333) to prevent one case of LGA. Evidence did not indicate effects of GWG interventions on risk of respiratory distress syndrome, shoulder dystocia, NICU admission, neonatal death, or stillbirth.

For weight-related outcomes, GWG interventions were associated with slightly less overall weight gain (MD, -1.02 kg) versus controls. The effects of interventions on GWG also tended to be greater in trials of high-intensity interventions (MD, -1.47 kg) compared with moderate- (MD, -0.32 kg) or low-intensity interventions (MD, -0.64 kg; p<0.001 for intensity subgroup interaction).

While the overall interaction between BMI and GWG was not statistically significant, the effects of GWG interventions on gestational weight gain were greater in women in the obese (MD, -1.63

kg) and overweight (MD, -0.89 kg) categories compared with women with normal prepregnancy BMI (MD, -0.48 kg; p=0.06 for BMI category interaction). Although average GWG differed according to prepregnancy BMI category, women with normal weight may experience greater relative benefit (percent change in overall BMI) for the same effects on weight gain compared with women categorized as obese (the IOM recommendations for GWG are higher [25-35 lbs.] in women with normal weight than in women in the obese category [11-20 lbs.]). Additionally, there were no statistically significant interactions between the type of intervention (counseling-only versus active, p=0.07) or timing of weight gain assessment (p=0.26) and effects of GWG interventions on the amount of weight gain.

GWG interventions also were associated with decreased likelihood of weight gain in excess of IOM recommendations versus controls. The absolute risk difference was approximately 7 percent, with the NNT to prevent one woman experiencing GWG in excess of IOM recommendations approximately 13. There were statistically significant interactions between effects of GWG interventions on likelihood of weight gain in excess of IOM recommendations and active interventions (p=0.003 for interaction) and high intensity interventions (p<0.001 for interaction), but not BMI category (p=0.60 for interaction).

There was no association between GWG interventions and likelihood of adhering to IOM recommendations for GWG (defined as neither gaining excess weight nor not gaining enough weight). The discrepancy between positive effects of GWG interventions on likelihood of gaining excess weight and no effect on likelihood of adhering to IOM recommendations could be explained by an increased likelihood of some women failing to gain enough weight. However, data were not available to verify this, as most studies did not report the proportion of women unable to gain sufficient weight. GWG interventions were associated with effects on postpartum weight retention at 12 months followup but not at less than 6 months or 6 months, although data were limited and estimates were imprecise.

Evidence on harms of GWG interventions was limited. Most studies were not designed to assess harms, though some reported outcomes unrelated to interventions (SGA, psychological outcomes) that could be considered either potential benefits or harms. Evidence on effects of GWG interventions on maternal depression and anxiety was limited and showed mixed results based on various symptom scales. There was no association between GWG interventions versus controls and risk of SGA. As noted above, studies did not report the proportion of women who failed to gain sufficient weight during pregnancy.

Reviews of observational studies evaluating associations between GWG interventions and maternal and infant outcomes were generally consistent with our findings,^{21-23,176,177} although some differences could be explained by use of observational data. Importantly, our findings are generally consistent with obesity and behavioral intervention literature that demonstrates more promising effects of interventions that offer frequent patient contact, and for more pronounced effects on absolute weight loss in obese populations.^{178,179}

Limitations

We excluded non-English language studies and did not search for studies published only as abstracts. There was substantial variability in interventions, comparisons, and timing and method of assessment of outcomes, with statistical heterogeneity in some pooled analysis that was only partially accounted for in stratified or subgroup analyses based on these and other factors. Because of anticipated heterogeneity, we performed random effects analyses, which resulted in wider confidence intervals than fixed effects models when statistical heterogeneity is present, reflecting the greater uncertainty in estimates. In addition, we used the profile-likelihood method for conducting meta-analysis, which may be more reliable when statistical heterogeneity is present.¹⁸⁰

There were limitations in the evidence. There was a lack of data on prepregnancy weight loss interventions. One trial of a prepregnancy intervention showed that intentional weight loss prior to pregnancy did not impact adherence to weight gain guidelines during pregnancy and, instead, resulted in increased gestational weight gain.¹²⁰ One arm of a trial that focused on reducing GDM risk through a lifestyle intervention included women who were planning pregnancy. However, not all women in the intervention arm were encouraged to lose weight, and weight change before pregnancy was not reported, precluding the evaluation of the effects of prepregnancy weight loss on pregnancy outcomes.¹⁴¹ Many individual trials had methodological limitations, though we excluded poor-quality trials due to serious flaws. Trials primarily focused on the effects of GWG interventions on mean GWG, an intermediate outcome, with less evidence on the direct effects of GWG interventions on maternal and infant health outcomes. Some of the subgroup analyses were underpowered to evaluate subgroup effects. Additionally, some trials enrolled mixed populations of women with different BMI categories, limiting the usefulness of stratified analyses. Evidence on harms was limited, particularly for effects on psychological well-being and quality of life. Most studies had some methodological limitations, though results were similar in analyses stratified by study quality.

Another limitation was inconsistent outcome measurement or characterization. For example, for studies of gestational diabetes, there was significant variation in diagnostic criteria. Maternal hemorrhage and infant outcomes (e.g., SGA) were also inconsistently defined. Studies reporting PPWR were limited by sparse data and lack of reporting on factors other than the GWG interventions that could influence PPWR (e.g., breastfeeding status, intentional weight loss efforts). For studies evaluating rates of cesarean delivery, indications for cesarean or emergency cesarean were not reported or were poorly defined (e.g., "failure to progress"). We pooled results separately for nonemergency or mixed cesarean section and emergency cesarean, with similar findings of no effects of GWG interventions on nonemergency cesarean, but statistically significant effects of interventions on emergency cesarean.

Emerging Issues/Next Steps

Given the lack of studies evaluating interventions to reduce weight before pregnancy, trials examining the impact of prepregnancy weight loss interventions are an important next step, and several are ongoing.¹⁸¹⁻¹⁸⁴ Importantly, for prepregnancy interventions to be effective it is

necessary to identify women who intend to become pregnant; therefore, studies that incorporate methods for evaluating pregnancy intention are needed for optimally implementing prepregnancy interventions.^{120,185} For example, the One Key Question© initiative works to improve pregnancy outcomes based on the premise that providing clinicians with a framework to routinely assess pregnancy intention offers an opportunity for patient-centered counseling that can be tailored based on a woman's desire or ambivalence about pregnancy.¹⁸⁶ Nearly half of all U.S. pregnancies are unplanned or unintended, further highlighting the potential impact of initiatives that assess pregnancy intention or contraceptive needs, as these pregnancies are more often associated with poor prepregnancy health and pregnancy outcomes.^{187,188} Additional emphasis on evaluating counseling content and methods in order to insure careful consideration of the impact on body image and weight stigma or bias is also important when counseling women in any weight category.

Relevance for Priority Populations

Data were too limited to determine how effects of GWG interventions on health outcomes or weight-related outcomes varied in populations defined by race or ethnicity, age (e.g., adolescents, older maternal age), or socioeconomic status given that outcomes were not reported according to these groups. However, 28 of the 68 included studies (41%) enrolled more than 20 percent of patients from diverse backgrounds, including those who are socioeconomically disadvantaged, racial or ethnic minorities, rural populations, or others as defined by the National Institute on Minority Health and Health Disparities as populations adversely affected by disparities.¹⁸⁹ As such, the potential applicability of various interventions is favorable given the diversity of enrolled study populations. Although the reported ages of enrolled participants in study samples ranged from 14 to 49 years, studies did not include large numbers of women of advanced maternal age or did not report data separately in this subgroup. A recent review summarized the associations between advanced maternal age and risks for adverse pregnancy outcomes; however, many of these associations were considered weak.¹⁹⁰ Additional data are needed to further characterize the impact of age on adverse pregnancy outcomes to help facilitate accurate counseling. No study was specifically conducted in pregnant adolescents. Evidence suggests an association with increased risk in adolescent mothers for developing and maintaining unhealthy BMI during and after pregnancy, which can be intensified by GWG.¹⁹¹ Excess GWG in pregnant adolescents may have lasting effects for future pregnancies and into adulthood.¹⁹² Trials did not address issues of health care disparities, access to prenatal care (or lack thereof), or feasibility of interventions in settings where access to care is limited or arrival to care is delayed.

Future Research

Research is needed to determine the effectiveness of interventions to limit GWG in populations of women of advanced maternal age (e.g., older than 34 years), adolescents, and in the priority populations described above. While there were many studies on effects of interventions on GWG, the effects on maternal and infant health outcomes is more limited, as these were mostly reported as secondary outcomes of interventions to reduce GWG. A recently published consortium of trials (Lifestyle Interventions for Expectant Moms) found diverse behavioral

intervention modalities implemented in a large, racially and socioeconomically diverse U.S. population of pregnant women were associated with modest, beneficial effect on GWG, but had no effects on health outcomes including preeclampsia, GDM, cesarean delivery, or birth weight.⁵⁷ At 12 months, they found beneficial effects on maternal postpartum weight retention but no effects on infant anthropometric outcomes.^{181,193,194} Eligible trials from this consortium that were completed and published are included this review.^{90,98,107,134,138,153} Future trials could evaluate more intensive behavioral interventions, which may be more effective, and whether components should be tailored to specific populations.⁶⁹ Research would be helpful for determining the optimal frequency, length of sessions, and number of sessions needed for an intervention to provide additional evidence on effectiveness, including approaches that utilize telehealth modalities to deliver care.^{195,196} Future trials could consider evaluating the impact of GWG and PPWR in the context of inter-conception care, which may be a key factor in determining prepregnancy BMI for multiparous women.¹⁹⁷ Another consideration is whether GWG is the most appropriate outcome measure, or whether an alternative indicator of gestational weight, such as maternal fat accumulation or weight gain relative to prepregnancy BMI, is more informative. Given that GWG is a composite outcome influenced by many factors, causal relationships may be difficult to measure,¹⁹⁸ as are indirect links between maternal weight and perinatal outcomes.¹⁹⁹ Future trials of interventions to limit GWG should evaluate health outcomes using standardized measures of postpartum hemorrhage, gestational hypertension, preeclampsia, and gestational diabetes, and should report indications for cesarean delivery, as well as stratify effects of interventions by BMI category. Given the lack of data directly evaluating harms of interventions to limit GWG, further investigation into the potential harms related to these interventions, including the harms of insufficient weight gain and harms related to the effect on eating disorders or disordered eating behavior, is needed.²⁰⁰ Other harms may include the effects of musculoskeletal injuries in women due to body changes occurring during the relatively short timeline of pregnancy.

Conclusions

Counseling and active behavioral interventions to limit GWG in pregnant women are associated with a modestly decreased risk of GDM, emergency cesarean delivery, macrosomia, and large for gestational age. GWG interventions are also associated with modest reductions in weight gain and decreased likelihood of exceeding IOM recommendations for GWG. Effects of these interventions on mean GWG are slightly more pronounced for high intensity interventions.

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Abbreviations: BMI = body mass index; GWG = gestational weight gain.

Figure 2. Meta-Analysis of Trials: Gestational Diabetes Mellitus

Study	Population	Intervention	Intensity	Treatment n/N	Control n/N		Risk Ratio (95% Cl)
Assaf-Balut, 2017	Mixed	Active	High	74/500	103/500	٠	0.72 (0.55, 0.94)
Al Wattar, 2019	Mixed	Counseling	Moderate	84/477	124/497	•	0.71 (0.55, 0.90)
Barakat, 2012	Mixed	Active	High	0/40	3/43	<u>+</u> Ţ	0.15 (0.01, 2.88)
Barakat, 2014	Mixed	Active	High	5/137	5/114	-	0.83 (0.25, 2.80)
Barakat, 2016	Mixed	Active	High	9/420	21/420	-	0.43 (0.20, 0.92)
Barakat, 2019	Mixed	Active	High	6/234	15/222		0.38 (0.15, 0.96)
Brownfoot, 2015	Mixed	Counseling	Low	21/386	21/396	+	1.03 (0.57, 1.85)
Daley, 2019	Mixed	Counseling	Low	12/315	17/317		0.71 (0.34, 1.46)
Guelfi, 2016	Mixed	Active	High	34/84	34/85	+	1.01 (0.70, 1.46)
Hui, 2012	Mixed	Active	High	2/112	3/112	—	0.67 (0.11, 3.91)
Hui, 2014	Mixed	Active	High	1/57	3/56 -		0.33 (0.04, 3.05)
Kunath, 2019	Mixed	Counseling	Moderate	109/1008	106/954	+	0.97 (0.76, 1.25)
Luoto, 2011	Mixed	Counseling	Moderate	34/343	22/297		1.34 (0.80, 2.24)
Olson, 2018	Mixed	Counseling	Moderate	37/1126	18/563	+	1.03 (0.59, 1.79)
Pelaez, 2019	Mixed	Active	High	3/100	13/201	_ → }	0.46 (0.14, 1.59)
Phelan, 2011	Mixed	Counseling	Moderate	19/201	13/200		1.45 (0.74, 2.86)
Polley, 2002	Mixed	Counseling	Low	2/61	3/59	+	0.64 (0.11, 3.72)
Rauh, 2013	Mixed	Counseling	Low	8/167	9/83	-+	0.44 (0.18, 1.10)
Ruiz, 2013	Mixed	Active	High	16/481	30/481		0.53 (0.29, 0.97)
Sagedal, 2017	Mixed	Active	High	32/303	25/303	+	1.28 (0.78, 2.11)
Dodd, 2019	Normal	Counseling	Moderate	39/316	39/313	+	0.99 (0.65, 1.50)
Bruno, 2017	0/0	Counseling	Moderate	13/96	23/95	-	0.56 (0.30, 1.04)
Cahill, 2018	0/0	Counseling	High	11/133	12/134	+	0.92 (0.42, 2.02)
Dodd, 2014	0/0	Counseling	Moderate	120/1108	148/1104		0.81 (0.64, 1.01)
Garnaes, 2016	0/0	Active	High	5/46	8/45		0.61 (0.22, 1.73)
Harrison, 2013	0/0	Counseling	Moderate	27/121	35/107	•	0.68 (0.44, 1.05)
McCarthy, 2016	0/0	Counseling	Low	37/190	35/192	+	1.07 (0.70, 1.62)
Peccei, 2017	0/0	Counseling	Moderate	9/200	4/100	_ →	1.13 (0.36, 3.56)
Petrella, 2014	0/0	Counseling	Low	7/33	16/30		0.40 (0.19, 0.83)
Phelan, 2018	0/0	Active	High	23/132	24/132	*	0.96 (0.57, 1.61)
Seneviratne, 2016	0/0	Active	High	4/37	2/37	_ + +	2.00 (0.39, 10.26)
Van Horn, 2018	0/0	Counseling	High	7/133	9/127	-	0.74 (0.29, 1.93)
Bogaerts, 2013	Obese	Counseling	Moderate	7/58	7/63	_ →	1.09 (0.41, 2.91)
Daly, 2017	Obese	Active	High	25/44	21/44	*	1.19 (0.80, 1.78)
Koivusalo, 2016	Obese	Counseling	Moderate	20/155	27/138		0.66 (0.39, 1.12)
Okesene-Gafa, 201	19 Obese	Counseling	High	30/96	23/100	•	1.36 (0.85, 2.16)
Renault, 2014	Obese	Counseling	High	6/142	7/141	-	0.85 (0.29, 2.47)
Rono, 2018a	Obese	Counseling	Moderate	39/65	34/63	•	1.11 (0.82, 1.50)
Rono, 2018b	Obese	Counseling	Moderate	107/239	111/231	•	0.93 (0.77, 1.13)
Simmons, 2017	Obese	Counseling	Moderate	27/108	35/105	-	0.75 (0.49, 1.15)
Vesco, 2014	Obese	Counseling	High	6/58	7/60	-	0.89 (0.32, 2.48)
Vinter, 2011	Obese	Active	High	9/180	8/180	_ _	1.13 (0.44, 2.85)
Wolff, 2008	Obese	Counseling	Moderate	0/28	3/38	→	0.19 (0.01, 3.58)
Overall				1086/10270	1226/9482		0.87 (0.79, 0.95)
(I-squared = 16.4%	6)					1	, ,
					0	1	11

Favors Treatment Favors Control

Figure 3. Meta-Analysis of Trials: Gestational Hypertension

Study	Population	Intervention	Intensity	Treatment n/N	Control n/N	Risk Ratio (95% Cl)
Assaf-Balut, 2017	Mixed	Active	High	13/500	19/500 -	0.68 (0.34, 1.37)
Barakat, 2016	Mixed	Active	High	8/420	22/420	0.36 (0.16, 0.81)
Brownfoot, 2015	Mixed	Counseling	Low	18/386	16/396 -	1.15 (0.60, 2.23)
Kunath, 2019	Mixed	Counseling	Moderate	99/1139	66/1122	 1.48 (1.09, 2.00)
Olson, 2018	Mixed	Counseling	Moderate	35/1126	20/563 🚽	0.88 (0.51, 1.50)
Phelan, 2011	Mixed	Counseling	Moderate	20/171	22/178 🚽	0.95 (0.54, 1.67)
Polley, 2002	Mixed	Counseling	Low	6/61	8/59 🗕	0.73 (0.27, 1.96)
Ruiz, 2013	Mixed	Active	High	13/481	30/481 🛨	0.43 (0.23, 0.82)
Thomson, 2016	Mixed	Counseling	High	0/39	1/43	0.37 (0.02, 8.75)
Dodd, 2019	Normal	Counseling	Moderate	5/315	4/313	1.24 (0.34, 4.58)
Bruno, 2017	0/0	Counseling	Moderate	2/96	13/95	0.15 (0.04, 0.66)
Cahill, 2018	0/0	Counseling	High	32/133	27/134	1.19 (0.76, 1.88)
Dodd, 2014	0/0	Counseling	Moderate	101/1108	94/1104	1.07 (0.82, 1.40)
Garnaes, 2016	0/0	Active	High	3/46	7/45	0.42 (0.12, 1.52)
McCarthy, 2016	0/0	Counseling	Low	17/190	19/192 🚽	0.90 (0.49, 1.69)
Peccei, 2017	0/0	Counseling	Moderate	3/200	2/100	0.75 (0.13, 4.42)
Petrella, 2014	0/0	Counseling	Low	1/33	7/30	0.13 (0.02, 0.99)
Phelan, 2018	0/0	Active	High	5/132	7/132 -	0.71 (0.23, 2.19)
Seneviratne, 2016	0/0	Active	High	1/38	0/37	2.92 (0.12, 69.54)
Bogaerts, 2013	Obese	Counseling	Moderate	19/142	6/63	 1.40 (0.59, 3.35)
Koivusalo, 2016	Obese	Counseling	Moderate	7/155	6/138 -	1.04 (0.36, 3.02)
Okesene-Gafa, 201	19 Obese	Counseling	High	8/116	10/114 -	0.79 (0.32, 1.92)
Renault, 2014	Obese	Counseling	High	9/284	9/141 🗕	0.50 (0.20, 1.22)
Rono, 2018a	Obese	Counseling	Moderate	4/65	3/63	1.29 (0.30, 5.54)
Rono, 2018b	Obese	Counseling	Moderate	18/249	13/243	 1.35 (0.68, 2.70)
Vesco, 2014	Obese	Counseling	High	5/58	6/60	0.86 (0.28, 2.67)
Vinter, 2011	Obese	Active	High	23/180	28/180 🚽	0.82 (0.49, 1.37)
Wolff, 2008	Obese	Counseling	Moderate	1/28	4/38	0.34 (0.04, 2.87)
Overall				476/7891	469/6984	0.87 (0.70, 1.04)
(I-squared = 32.5%	6)					
					I 1 0 1	1 70

Favors Treatment Favors Control

Figure 4. Meta-Analysis of Trials: Cesarean Delivery*

Study	Population	Intervention	Intensity	Treatment n/N	Control n/N	Risk Ratio (95% Cl)
Al Wattar, 2019	Mixed	Counseling	Moderate	175/593	176/625	1.05 (0.88, 1.25)
Althuizen, 2013	Mixed	Counseling	Moderate	16/103	22/107 🔶	0.76 (0.42, 1.36)
Barakat, 2012	Mixed	Active	High	12/40	6/43	 2.15 (0.89, 5.19)
Barakat, 2014	Mixed	Active	High	18/107	26/93 🔶	0.60 (0.35, 1.03)
Barakat, 2016	Mixed	Active	High	73/382	83/383	0.88 (0.67, 1.17)
Barakat, 2019	Mixed	Active	High	48/234	46/222 🔶	0.99 (0.69, 1.42)
Daley, 2019	Mixed	Counseling	Low	68/304	69/302	0.98 (0.73, 1.31)
Guelfi, 2016	Mixed	Active	High	35/85	37/87 🔶	0.97 (0.68, 1.38)
Hui, 2012	Mixed	Active	High	2/102	3/88	0.58 (0.10, 3.36)
Hui, 2014	Mixed	Active	High	0/57	2/56	0.20 (0.01, 4.00)
Kunath, 2019	Mixed	Counseling	Moderate	307/1139	276/1122	1.10 (0.95, 1.26)
Olson, 2018	Mixed	Counseling	Moderate	226/1126	91/563	1.24 (1.00, 1.55)
Pelaez, 2019	Mixed	Active	High	17/100	48/201 🔸	0.71 (0.43, 1.17)
Phelan, 2011	Mixed	Counseling	Moderate	57/171	67/178	0.89 (0.67, 1.18)
Polley, 2002	Mixed	Counseling	Low	4/57	7/53	0.53 (0.16, 1.71)
Rauh, 2013	Mixed	Counseling	Low	47/156	33/79 🔹	0.72 (0.51, 1.03)
Ruiz, 2013	Mixed	Active	High	93/481	95/481	0.98 (0.76, 1.27)
Dodd, 2019	Normal	Counseling	Moderate	73/316	74/313	0.98 (0.74, 1.30)
Bruno, 2017	0/0	Counseling	Moderate	17/69	25/62 🔸	0.61 (0.37, 1.02)
Cahill, 2018	0/0	Counseling	High	53/133	47/134	1.14 (0.83, 1.55)
Dodd, 2014	0/0	Counseling	Moderate	370/1075	389/1067	0.94 (0.84, 1.06)
Gallagher, 2018	0/0	Counseling	High	29/97	31/99 🔶	0.95 (0.63, 1.46)
Garnaes, 2016	0/0	Active	High	9/38	6/36 -	1.42 (0.56, 3.59)
Peccei, 2017	0/0	Counseling	Moderate	43/180	20/92	1.10 (0.69, 1.75)
Perales, 2015	0/0	Active	High	15/50	19/34 🔶	0.54 (0.32, 0.90)
Phelan, 2018	0/0	Active	High	46/129	40/128	1.14 (0.81, 1.61)
Seneviratne, 2016	0/0	Active	High	18/38	13/37	1.35 (0.78, 2.34)
Van Horn, 2018	0/0	Counseling	High	55/140	37/141	1.50 (1.06, 2.11)
Koivusalo, 2016	Obese	Counseling	Moderate	31/144	30/125 🔶	0.90 (0.58, 1.39)
Okesene-Gafa, 201	9 Obese	Counseling	High	39/116	36/114 🔶	1.06 (0.73, 1.54)
Renault, 2014	Obese	Counseling	High	83/284	50/141	0.82 (0.62, 1.10)
Rono, 2018b	Obese	Counseling	Moderate	55/249	59/243	0.91 (0.66, 1.26)
Vesco, 2014	Obese	Counseling	High	21/56	26/58 🔸	0.84 (0.54, 1.30)
Wolff, 2008	Obese	Counseling	Moderate	2/23	3/27	0.78 (0.14, 4.29)
Overall				2157/8374	1992/7534	0.98 (0.91, 1.04)
(I-squared = 10.8%)					
						5
					Favors Treatment	Favors Control

* Any cesarean delivery outcome.

Figure 5. Meta-Analysis of Trials: Preeclampsia

Study	Population	Intervention	Intensity	Treatment n/N	Control n/N	Risk Ratio (95% Cl)
Al Wattar, 2019	Mixed	Counseling	Moderate	34/593	27/625	1.33 (0.81, 2.17)
Assaf-Balut, 2017	Mixed	Counseling	Low	7/500	11/500	0.64 (0.25, 1.63)
Barakat, 2016	Mixed	Active	High	2/420	9/420	0.22 (0.05, 1.02)
Daley, 2019	Mixed	Counseling	Low	6/315	8/317	0.75 (0.26, 2.15)
Guelfi, 2016	Mixed	Active	High	2/85	1/87	2.05 (0.19, 22.16)
Kunath, 2019	Mixed	Counseling	Moderate	14/1139	13/1122 🕂	1.06 (0.50, 2.25)
Luoto, 2011	Mixed	Counseling	Moderate	14/246	10/196	1.12 (0.51, 2.46)
Olson, 2018	Mixed	Counseling	Moderate	42/1126	25/563	0.84 (0.52, 1.36)
Phelan, 2011	Mixed	Counseling	Moderate	20/171	20/178	1.04 (0.58, 1.87)
Polley, 2002	Mixed	Counseling	Low	2/61	3/59	0.64 (0.11, 3.72)
Sagedal, 2017	Mixed	Active	High	10/303	15/303	0.67 (0.30, 1.46)
Thomson, 2016	Mixed	Counseling	High	0/54	1/51	0.32 (0.01, 7.56)
Olson, 2018	Normal	Counseling	Moderate	34/601	18/301 📥	0.95 (0.54, 1.65)
Dodd, 2019	Normal	Counseling	Moderate	6/316	9/313	0.66 (0.24, 1.83)
Dodd, 2014	0/0	Counseling	Moderate	56/1108	53/1104 🔶	1.05 (0.73, 1.52)
McCarthy, 2016	O/O	Counseling	Low	17/190	19/192 🕂	0.90 (0.49, 1.69)
Olson, 2018	0/0	Counseling	Moderate	8/525	7/262	0.57 (0.21, 1.56)
Peccei, 2017	0/0	Counseling	Moderate	5/200	0/100	5.53 (0.31, 98.98)
Phelan, 2018	0/0	Active	High	10/132	8/132	1.25 (0.51, 3.07)
Seneviratne, 2016	0/0	Active	High	1/38	1/37	0.97 (0.06, 15.00)
Bogaerts, 2013	Obese	Counseling	Moderate	16/206	4/63	1.22 (0.42, 3.53)
Koivusalo, 2016	Obese	Counseling	Moderate	7/155	3/138	2.08 (0.55, 7.88)
Okesene-Gafa, 2019	Obese	Counseling	High	8/116	10/114 -	0.79 (0.32, 1.92)
Peccei, 2017	Obese	Counseling	Moderate	5/115	0/57	5.50 (0.31, 97.77)
Renault, 2014	Obese	Counseling	High	12/284	3/141	1.99 (0.57, 6.92)
Rono, 2018a	Obese	Counseling	Moderate	1/65	1/63	0.97 (0.06, 15.16)
Rono, 2018b	Obese	Counseling	Moderate	14/249	7/243	1.95 (0.80, 4.75)
Vesco, 2014	Obese	Counseling	High	5/58	6/60 -	0.86 (0.28, 2.67)
Vinter, 2011	Obese	Active	High	23/180	28/180	0.82 (0.49, 1.37)
Wolff, 2008	Obese	Counseling	Moderate	0/28	1/38	0.45 (0.02, 10.61)
Overall		-		381/9579	321/7959	0.98 (0.84, 1.13)
(I-squared = 0.0%)					l l	· •
					0 1	1 99
					Favors Treatment	Favors Control

Note: Some trials reported multiple discrete BMI subcategories. **Abbreviations:** CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; O/O = overweight and obese combined BMI category.

Figure 6. Meta-Analysis of Trials: Postpartum Hemorrhage

Study	Population	Intervention	Intensity	Treatment n/N	Control n/N		Risk Ratio (95% Cl)
Al Wattar, 2019	Mixed	Counseling	Moderate	9/593	13/625	-	0.73 (0.31, 1.69)
Brownfoot, 2015	Mixed	Counseling	Low	72/386	72/396	+	1.03 (0.76, 1.38)
Guelfi, 2016	Mixed	Active	High	2/85	3/87 —		- 0.68 (0.12, 3.98)
Sagedal, 2017	Mixed	Active	High	60/303	57/303	+	1.05 (0.76, 1.46)
Dodd, 2019	Normal	Counseling	Moderate	53/316	45/313	-	1.17 (0.81, 1.68)
Dodd, 2014	0/0	Counseling	Moderate	168/1075	177/1067		0.94 (0.78, 1.14)
McCarthy, 2016	0/0	Counseling	Low	15/190	15/192	+	1.01 (0.51, 2.01)
Peccei, 2017	0/0	Counseling	Moderate	16/200	3/100	+-•	2.67 (0.80, 8.94)
Seneviratne, 2016	0/0	Active	High	3/38	5/37 -	-+	0.58 (0.15, 2.27)
Overall				398/3186	390/3120		1.00 (0.88, 1.15)
(i-squared = 0.0%)							
					1	1	9
					Favors Tr	reatment	Favors Control

Figure 7. Meta-Analysis of Trials: Perineal Trauma

				Treatment	Control	Risk Ratio
Study	Population	Intervention	Intensity	n/N	n/N	(95% CI)
Assaf-Balut, 2017	Mixed	Counseling	Low	14/500	48/500	0.29 (0.16, 0.52)
Brownfoot, 2015	Mixed	Counseling	Low	9/386	15/396	0.62 (0.27, 1.39)
Sagedal, 2017	Mixed	Active	High	9/303	9/303	1.00 (0.40, 2.48)
Dodd, 2019	Normal	Counseling	Moderate	9/316	5/313	1.78 (0.60, 5.26)
Dodd, 2014	0/0	Counseling	Moderate	28/1075	20/1067	1.39 (0.79, 2.45)
Garnaes, 2017	0/0	Active	High	4/46	2/45	1.96 (0.38, 10.16)
McCarthy, 2016	0/0	Counseling	Low	7/190	5/192	1.41 (0.46, 4.38)
Seneviratne, 2016	0/0	Active	High	6/38	10/37	0.58 (0.24, 1.44)
Overall (I-squared = 57.0%)				86/2854	114/2853	0.86 (0.52, 1.50)
					0 1	I 11
					Favors Treatment	Favors Control

Figure 8. Meta-Analysis of Trials: Macrosomia

					Treatment	Control	Risk Ratio
Study	Population	Intervention	Intensity	Outcome	n/N	n/N	(95% CI)
Althuizon 2012	Mixed	Courselles	Madarata	d ka	40/402	14/107	4 44 /0 75 0 661
Althuizen, 2013	Mixed	Counseling	Moderate	4 Kg	19/103	0/62	0.56 (0.19, 1.72)
Bacchi, 2018	Mixed	Active	High	4 Kg	4/49	9/62	0.56 (0.18, 1.72)
Barakat, 2016	Mixed	Active	High	4 Kg	7/382	18/383	0.39 (0.16, 0.92)
Barakat, 2018	Mixed	Active	High	4 kg	8/227	14/202	0.51 (0.22, 1.19)
Barakat, 2019	Mixed	Active	High	4 kg	8/234	16/222	0.47 (0.21, 1.09)
Luoto, 2011	Mixed	Counseling	Moderate	4 kg	37/216	36/179	0.85 (0.56, 1.29)
Olson, 2018	Mixed	Counseling	Moderate	4 kg	75/1126	50/563	0.75 (0.53, 1.06)
Pelaez, 2019	Mixed	Active	High	4 kg	0/100	10/201	0.10 (0.01, 1.61)
Phelan, 2011	Mixed	Counseling	Moderate	4 kg	20/171	17/178	1.22 (0.66, 2.26)
Polley, 2002	Mixed	Counseling	Low	4 kg	1/57	0/53	2.79 (0.12, 67.10)
Ruiz, 2013	Mixed	Active	High	4 kg	10/481	26/481	0.38 (0.19, 0.79)
Sagedal, 2017	Mixed	Active	High	4 kg	33/296	39/295 📥	0.84 (0.55, 1.30)
Thomson, 2016	Mixed	Counseling	High	4 kg	2/24	2/30	1.25 (0.19, 8.23)
Assaf-Balut, 2017	Mixed	Counseling	Low	4.5 kg	0/434	2/440	0.20 (0.01, 4.21)
Kunath, 2019	Mixed	Counseling	Moderate	4.5 kg	13/1139	6/1122	2.13 (0.81, 5.60)
Dodd, 2019	Normal	Counseling	Moderate	4 kg	24/316	26/313	0.91 (0.54, 1.56)
Bruno, 2017	0/0	Counseling	Moderate	4 kg	2/69	7/62	0.26 (0.06, 1.19)
Dodd, 2014	0/0	Counseling	Moderate	4 kg	164/1075	201/1067	0.81 (0.67, 0.98)
Phelan, 2018	0/0	Active	High	4 kg	8/129	9/128	0.88 (0.35, 2.21)
Seneviratne, 2016	6 O/O	Active	High	4 kg	10/38	7/37	1.39 (0.59, 3.26)
Renault, 2014	Obese	Counseling	High	4 kg	66/284	66/141	0.50 (0.38, 0.65)
Vesco, 2014	Obese	Counseling	High	4 kg	6/56	13/58	0.48 (0.20, 1.17)
Vinter, 2011	Obese	Active	High	4 kg	40/150	39/154	1.05 (0.72, 1.54)
Daly, 2017	Obese	Active	High	4.5 kg	1/44	0/43	2.93 (0.12, 70.08)
Koivusalo, 2016	Obese	Counseling	Moderate	4.5 kg	6/144	5/125	- 1.04 (0.33, 3.33)
Overall				-	564/7344	632/6646	0.77 (0.65, 0.92)
(I-squared = 38.3	1%)					Y	
						0 1	71
						Favors Treatment	Favors Control

Note: Outcome column reflects study definition of macrosomia as greater than 4 kg or 4.5 kg. Outcome with Dodd 2019 defining macrosomia as >4.5 kg: RR 0.76, 95% CI, 0.63 to 0.92, I^2 =40%.

Figure 9. Meta-Analysis of Trials: Large for Gestational Age

Chudu	Demulation	Interrention	Intereite	Treatment	Control	Risk Ratio
Study	Population	intervention	intensity	n/N	n/n	(95% CI)
Al Wattar, 2019	Mixed	Counseling	Moderate	59/593	61/625	1.02 (0.73, 1.43)
Assaf-Balut, 2017	Mixed	Counseling	Low	4/434	18/440	0.23 (0.08, 0.66)
Brownfoot, 2015	Mixed	Counseling	Low	27/386	28/396	0.99 (0.59, 1.65)
Guelfi, 2016	Mixed	Active	High	12/85	10/87	1.23 (0.56, 2.69)
Hui, 2012	Mixed	Active	High	12/102	15/88 🔸	0.69 (0.34, 1.39)
Hui, 2014	Mixed	Active	High	6/57	4/56	1.47 (0.44, 4.94)
Kunath, 2019	Mixed	Counseling	Moderate	73/1139	75/1122	0.96 (0.70, 1.31)
Rauh, 2013	Mixed	Counseling	Low	10/156	7/79 -	0.72 (0.29, 1.83)
Sagedal, 2017	Mixed	Active	High	7/296	11/295 -	0.63 (0.25, 1.61)
Thomson, 2016	Mixed	Counseling	High	3/24	2/30 -	1.88 (0.34, 10.33)
Dodd, 2019	Normal	Counseling	Moderate	22/316	25/313	0.87 (0.50, 1.51)
Bruno, 2017	0/0	Counseling	Moderate	1/69	7/62	0.13 (0.02, 1.01)
Cahill, 2018	O/O	Counseling	High	11/133	6/134	1.85 (0.70, 4.85)
Dodd, 2014	0/0	Counseling	Moderate	203/1075	224/1067	0.90 (0.76, 1.07)
Gallagher, 2018	O/O	Counseling	High	10/97	6/99	1.70 (0.64, 4.50)
Luoto, 2011	0/0	Counseling	Moderate	26/216	34/179 🔶	0.63 (0.40, 1.01)
Peccei, 2017	O/O	Counseling	Moderate	11/180	12/92	0.47 (0.22, 1.02)
Seneviratne, 2016	0/0	Active	High	9/38	4/37	2.19 (0.74, 6.50)
Van Horn, 2018	0/0	Counseling	High	8/140	12/141 -	0.67 (0.28, 1.59)
Daly, 2017	Obese	Active	High	3/44	2/43	1.47 (0.26, 8.34)
Okesene-Gafa, 201	9 Obese	Counseling	High	28/132	25/132	1.12 (0.69, 1.81)
Renault, 2014	Obese	Counseling	High	17/284	9/141 -	0.94 (0.43, 2.05)
Rono, 2018b	Obese	Counseling	Moderate	8/249	13/243	0.60 (0.25, 1.42)
Simmons, 2017	Obese	Counseling	Moderate	35/331	16/105 🔸	0.69 (0.40, 1.20)
Vesco, 2014	Obese	Counseling	High	5/56	15/58 -	0.35 (0.13, 0.89)
Vinter, 2011	Obese	Active	High	23/150	18/154	 1.31 (0.74, 2.33)
Overall				633/6782	659/6218	0.89 (0.80, 0.99)
(I-squared = 0.0%)]	
						11
					Favors Treatment	Favors Control

Note: Large for gestational age defined as birthweight above the 90th percentile for gestational age. **Abbreviations:** CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; O/O = overweight and obese combined BMI category.

Figure 10. Meta-Analysis of Trials: Preterm Birth

					Treatment	Control		Risk Ratio
Study	Population	Intervention	Intensity	Outcome	n/N	n/N		(95% CI)
Al Wattar, 2019	Mixed	Counseling	Moderate	<37 weeks	52/593	64/625	•	0.86 (0.60, 1.21)
Althuizen, 2013	Mixed	Counseling	Moderate	<37 weeks	6/103	7/107		0.89 (0.31, 2.56)
Assaf-Balut, 2017	Mixed	Counseling	Low	<37 weeks	5/434	17/440		0.30 (0.11, 0.80)
Bacchi, 2018	Mixed	Active	High	<37 weeks	2/49	3/62	_ -	0.84 (0.15, 4.85)
Barakat, 2014	Mixed	Active	High	<37 weeks	4/107	4/93	-	0.87 (0.22, 3.38)
Barakat, 2016	Mixed	Active	High	<37 weeks	29/382	37/383		0.79 (0.49, 1.25)
Barakat, 2018	Mixed	Active	High	<37 weeks	10/227	7/202	+	1.27 (0.49, 3.28)
Barakat, 2019	Mixed	Active	High	<37 weeks	10/234	7/222	-	1.36 (0.53, 3.50)
Daley, 2019	Mixed	Counseling	Low	<37 weeks	17/304	14/302	+	1.21 (0.61, 2.40)
Kunath, 2019	Mixed	Counseling	Moderate	<37 weeks	72/1139	60/1122	•	1.18 (0.85, 1.65)
Olson, 2018	Mixed	Counseling	Moderate	<37 weeks	41/1126	26/563	•	0.79 (0.49, 1.28)
Sagedal, 2017	Mixed	Active	High	<37 weeks	17/296	17/295	+	1.00 (0.52, 1.91)
Thomson, 2016	Mixed	Counseling	High	<37 weeks	2/24	5/30	_+ -	0.50 (0.11, 2.35)
Ruiz, 2013	Mixed	Active	High	<36 weeks	12/481	4/481		3.00 (0.97, 9.24)
Phelan, 2011	Mixed	Counseling	Moderate	<36 weeks	16/171	20/178	+	0.83 (0.45, 1.55)
Polley, 2002	Mixed	Counseling	Low	<36 weeks	7/57	7/53	+	0.93 (0.35, 2.47)
Guelfi, 2016	Mixed	Active	High	NR	3/85	4/87	-	0.77 (0.18, 3.33)
Rauh, 2013	Mixed	Counseling	Low	NR	4/156	5/79	-+	0.41 (0.11, 1.47)
Skouteris, 2016	Mixed	Counseling	Moderate	NR	4/130	2/131		2.02 (0.38, 10.81)
Dodd, 2019	Normal	Counseling	Moderate	<37 weeks	23/316	20/313	+	1.14 (0.64, 2.03)
Cahill, 2018	0/0	Counseling	High	<37 weeks	18/133	12/134		1.51 (0.76, 3.01)
Dodd, 2014	0/0	Counseling	Moderate	<37 weeks	62/1075	83/1067	•	0.74 (0.54, 1.02)
Gallagher, 2018	0/0	Counseling	High	<37 weeks	5/97	7/99	-	0.73 (0.24, 2.22)
Seneviratne, 2016	0/0	Active	High	<37 weeks	2/38	2/37	_ —	0.97 (0.14, 6.56)
Van Horn, 2018	0/0	Counseling	High	<37 weeks	6/140	12/141		0.50 (0.19, 1.30)
Phelan, 2018	0/0	Active	High	<36 weeks	4/129	5/128	-	0.79 (0.22, 2.89)
Bruno, 2017	0/0	Counseling	Moderate	NR	0/69	5/62	→	0.08 (0.00, 1.45)
Petrella, 2014	0/0	Counseling	Low	NR	0/33	10/28	• <u> </u>	0.04 (0.00, 0.66)
Daly, 2017	Obese	Active	High	<37 weeks	2/44	1/43	_ +	1.95 (0.18, 20.77)
Okesene-Gafa, 2019	Obese	Counseling	High	<37 weeks	10/132	1/132	↓	10.00 (1.30, 77.02)
Renault, 2014	Obese	Counseling	High	<37 weeks	12/284	6/141	+	0.99 (0.38, 2.59)
Rono, 2018b	Obese	Counseling	Moderate	<37 weeks	12/249	7/243	+	1.67 (0.67, 4.18)
Vesco, 2014	Obese	Counseling	High	<37 weeks	4/56	1/58	++	4.14 (0.48, 35.93)
Overall					473/8893	482/8081	4	0.93 (0.81, 1.07)
(I-squared = 2.2%)								
								1
						0	1	78

Favors Treatment Favors Control

Note: Outcome column reflects study definition of preterm birth as prior to 36 weeks' gestation (<36 w), 37 weeks' gestation (<37 w), or not reported.

				Treatment	Control		Risk Ratio
Study	Population	Intervention	Intensity	n/N	n/N		(95% CI)
Assaf-Balut, 2017	Mixed	Counseling	Low	3/500	4/500	•	0.75 (0.17, 3.33)
Brownfoot, 2015	Mixed	Counseling	Low	7/386	12/396 -	→	0.60 (0.24, 1.50)
Cahill, 2018	0/0	Counseling	High	16/133	11/134	+	1.47 (0.71, 3.04)
Seneviratne, 2016	0/0	Active	High	5/38	2/37	+	2.43 (0.50, 11.77)
Koivusalo, 2016	Obese	Counseling	Moderate	7/155	7/138	_ -	0.89 (0.32, 2.47)
Rono, 2018a	Obese	Counseling	Moderate	3/65	4/63	- -	0.73 (0.17, 3.12)
Rono, 2018b	Obese	Counseling	Moderate	16/249	13/243	+	1.20 (0.59, 2.44)
Vesco, 2014	Obese	Counseling	High	3/58	7/60	•	0.44 (0.12, 1.63)
Overall				60/1584	60/1571		1.00 (0.67, 1.42)
(I-squared = 0.0%)					Ĭ	
							1
					0	1	16
					Favors Treatme	nt Favor	s Control

Figure 11. Meta-Analysis of Trials: Infant Respiratory Distress Syndrome

Figure 12. Meta-Analysis of Trials: Shoulder Dystocia

				Treatment	Control	Risk Ratio
Study	Population	Intervention	Intensity	n/N	n/N	(95% CI)
Assaf-Balut, 2017	Mixed	Counseling	Low	0/500	1/500	0.33 (0.01, 8.16)
Brownfoot, 2015	Mixed	Counseling	Low	4/386	1/396	4.10 (0.46, 36.55)
Daley, 2019	Mixed	Counseling	Low	3/312	2/314	1.51 (0.25, 8.97)
Sagedal, 2017	Mixed	Active	High	2/303	3/303	0.67 (0.11, 3.96)
Dodd, 2019	Normal	Counseling	Moderate	9/316	13/313	0.69 (0.30, 1.58)
Dodd, 2014	0/0	Counseling	Moderate	44/1075	35/1067	1.25 (0.81, 1.93)
McCarthy, 2016	0/0	Counseling	Low	3/190	5/192	0.61 (0.15, 2.50)
Peccei, 2017	0/0	Counseling	Moderate	4/200	3/100	0.67 (0.15, 2.92)
Overall				69/3282	63/3185	1.05 (0.63, 1.47)
(I-squared = 0.0%)				Ĭ	
					I I 0 1	1 37
					Favors Treatment	Favors Control

Figure 13. Meta-Analysis of Trials: Neonatal Intensive Care Unit Admission

Church	Description		Inda and idea	Treatment	Control		Risk Ratio
Study	Population	Intervention	Intensity	n/N	n/N		(95% CI)
Al Wattar, 2019	Mixed	Counseling	Moderate	49/593	64/625	-	0.81 (0.57, 1.15)
Assaf-Balut, 2017	Mixed	Counseling	Low	8/500	14/500	→-	0.57 (0.24, 1.35)
Brownfoot, 2015	Mixed	Counseling	Low	43/386	52/396		0.85 (0.58, 1.24)
Daley, 2019	Mixed	Counseling	Low	26/261	21/262	→	1.24 (0.72, 2.15)
Guelfi, 2016	Mixed	Active	High	8/85	14/87	→-	0.58 (0.26, 1.32)
Sagedal, 2017	Mixed	Active	High	38/303	38/303	+	1.00 (0.66, 1.52)
Dodd, 2019	Normal	Counseling	Moderate	27/316	34/313	→	0.79 (0.49, 1.27)
Cahill, 2018	0/0	Counseling	High	25/133	19/134	∔ ⊷	1.33 (0.77, 2.29)
Dodd, 2014	0/0	Counseling	Moderate	394/1075	385/1067	÷.	1.02 (0.91, 1.14)
Peccei, 2017	0/0	Counseling	Moderate	7/200	3/100 -	_ - •	1.17 (0.31, 4.42)
Seneviratne, 2016	0/0	Active	High	3/38	3/37		0.97 (0.21, 4.52)
Daly, 2017	Obese	Active	High	4/44	7/44	•	0.57 (0.18, 1.81)
Okesene-Gafa, 2019	Obese	Counseling	High	13/132	7/132	+	1.86 (0.77, 4.51)
Vinter, 2011	Obese	Active	High	21/180	22/180	-	0.95 (0.54, 1.67)
Overall				666/4246	683/4180		0.98 (0.86, 1.08)
(I-squared = 0.0%)							
					0	1 5	
					Favors Treatr	nent Favors	Control
Figure 14. Meta-Analysis of Trials: Mean Gestational Weight Gain

AuthorYear	Population	Outcome Assessment Timepoint	Intervention Type	Intervention Intensity		Mean Dit (95% CI)	ference	Trtment, N, Mean (SD)	Control, N, Mean (SD)
Luoto, 2011 (adjusted MD)	Overweight/Obese	36 wks to delivery	Counseling	Moderate		-0.43 (-1	52, 0.66)	216, 13.80 (5.80)	179, 14.20 (5.10)
Harrison, 2013	Overweight/Obese	28 wks	Counseling	Moderate	-₩-	-0.80 (-1	67, 0.07)	106, 5.96 (2.83)	97, 6.76 (3.44)
Dodd, 2014	Overweight/Obese	36 wks to delivery	Counseling	Moderate	· •	-0.05 (-0	59, 0.49)	897, 9.39 (5.74)	871, 9.44 (5.77)
Hawkins, 2014	Overweight/Obese	Delivery	Counseling	Moderate		-0.14 (-2	45, 2.17)	32, 17.73 (5.74)	34, 17.87 (3.49)
Petrella, 2014	Overweight/Obese	Delivery	Counseling	Low		-1.60 (-4	49, 1.29)	33, 8.80 (6.50)	28, 10.40 (5.00)
Garnaes, 2016	Overweight/Obese	Delivery	Active	High		1.30 (-1.3	79, 4.39)	38, 10.50 (5.22)	36, 9.20 (7.99)
Herring, 2016 (adjusted MD)	Overweight/Obese	36 wks to delivery	Counseling	High		-3.10 (-6	09, -0.11)	27, 8.70 (6.60)	29, 12.30 (6.40)
McCarthy, 2016	Overweight/Obese	34-36 wks	Counseling	Low	₩-+	-1.01 (-2	23, 0.21)	159, 8.59 (5.38)	154, 9.60 (5.59)
Seneviratne, 2016	Overweight/Obese	36 wks to delivery	Active	High		-1.20 (-3	73, 1.33)	37, 12.00 (5.30)	37, 13.20 (5.80)
Bruno, 2017	Overweight/Obese	34-36 wks	Counseling	Moderate	1	- 0.40 (-1.8	35, 2.65)	69, 9.50 (6.40)	62, 9.10 (6.70)
Peccei, 2017	Overweight/Obese	36 wks to delivery	Counseling	Moderate		-1.00 (-2	98, 0.98)	180, 11.20 (10.46)	92, 12.20 (6.14)
Redman, 2017	Overweight/Obese	34-36 WKS	Counseling	High		-3.77 (-7.	22, -0.32)	37, 9.03 (5.59)	17, 12.80 (6.18)
WillCox, 2017	Overweight/Obese	34-36 WKS	Counseling	High	1	-1.90 (-3	68, -0.12)	45, 7.80 (4.70)	46, 9.70 (3.90)
Callagher 2018	Overweight/Obese	So was to delivery	Counseling	High		-1.59 (-2.	96, -0.20)	119, 0.05 (5.00)	121, 9.64 (5.40)
Phelan 2018	Overweight/Obese	34-36 wke	Active	High	<u> </u>	-1.80 (-2	50 -0.10)	129 9 40 (6 90)	127 11 20 (7 00)
Van Horn 2018	Overweight/Obese	34-36 wks	Counseling	High		-1.00 (-3	41 -0 59)	140 10 00 (6 00)	140, 12,00 (6,00)
Wolff 2008	Ohese	34-36 wks	Counseling	Moderate		-6 70 (-1)	31, 309	23 6 60 (5 50)	27 13 30 (7 50)
Vinter, 2011	Obese	34-36 wks	Active	High		-2.10 (-3	071.13)	144, 7,00 (4,14)	148, 9,10 (4,36)
Bogaerts, 2013	Obese	Delivery	Counselina	Moderate		-3.38 (-5	531.23)	134, 10, 12 (6,91)	63, 13,50 (7,30)
Renault, 2014	Obese	36 wks to delivery	Counseling	High		-1.90 (-3	12, -0.68)	255, 9.00 (6.36)	134, 10.90 (5.52)
Vesco, 2014	Obese	PP 2 wks	Counseling	High		-3.40 (-5	03, -1.77)	55, 5.00 (4.10)	57, 8.40 (4.70)
Koivusalo, 2016	Obese	Delivery	Counseling	Moderate	- -	-0.10 (-1	12, 0.92)	144, 7.60 (4.86)	125, 7.70 (3.67)
Daly, 2017	Obese	34-36 wks	Active	High		-1.70 (-4	18, 0.78)	34, 6.20 (6.00)	42, 7.90 (4.80)
Simmons, 2017	Obese	34-36 wks	Counseling	Moderate		-1.13 (-2	32, 0.06)	225, 7.67 (4.53)	79, 8.80 (4.70)
Okesene-Gafa, 2019 (adjusted MD)	Obese	36 wks to delivery	Counseling	High		-1.76 (-3	54, 0.02)	100, 9.70 (6.60)	101, 11.40 (6.30)
Dodd, 2019 (adjusted MD)	Normal weight	36 wks to delivery	Counseling	Moderate		-0.37 (-0	97, 0.23)	316, 11.30 (4.00)	313, 11.70 (3.80)
Polley, 2002	Mixed population	36 wks to delivery	Counseling	Low	_ →+■	0.76 (-1.0	50, 3.12)	57, 14.55 (7.15)	53, 13.78 (5.43)
Asbee, 2009	Mixed population	Delivery	Counseling	Low		-3.10 (-5	66, -0.54)	57, 13.00 (5.70)	43, 16.10 (7.00)
Haakstad, 2011	Mixed population	36 wks to delivery	Active	High		-0.80 (-2	33, 0.73)	52, 13.00 (4.00)	53, 13.80 (4.00)
Phelan, 2011 Borokot, 2012	Mixed population	36 wks to delivery	Active	High		-0.05 (-1.	92, 0.01)	109, 15.01 (5.75)	174, 13.00 (0.19)
Balakat, 2012	Mixed population	Delivery	Active	High		-1.30 (-2.	80, 0.00)	40, 12.50 (3.20)	43, 13.80 (3.10)
Althuizen 2013	Mixed population	34-36 wks	Counseling	Moderate		0.50 (-0.4	18 1 48)	106 11 60 (4 10)	113 11 10 (3 20)
Rauh 2013 (adjusted MD)	Mixed population	36 wks to delivery	Counseling	Low		-1 70 (-3	05 -0.35)	152 14 10 (4 10)	74 15 60 (5 80)
Ruiz, 2013	Mixed population	36 wks to delivery	Active	High		-1.30 (-1	81, -0,79)	481, 11,90 (3,80)	481, 13,20 (4,30)
Barakat, 2014	Mixed population	Delivery	Active	High		-1.94 (-4	04, 0.16)	107, 11.72 (4.06)	93, 13.66 (9.62)
Hui, 2014	Mixed population	Delivery	Active	High		-1.28 (-3	45, 0.88)	57, 13.99 (5.82)	56, 15.28 (5.92)
Ronnberg, 2014	Mixed population	Delivery	Counseling	Low		-1.12 (-2	12, -0.12)	192, 14.19 (4.45)	182, 15.31 (5.38)
Daley, 2015	Mixed population	36 wks to delivery	Counseling	Low		-0.10 (-2	59, 2.39)	34, 12.00 (4.50)	34, 12.10 (5.90)
Gesell, 2015	Mixed population	36 wks to delivery	Active	High		-1.32 (-4	23, 1.59)	38, 8.85 (5.57)	36, 10.17 (7.06)
Barakat, 2016	Mixed population	36 wks to delivery	Active	High	₩ <u></u>	-0.80 (-1	38, -0.22)	382, 12.10 (3.70)	383, 12.90 (4.50)
Skouteris, 2016	Mixed population	34-36 wks	Counseling	Moderate		0.75 (-0.8	38, 2.38)	130, 12.82 (6.66)	131, 12.07 (6.76)
Smith, 2016	Mixed population	34-36 wks	Counseling	Moderate		2.40 (-0.8	30, 5.60)	22, 13.60 (5.60)	21, 11.20 (5.10)
Assat-Balut, 2017	Mixed population	36 wks to delivery	Counseling	Low		0.50 (-0.1	10, 1.10)	434, 9.90 (4.70)	440, 9.40 (4.30)
Sagedal, 2017 Basabi, 2018	Mixed population	Delivery	Active	High		-1.40 (-2	39, -0.41)	279, 14.40 (6.20)	278, 15.80 (5.70)
Bacchi, 2018	Mixed population	36 wks to delivery	Active	High		-1.20 (-2	49,0.09)	49, 12.70 (2.00)	02, 13.90 (4.30)
Olson 2018 (adjusted MD)	Mixed population	36 wks to delivery	Counseling	Moderate		-1.00 (-1.	57 0 77)	1126 13 73 (15 14)	202, 13.30 (4.10) 563 13 73 (10.68)
Aquilar-Cordero 2019	Mixed population	36 wks to delivery	Active	High		-2 90 (-4	68 -1 12)	65 8 30 (4 95)	64 11 20 (5 35)
Al Wattar, 2019 (adjusted MD)	Mixed population	36 wks to delivery	Counselina	Moderate		-1.20 (-2	220.18)	230, 6.80 (5.60)	238, 8,30 (6,40)
Barakat, 2019	Mixed population	36 wks to delivery	Active	High		-1.10 (-1	82, -0.38)	234, 12.20 (3.70)	222, 13.30 (4.10)
Daley, 2019 (adjusted MD)	Mixed population	36 wks to delivery	Counseling	Low		-0.42 (-1	48, 0.64)	305, 10.30 (5.90)	311, 10.70 (6.90)
Kunath, 2019 (adjusted MD)	Mixed population	nR .	Counseling	Moderate		0.09 (-0.1	79, 0.97)	946, 14.10 (5.30)	939, 14.10 (5.20)
Pelaez, 2019	Mixed population	36 wks to delivery	Active	High	- -	-2.20 (-3	09, -1.31)	100, 11.50 (3.50)	201, 13.70 (4.10)
Overall (I-squared = 59.8%, p = 0.000)					• I	-1.03 (-1	32, -0.76)		
					-5 0	5			
					-5 0	5			
					Favors Treatment	Favors Control			

Note: Outcome excluding Wolff, 2008: MD -0.99 kg, 95% CI, -1.26 to -0.73, $I^2 = 58.8\%$, p<0.001. Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; MD = mean difference; N = number; NR = not reported; PP = postpartum; SD = standard deviation.

Figure 15. Meta-Analysis of Trials: Exceeding IOM Recommendations for Gestational Weight Gain

Study	Population	Intervention	Intensity	Treatment n/N	Control n/N	Risk Ratio (95% Cl)
Dodd, 2019	Normal	Counseling	Moderate	28/316	41/313	0.68 (0.43, 1.07)
Althuizen, 2013	Mixed	Counseling	Moderate	75/106	82/113	0.98 (0.83, 1.15)
Asbee, 2009	Mixed	Counseling	Low	22/57	22/43	0.75 (0.49, 1.17)
Bacchi, 2018	Mixed	Active	High	12/49	28/62	0.54 (0.31, 0.95)
Barakat, 2014	Mixed	Active	High	22/107	31/93	0.62 (0.39, 0.99)
Barakat, 2016	Mixed	Active	High	101/382	131/383	0.77 (0.62, 0.96)
Barakat, 2018	Mixed	Active	High	47/227	61/202	0.69 (0.49, 0.95)
Barakat, 2019	Mixed	Active	High	48/234	67/222	0.68 (0.49, 0.94)
Brownfoot, 2015	Mixed	Counseling	Low	267/386	204/396 • 🔹	1.34 (1.20, 1.51)
Daley, 2015	Mixed	Counseling	Low	8/34	10/34	 0.80 (0.36, 1.78)
Daley, 2019	Mixed	Counseling	Low	81/305	90/311	0.92 (0.71, 1.18)
Gesell, 2015	Mixed	Active	High	12/44	19/43	0.62 (0.34, 1.11)
Hui, 2012	Mixed	Active	High	37/102	42/88	0.76 (0.54, 1.07)
Hui, 2014	Mixed	Active	High	21/57	30/56	0.69 (0.45, 1.04)
Kinnunen, 2012	Mixed	Counseling	Moderate	101/219	92/180	0.90 (0.74, 1.10)
Kunath, 2019	Mixed	Counseling	Moderate	427/1139	429/1122	0.98 (0.88, 1.09)
Magriples, 2015	Mixed	Counseling	Moderate	205/495	215/489	0.94 (0.81, 1.09)
Olson, 2018	Mixed	Counseling	Moderate	271/563	260/563	1.04 (0.92, 1.18)
Pelaez, 2019	Mixed	Active	High	22/100	69/201	0.64 (0.42, 0.97)
Phelan, 2011	Mixed	Counseling	Moderate	95/179	104/184	0.94 (0.78, 1.13)
Polley, 2002	Mixed	Counseling	Low	26/57	25/53	0.97 (0.65, 1.45)
Rauh, 2013	Mixed	Counseling	Low	58/152	44/74	0.64 (0.49, 0.85)
Ronnberg, 2014	Mixed	Counseling	Low	79/221	91/224	0.88 (0.69, 1.12)
Ruiz, 2013	Mixed	Active	High	115/481	154/481	0.75 (0.61, 0.92)
Skouteris, 2016	Mixed	Counseling	Moderate	53/130	48/131	1.11 (0.82, 1.51)
Smith, 2016	Mixed	Counseling	Moderate	15/22	11/21	- 1.30 (0.79, 2.14)
Altazan, 2019	0/0	Counseling	High	18/37	9/17	0.92 (0.53, 1.60)
Cahill, 2018	0/0	Counseling	High	48/119	61/121	0.80 (0.60, 1.06)
Garnaes, 2016	0/0	Active	High	21/46	16/45	- 1.28 (0.78, 2.13)
Herring, 2016	0/0	Counseling	High	10/27	19/29	0.57 (0.32, 0.99)
Perales, 2015	0/0	Active	High	24/52	36/54	0.69 (0.49, 0.98)
Phelan, 2018	0/0	Active	High	53/129	69/127	0.76 (0.58, 0.98)
Redman, 2017	0/0	Counseling	High	21/37	11/13	0.67 (0.47, 0.97)
Van Horn, 2018	0/0	Counseling	High	96/140	119/141 📥	0.81 (0.71, 0.93)
Willcox, 2017	0/0	Counseling	High	21/45	28/46	0.77 (0.52, 1.13)
Daly, 2017	Obese	Active	High	8/36	19/44	0.51 (0.26, 1.04)
Simmons, 2017	Obese	Counseling	Moderate	153/225	60/79	0.90 (0.77, 1.04)
Vesco, 2014	Obese	Counseling	Hiah	24/54	47/58	0.55 (0.40, 0.76)
Vinter, 2011	Obese	Active	High	57/150	75/154	0.78 (0.60, 1.01)
Overall				2802/7261	2969/7010	0.83 (0.77, 0.89)
(I-squared = 63.	8%)				•	(, 0.00)
						4
					Favors Treatment	Favors Control

Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; IOM = Institute of Medicine; O/O = overweight and obese combined BMI category.

Figure 16. Meta-Analysis: Adherence to IOM Recommendations for Gestational Weight Gain

				Treatment	Control		Risk Ratio
Study	Population	Intervention	Intensity	n/N	n/N		(95% CI)
Barakat, 2014	Mixed	Active	High	82/107	56/93	•	1.27 (1.05, 1.55)
Gesell, 2015	Mixed	Active	High	17/44	11/43 -	•	1.51 (0.80, 2.84)
Ruiz, 2013	Mixed	Active	High	42/481	78/224 🔶		0.25 (0.18, 0.35)
Perales, 2015	0/0	Active	High	28/52	18/54	 ←	1.62 (1.03, 2.54)
Vinter, 2011	Obese	Active	High	98/150	82/154	•	1.23 (1.02, 1.48)
Asbee, 2009	Mixed	Counseling	Low	35/57	21/43	•	1.26 (0.87, 1.82)
Brownfoot, 2015	Mixed	Counseling	Low	45/386	41/396 -	┝-	1.13 (0.76, 1.68)
Daley, 2019	Mixed	Counseling	Low	96/305	108/311 🔹		0.91 (0.72, 1.14)
Dodd, 2019	Normal	Counseling	Moderate	128/316	110/313	•	1.15 (0.94, 1.41)
Phelan, 2011	Mixed	Counseling	Moderate	60/179	55/184 -	►	1.12 (0.83, 1.52)
Polley, 2002	Mixed	Counseling	Low	17/57	16/53 🗕	-	0.99 (0.56, 1.75)
Ronnberg, 2014	Mixed	Counseling	Low	77/221	61/224	•	1.28 (0.97, 1.69)
Skouteris, 2016	Mixed	Counseling	Moderate	48/130	44/131 -	►	1.10 (0.79, 1.53)
Thomson, 2016	Mixed	Counseling	High	4/39	11/43		0.40 (0.14, 1.16)
McCarthy, 2016	0/0	Counseling	Low	51/159	54/154 🚽	-	0.91 (0.67, 1.25)
Peccei, 2017	0/0	Counseling	Moderate	58/168	23/87	-	1.31 (0.87, 1.96)
Petrella, 2014	0/0	Counseling	Low	22/33	11/28	-	1.70 (1.01, 2.85)
Simmons, 2017	Obese	Counseling	Moderate	72/225	19/79	•	1.33 (0.86, 2.06)
Vesco, 2014	Obese	Counseling	High	10/54	3/58	→	3.58 (1.04, 12.32)
Overall				990/3163	822/2672		1.10 (0.89, 1.35)
(I-squared = 84.3	%)						
					1	12	
					Favors Treatment	Favors 0	Control

Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; IOM = Institute of Medicine; O/O = overweight and obese combined BMI category.

Postpartum Time and Author, Year	Population	Intervention Type	Intervention Intensity			Mean Difference (95% Cl)	Treatment, N, Mean (SD)	Control, N, Mean (SD)
<6 months								
Polley, 2002	Mixed	Counseling	Low			0.27 (-1.82, 2.36)	57, 4.02 (5.50)	53, 3.75 (5.67)
Haakstad, 2011	Mixed	Active	High			0.00 (-1.53, 1.53)	52, 3.30 (3.90)	53, 3.30 (4.10)
Rauh, 2013	Mixed	Counseling	Low			-1.20 (-2.48, 0.08)	167, 2.10 (4.30)	83, 3.30 (5.10)
Hoffman, 2019 (adj MD)	Mixed	Counseling	Moderate	+		-0.19 (-1.01, 0.63)	976, 4.00 (4.80)	934, 4.30 (4.80)
Wolff, 2008	Obese	Counseling	Moderate	⊷ il		-6.90 (-9.72, -4.08)	16, -4.50 (3.52)	19, 2.40 (4.96)
Huvinen, 2018	Obese	Counseling	Moderate			0.00 (-1.92, 1.92)	110, 0.00 (7.02)	90, 0.00 (6.79)
Harrison, 2014	0/0	Counseling	Moderate	- e ÷		-1.45 (-2.80, -0.10)	121, 0.51 (4.48)	107, 1.96 (5.74)
Garnaes, 2018	0/0	Active	High			0.80 (0.41, 1.19)	46, -0.80 (0.94)	45, -1.60 (0.94)
Subgroup (I-squared = 84.	4%)		-	-		-0.81 (-2.40, 0.55)		
6 months								
Phelan, 2011	Mixed	Counseling	Moderate	-0-		-0.91 (-1.97, 0.15)	179, 2.88 (5.32)	184, 3.79 (5.01)
Vinter, 2014	Obese	Active	High			0.10 (-1.12, 1.32)	180, 0.00 (5.58)	180, -0.10 (6.22)
Herring, 2017	0/0	Counseling	High ·			-4.00 (-6.89, -1.11)	33, 0.80 (6.33)	33, 4.80 (5.62)
Subgroup (I-squared = 70.	6%)			-		-0.85 (-3.67, 0.81)		
12 months								
Althuzien, 2013 (adj MD)	Mixed	Counseling	Moderate	:+=		0.94 (-0.53, 2.41)	123, -0.53 (5.50)	123, -1.75 (5.10)
Phelan, 2014	Mixed	Counseling	Moderate	- e		-1.60 (-2.90, -0.30)	164, 1.40 (6.30)	167, 3.00 (5.70)
Rauh, 2015 (adj MD)	Mixed	Counseling	Low			-1.00 (-3.20, 1.20)	148, 0.20 (3.60)	65, 0.80 (5.70)
Sagedal, 2017 (adj MD)	Mixed	Active	High	-+		-0.75 (-1.70, 0.20)	303, 0.66 (5.48)	303, 1.42 (4.96)
Hoffman, 2019 (adj MD)	Mixed	Counseling	Moderate	-+		-0.74 (-1.55, 0.07)	902, -0.20 (4.80)	881, 0.60 (5.20)
Vesco, 2016 (adj MD)	Obese	Counseling	High	<u>i</u>		-0.47 (-4.02, 3.08)	56, -1.30 (7.63)	58, -0.90 (7.91)
Huvinen, 2018	Obese	Counseling	Moderate	_		0.00 (-2.03, 2.03)	110, -1.00 (7.42)	90, -1.00 (7.20)
Herring, 2017	0/0	Counseling	High	_ _		-2.20 (-5.08, 0.68)	33, 2.90 (6.09)	33, 5.10 (5.86)
Haire-Joshu, 2019	0/0	Counseling	High	_		-3.30 (-5.53, -1.07)	92, 0.90 (6.80)	93, 4.20 (8.60)
Phelan, 2019	0/0	Active	High			0.10 (-0.06, 0.26)	103, 1.50 (0.58)	110, 1.40 (0.58)
Subgroup (I-squared = 65.	5%)			•		-0.63 (-1.44, -0.01)	,	,
						1		
			-10 Favors Treatm	-5 0 ent	5 Fav	10 ors Control		

Note: Outcome (<6 months) excluding Wolff, 2008: MD -0.17 kg, 95% CI, -0.97 to 0.53, $I^2 = 69.5\%$, p=0.003. Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; O/O = overweight and obese combined BMI category; N = number; SD = standard deviation.

Figure 18. Meta-Analysis of Trials: Small for Gestational Age

				Treatment	Control		Risk Ratio
Study	Population	Intervention	Intensity	n/N	n/N		(95% CI)
						_	
Al Wattar, 2019	Mixed	Counseling	Moderate	52/593	69/625		0.79 (0.56, 1.12)
Assaf-Balut, 2017	Mixed	Counseling	Low	5/434	25/440		0.20 (0.08, 0.52)
Guelfi, 2016	Mixed	Active	High	0/85	2/87	-	0.20 (0.01, 4.20)
Kunath, 2019	Mixed	Counseling	Moderate	88/1139	84/1122	•	1.03 (0.77, 1.38)
Rauh, 2013	Mixed	Counseling	Low	6/156	3/79 —	-	1.01 (0.26, 3.94)
Sagedal, 2017	Mixed	Active	High	31/296	27/295	-	1.14 (0.70, 1.87)
Thomson, 2016	Mixed	Counseling	High	5/24	2/30		3.13 (0.66, 14.72)
Dodd, 2019	Normal	Counseling	Moderate	21/316	25/313	ŀ	0.83 (0.48, 1.45)
Bruno, 2017	0/0	Counseling	Moderate	6/69	5/62 -	-	1.08 (0.35, 3.36)
Cahill, 2018	0/0	Counseling	High	13/133	13/134 🚽	-	1.01 (0.49, 2.09)
Gallagher, 2018	0/0	Counseling	High	8/97	13/99 🗕	-	0.63 (0.27, 1.45)
Luoto, 2011	0/0	Counseling	Moderate	10/216	5/179	•	1.66 (0.58, 4.76)
Peccei, 2017	0/0	Counseling	Moderate	11/180	3/92	•	1.87 (0.54, 6.55)
Seneviratne, 2016	0/0	Active	High	4/38	3/37 —	←	1.30 (0.31, 5.41)
Van Horn, 2018	0/0	Counseling	High	25/140	27/141		0.93 (0.57, 1.52)
Daly, 2017	Obese	Active	High	3/44	7/43	-	0.42 (0.12, 1.51)
Okesene-Gafa, 2019	Obese	Counseling	High	4/132	4/132 -	-	1.00 (0.26, 3.91)
Renault, 2014	Obese	Counseling	High	11/284	2/141		2.73 (0.61, 12.15)
Simmons, 2017	Obese	Counseling	Moderate	22/331	5/105	←	1.40 (0.54, 3.59)
Vesco, 2014	Obese	Counseling	High	3/56	4/58	—	0.78 (0.18, 3.32)
Overall				328/4763	328/4214		0.94 (0.80, 1.10)
(I-squared = 0.0%)							
					1	1 15	
					Favors Treatment	Favors C	Control

Note: Small for gestational age defined as birthweight below the 10^{th} percentile for gestational age. **Abbreviations:** CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; O/O = overweight and obese combined BMI category.

Table 1. Recommendations Made by Organizations Regarding Obesity in Pregnancy andGestational Weight Gain

Organization	Year	Title	Recommendation
American College of Obstetricians and Gynecologists ³	2013, 2016	Committee Opinion Number 548: Weight Gain During Pregnancy Committee	Recommends nutrition assessment and counseling during preconception and prenatal visits, including counseling on nutrition, exercise, and weight gain based on height and prepregnancy weight. ²⁰¹ Health care providers who care for pregnant women should determine a woman's BMI at the initial prenatal visit. It is important to discuss
		591: Challenges for Overweight and Obese Women	Individualized care and clinical judgment are necessary in managing overweight or obese women who are gaining (or wish to gain) less weight than recommended but have an appropriately growing fetus. Balancing the risks of fetal growth, obstetric complications, and maternal weight retention is essential but will remain challenging until research provides evidence to further refine the recommendations for GWG, especially among women with high degrees of obesity.
National Institute for Health and Care Excellence ²⁰²	2010	Weight Management Before, During and After Pregnancy	Women with a BMI greater than or equal to 30 kg/m ² who may become pregnant should be told that their weight poses a risk and should be advised about the health benefits of losing weight before pregnancy and referred to weight loss support programming. Women with a BMI of 30 kg/m ² or greater when pregnant should be advised of the risk but that they should not diet during pregnancy. These women should be offered a referral to a dietician or appropriately trained health professional for assessment and personalized advice on healthy eating and physical activity.
Centre for Maternal and Child Enquiries & Royal College of Obstetricians and Gynaecologists ²⁰³	2010	Joint Guideline: Management of Women with Obesity in Pregnancy	All pregnant women with a booking BMI greater than or equal to 30 kg/m ² should be provided with accurate and accessible information about the risks associated with obesity in pregnancy and how they may be minimized. Women should be given the opportunity to discuss this information.
Society of Obstetricians and Gynaecologists of Canada ²⁰⁴	2010	Clinical Practice Guideline Number 239: Obesity in Pregnancy	Pregnant women with a prepregnancy BMI greater than 30 kg/m ² should receive counseling about weight gain, nutrition, food choices, and the risks to themselves and their fetus associated with obesity.
Institute of Medicine ¹	2009	Weight Gain During Pregnancy: Reexamining the Guidelines	Recommends that providers of prenatal care should offer women counseling, such as guidance on dietary intake and physical activity that is tailored to their life circumstances. Federal, State, and local agencies, as well as health care providers, should inform women of the importance of conceiving at a normal BMI, and those who provide healthcare or related services to women of childbearing age should include preconception counseling in their care.

Abbreviations: BMI = body mass index (kilograms per meter squared); GWG = gestational weight gain.

Table 2. Meta-Analysis of Trials: Gestational Diabetes Mellitus Stratified Analysis

Stratified Analysis	Catagony	Number of Trials	RR (95% Confidence	12	p for Subgroup	
Stratified Analysis	Category	Number of Trials	interval)	1-	Interaction	
Study Population	Overall	43	0.87 (0.79 to 0.95)	16.4%	NA	
BMI Category	Normal only	1	0.99 (0.65 to 1.50)	NA		
	Overweight only	0	NA	NA		
	Obese only	11	0.98 (0.84 to 1.13)	0%	0.14	
	Overweight- obese combined	11	0.80 (0.67 to 0.94)	0%	0.14	
	Mixed	20	0.83 (0.69 to 0.97)	26.5%		
Intervention	Low	6	0.75 (0.47 to 1.08)	29%		
Intervention	Moderate	16	0.88 (0.79 to 0.99)	9.8%	0.92	
Intensity	High	21	0.86 (0.70 to 1.03)	22.9%		
Intervention Tures	Active	15	0.82 (0.63 to 1.01)	26.3%	0.69	
intervention Type	Counseling-only	25	0.88 (0.80 to 0.98)	11%	0.68	

Table 3. Meta-Analysis of Trials: Gestational Hypertension Stratified Analysis

Stratified			RR (95% Confidence		p for Subgroup
Analysis	Category	Number of Trials	Interval)	I ²	Interaction
Study Population	Overall	28	0.87 (0.70 to 1.04)	32.5%	NA
BMI Category	Normal only	6	0.46 (0.21 to 0.93)	40.8%	
	Overweight only	2	0.71 (0.25 to 2.06)	0%	
	Obese only	10	0.93 (0.70 to 1.25)	0%	0.09
	Overweight- obese combined	12	0.98 (0.67 to 1.18)	0%	0.08
	Mixed	9	0.81 (0.54 to 1.14)	55%	
Intervention	Low	4	0.89 (0.48 to 1.33)	0%	
Intervention	Moderate	12	1.12 (0.86 to 1.35)	5.3%	0.006
Intensity	High	12	0.69 (0.50 to 0.91)	23.5%	
Intervention	Active	7	0.60 (0.41 to 0.82)	0%	-0.001
Туре	Counseling only	21	1.05 (0.84 to 1.23)	7.1%	<0.001

Table 4. Meta-Analysis of Trials: Cesarean Delivery Stratified Analysis

Stratified Analysis	Category	Number of Trials	RR (95% Confidence Interval)	²	p for Subgroup Interaction	
Study Population	Cesarean (type not specified)*	34	0.98 (0.91 to 1.04)	10.8%	NA	
	Emergency Cesarean	14	0.85 (0.74 to 0.96)	0%	NA	
	Normal only	5	1.02 (0.81 to 1.27)	0%		
	Overweight only	3	0.78 (0.44 to 1.34)	23%		
BMI Cotogory	Obese only	9	0.98 (0.82 to 1.21)	13%	0.70	
Divil Category	Overweight- obese combined	15	1.02 (0.89 to 1.16)	24%	0.70	
	Mixed	17	0.98 (0.87 to 1.07)	15.4%		
Intervention	Low	3	0.85 (0.57 to 1.12)	0%		
Intervention	Moderate	12	1.00 (0.91 to 1.08)	6.9%	0.37	
intensity	High	19	0.97 (0.87 to 1.09)	15.8%		
Intervention	Active	13	0.94 (0.81 to 1.07)	0%	0.27	
Туре	Counseling only	21	0.99 (0.91 to 1.06)	13.3%	0.37	

* Reported as any cesarean delivery (type not specified), excluding emergency or elective. Stratified analyses (BMI, intervention intensity and type) conducted only for type not specified. **Abbreviations:** BMI = body mass index; I^2 = index of heterogeneity; NA = not applicable; RR = relative risk.

Table 5. Meta-Analysis of Trials: Preeclampsia Stratified Analysis

			RR		p for	
Stratified			(95% Confidence		Subgroup	
Analysis	Category	Number of Trials	Interval)	²	Interaction	
Study Population	Overall	27	0.98 (0.84 to 1.13)	0%	NA	
BMI Category	Normal only	2	0.87 (0.43 to 1.55)	0%		
	Overweight only	0	NA	NA		
	Obese only	10	1.09 (0.79 to 1.70)	0%	0.96	
	Overweight-	6	1.00(0.73 to 1.35)	0%	0.00	
	obese combined	0	1.00 (0.73 to 1.33)	0 /0		
	Mixed	12	0.93 (0.72 to 1.17)	0%	7	
Intervention	Low	4	0.79 (0.48 to 1.24)	0%		
Intervention	Moderate	16	1.06 (0.89 to 1.27)	0%	0.29	
mensity	High	10	0.84 (0.62 to 1.16) 0			
Intervention	Active	6	0.80 (0.52 to 1.19)	0%	0.25	
Туре	Counseling only	24	1.01 (0.86 to 1.19)	0%	0.25	

Note: Some trials reported multiple discrete populations. Overall number of trials reflects number of unique trials. **Abbreviations:** BMI = body mass index; I^2 = index of heterogeneity; NA = not applicable; RR = relative risk.

Table 6. Meta-Analysis of Trials: Postpartum Hemorrhage Stratified Analysis

			RR		p for	
Stratified			(95% Confidence		Subgroup	
Analysis	Category	Number of Trials	Interval)	²	Interaction	
Study Population	Overall	9	1.00 (0.88 to 1.15)	0%	NA	
BMI Category	Normal only	1	1.17 (0.81 to 1.68)	NA		
	Overweight only	0	NA	NA		
	Obese only	0	NA	NA	0.65	
	Overweight-	4	0.96 (0.77 to 1.35)	0%	0.05	
	Mixed	4	1.01 (0.78 to 1.25)	0%		
Intervention	Low	2	1.02 (0.72 to 1.45)	0%		
Intervention	Moderate	4	0.99 (0.83 to 1.34)	0%	0.99	
	High	3	1.01 (0.53 to 1.46) 0%			
Intervention	Active	3	1.01 (0.53 to 1.46)	0%	1.00	
Туре	Counseling only	6	1.00 (0.87 to 1.20)	0%	1.00	

Table 7. Meta-Analysis of Trials: Perineal Trauma Stratified Analysis

Stratified			RR (95% Confidence		p for Subgroup
Analysis	Category	Number of Trials	Interval)	I ²	Interaction
Study Population	Overall	8	0.86 (0.52 to 1.50)	57.0%	NA
BMI Category	Normal only	1	1.78 (0.60 to 5.26)	NA	
	Overweight only	0	NA	NA	
	Obese only	0	NA	NA	0.003
	Overweight-obese combined	4	1.18 (0.66 to 2.01)	0%	0.003
	Mixed	3	0.51 (0.24 to 1.28)	46.3%	
Intervention	Low	3	0.54 (0.22 to 1.67)	54%	
Intervention	Moderate	2	1.47 (0.81 to 2.90)	0%	0.003
Intensity	High	3	0.86 (0.45 to 1.95)	0%	
Intervention	Active	3	0.86 (0.45 to 1.95)	0%	0.72
Туре	Counseling only	5	0.85 (0.41 to 1.89)	69.5%	0.73

Table 8. Meta-Analysis of Trials: Macrosomia Stratified Analysis

Stratified	Catagory	Number of Trials	RR (95% Confidence	12	p for Subgroup	
Study	Category				Interaction	
Population	Overall	25	0.77 (0.65 to 0.92)	38.3%	NA	
	Normal only	5	0.73 (0.51 to 1.30)	0%		
	Overweight only	0	NA	NA		
BMI Category	Obese only	3	1.00 (0.68 to 1.26)	0%	0.24	
	Overweight-obese combined	7	0.83 (0.68 to 1.04)	0%		
	Mixed	14	0.76 (0.56 to 0.93)	0%		
Intervention	Low	2	0.71 (0.03 to 19.79)	0%		
Intervention	Moderate	9	0.86 (0.75 to 1.08)	0%	0.03	
Intensity	High	14	0.65 (0.49 to 0.84) 37%			
Intervention	Active	11	0.70 (0.49 to 0.94)	30.7%	1.00	
Туре	Counseling only 14		0.82 (0.65 to 1.07) 45.6%		1.00	

Table 9. Meta-Analysis of Trials: Large for Gestational Age Stratified Analysis

			RR		p for	
Stratified			(95% Confidence		Subgroup	
Analysis	Category	Number of Trials	Interval)	²	Interaction	
Study Population	Overall	26	0.89 (0.80 to 0.99)	0%	NA	
	Normal only	1	0.87 (0.64 to 1.27)	NA		
	Overweight only	0	NA	NA		
BMI Category	Obese only	7	0.88 (0.59 to 1.19)	12%	0.09	
	Overweight-obese combined	8	0.87 (0.64 to 1.20)	0%	0.96	
	Mixed	10	0.92 (0.75 to 1.11)	0%		
Intervention	Low	3	0.64 (0.22 to 1.49)	46%	t	
Intervention	Moderate	9	0.86 (0.71 to 0.97)	0%	0.22	
Intensity	High	14	14 1.05 (0.83 to 1.34)			
Intervention	Active	7	1.10 (0.78 to 1.59)	0%	0.19	
Туре	Counseling only 19		0.87 (0.75 to 0.97)	0%	0.10	

Note: Large for gestational age defined as birthweight above the 90th percentile for gestational age. **Abbreviations:** BMI = body mass index; I^2 = index of heterogeneity; NA = not applicable; RR = relative risk.

Table 10. Meta-Analysis of Trials: Preterm Birth Stratified Analysis

Stratified Analysis	Category	Number of Trials	RR (95% Confidence Interval)	l ²	p for Subgroup Interaction	
Study Population	Overall	33	0.93 (0.81 to 1.07)	2.2%	NA	
	Normal only	1	1.14 (0.64 to 2.03)	NA		
	Overweight only	0	NA	NA		
BMI Category	Obese only	5	1.72 (0.95 to 4.78)	0%	0 10	
	Overweight- obese combined	8	0.77 (0.47 to 1.07)	0%	0.10	
	Mixed	19	0.94 (0.79 to 1.09)	0%		
Intervention	Low	5	0.58 (0.20 to 1.17)	43%		
Intervention	Moderate	10	0.92 (0.77 to 1.12)	4.6%	0.42	
Intensity	High	High 18 1.03 (0.81 to 1.35)		0%		
Intervention	Active	11	1.01 (0.76 to 1.43)	0%	0.56	
Type	Counseling only	22	0.91 (0.77 to 1.07)	6.2%	0.56	

Table 11. Meta-Analysis of Trials: Infant Respiratory Distress Syndrome Stratified Analysis

Stratified Analysis	Category	Number of Trials	RR (95% Confidence Interval)	l ²	p for Subgroup Interaction	
Study Population	Overall	8	1.00 (0.67 to 1.42)	0%	NA	
	Normal only	0	NA	NA		
	Overweight only	0	NA	NA		
BMI Category	Obese only	4	0.91 (0.48 to 1.50)	0%	0.10	
	Overweight- obese combined	2	1.60 (0.72 to 4.32)	0%	0.19	
	Mixed	2	0.64 (0.25 to 1.69)	0%		
Intervention	Low	2	0.64 (0.25 to 1.69)	0%		
Intervention	Moderate	3	1.03 (0.54 to 1.80) 0%		0.42	
Intensity	High 3 1.23 (0.45 to 2.93)		0%			
Intervention	Active	1	2.43 (0.50 to 11.77)	NA	0.25	
Туре	Counseling only	7	0.95 (0.61 to 1.37)	0%	0.25	

Table 12. Meta-Analysis of Trials: Shoulder Dystocia Stratified Analysis

Stratified Analysis	Category	Number of Trials	RR (95% Confidence Interval)	l ²	p for Subgroup Interaction	
Study Population	Overall	8	1.05 (0.63 to 1.47)	0%	NA	
	Normal only	1	0.69 (0.30 to 1.58)	NA		
	Overweight only	0	NA	NA		
BMI Category	Obese only	0	NA	NA	0.55	
	Overweight- obese combined	3	1.12 (0.75 to 1.68)	0%	0.55	
	Mixed	4	1.22 (0.44 to 3.44)	0%		
Intervention	Low	4	1.06 (0.41 to 2.74)	0%		
Intervention	Moderate	3	1.06 (0.73 to 1.55)	0%	0.89	
Intensity	High	1 0.67 (0.11 to 3.96)		0%		
Intervention	Active	1	0.67 (0.11 to 3.96)	NA	0.61	
Туре	Counseling only	7	1.06 (0.75 to 1.51)	0%	0.61	

Table 13. Meta-Analysis of Trials: NICU Admission Stratified Analysis

Stratified Analysis	Category	Number of Trials	RR (95% Confidence Interval)	l ²	p for Subgroup Interaction	
Study Population	Overall	14	0.98 (0.86 to 1.08)	0%	NA	
	Normal only	1	0.79 (0.49 to 1.27)	NA		
	Overweight only	0	NA	NA		
BMI Category	Obese only	3	1.04 (0.84 to 1.12)	0%	0.20	
	Overweight- obese combined	4	1.03 (0.89 to 1.31)	0%	0.36	
	Mixed	6	0.87 (0.71 to 1.06)	0%		
Intervention	Low	3	0.90 (0.59 to 1.32)	0%		
Intervention	Moderate	4	0.98 (0.76 to 1.10)	0%	0.82	
Intensity	High	High 7 1.02 (0.78 to 1.32)		0%		
Intervention	Active	5	0.89 (0.61 to 1.19)	0%	0.47	
Туре	Counseling only	9	0.99 (0.86 to 1.10)	0%	0.47	

Table 14. Meta-Analysis of Trials: Mean Gestational Weight Gain Stratified Analysis

Stratified Analysis	Category	Number of Trials	Mean Difference (kg) (95% Confidence Interval)	l ²	p for Subgroup Interaction	
Study Population	Overall	55	-1.02 (-1.30 to -0.75)	60.3%	NA	
	Normal only	8	-0.48 (-0.96 to -0.21)	0.0%		
	Overweight only	10	-0.89 (-1.54 to -0.32)	15.5%		
PMI Cotogony	Obese only	18	-1.63 (-2.45 to -0.91)	63.0%	0.06	
Bivil Category	Overweight-obese combined	20	-0.90 (-1.38 to -0.46)	31.1%	0.06	
	Mixed	28	-0.81 (-1.16 to -0.46)	60.7%		
Intervention	Low	9	-0.64 (-1.44 to 0.02)	48.4%	<0.001	
Intervention	Moderate	18	-0.32 (-0.71 to -0.04)	17.6%		
mensity	High	28	-1.47 (-1.78 to -1.22)	13.0%		
Intervention	Active	19	-1.29 (-1.60 to -1.04)	2.2%	0.07	
Туре	Counseling only	36	-0.86 (-1.27 to -0.50)	66.0%	0.07	
	28 weeks	1	-0.80 (-1.62 to 0.03)	NA		
Waight	34-36 weeks	13	-1.16 (-2.13 to -0.29)	66.9%		
Assossment	36 weeks to delivery	27	-0.89 (-1.24 to -0.58)	59.9%	0.26	
Timenoint	Delivery	12	-1.22 (-1.83 to -0.69)	17.5%	0.20	
Timepoint	2 weeks postpartum	1	-3.40 (-5.03 to -1.77)	NA		
	NR	1	0.09 (-0.79 to 0.97)	NA		
Intervention	Fair	41	-1.11 (-1.42 to -0.81)	45.7%	0.20	
Quality	Good	14	-0.82 (-1.42 to -0.31)	73.3%	0.30	

Note: Overall, excluding Wolff (2008): 54 trials; -0.99 kg, 95% CI, -1.26 to -0.73, I²=58.8%, p<0.001.

Abbreviations: BMI = body mass index; I^2 = index of heterogeneity; kg = kilogram; NA = not applicable.

Table 15. Meta-Analysis of Trials: Exceeding IOM Recommendations for Gestational Weight Gain Stratified Analysis

Stratified			RR (95% Confidence		p for Subgroup
Analysis	Category	Number of Trials	Interval)	²	Interaction
Study Population	Overall	39	0.83 (0.77 to 0.89)	63.8%	NA
	Normal only	9	0.74 (0.56 to 0.88)	38.7%	
	Overweight only	5	0.91 (0.78 to 1.01)	0%	
BMI Category	Obese only	8	0.81 (0.66 to 0.97)	58.5%	0.60
	Overweight-obese combined	13	0.85 (0.76 to 0.94)	13.7%	
Intervention	Low	7	0.91 (0.72 to 1.13)	71.8%	
Intervention	Moderate	10	0.97 (0.92 to 1.02)	0%	<0.001
mensity	High	22	0.74 (0.69 to 0.79)	0%	
Intervention	Active	15	0.73 (0.67 to 0.80)	0%	0.002
Туре	Counseling only	24	0.89 (0.81 to 0.97)	68.2%	0.003

Note: Mixed BMI category removed from analysis, as participants would be double-counted in other categories. **Abbreviations:** BMI = body mass index; I^2 = index of heterogeneity; IOM = Institute of Medicine; NA = not applicable; RR = relative risk.

Table 16. Meta-Analysis of Trials: Adherence to IOM Recommendations for Gestational Weight Gain Stratified Analysis

			RR		p for	
Stratified			(95% Confidence		Subgroup	
Analysis	Category	Number of Trials	Interval)	²	Interaction	
Study Population	Overall	19	1.10 (0.89 to 1.35)	84.3%	NA	
	Normal only	1	1.15 (0.94 to 1.41)	NA		
	Overweight only	0	NA	NA		
BMI Category	Obese only	3	1.27 (1.05 to 1.80)	0%	0.00	
	Overweight-obese combined	4	1.27 (0.94 to 1.84)	39%	0.09	
	Mixed	11	0.95 (0.68 to 1.31)	88%		
Intervention	Low	7	1.09 (0.94 to 1.32)	0%		
Intervention	Moderate	5	1.17 (1.02 to 1.34)	0%	1.00	
Intensity	High	High 7		94%		
Intervention	Active	5	0.98 (0.46 to 2.09)	95.4%	1 00	
Туре	Counseling only	14	1.12 (1.02 to 1.25)	0%	1.00	

Abbreviations: BMI = body mass index; I^2 = index of heterogeneity; IOM = Institute of Medicine; NA = not applicable; RR = relative risk.

Table 17. Meta-Analysis of Trials: Postpartum Weight Retention Stratified Analysis

Study Population	Number of Trials	Mean Difference (kg) (95% Confidence	12	p for Subgroup
Less than 6 months		-0.81 (-2.40 to 0.55)	84.4%	NA
Normal only	1	-1.80 (-4.30 to 0.70)	NA	
Overweight only	1	-1.85 (-3.65 to -0.05)	NA	
Obese only	3	-2.30 (-7.35 to 2.49)	88.5%	0.41
Overweight-obese combined	3	0.32 (-1.97 to 3.34)	83.3%	
Mixed	4	-0.35 (-1.06 to 0.35)	0.0%	
6 months	3	-0.85 (-3.67 to 0.81)	70.6%	NA
Normal only	1	-1.20 (-2.39 to -0.01)	NA	
Overweight only	0	-	-	
Obese only	1	0.10 (-1.12 to 1.32)	NA	NA
Overweight-obese combined	2	-1.88 (-6.27 to 1.79)	74.1%	
Mixed	1	-0.91 (-1.97 to 0.15)	NA	
12 months	10	-0.63 (-1.44 to -0.01)	65.5%	NA
Normal only	0	-	-	
Overweight only	0	-	-	
Obese only	2	-0.12 (-2.35 to 1.98)	0.0%	0.75
Overweight-obese combined	3	-1.38 (-4.26 to 0.88)	82.2%]
Mixed	5	-0.69 (-1.39 to 0.11)	40.5%	

Note: Less than 6 months, excluding Wolff (2008): 8 trials; MD -0.17 kg, 95% CI, -0.97 to 0.53, I^2 =69.5%. **Abbreviations:** BMI = body mass index; I^2 = index of heterogeneity; NA = not applicable.

Table 18. Meta-Analysis of Trials: Small for Gestational Age Stratified Analysis

			RR		p for
Stratified			(95% Confidence		Subgroup
Analysis	Category	Number of Trials	Interval)	²	Interaction
Study Population	Overall	20	0.94 (0.80 to 1.10)	0%	NA
	Normal only	1	0.83 (0.48 to 1.45)	NA	
	Overweight only	0	NA	NA	
DMI Cotomoru	Obese only	5	1.06 (0.55 to 1.96)	0%	0.01
Bivil Category	Overweight-	7	1.01(0.74 to 1.42)	0%	0.91
	obese combined	1	1.01 (0.74 to 1.42)	0 /0	
	Mixed	7	0.87 (0.47 to 1.42)	43.6%	
Intervention	Low	2	0.39 (0.07 to 3.02)	42%	
Intervention	Moderate	7	0.97 (0.79 to 1.25)	0%	0.04
Intensity	High	11 0.99		0%	
Intervention	Active	4	1.00 (0.42 to 1.58)	0%	0.77
Туре	Counseling only	16	0.93 (0.78 to 1.12)	0%	0.77

Note: SGA defined as birthweight below the 10^{th} percentile for gestational age; analyses do not include infants with low birth weight (less than 2,500 g, k=12).

		Studies (k);		Consistency		Strongth	
Outcome		(n): study	Summary of	and	Other	of	
Category	Outcome	Designs	Findings	Precision	Limitations	Evidence	Applicability
Maternal Health Outcomes	Gestational diabetes mellitus	43 RCTs, 2 CCTs (N=20,149)	Reduced rates of GDM (43 trials, RR, 0.87 [95% CI, 0.79 to 0.95]; f^2 =16.4%; ARD - 1.6% [95% CI, - 2.5 to -0.7]). No effect when stratified by prepregnancy BMI subgroups (a, 0.14 for	Consistent; reasonably precise	Variation in diagnostic criteria for GDM; differences in study groups by maternal BMI.	Moderate	Moderate
	Contational	29 DCTc 1 CCT	(p=0.14 for interaction), intervention type (p=0.68), or intensity (p=0.92).	Consistant	Variation in	Modorato	Modorato
	hypertension	(N=15,053)	of gestational hypertension (28 trials; RR, 0.87 [95% CI, 0.70 to 1.04]; l^2 =32.5%; ARD, -0.8% [95% CI, -1.9 to 0.2]). Statistically significant effects when stratified by intervention type (p<0.001 for interaction) and intensity (p=0.006), but not BMI subgroup (p=0.08).	precise	timing of outcome assessment and followup; interventions heterogeneous and varied in intensity; variations in prepregnancy weight and other demographic characteristics.		

		Studies (k); observations		Consistency		Strength	
Outcome	-	(n); study	Summary of	and	Other	of	
Category	Outcome	Designs	Findings	Precision	Limitations	Evidence	Applicability
Maternal Health Outcomes	Cesarean delivery	46 RCTs, 2 CCTs (N=19,970)	No effect on rates of cesarean delivery (any type, 34 trials; RR, 0.98 [95% CI, 0.91 to 1.04]; P=10.8%; ARD, - 0.7% [95% CI, - 2.4 to 0.8]); increased risk of emergency cesarean (14 trials; RR, 0.85 [95% CI, 0.74 to 0.96]; $P=0\%$; ARD, -2.4% [95% CI, -4.2 to -0.3]). No effect when cesarean delivery (any type) stratified by BMI subgroup (p=0.70 for interaction), intervention type (p=0.37), or intensity (n=0.37)	Consistent; reasonably precise	Indication for cesarean delivery not reported in any study; unclear indications for cesarean among the studies reporting statistical differences between groups, including lack of reporting of parameters to determine elective or emergency cesarean.	Moderate	Moderate
	Preeclampsia	27 RCTs, 1 CCT (N=17,716)	No association between interventions and rates of preeclampsia (27 trials; RR, 0.98 [95% CI, 0.84 to 1.13]; ℓ =0.0%; ARD, 0.1% [95% CI, -0.6 to 0.5]). No effect when stratified by BMI subgroup (p=0.86 for interaction), intervention type (p=0.25), or intensity (p=0.29).	Consistent; precise	Differences in followup duration and outcome assessment timing; low event rates; heterogeneous interventions; populations varied in prepregnancy weight and demographic characteristics.	High	Moderate

Outcome	Outcome	Studies (k); observations (n); study	Summary of	Consistency and	Other	Strength of	Applicability
Category Maternal Health Outcomes	Postpartum hemorrhage	9 RCTs, 1 CCT (N=6,484)	No effect was on rates of postpartum hemorrhage (9 trials; RR, 1.00 [95% CI, 0.88 to 1.15]; $P=0\%$; ARD, -0.1% [95% CI, -1.3 to 1.5]). No effect when stratified by BMI subgroup (p=0.65 for interaction), intervention type (p=1.00), or intensity (n=0.99)	Consistent; precise	Variation in outcome definition; majority of studies not powered to detect statistical differences in outcomes; low event rates.	Low	Low
	Perineal trauma	8 RCTs (N=5,707)	No effect on rates of perineal trauma (8 trials; RR, 0.86 [95% CI, 0.52 to 1.50]; l^2 =57%; ARD, - 0.7%, [95% CI, - 3.2 to 1.7]). Statistically significant effects when stratified by BMI subgroup (p=0.003 for interaction) and intervention intensity (p=0.003), but not type (p=0.73).	Consistent; imprecise	Variation in outcome definition; majority of studies not powered to detect statistical differences in outcomes; low event rates.	Low	Moderate
	Maternal mortality	2 RCTs (N=2,994)	No effect on rates of maternal death in 2 trials. No deaths were reported to be related to the interventions.	Consistent; imprecise	Low event rates; studies not designed or powered to detect statistical differences in outcomes; rare events unrelated to intervention.	Low	Low
Prepregnancy Weight Reduction Outcomes	Weight outcomes	1 RCT (N=326)	No effect on rates of excess gestational weight gain; increased GWG for intervention vs. controls (13.2 kg [SD, 8.2] vs. 10.3 kg [SD, 7.4], p=0.03)	N/A	Only one study included; large confidence intervals in some analyses.	Insufficient	Low

		Studies (k); observations		Consistency		Strength	
Category	Outcome	(n); study Designs	Findings	and Precision	Limitations	of Evidence	Applicability
Infant Health Outcomes	Macrosomia	25 RCTs, 1 CCT (N=14,209)	Reduction in rates of macrosomia (25 trials; RR, 0.77, [95% CI, 0.65 to 0.92]; P =38.3%; ARD, -1.9% [95% CI, -3.3 to -0.7]).	Consistent; imprecise	Varied definitions for outcome (less than 4,000 g and more than 4,500 g); low event rates.	Moderate	Moderate
			Statistically significant effects when stratified by intervention intensity (p=0.03 for interaction) but not BMI subgroup (p=0.24) or intervention type (p=1.00).				
	Large for gestational age	26 RCTs (N=13,000)	Reduced rates of LGA (26 trials; RR, 0.89 [95% CI, 0.80 to 0.99]; l^2 =0%; ARD, - 1.3% [95% CI, - 2.3 to -0.3]). No effect when stratified by BMI subgroup (p=0.98 for interaction), intervention type (p=0.18), or intensity (p=0.22).	Consistent; precise	Studies not powered to address LGA; low event rates.	Moderate	Moderate
	Preterm birth	33 RCTs, 1 CCT (N=17,152)	No effect on rates of preterm birth (33 trials; RR, 0.93 [95% CI, 0.81 to 1.07]; $l^2=2.2\%$; ARD, - 0.2% [95% CI, - 1.1 to 0.7]). No effect when stratified by BMI subgroup (p=0.10 for interaction), intervention type (p=0.56), or intensity (p=0.42).	Consistent; precise	Studies not powered to address preterm birth; varied definitions used for preterm birth (less than 36 weeks, 37 weeks, or not reported); low event rates.	Moderate	Moderate

		Studies (k);		Consistency		Strength	
Outcome		(n); study	Summary of	and	Other	of	A
Category	Outcome	Designs	Findings	Precision	Limitations	Evidence	Applicability
Infant Health Outcomes	Respiratory distress syndrome	8 RCTs (N=3,155)	No effect on rates of RDS (8 trials; RR, 1.00 [95% CI, 0.67 to 1.42]; $l^2=0\%$; ARD - 0.3% [95% CI, - 1.3 to 0.7]).	Consistent; precise	Studies not powered to address RDS; low event rates.	Low	Low
			No effect when stratified by BMI subgroup ($p=0.19$ for interaction), intervention type ($p=0.25$), or intensity ($p=0.42$).				
	Shoulder dystocia	8 RCTs (N=6,467)	No effect on rates of shoulder dystocia (8 trials; RR, 1.05 [95% CI, 0.63 to 1.47]; f^2 =0%; ARD, 0.0%, [95% CI, - 0.4 to 0.5]). No effect when stratified by BMI subgroup (p=0.55 for interaction),	Consistent; precise	Studies not powered to address shoulder dystocia; low event rates.	Low	Low
			intervention type (p=0.61), or intensity (p=0.89).	Consistent	Ctudios pot	1.004	Low
	admissions	(N=8,426)	of NICU admission (14 trials; RR, 0.98 [95% CI, 0.86 to 1.08]; $P=0\%$; ARD, -0.7%, [95% CI, -1.9 to 0.5]).	precise	powered to address NICU admission; low event rates.	LOW	LOW
			No effect when stratified by BMI subgroup ($p=0.38$ for interaction), intervention type ($p=0.47$), or intensity ($p=0.82$).				

Outcome Category	Outcome	Studies (k); observations (n); study Designs	Summary of Findings	Consistency and Precision	Other Limitations	Strength of Evidence	Applicability
Infant Health Outcomes	Infant mortality / stillbirth	11 RCTs (N=7,090)	No effect reported for neonatal death or stillbirth. No deaths were reported to be related to the interventions.	Consistent; imprecise	Studies not powered to address infant mortality/ stillbirth; low event rates.	Low	Low
	Growth during first year of life	3 RCTs (N=2,516)	No differences between interventions during pregnancy versus usual care on infant growth during the first year of life	Consistent; imprecise	Studies not powered to address growth during first year of life.	Low	Low
Gestational Weight Outcomes	Mean gestational weight gain	63 RCTs, 4 CCTs (N=25,789)	Greater reductions in overall gestational weight gain for interventions versus controls (55 trials; MD, - 1.02 kg [95% CI, -1.30 to -0.75]; l^2 =60.3%). Statistically significant effect when stratified by intervention intensity (p<0.001 for interaction), but not BMI subgroup (p=0.06), intervention type (p=0.07), weight assessment timepoint (p=0.26), or intervention quality (p=0.30).	Reasonably consistent direction within BMI categories but inconsistent magnitude of effect; imprecise	Variation in timing of outcome assessment (e.g., from one month prior to delivery to delivery); type of GWG not defined (e.g., fat vs. fluid retention); variation in prepregnancy weight categories enrolled; few studies report on enrollment or outcomes related to subgroups of importance (e.g., SES or racial and ethnic minorities); heterogeneous interventions, components not always well- described; differences in timing of initiation and/or duration of intervention.	Moderate	Moderate

		Studies (k);		Consistency		Strongth	
Outcome		(n): study	Summary of	and	Other	of	
Category	Outcome	Designs	Findings	Precision	Limitations	Evidence	Applicability
Category Gestational Weight Outcomes	Exceeding IOM recommendati ons for GWG	39 RCTs, 1 CCT (N=14,449)	Lower likelihood of gaining weight in excess of IOM recommendation s (39 trials; RR, 0.83 [95% CI, 0.77 to 0.89]; l^2 =63.8%; ARD, - 7.6% [95% CI, - 11.0 to -4.6]). Statistically significant effect for excess GWG and intervention type (p=0.003 for interaction) and intensity (p<0.001), but not BMI (p=0.60).	Consistent; imprecise	Same as above	Moderate	Moderate
	Adherence to IOM recommendati ons for GWG	19 RCTs (N=5,835)	No effect on rates of adherence to IOM recommendation s for GWG (19 trials; RR, 1.10, [95% CI, 0.89 to 1.35]; ℓ =84.3%; ARD, 4.2% [95% CI, -1.2 to 10]). No effect when stratified by BMI subgroup (p=0.09 for interaction), intervention type (p=1.00), or intensity (p=1.00).	Relatively consistent; imprecise	Same as above	Low	Moderate

Outcome		Studies (k); observations (n): study	Summary of	Consistency	Other	Strength	
Category	Outcome	Designs	Findings	Precision	Limitations	Evidence	Applicability
Gestational Weight Outcomes	Postpartum weight retention	13 RCTs, 1 CCT (N=5,060)	Greater reductions in postpartum weight retention at followup time of 12 months (MD, -0.63 kg [95% CI, -1.44 to -0.01]; l^2 =65.5%), but not followup times of less than 6 months (MD, - 0.81 kg [95% CI, -2.40 to 0.55]; l^2 =84.4%) or 6 months (MD, - 0.85 kg [95% CI, -3.67 to 0.81]; l^2 =70.6%). No effect when stratified by BMI subgroup at less than 6 months (p=0.41 for interaction) or 12	Reasonably consistent; imprecise	Differences in followup time; differing duration of interventions; limited or no reporting of known factors associated with postpartum weight retention (e.g. breastfeeding); substantial heterogeneity of pooled estimates.	Low	Moderate
Harms	Depression and anxiety	10 RCTs, 2 CCT (N=3,116)	months (p=0.75). Mixed effects reported for rates of depression and anxiety as measured by various, validated symptom scales.	Inconsistent, imprecise	Not reported as harms of intervention; measured as changes in symptoms; heterogeneous intervention components, duration, intensity, and followup, and few studies overall.	Low	Moderate

		Studies (k); observations		Consistency		Strength	
Outcome		(n): study	Summarv of	and	Other	of	
Category	Outcome	Designs	Findings	Precision	Limitations	Evidence	Applicability
Harms	Small for gestational age, low birth weight	29 RCTs, 1 CCT (N=14,168)	No difference in rates of SGA (20 trials; RR, 0.94 [95% CI, 0.80 to 1.10]; P =0.0%; ARD, -0.4% [95% CI, -1.7 to 1.0]). No differences between interventions during pregnancy versus usual care on low birth weight in 12 trials. Statistically significant effect when stratified by intervention intensity (p=0.04 for interaction), but not BMI subgroup (p=0.91) or intervention type (p=0.77).	Consistent; reasonably precise	Studies not powered to address SGA; varied definitions used for SGA (less than 10% for gestational age) or low birth weight (less than 2,500 g); low event rates.	Moderate	Moderate

Abbreviations: ARD = absolute risk difference; BMI = body mass index; CCT = controlled clinical trials; CI = confidence interval; GDM = gestational diabetes mellitus; GWG = gestational weight gain; I^2 = statistic for heterogeneity; IOM = Institute of Medicine; LGA = large for gestational age; MD = mean difference; N = number; NA = not applicable; NICU = neonatal intensive care unit; RCT = randomized controlled trials; RDS = respiratory distress syndrome; RR = relative risk; SGA = small for gestational age.

Ovid MEDLINE® *Database Searches* Search Strategy:

- 1 Pregnant Women/
- 2 exp Pregnancy/
- 3 perinatal care/ or prenatal care/
- 4 (pregnan* or maternal or gestation* or perinatal or prenatal or antenatal or postpartum).ti,ab.
- 5 or/1-4
- 6 PRECONCEPTION CARE/
- 7 (prepregnan* or preconception* or "pre-pregnan*" or "pre-conception").ti,ab.
- 8 6 or 7
- 9 Pregnancy Outcome/
- 10 exp Pregnancy Complications/
- 11 9 or 10
- 12 5 or 8 or 11
- 13 body weight/ or exp body weight changes/ or exp overweight/
- 14 body mass index/
- 15 (weight or overweight or obes* or BMI).ti,ab.
- 16 12 and (13 or 14 or 15)
- 17 exp Life Style/
- 18 exp Diet Therapy/
- 19 exp Exercise/
- 20 exp Physical Fitness/
- 21 counseling/ or exp directive counseling/
- 22 exp Behavior Therapy/
- 23 exp Motivation/
- 24 health behavior/ or risk reduction behavior/
- 25 exp Patient Education as Topic/
- 26 exp social support/
- 27 health education/ or exp health promotion/
- 28 (diet or exercise or lifestyle or "life style" or advice or advise or behavior* or behaviour* or nonpharma* or "non-pharma*").ti,ab.
- 29 or/17-28
- 30 16 and 29
- 31 limit 30 to (english language and humans)
- 32 limit 31 to (clinical trial, all or comparative study or controlled clinical trial or randomized controlled trial)
- 33 31 and (random* or control* or cohort or trial).ti,ab,kw.
- 34 32 or 33

Ovid MEDLINE® In-Process & Other Non-Indexed Citations Search Strategy:

- 1 (pregnan* or maternal or gestation* or perinatal or prenatal or antenatal or postpartum).ti,ab.
- 2 (prepregnan* or preconception* or "pre-pregnan*" or "pre-conception").ti,ab.
- 3 (weight or overweight or obes* or BMI).ti,ab.

4 (diet or exercise or lifestyle or "life style" or counsel* or advice or advise or behavior* or behaviour* or nonpharma* or "non-pharma*").ti,ab.

- 5 (1 or 2) and 3 and 4
- 6 5 and (random* or control* or trial or cohort).ti,ab,kw.

EBM Reviews - Cochrane Central Register of Controlled Trials Search Strategy:

- 1 Pregnant Women/
- 2 exp Pregnancy/
- 3 perinatal care/ or prenatal care/
- 4 (pregnan* or maternal or gestation* or perinatal or prenatal or antenatal or postpartum).ti,ab.
- 5 or/1-4
- 6 PRECONCEPTION CARE/
- 7 (prepregnan* or preconception* or "pre-pregnan*" or "pre-conception").ti,ab.
- 8 6 or 7
- 9 Pregnancy Outcome/
- 10 exp Pregnancy Complications/
- 11 9 or 10
- 12 5 or 8 or 11
- 13 body weight/ or exp body weight changes/ or exp overweight/
- 14 body mass index/
- 15 (weight or overweight or obes* or BMI).ti,ab.
- 16 12 and (13 or 14 or 15)
- 17 exp Life Style/
- 18 exp Diet Therapy/
- 19 exp Exercise/
- 20 exp Physical Fitness/
- 21 counseling/ or exp directive counseling/
- 22 exp Behavior Therapy/
- 23 exp Motivation/
- 24 health behavior/ or risk reduction behavior/
- 25 exp Patient Education as Topic/
- 26 exp social support/
- 27 health education/ or exp health promotion/
- 28 (diet or exercise or lifestyle or "life style" or advice or advise or behavior* or behaviour* or
- nonpharma* or "non-pharma*").ti,ab.
- 29 or/17-28
- 30 16 and 29
- 31 limit 30 to english language

EBM Reviews - Cochrane Database of Systematic Reviews Search Strategy:

- 1 pregnan*,ti,ab.mp. [mp=title, short title, abstract, full text, keywords, caption text]
- 2 (pregnant or pregnancy or gestation*).ti,ab.

3 2 and (weight or Overweight and obese or obesity).ti,ab.

4 3 and (diet or exercise or counsel* or advise or advise or behavior* of behaviour* or nonpharm* or "non-pharma*").ti,ab.

PsycINFO

Search Strategy:

- 1 exp Pregnancy/
- 2 perinatal care/ or prenatal care/
- 3 (pregnan* or maternal or gestation* or perinatal or prenatal or antenatal or postpartum).ti,ab.
- 4 (prepregnan* or preconception* or "pre-pregnan*" or "pre-conception").ti,ab.
- 5 Pregnancy Outcome/
- 6 body weight/ or exp body weight changes/ or exp overweight/
- 7 body mass index/
- 8 (weight or overweight or obes* or BMI).ti,ab.
- 9 exp Exercise/
- 10 exp Physical Fitness/
- 11 counseling/ or exp directive counseling/
- 12 exp Behavior Therapy/
- 13 exp Motivation/
- 14 health behavior/ or risk reduction behavior/
- 15 exp social support/
- 16 health education/ or exp health promotion/
- 17 (diet or exercise or lifestyle or "life style" or counsel* or advice or advise or behavior* or
- behaviour* or nonpharma* or "non-pharma*").ti,ab.
- 18 (or/1-5) and (or/6-8)
- 19 18 and (or/9-17)
- 20 19 and (random* or control* or trial or cohort).ti,ab.

	Included	Excluded
Population	Pregnant women with normal or high BMI	• Studies limited to pregnant
	• Women who are overweight and obese (defined by	women with gestational
	BMI) and planning pregnancy, including	Women with preexisting
		diabetes
Intervention	• Primary care–relevant interventions that aim to limit	• Pharmacologic interventions
	excess gestational weight gain or reduce	Broader community-based
	prepregnancy weight, and focus on one or more of	programs (e.g., mass media,
	Conducted in an manufited from mirrory, core on	changes to community-built
	Conducted in or recruited from primary care of health care system, or could feasibly be	environment)
	implemented in or referred from primary care	
Outcome	KO1 – health outcomes:	KO1
	• Maternal or infant mortality (incl. stillbirth)	• Behavioral changes (e.g.,
	• Maternal morbidity (e.g., postpartum hemorrhage,	physical activity level)
	perineal trauma, depression)	KQ2
	• Infant morbidity (e.g., birth trauma, shoulder	Cardiometabolic measures
	dystocia, respiratory distress syndrome)	(e.g., glucose level, blood
	KQ2 – weight outcomes:	pressure, lipid level)
	• Preconception weight loss (kg or BMI)	
	• Excessive gestational weight gain (per IOM	
	recommendation or as described by authors)	
	 Measured gestational weight loss or retention 	
	 Incidence or prevalence of maternal obesity-related 	
	perinatal conditions (e.g. macrosomia preterm	
	birth, gestational diabetes mellitus, hypertension,	
	cesarean delivery)	
	KQ3 – harms	
	• Harms associated with interventions (e.g., anxiety,	
	stigma, maternal musculoskeletal injuries)	
	• Harms related to insufficient weight gain (e.g.,	
Commentant	small for gestational age infants)	
Comparator	 Interventions with a comparator or control group; for example; 	comparator group
	• No treatment (wait-list usual care)	comparator group
	• Attention control	
	• Minimal intervention	
Study	KQ1-KQ3	All other study designs
Design	Controlled clinical trial	
	KQ3	
	Cohort or case-control studies reporting harms	
	related to interventions to reduce gestational weight	
Star Jan	gain and prepregnancy weight	De en englise etc. l'
Study	rair- or good-quality studies	Poor-quality studies
Country	Countries considered 'very high' on the 2016 Human	Countries not rated 'very high'
	Development Index	Countries not rated very high
Appendix A2. Included and Excluded Criteria

Notes on Included/Excluded criteria

<u>Mode of delivery</u>: Interventions may be delivered via face-to-face contact, telephone, print materials, or technology (e.g., computer-based, text messages) and can be delivered by numerous potential providers (e.g., clinicians, nurses, exercise specialists, dietitians, nutritionists, behavioral health specialists, etc.)

Countries rated 'very high' on the 2016 HDI

Australia	Denmark	Japan	Poland	U.K.
Andorra	Estonia	South Korea	Portugal	U.S.
Argentina	Finland	Kuwait	Qatar	U.A.E.
Austria	France	Latvia	Romania	
Bahrain	Germany	Liechtenstein	Russia	
Belgium	Greece	Lithuania	Saudi Arabia	
Brunei	Hong Kong	Luxembourg	Singapore	
Canada	Hungary	Malta	Slovakia	
Chile	Iceland	Montenegro	Slovenia	
Croatia	Ireland	Netherlands	Spain	
Cyprus	Israel	New Zealand	Sweden	
Czech Republic	Italy	Norway	Switzerland	

Appendix A3. Literature Flow Diagram



*Some included publications are counted in multiple sections.

Note: Targeted searches for the contextual questions are not included in the current diagram.

- Aguilar-Cordero MJ, Sanchez-Garcia JC, Rodriguez-Blanque R, et al. Moderate physical activity in an aquatic environment during pregnancy (SWEP Study) and its influence in preventing postpartum depression. J Am Psychiatr Nurses Assoc. 2019 Apr;25(2):112-21. doi: 10.1177/1078390317753675. PMID: 29490560.
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- 12. Barakat R, Refoyo I, Coteron J, et al. Exercise during pregnancy has a preventative effect on excessive maternal weight gain and gestational diabetes. A randomized controlled trial. Braz J Phys Ther. 2019 Apr;23(2):148-55. doi: 10.1016/j.bjpt.2018.11.005. PMID: 30470666.
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- 533. Timmermans Yeg VDKKDGRDKLMPDEKBWZLJIS-T. Towards Prepared mums (TOP-mums) for a healthy start, a lifestyle intervention for women with overweight and a child wish: study protocol for a randomised controlled trial in the Netherlands. BMJ Open. 2019;9(11) doi: 10.1136/bmjopen-2019-030236. PMID: 31748290. Exclusion: wrong publication type.
- 534. Tobias DK, Stuart JJ, Li S, et al. Association of history of gestational diabetes with long-term cardiovascular disease risk in a large prospective cohort of US women. JAMA Intern Med. 2017 Dec 1;177(12):1735-42. doi: 10.1001/jamainternmed.2017.2790. PMID: 29049820. Exclusion: wrong study design.
- 535. Trak-Fellermeier MA, Campos M, Meléndez M, et al. PEARLS randomized lifestyle trial in pregnant Hispanic women with overweight/obesity: gestational weight gain and offspring birthweight. Diabetes Metab Syndr Obes. 2019 Feb;12:225-38. doi: 10.2147/DMSO.S179009. PMID: 30858715. Exclusion: inadequate sample size.
- 536. Tundidor D, Zawiejska A, Mathiesen E, et al. DALI lifestyle intervention in pregnant women with BMI >29 kg/m. Continuous glucose monitoring substudy. Diabetologia. 2016;Conference: 52nd annual meeting of the european association for the study of diabetes, EASD. 2016. Germany. Conference start: 20160912. Conference end: 20160916 59(1 Supplement 1):S449. **Exclusion: wrong publication type.**
- 537. Upadhyaya NB, Bryant SB, Heidel RE, et al. Early diagnosis of gestational diabetes mellitus in patients with elevated body mass index. Obstet Gynecol. 2015;125. Exclusion: wrong publication type.
- 538. Vahamiko S, Isolauri E, Laitinen K. Weight status and dietary intake determine serum leptin concentrations in pregnant and lactating women and their infants. Br J Nutr. 2013 Sep 28;110(6):1098-106. doi: 10.1017/S0007114513000214. PMID: 23432806. Exclusion: wrong outcome.
- 539. Valkama A, Koivusalo S, Lindstrom J, et al. The effect of dietary counselling on diet in pregnant women at risk for gestational diabetes. Conference: 12th european nutrition conference, FENS. Ann Nutr Metab. 2015;67(138). Exclusion: wrong outcome.
- 540. Valkama A, Koivusalo S, Lindstrom J, et al. The effect of dietary counselling on food intakes in pregnant women at risk for gestational diabetes: a secondary analysis of a randomised controlled trial RADIEL. Eur J Clin Nutr. 2016 Aug;70(8):912-7. doi: 10.1038/ejcn.2015.205. PMID: 26669570. **Exclusion: wrong outcome.**
- 541. Valkama AJ, Meinila J, Koivusalo S, et al. The effect of pre-pregnancy lifestyle counselling on food intakes and association between food intakes and gestational diabetes in high-risk women: results from a randomised controlled trial. J Hum Nutr Diet. 2018 Jun;31(3):301-5. doi: 10.1111/jhn.12547. PMID: 29468749. Exclusion: wrong outcome.
- 542. Van Buul BJA, Steegers EAP, Van der Maten GD, et al. Dietary sodium restriction does not prevent gestational hypertension: a dutch two-center randomized trial. Hypertens. 1997 Jul 7;16(3):335-46. doi: 10.3109/10641959709031642 Exclusion: wrong intervention.
- 543. van der Maten GD. Low sodium diet in pregnancy: effects on maternal nutritional status. Eur J Obstet Gynecol Reprod Biol. 1995 Jul;61(1):63-4. doi: 10.1016/0028-2243(95)02154-K. PMID: 8549849. Exclusion: wrong publication type.
- 544. van der Maten GD, van Raaij JM, Visman L, et al. Low-sodium diet in pregnancy: effects on blood pressure and maternal nutritional status. Br J Nutr. 1997 May;77(5):703-20. doi: 10.1079/BJN19970069. PMID: 9175991.
 Exclusion: wrong intervention.
- 545. van Elten TM, van de Beek C, Geelen A, et al. Preconception lifestyle and cardiovascular health in the offspring of overweight and obese women. Nutrients. 2019 Oct 14;11(10):14. doi: 10.3390/nu11102446. PMID: 31615021.
 Exclusion: wrong outcome.
Appendix A5. List of Excluded Studies

- 546. Van Poppel M, Oostdam N, Wouters M, et al. FitFor2: effects of an exercise training program on the incidence of gestational diabetes. J Sci Med Sport. 2012;15(31). Exclusion: wrong outcome.
- 547. Van Poppel MN, Oostdam N, Wouters MG, et al. A training program for women at risk for gestational diabetes. Diabetes. 2011;60(24). **Exclusion: wrong outcome.**
- 548. van Zutphen M, Milder IE, Bemelmans WJ. Usage of an online healthy lifestyle program by pregnant women attending midwifery practices in Amsterdam. Prev Med. 2008 Jun 01;46(6):552-7. doi: 10.1016/j.ypmed.2008.01.003. PMID: 18302971 Exclusion: wrong outcome.
- 549. Vanstone M, Kandasamy S, Giacomini M, et al. Pregnant women's perceptions of gestational weight gain: a systematic review and meta-synthesis of qualitative research. Matern Child Nutr. 2017 Oct;13(4) doi: 10.1111/mcn.12374. PMID: 27873484. Exclusion: wrong publication type.
- 550. Vesco K, Leo M, Gillman M, et al. Impact of a weight management intervention on pregnancy outcomes among obese women: the Healthy Moms Trial. Am J Obstet Gynecol. START: 2013 Feb 11 CONFERENCE END: 2013 Feb 16, 33rd Annual Meeting of the Society for Maternal-Fetal Medicine: The Pregnancy Meeting San Francisco, CA United States;208(1 SUPPL.1):S352. Exclusion: wrong publication type.
- 551. Vesco KK, Karanja N, King JC, et al. Healthy Moms, a randomized trial to promote and evaluate weight maintenance among obese pregnant women: study design and rationale. Contemp Clin Trials. 2012 Jul;33(4):777-85. doi: 10.1016/j.cct.2012.03.006. PMID: 22465256. **Exclusion: wrong publication type.**
- 552. Vinter CA, Jensen DM, Ovesen PG, et al. Lifestyle and Pregnancy (LIP) study: the clinical effect of lifestyle intervention during pregnancy in obese women. Diabetes. 2011;60(24). **Exclusion: wrong publication type.**
- 553. Vinter CA, Jorgensen JS, Ovesen P, et al. Metabolic effects of lifestyle intervention in obese pregnant women. Results from the randomized controlled trial 'Lifestyle in Pregnancy' (LiP). Diabet Med. 2014 Nov;31(11):1323-30. doi: 10.1111/dme.12548. PMID: 24989831. Exclusion: wrong outcome.
- 554. Vinter CA, Tanvig MH, Christensen MH, et al. Lifestyle intervention in Danish obese pregnant women with early gestational diabetes mellitus according to WHO 2013 criteria does not change pregnancy outcomes: results from the LiP (Lifestyle in Pregnancy) study. Diabetes Care. 2018 Oct;41(10):2079-85. doi: 10.2337/dc18-0808. PMID: 30061318. Exclusion: wrong population.
- 555. Walker Lo KSSSB. Weight-loss resilience among low-income postpartum women: association with health habits effect of a low glycaemic index diet during pregnancy on maternal and cord blood metabolomic profiles: results from the ROLO randomized controlled trial. West J Nurs Res. 2019 Dec;41(12):1709-23. doi: 10.1177/0193945918824598. PMID: 30658560. Exclusion: wrong population.
- 556. Walsh J, Mahony R, Foley M, et al. A randomised control trial of low glycaemic index carbohydrate diet versus no dietary intervention in the prevention of recurrence of macrosomia. BMC Pregnancy Childbirth. 2010 Apr 23;10(16) doi: 10.1186/1471-2393-10-16. PMID: 20416041. **Exclusion: wrong publication type.**
- 557. Walsh J, McGowan C, Byrne J, et al. The influence of a low glycaemic index dietary intervention on maternal glycaemic index, dietary intake and gestational weight gain. Am J Obstet Gynecol. START: 2013 Feb 11 CONFERENCE END: 2013 Feb 16, 33rd Annual Meeting of the Society for Maternal-Fetal Medicine: The Pregnancy Meeting San Francisco, CA United States;208(1 SUPPL.1):S33. **Exclusion: wrong publication type.**
- 558. Walsh JM, Mahony RM, Canty G, et al. Identification of those most likely to benefit from a low-glycaemic index dietary intervention in pregnancy. Br J Nutr. 2014 Aug 28;112(4):583-9. doi: 10.1017/S000711451400110X. PMID: 24896237. Exclusion: wrong intervention.
- 559. Walsh JM, McGowan CA, Mahony R, et al. Low glycaemic index diet in pregnancy to prevent macrosomia (ROLO study): randomised control trial. Bmj. 2012 Aug 30;345(e5605) doi: 10.1136/bmj.e5605. PMID: 22936795. Exclusion: wrong outcome.
- 560. Wang C, Wei Y, Zhang X, et al. Effect of regular exercise commenced in early pregnancy on the incidence of gestational diabetes mellitus in overweight and obese pregnant women: a randomized controlled trial. Diabetes Care. 2016 Oct;39(10):e163-4. doi: 10.2337/dc16-1320. PMID: 27660125. Exclusion: wrong country.
- 561. Wang C, Wei Y, Zhang X, et al. A randomized clinical trial of exercise during pregnancy to prevent gestational diabetes mellitus and improve pregnancy outcome in overweight and obese pregnant women. Am J Obstet Gynecol. 2017 Apr;216(4):340-51. doi: 10.1016/j.ajog.2017.01.037. PMID: 28161306. Exclusion: wrong country.
- 562. Wang S, Ma J-M, Yang H-X. Lifestyle intervention for gestational diabetes mellitus prevention: a cluster-randomized controlled study. Chronic Dis Transl Med. 2015 Oct 21;1(3):169-74. doi: 10.1016/j.cdtm.2015.09.001. PMID: 29063004. Exclusion: wrong country.
- 563. Washington Cole KO, Gudzune KA, Bleich SN, et al. Influence of the 5A's counseling strategy on weight gain during pregnancy: an observational study. J Womens Health. 2017 Oct;26(10):1123-30. doi: 10.1089/jwh.2016.6115. PMID: 28525296. Exclusion: wrong study design.
- 564. Webb JB, Siega-Riz AM, Dole N. Psychosocial determinants of adequacy of gestational weight gain. Obesity (Silver Spring). 2009 Feb;17(2):300-9. doi: 10.1038/oby.2008.490. PMID: 19008871. Exclusion: wrong study design.
- 565. Weisman CS, Hillemeier MM, Downs DS, et al. Preconception predictors of weight gain during pregnancy: prospective findings from the Central Pennsylvania Women's Health Study. Womens Health Issues. 2010 Mar-Apr;20(2):126-32. doi: 10.1016/j.whi.2009.12.002. PMID: 20133152. **Exclusion: wrong study design.**
- 566. Weisman CS, Hillemeier MM, Downs DS, et al. Improving women's preconceptional health: long-term effects of the Strong Healthy Women behavior change intervention in the central Pennsylvania Women's Health Study. Womens

Health Issues. 2011 Jul-Aug;21(4):265-71. doi: 10.1016/j.whi.2011.03.007. PMID: 21536455. Exclusion: wrong population.

- 567. Weisman CS, Misra DP, Hillemeier MM, et al. Preconception predictors of birth outcomes: prospective findings from the central Pennsylvania Women's Health Study. Matern Child Health J. 2011 Oct;15(7):829-35. doi: 10.1007/s10995-009-0473-2. PMID: 19472041. Exclusion: wrong study design.
- 568. Wekker V, Van Dammen L, Van Oers AM, et al. Effect of a lifestyle intervention in obese infertile women on cardiometabolic health and quality of life: results of a randomised controlled trial. Hum Reprod. Conference: 33rd annual meeting of the european society of human reproduction and embryology. Switzerland. 2017;32:i28-i9. **Exclusion: wrong population.**
- 569. Wells CS, Schwalberg R, Noonan G, et al. Factors influencing inadequate and excessive weight gain in pregnancy: Colorado, 2000-2002. Matern Child Health J. 2006 Jan;10(1):55-62. doi: 10.1007/s10995-005-0034-2 PMID: 16496222. Exclusion: wrong study design.
- 570. Whitaker KM. Patient and provider perceptions of weight gain, physical activity, and nutrition in pregnancy. Diss Abstr Int. 2016;76(10-B(E)). Exclusion: wrong study design.
- 571. Whitaker KM, Wilcox S, Liu J, et al. Patient and provider perceptions of weight gain, physical activity and nutrition counseling during pregnancy: a qualitative study. Womens Health Issues. 2016 Jan-Feb 11/24;26(1):116-22. doi: 10.1016/j.whi.2015.10.007. PMID: 26621605 Exclusion: wrong study design.
- 572. Wilcox S, Liu J, Addy CL, et al. A randomized controlled trial to prevent excessive gestational weight gain and promote postpartum weight loss in overweight and obese women: Health In Pregnancy and Postpartum (HIPP). Contemp Clin Trials. 2018 Mar;66:51-63. doi: 10.1016/j.cct.2018.01.008. PMID: 29371061. Exclusion: wrong study design.
- 573. Wilkinson SA, McIntyre HD. Evaluation of the 'healthy start to pregnancy' early antenatal health promotion workshop: a randomized controlled trial. BMC Pregnancy Childbirth. 2012 Nov 19;12(131) doi: 10.1186/1471-2393-12-131. PMID: 23157894. **Exclusion: wrong outcome.**
- 574. Willcox JC, Campbell KJ, McCarthy EA, et al. Testing the feasibility of a mobile technology intervention promoting healthy gestational weight gain in pregnant women (txt4two) study protocol for a randomised controlled trial. Trials. 2015 May 7;16(209) doi: 10.1186/s13063-015-0730-1. PMID: 25947578. Exclusion: wrong publication type.
- 575. Yeo S, Walker JS, Caughey MC, et al. What characteristics of nutrition and physical activity interventions are key to effectively reducing weight gain in obese or overweight pregnant women? A systematic review and meta-analysis. Obes Rev. 2017 Apr;18(4):385-99. doi: 10.1111/obr.12511. PMID: 28177566. Exclusion: systematic review or meta-analysis used only as a source document for pearling.
- 576. Zeron HM, Flores AP, Chavez AA, et al. Pregnancy weight gain limitation by a supervised nutritional program influences placental NF-kappaB/IKK complex expression and oxidative stress. Oman med. 2013 May;28(3):167-72. doi: 10.5001/omj.2013.48. PMID: 23772281. Exclusion: wrong outcome.

Randomized Controlled Trials (RCTs) and Cohort Studies

Criteria:

- Initial assembly of comparable groups:
 - For RCTs: Adequate randomization, including first concealment and whether potential confounders were distributed equally among groups
 - For cohort studies: Consideration of potential confounders, with either restriction or measurement for adjustment in the analysis; consideration of inception cohorts
- Maintenance of comparable groups (includes attrition, cross-overs, adherence, contamination)
- Important differential loss to followup or overall high loss to followup
- Measurements: equal, reliable, and valid (includes masking of outcome assessment)
- Clear definition of interventions
- All important outcomes considered
- Analysis: adjustment for potential confounders for cohort studies or intention-to treat analysis for RCTs

Definition of ratings based on above criteria:

Good: Meets all criteria: Comparable groups are assembled initially and maintained throughout the study (followup \geq 80%); reliable and valid measurement instruments are used and applied equally to all groups; interventions are spelled out clearly; all important outcomes are considered; and appropriate attention to confounders in analysis. In addition, intention-to-treat analysis is used for RCTs.

Fair: Studies are graded "fair" if any or all of the following problems occur, without the fatal flaws noted in the "poor" category below: Generally comparable groups are assembled initially, but some question remains whether some (although not major) differences occurred with followup; measurement instruments are acceptable (although not the best) and generally applied equally; some but not all important outcomes are considered; and some but not all potential confounders are accounted for. Intention-to-treat analysis is used for RCTs. **Poor:** Studies are graded "poor" if any of the following fatal flaws exists: Groups assembled initially are not close to being comparable or maintained throughout the study; unreliable or

invalid measurement instruments are used or not applied equally among groups (including not masking outcome assessment); and key confounders are given little or no attention. Intention-to-treat analysis is lacking for RCTs.

Source: Procedure Manual. U.S. Preventive Services Task Force.

https://www.uspreventiveservicestaskforce.org/Page/Name/appendix-vi-criteria-for-assessing-internal-validity-ofindividual-studies Accessed on 4/12/19.

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Author, Year Study	Study		Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria	Time	B=Control	Source	Rating
Cordero et al., 2019 ⁷¹ SWEP		university- affiliated aquatic facility Granada, Spain		intensity	A. n=70 B. n=70	gestational age 12-20 weeks Excluded: gestational age <12 or >20 weeks, absolute contraindications for aerobic exercise during pregnancy, attendance at <80% of 54 scheduled sessions	classes 3x per week (planned 54 classes), weeks 20- 37	Age, mean (SD): 34.5 years (4.5) vs. 33.7 years (5.4) BMI first trimester, median (P25 to P75): 23.9 kg/m ² (21.5 to 27.5) vs. 24.0 kg/m ² (21.8 to 26.6) BMI third trimester, median (SD): 27.8 kg/m ² (4.0) vs. 29.0	funding, no conflicts of interest	
								kg/m ² (4.0) vs. 29.0 kg/m ² (4.5) Normal weight (BMI 18.5-24.99 kg/m ²): 29.2% vs. 17.2% Overweight (BMI 25- 29.99 kg/m ²): 46.2% vs. 48.4% Obese (BMI >30 kg/m ²): 24.6% vs. 34.4% Multiparity: 30.8% vs. 26.6%		

Author, Year Study	Study		Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Al Wattar et al., 2019 ⁷² ESTEEM	RCT	5 inner-city maternity units London and Birmingham, UK	Mixed	Counseling; Moderate intensity	N=1,218 A. n=593 B. n=625	Included: Pregnant women aged >16 years, <18 weeks' gestation, singleton, able to consume nuts and olive oil Excluded: preexisting diabetes, GDM, chronic renal disease, autoimmune disease, taking lipid- altering drugs	3 in- person sessions, 2 phone calls	A vs. B Age, mean years (SD): 31.4 (5.2) vs. 30.9 (5.2) Age, >40 years: 3.9% vs. 3.1% BMI normal (15.5- 24.9 kg/m ²): 14.2% vs. 13.7% BMI overweight (25- 29.9): 16.7% vs. 16.7% BMI obese (30-39.9): 69.1% vs. 69.6% White: 36.6% vs. 35.5% Asian: 43.3% vs. 44.1% Black: 16.4% vs. 17.2% Other: 3.7% vs. 3.3% Primigravida: 27.3% vs. 27.5% Baseline ESTEEM Q score (adherence to Med diet), mean (SD): 5.0 (1.9) vs. 5.0 (1.9)	Barts Charity	Fair

Author, Year Study	Study		Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Altazan et al., 2019 ⁷³ Expecting Success / SmartMoms *Note: associated with Redman, 2017	Design RCT	Setting Clinic or smartphone Baton Rouge, LA	Overweight and obese	Counseling; High intensity	B=Control N=54 A. n=37 B. n=17	Included and Excluded Criteria Included: pregnant women, BMI ≥25 kg/m ² , aged 18-40 years, singleton, no history or current psychotic disorder or major depression, <12 weeks' gestation Excluded: no plans to delivery at Women's Hospital in Baton Rouge, habitual smoker or abuser of drugs in past 6 months, contraindications to exercise	18 lessons (time NR)	B=Control A vs. B Age, mean (SD): 29.1 years (5.1) BMI enrollment, mean (SD): 31.0 kg/m² (4.2) vs. 31.1 kg/m² (3.7) BMI overweight (25.0-29.9 kg/m²): 43.2% (16/37) vs. 52.9% (9/17) BMI obese (30.0- 40.0): 56.8% (21/37) vs. 47.1% (8/17) Black: 18.9% vs. 35.3% White: 73% vs. 64.7% Other: 8.1% vs. 0% Gestational age, mean weeks (SD): 10.2 (1.2) vs. 9.6 (1.0)	Source NIDDK, NHLBI, NCCIH, NIH ORWH, ODP, OBSSR, NIGMS	<u>Ratıng</u> Fair
Althuizen et al., 2013 ⁷⁴ New Life(style)	RCT	Eight midwifery clinics, Netherlands	Mixed	Counseling; Moderate intensity	N=246 A. n=123 B. n=123	Included: Pregnant women <14 weeks gestation, expecting first child, ability to read, write, and speak Dutch.	30-min phone call; three 15-min in person; one 15- min phone call	A vs. B Age, mean (SD): 29.1 years (3.8) vs. 30.4 years (4.0) Prepregnancy BMI, mean (SD): 24.0 kg/m ² (4.2) vs. 23.5 kg/m ² (3.8) Underweight: 10% vs. 14% Normal weight: 66% vs. 67% Overweight: 9% vs. 8% Obese: 14% vs. 12% Race: NR	Grant from Netherlands Organization for Health Research and Developmen t	Good

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Asbee et al., 2009 ⁷⁵	RCT	One prenatal care center, Charlotte, North Carolina	Mixed	Counseling; Low intensity	N=144 A. n=57 B. n=43	Included: Women between 6-16 weeks of gestation, aged 18-49 years, all prenatal care received at the Resident Obstetrics Clinic, singleton pregnancy, speaks English or Spanish Excluded: BMI >40 kg/m ² , preexisting diabetes, untreated thyroid disease, or hypertension requiring medication or other medical conditions that might affect body weight, delivery at institution other than Carolinas Medical Center-Main, pregnancy ending in preterm birth (<37 weeks), limited prenatal care (<4 visits)	NR - one initial study visit	A vs. B Age, mean: 26.7 years vs. 26.4 years Prepregnancy BMI, mean: 25.5 kg/m ² vs. 25.6 kg/m ² Prepregnancy weight, mean: 143.0 lbs vs. 143.2 lbs Hispanic: 57.9% vs. 54.8% Black: 26.3% vs. 21.4% White: 8.8% vs. 19.0% Asian: 5.3% vs. 2.4%	Grant from Carolinas Healthcare Foundation	Fair
Assaf-Balut et al., 2017 ⁷⁶	RCT	One hospital- affiliated clinic, Madrid, Spain	Mixed	Counseling; Low intensity	N=1,000 A. n=500 B. n=500	Included: pregnant women, singleton, aged ≥18 years Excluded: gestational age >14 weeks, intolerance to nuts or olive oil, medical conditions or pharmacological therapy that could compromise effect of intervention or follow-up	1 hour initial study visit	A vs. B Age, mean (SD): 33.2 years (5.0) vs. 32.7 years (5.3) Baseline BMI, mean (SD): 23.7 kg/m ² (3.8) vs. 24.1 kg/m ² (4.1) White: 69.0% vs. 67.8% Hispanic: 28.6% vs. 28.4% Other: 2.4% vs. 3.8%	Fundacion para Estudios Endocrinom etabolicos, IdISSC Hospital Clinico San Carlos, Instituto de Salud Carlos III of Spain, Fondo Europeo de Desarrollo Regional	Good

Author, Year Study	Study		Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria	Time	B=Control	Source	Rating
Bacchi et al., 2018 ⁷⁷	RCT	One primary care obstetric clinic, Buenos Aires, Argentina	Mixed	Active; High intensity	N=140 A. n=70 B. n=70	Included: Pregnant women, singleton, uncomplicated pregnancies Excluded: Women not planning to give birth at study obstetric clinic, not under medical care throughout pregnancy period, women with conditions preventing them from exercising safely, heart disease, thrombophlebitis, cervical incompetence, multiple pregnancy, vaginal bleeding, premature leakage of membranes, intrauterine growth restriction, preeclampsia, risk of premature labor, prepregnant T1D or T2D	55-60 min 3x per week	A vs. B Age, mean (SD): 30.4 years (4) vs. 31.0 years (5) Baseline BMI, mean (SD): 23.1 kg/m ² (3.2) vs. 24.0 kg/m ² (4) BMI underweight (<18 kg/m ²): 2% vs. 3.2% BMI normal weight (18-24.9): 65.3% vs. 58.1% BMI overweight (25- 29.0): 26.5% vs. 30.6% BMI obese (≥30): 6.1% vs. 8.1% Race: NR	Technical University of Madrid; Spanish Ministry of Culture, Education, and Sport; University of Flores	Fair
Barakat et al., 2012 ⁷⁸	RCT	One primary care obstetric clinic, Madrid, Spain	Mixed	Active; High intensity	N=100 A. n=50 B. n=50	Included: Pregnant women, singleton, gestational age 6-9 weeks, uncomplicated pregnancies Excluded: Women not planning to give birth at study obstetric clinic, not under medical care throughout pregnancy period, women with absolute obstetric contraindication, heart disease, thrombophlebitis, recent pulmonary embolism, acquired infectious disease, cervical incompetence, multiple pregnancy, genital hemorrhage, premature leakage of membranes, intrauterine growth restriction, macrosomia, serious blood disease, serious HTN, absence of prenatal control, suspects of fetal suffering, risk of premature labor, preoregnant T1D or T2D	35-45 min 3x per week	A vs. B Age, mean (SD): 32 years (4) vs. 31 years (3) Baseline BMI, mean (SD): 22.7 kg/m ² (2.8) vs. 23 kg/m ² (2.9) Race: NR	Ministerio de Ciencia e Innovación, Spain	Fair

Author, Year			Population	Intervention	Total N			Population Characteristics		
Study	Study		вмі	Туре;	A=Intervention		Estimated	A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria	Time	B=Control	Source	Rating
Barakat et al., 2014 ⁸¹	RCT	One maternity care hospital, Madrid, Spain	Mixed	Active; High intensity	N=251 A. n=137 B. n=114	Included: Pregnant women at 6 to 7 weeks of pregnancy living in Madrid, Spain Excluded: Any type of absolute obstetrical contraindication to exercise as suggested by ACOG; not planning to give birth in the obstetrics department of the study hospital, not receiving medical followup throughout the pregnancy, participating in another physical program or having a high level of pregestational physical exercise	55-60 min 3x per week	A vs. B Age (mean): 31 years baseline BMI, mean: 23.8 kg/m ² vs. 24.1 kg/m ² Baseline BMI <18 kg/m ² : 9% vs. 2.2% Baseline BMI 18-24.9 kg/m ² : 68.9% vs. 34.4% Baseline BMI 25-29.9 kg/m ² : 23.6% vs. 23.3% Baseline BMI >30 kg/m ² : 6.6% vs. 10%	Technical University of Madrid and University of Flores- Argentina	Fair
Barakat et al., 2016 ⁸⁰	RCT	One hospital, Madrid, Spain	Mixed	Active; High intensity	N=840 A. n=420 B. n=420	Included: Caucasian, spoke Spanish, singleton, gestational age 9-11 weeks, uncomplicated pregnancy, no history or risk of preterm delivery Excluded: preexisting T1D or T2D, GDM at baseline, not under medical care during pregnancy, not planning to give birth at study hospital, any serious medical contraindications to exercise	55-60 min 3x per week	A vs. B Age, mean (SD): 31.6 years (4.2) vs. 31.8 years (4.5) BMI, mean (SD): 23.6 kg/m ² (3.8) vs. 23.4 kg/m ² (4.2) Underweight: 2.6% vs. 5.2% Normal: 67.5% vs. 67.6% Overweight: 23.3% vs. 19.6% Obese: 6.5% vs. 7.6%	Technical University of Madrid	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Barakat et al., 2018 ⁷⁹	RCT	2 primary care medical centers Madrid, Spain	Mixed	Active; High intensity	N=429 A. n=202 B. n=227	Included: singleton, no preexisting GDM or diabetes, gestational age 9-11 weeks, no history or risk of preterm delivery, no other trial participation Excluded: not planning to give birth at study hospital, no medical follow-up, contraindications to exercise during pregnancy	55-60 min 3x per week	A vs. B Age, mean (SD): 31.8 years (4.6) vs. 31.3 years (3.4) BMI, mean (SD): 23.4 kg/m ² (3.7) vs. 23.7 kg/m ² (3.8) BMI underweight (<18 kg/m ²): 1.8% vs. 2% BMI normal (18-24.9): 70.5% vs. 71.6% BMI overweight (25- 29.9): 21.9% vs. 19.9% BMI obese (>30): 5.8% vs. 6.5% Nulliparous: 62.1% vs. 70.3% Smoker: 18.2% 22.1% Cesarean: 22.5% vs. 25.2%	NR; authors report no conflicts of interest	Fair

Author, Year			Population	Intervention	Total N			Population Characteristics		
Study Name	Study Design	Setting	BMI Category	Type; Intensity	A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	A=Intervention B=Control	Funding Source	Quality Rating
Barakat et al., 2019 ⁸²	RCT	2 tertiary care hospitals Madrid, Spain	Mixed	Active; High intensity	N=456 A. n=234 B. n=222	Included: singleton, gestational age 8-10 weeks, no preexisting GDM or diabetes, no history or risk of preterm delivery, no other trial participation Excluded: not planning to give birth at study hospital, no medical follow-up, contraindications to exercise during pregnancy	55-60 min 3x per week	A vs. B Age, mean years (SD): 31.8 (4.7) vs. 31.0 (3.8) BMI baseline, mean (SD): 23.5 kg/m ² (3.8) vs. 23.7 kg/m ² (3.8) BMI underweight (<18 kg/m ²): 2.1% vs. 2.7% BMI normal (18-24.9): 68.4% vs. 70.7% BMI overweight (25- 29.9): 23.1% vs. 20.3% BMI obese (>30): 6.4% vs. 6.3% Nulliparous: 60.7% vs. 73%	NR; authors report no conflicts of interest	Fair
Bogaerts et al., 2013 ⁸³	RCT	Three hospital- based antenatal units, Belgium	Obese	Counseling; Moderate intensity	N=205 A. n=76 B. n=58 C. n=63	Included: Obese (BMI ≥29 kg/m ²) pregnant women <15 weeks of pregnancy attending antenatal clinic at 3 regional hospitals in Belgian Flanders between March 2008 and April 2011 Excluded: preexisting type 1 diabetes, multiple pregnancy	Four 1.5-2 hour in person groups	A vs. B vs. C Age, mean (SD): 28.8 years (4.5) vs. 29.6 years (4.9) vs. 28.7 years (4.2) Prepregnancy BMI, mean, (SD): 34.4 kg/m ² (4.6) vs. 35.4 kg/m ² (5.2) vs. 34.4 kg/m ² (5.2) vs. 34.4 kg/m ² (4.1) Belgian/Dutch ethnicity: 81.6% vs. 81% vs. 77.8% Turkish/Moroccan ethnicity: 10.5% vs. 13.8% vs. 14.3 Other ethnicity: 7.9% vs. 5.2% vs. 7.9%	PWO project from Flanders, FWO Vlaanderen Netherland organization for Scientific Research, European Commission' s seventh Framework Programme	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Brownfoot et al., 2016 ⁸⁴	RCT	One tertiary obstetric hospital, Melbourne, Australia	Mixed	Counseling; Low intensity	N=782 A. n=386 B. n=396	Included: women 18-45 years old, singleton pregnancy, attending first antenatal visit prior to 21 weeks, planning to receive care through hospital clinics. Excluded: medical comorbidities, substance abuse, inability to understand English	NR - during visits	A vs. B Age, mean (SD): 31.6 years (4.9) vs. 32.3 years (4.7) BMI normal weight (18-24.9 kg/m ²): 53.9% vs. 53.5% BMI overweight (25- 29.9): 29% vs. 29.3% BMI obese (≥30): 15.5% vs. 14.7% White: 55% vs. 54% Asian: 13% vs. 15% Middle East: 4% vs. 4% Other: 27% vs. 27%	Victorian Managed Insurance Agency	Fair
Bruno et al., 2017 ⁸⁵	RCT	One university hospital, Modena, Italy	Overweight and obese	Counseling; Moderate intensity	N=191 A. n=96 B. n=95	Included: women >18 years old, BMI ≥ 25 kg/m ² , singleton, gestational age 9-12 weeks Excluded: preexisting diabetes, history of GDM, GDM in first trimester, hypertension, medical conditions that could affect body weight (e.g. thyroid disease), prior bariatric surgery, contraindications to exercise, plans to delivery outside the study hospital, smoking 5+ cigarettes per day	1 hour initial study visit; four follow-up visits (time NR)	A vs. B Age, mean (SD): 31.5 years (5) vs. 30.8 years (5.5) Prepregnancy BMI, mean (SD): 33.3 kg/m ² (6) vs. 33.4 kg/m ² (6) vs. 33.4 kg/m ² (5.5) BMI at enrollment: 33.9 kg/m ² (5.7) vs. 34.5 kg/m ² (6.8) Obese: 65.6% vs. 72.6% White: 82.3% vs. 82.1% African: 12.6% vs. 13.7% Other: 5.2% vs. 4.3%	Policlinico university Hospital of Modena	Fair

Author, Year Study Name	Study	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated	Population Characteristics A=Intervention B=Control	Funding	Quality Rating
Cahill et al., 2018 ⁸⁶ PreGO	RCT	One university hospital, St. Louis, Missouri	Overweight and obese	Counseling; High intensity	N=240 A. n=119 B. n=121	Included: African American, age 18-45, BMI 25-45 at initial first trimester visit, single viable gestation at or before 15 0/7 weeks (by LMP), disadvantaged SES (Medicaid recipient or home zip code associated with median household income below FPL) Excluded: diabetes, history of GDM or contraindication macrosomia, HbA1c ≥6.5%, any contraindication to exercise during pregnancy, substance abuse, non-English speaker	10 biweekly 1-hour visits	A vs. B Age, mean (SD): 24.7 years (4.9) vs. 26.0 years (4.9), p=0.04 BMI, mean (SD): 32.8 kg/m ² (5.1) vs. 31.9 kg/m ² (4.9) Race: NR	NIH	Good
Haire-Joshu et al., 2019 ¹⁰³ *Note: f/u of Cahill et al., 2018	Same as Cahill et al., 2018	Same as Cahill et al., 2018	Same as Cahill et al., 2018	Same as Cahill et al., 2018	N=185 A. n=92 B. n=93	Same as Cahill et al., 2018	10 prenatal biweekly visits, 12 monthly postpartu m visits (1 hour)	A vs. B (2019 sample) Age, mean (SD): 24.7 years (5) vs. 26.2 years (5) BMI baseline, mean (SD): 32.7 kg/m ² (5.2) vs. 31.9 kg/m ² (5) BMI overweight: 33.7% vs. 35.6% BMI obese: 66.3% vs. 63.4% Nulliparous: 25% vs. 18.3% GDM: 10.9% vs. 9.7%	NIH	Fair

Author, Year Study	Study		Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria	Time	B=Control	Source	Rating
Claesson et al., 2010 ⁸⁷	ССТ	Multiple antenatal care clinics, Sweden	Obese	Active; High intensity	N=348 A. n=155 B. n=193	Included: BMI ≥30 kg/m ² , speak Swedish, mean gestational age 15 weeks, singleton pregnancy, registered at antenatal care clinics in Linköping and surrounding area (intervention) or two nearby cities (control) Excluded: Prepregnant diabetes, thyroid dysfunction, psychiatric condition treated with neuroleptic drugs, had miscarriage or legal abortion during study	Weekly 30-min in person; 1- 2x per week exercise class (time NR), 3 follow-up visits (time NR)	A vs. B Age, mean (SD): 29.7 years (4.48) vs. 30.2 years (4.92) BMI Class I obese (30-34.9 kg/m ²): 64.5% vs. 65.8% BMI Class II obese (35-39.9): 23.2% vs. 21.8% BMI Class III obese (≥40): 12.3% vs. 12.4%	The Research Fund of County Council in the South East Sweden and ALF, Council of Östergötland	Fair
Daley et al., 2015 ⁸⁸	RCT	One community midwifery clinic, Birmingham, UK	Mixed	Counseling; Low intensity	N=76 A. n=36 B. n=40	Included: Pregnant women, ≥18 years old, BMI 18-29.9 kg/m², 12- 14 weeks' gestation Excluded: Obese women (BMI ≥30 kg/m²), women with high-risk pregnancies	NR - during visits	A vs. B Age, mean (SD): 28.1 years (5.9) vs. 28.9 years (6.8) BMI normal weight (18.5-24.9 kg/m ²): 57.5% vs. 55.6% BMI overweight (25.0-29.9): 42.5% vs. 44.4% White ethnicity: 85.0% vs. 91.7%	NIHR	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Daley et al., 2019 ⁸⁹ POPS2	RCT	Four maternity centers, England	Mixed	Counseling; Low intensity	N=616 A. n=305 B. n=311	Included: singleton, ≥18 years old, BMI ≥18.5 kg/m², expected to receive midwife-led or shared care, 10-14 weeks' gestation. Excluded: unable to understand English, attend weight management program, severe mental illness, illicit drug or alcohol dependency	NR – during visits	A vs. B Age, mean (SD): 29.4 years (5.0) vs. 29.7 years (5.2) BMI mean (SD): 25.9 kg/m² (4.6) vs. 26.1 kg/m² (4.8) BMI normal weight (18.5-24.9 kg/m²): 49.2% vs. 48.9% BMI overweight (25- 29.9): 31.5% vs. 32.2% BMI obese (≥30): 19.3% vs. 18.8% Caucasian: 73.5% vs. 72.8% Pakistani: 10.4% vs. 11.9% IMD most deprived: 44.3% vs. 44.9% Smoker: 8.5% vs. 6.3%	NIHR	Fair
Daly et al., 2017 ⁹⁰ Healthy eating, Exercise and Lifestyle Trial	RCT	One university hospital, Dublin, Ireland	Obese	Active; High intensity	N=88 A. n=44 B. n=44	Included: Pregnant women <17 weeks' gestation, BMI ≥30 kg/m ² at first prenatal visit, understood English, ≥18 years old Excluded: multiple pregnancy, preexisting diabetes, hypertension, alcohol or drug abuse, medication affecting insulin secretion or sensitivity, serious cardiorespiratory disorders, hepatic or renal impairment, lupus, hematologic disorders, celiac disease, thyroid disorders, current psychosis, malignant disease, known fetal anomaly	50-60 min 3x per week	A vs. B Age, mean (SD): 30.0 years (5.1) vs. 29.4 years (4.8) BMI, mean (SD): 34.7 kg/m ² (4.6) vs. 34.7 kg/m ² (5.1) Race: NR	Friends of the Coombe	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Dodd et al., 2014 ⁵⁶ LIMIT	RCT	Three maternity hospitals, Adelaide, Australia	Overweight and obese	Counseling; Moderate intensity	N=2,212 A. n=1,108 B. n=1,104	Included: Singleton, BMI ≥25 kg/m², between 10-20 weeks' gestation Excluded: preexisting diabetes	3 in- person visits; 3 phone calls (time NR)	A vs. B Age, mean (SD): 29.3 years (5.4) vs. 29.6 years (5.6) Median BMI (IQR): 31.0 kg/m ² (28.1- 35.9) vs. 31.1 kg/m ² (27.7-35.6) BMI overweight (25- 29.9 kg/m ²): 41.4% vs. 42.7% BMI Class I obese (30.0-34.9): 29.5% vs. 29.0% BMI Class II obese (35.0-39.9): 18.3% vs. 16.7% BMI Class III obese (≥40): 10.8% vs. 11.7% White: 90% vs. 91% Asian: 2.4% vs. 3.1% Indian: 3.6% vs. 3.2% Other: 4.0% vs. 2.7%	University of Adelaide, NHMRC Practitioner Fellowship	Good
Dodd et al., 2018 ⁹¹ *Note: f/u of Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014

Author, Year Study	Study		Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria	Time	B=Control	Source	Rating
Dodd et al.,	RCI	One nospital,	Normal	Counseling;	N=633	Included: Singleton, BIVI 18.5-24.9	3 in-	A VS. B	University of	Good
		Auetralia		intensity	A. 11=310 B n=317	kg/m², between 10-20 weeks	visite: 3	Age, mean (SD) . 31.0		
		Australia		Intensity	D. 11–317	Excluded: multiple pregnancy	phone	vears (4.6) vs. 51.5	Practitioner	
						preexisting diabetes	calls (time	BMI, median (IQR):	Fellowship	
							NR)	22.2 kg/m ² (20.8,	· • · • · • · • · · · ·	
							,	23.7) vs. 22.2 kg/m ²		
								(20.9, 23.5)		
								Caucasian: 67.1% vs.		
								67.8%		
								Asian: 15.8% vs.		
								14.2% Indian Dekistoni Sri		
								Indian, Pakistani, Sh		
								Nullinarous: 59.8%		
								vs. 58.7%		
								Smoker: 4.8% vs.		
								4.1%		
								Socioeconomic Index		
								for Areas, most		
								disadvantaged:		
								15.2% vs. 18.3%		

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Epel et al., 2019 ⁹³ MMT	Prospe ctive cohort	Hospital and community health centers San Francisco, CA	Overweight and obese	Counseling; High intensity	N=215 A. n=110 B. n=105	Included: aged 18-45 years, singleton, BMI 25-41 kg/m ² , gestational age 12-19 weeks, able to attend 8 weekly 2-hr classes, household income <500% FPL Excluded: not able to complete forms in English, have substance abuse / mental health / medical condition making it difficult to participate in group class or affect GWG, needle phobia or fainting response, PCOS tx with metformin, meditation practice >2x/week, recent weight loss (>5% in 6 months), chronic corticosteroids, hx of gastric bypass surgery	1 initial session, 8 group classes (2 hours 1x/wk), 2 phone calls (time NR), 1 postpartu m group session	A vs. B Age, mean (SD): 27.8 years (5.7) vs. 28 years (6) BMI normal or overweight (BMI <30 kg/m ²): 55.2% vs. 51% BMI Class I obese (30-34.9): 28.6% vs. 24% BMI Class II obese (≥35): 16.2% vs. 25% White: 12.8% vs. 14.3% African-American: 35.8% vs. 42.9% Latino: 32.1% vs. 27.6% Other: 19.2% vs.	NHLBI	Good
Gallagher et al., 2018 ⁹⁴ LIFT	RCT	Multiple hospital- affiliated clinics, U.S.	Overweight and obese	Counseling; High intensity	N=210 A. n=105 B. n=105	Included: age ≥18 years, BMI ≥25 kg/m ² , singleton pregnancy, gestation age 9-15 weeks and 6 days, intent to deliver at St. Luke's- Roosevelt hospital Excluded: Prepregnant diabetes, known fetal anomaly, planned termination of pregnancy, history of ≥3 consecutive first trimester miscarriages, current eating disorder, suicidal ideation, planned bariatric surgery, current use of metformin, steroids, or certain psych drugs, use of weight loss medication, contraindications to exercise in pregnancy, drug/alcohol addition, smoker, chronic health problems precluding regular exercise	3 visits	A vs. B Age, mean (SD): 33.8 years (4.0) vs. 33.8 years (4.7) Baseline BMI, mean (SD): 30.1 kg/m ² (4.1) vs. 30.7 kg/m ² (5.0) BMI overweight (25- 29.9 kg/m ²): 62% vs. 57% BMI obesity (≥30): 38% vs. 43% White: 46% vs. 48% Black: 24% vs. 24% Other: 25% vs. 21% More than one: 5% vs. 8% Hispanic: 30% vs. 24%	NIH grants (NIDDKD, NHLBI, NICHHD, NCCIH, ORWH, OBSSR, IHS)	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Garnaes et al., 2016 ⁹⁷ ETIP	RCT	Two university hospitals Trondheim, Norway	Overweight and obese	Active; High intensity	N=91 A. n=46 B. n=45	Included: BMI ≥28 kg/m ² ; age ≥18 years, gestational week <18, carrying one singleton live fetus at 11-14 week ultrasound, able to come to hospital for assessments an exercise classes Excluded: high risk for preterm labor, diseases that could interfere with participation, and habitual exercise training (twice or more weekly) in the period before <18 weeks' gestation	60 mins sessions 3x per week	A vs. B Age, mean (SD): 31.3 years (3.8) vs. 31.4 years (4.7) BMI, mean (SD): 33.9 kg/m² (3.8) vs. 35.1 kg/m² (4.6) BMI overweight (28- 29.9 kg/m²): 6.6% vs. 11.1% BMI Class I obese (30-34.9): 62.2% vs. 42.2% BMI Class II obese (35-39.9): 24.4% vs. 33.3% BMI Class III obese (≥40): 6.6% vs. 13.3% Race: NR	Norwegian fund for post- graduate training supported by NOK grant; Regional health authority and University	Fair
Garnaes et al., 2017 ⁹⁸ *Note: f/u of Garnaes et al., 2016	Same as Garnae s et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Garnaes et al., 2018 ⁹⁶ *Note: f/u of Garnaes et al., 2016	Same as Garnae s et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	A vs. B (2018 analysis) Age, mean (SD): 31.6 years (3.6) vs. 31.3 years (4.6) BMI baseline, mean (SD): 33.9 kg/m ² (3.8) vs. 35.2 kg/m ² (4.5) BMI overweight (<30 kg/m ²): 5.6% vs. 8.8% BMI Class I obese (30-34.9): 63.9% vs. 44.1% BMI Class II obese (35-39.9): 25% vs. 32.4% BMI Class III obese (\geq 40): 5.6% vs. 14.7% Primiparous: 50% vs. 44.1%	Same as Garnaes et al., 2016	Good
Garnaes et al., 2019 ⁹¹ *Note: f/u of Garnaes et al., 2016	Same as Garnae s et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al; 2016; 3 months postpartu m followup	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Fair
Gesell et al., 2015 ⁹⁹ Madre Sana, Bebé Sano / Healthy Mother, Healthy Baby	RCT	Community center, Nashville, Tennessee	Mixed	Active; High intensity	N=135 A. n=68 B. n=67	Included: Between 10-28 weeks' gestation, aged ≥16 years, in prenatal care, English or Spanish speaking, expecting to remain in Middle Tennessee for pregnancy, signed release form for medical abstraction Excluded: None based on prior pregnancies or other medical conditions	12 weekly 90-min group sessions	A vs. B Age, mean (SD): 27.6 years (5.8) vs. 25. 9 years (6) Hispanic: 43% vs. 37% White: 1% vs. 5% African-American: 3% vs. 6% Other: 3% vs. 1%	State of Tennessee department of health, NICH K23, national center for advancing translational sciences	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Gray- Donald, et al., 2000 ¹⁰⁰	ССТ	Community- based prenatal clinics in Cree villages, Quebec	Mixed	Counseling; Moderate intensity	N=219 A. n=112 B. n=107	Included: All Cree women receiving prenatal services prior to 26 weeks gestation in Cree communities during certain time periods. Excluded: pregestational diabetes, serious health problems	NR	A vs. B Age, mean (SD): 24.3 years (6.3) vs. 23.8 years (5.9) BMI, mean (SD): 30.8 kg/m ² (6.9) vs. 29.6 kg/m ² (6.5) Cree: 100%	NHRDP	Fair
Guelfi et al., 2016 ¹⁰¹	RCT	Home-based supervised exercise Perth, Australia	Mixed	Active; High intensity	N=172 A. n=85 B. n=87	Included: pregnant women with history of GDM, <14 weeks gestation, aged >18 years, able to participate in exercise program Excluded: women with preexisting diabetes, elevated baseline OGTT, multiple pregnancy, contraindication to exercise during pregnancy	3 sessions per week (20-60 min) from weeks 14 to 28	A vs. B Age, mean (SD): 33.6 years (4.1) vs. 33.8 years (3.9) BMI normal weight (<25 kg/m ²): 44% vs. 55% BMI overweight (25- 29.9): 35% vs. 22% BMI obese (≥30): 21% vs. 23% Caucasian: 89% vs. 78%	National Health and Medical Research Council of Australia	Fair
Haakstad et al., 2011 ¹⁰²	RCT	Community location, Oslo, Norway	Mixed	Active; High intensity	N=105 A. n=52 B. n=53	Included: Nulliparous women who had not participated in structured exercise program (>60 min q weekly) or brisk walking (>120 min q weekly) in prior 6 months; ability to read, understand, speak Norwegian; duration of pregnancy ≤24 weeks. Excluded: History of ≥2 miscarriages, severe heart disease, persistent bleeding after 12 weeks' gestation, multiple pregnancy, poorly controlled thyroid disease, pregnancy- induced HTN or eclampsia, other diseases preventing participation, not able to attend weekly exercise classes.	60 mins 2x week for 12 weeks	A vs. B Age, mean (SD): 31.2 years (3.7) vs. 30.3 years (4.4) Prepregnancy BMI, mean (SD): 23.8 kg/m ² (3.8) vs. 23.9 kg/m ² (4.7) Race: NR	NR; authors declare no conflict of interest	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Harrison et al., 2013 ¹⁰⁴ HeLP-her	RCT	Three teaching hospitals, Victoria, Australia	Overweight and obese	Counseling; Moderate intensity	N=228 A. n=121 B. n=107	Included: Women 12-15 weeks' gestation, overweight (if Polynesian, Asian, or African) or obese (if other ethnicities) and at increased risk of GDM by a validated risk prediction tool, Excluded: multiple pregnancies, preexisting diabetes, BMI ≥45 kg/m ² , preexisting chronic conditions, non-English speaking	4 sessions	A vs. B Age, mean (SD): 32.4 years (4.6) vs. 31.7 years (4.5) BMI, mean: 30.4 kg/m ² (5.6) vs. 30.3 kg/m ² (5.9) BMI ≥30: 52% vs. 43%	International Diabetes Federation; Lilly Diabetes; Jack Brockhoff Foundation	Good
Harrison et al., 2014 ¹⁰⁵ *Note: f/u of Harrison et al., 2013	Same as Harriso n et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013
Hawkins et al., 2014 ¹⁰⁶ Estudio Vida	RCT	Two medical centers, Massachuset ts	Overweight and obese	Counseling; Moderate intensity	N=68 A. n=33 B. n=35	Included: Overweight and obese pregnant Hispanic women aged 18-40 years, gestational week <18, and reporting <30 minutes of moderate-to-vigorous physical activity per week Exclude: preexisting diabetes, hypertension, heart disease, chronic renal disease, medications affecting glucose tolerance	1 in- person session per month for 6 months, 5 phone booster sessions	A vs. B Age ≤20 years: 18% vs. 9% Age 21-24 years: 42% vs. 40% Age 25-28 years: 15% vs. 23% Age ≥29 years: 24% vs. 29% BMI overweight (25- 29.9 kg/m²): 46% vs. 51% BMI obese (≥30): 55% vs. 49%	CDC/ASPH	Fair
Herring et al., 2016 ¹⁰⁸	RCT	Two hospital- affiliated obstetric clinics, Philadelphia, Pennsylvania	Overweight and obese	Counseling; High intensity	N=66 A. n=33 B. n=33	Included: Overweight and obese pregnant African American women age ≥18 years, <20 weeks' gestation, singleton and receiving Medicaid Exclude: women with conditions requiring specialized nutritional care, used tobacco	1 in- person session, 7 calls over 12 weeks	A vs. B Age, mean (SD) : 25.9 years (4.9) vs. 25.0 years (5.7) BMI, mean (SD): 33.5 kg/m ² (5.8) vs. 32.2 kg/m ² (5.4) Black: 100%	NIH, HRSA	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Herring et al., 2017 ¹⁰⁷ Note: f/u of Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016
Hui et al., 2012 ¹¹⁰	RCT	One prenatal clinic, Winnipeg, Manitoba	Mixed	Active; High intensity	N=224 A. n=112 B. n=112	Included: Nondiabetic pregnant women <26 weeks of pregnancy, living in Winnipeg Excluded: NR	30-45 mins per session 3- 5x per week	A vs. B Age, mean (SD): 30.1 years (5.2) vs. 28.7 years (5.9) BMI, mean (SD): 24.9 kg/m ² (5.4) vs. 25.7 kg/m ² (5.1) First Nations: 17.4% vs. 25.0%	Lawson Foundation, the Canadian Institutes of Health Research and the Public Health Agency of Canada	Fair
Hui et al., 2014 ¹¹¹	RCT	Community location, Winnipeg, Manitoba	Mixed	Active; High intensity	N=113 A. n=57 B. n=56	Included: Pregnant women <20 weeks of pregnancy, no existing diabetes during pregnancy, who lived in Winnipeg, Manitoba between May 2009 and December 2011 Excluded: Medical or obstetric contraindication for exercise during pregnancy	30-45 mins per session 3- 5x per week	A vs. B Age, mean (SD), normal weight: 31 years (3) vs. 29 years (6) Age, mean (SD), overweight: 31 years (4) vs. 32 years (5) BMI, mean (SD), normal weight: 21.6 kg/m ² (2.2) vs. 22.6 kg/m ² (1.9) BMI, mean (SD), overweight: 29.5 kg/m ² (5.1) vs. 29.7 kg/m ² (5.1) vs. 29.7 kg/m ² (1.3) First Nations, normal weight: 6.7% vs. 3.7% First Nations, overweight: 11.1% vs. 13.8%	Canadian Institutes of Health Research, the Lawson Foundation, the Public Health Agency of Canada	Fair

Author, Year			Population	Intervention	Total N			Population Characteristics		
Study Name	Study Design	Setting	BMI Category	Type; Intensity	A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	A=Intervention B=Control	Funding Source	Quality Rating
Koivusalo et al., 2016 ¹¹⁴ RADIEL	RCT	Four maternity hospitals, Finland	Obese	Counseling; Moderate intensity	N=293 A. n=155 B. n=138	Included: aged ≥18 years, BMI ≥30 kg/m ² or history of GDM in a previous pregnancy (dx >20 weeks), women who had at least one OGTT done after delivery *Specific to Koivusalo 2016 and Rono 2018b: women <20 weeks' gestation Excluded: Preexisting diabetes (FPG ≥7.0 mmol/L, 2-hr PGL ≥11.1 mmol/L in 75 g OGTT, HbA1c ≥48 mmol/mol), medication that influences glucose metabolism (e.g., oral corticosteroids or metformin), multiple pregnancy, physical disability that prevents regular exercise, current substance abuse, severe psychiatric disorder (i.e., psychotic disorders, schizophrenia, or schizoaffective disorders), or inadequate Finnish language skills *Specific to Koivusalo 2016: women with current dx of GDM <20 weeks' gestation	Three 2- hour sessions	RADIEL: normal OGTT sample A vs. B Age, mean (SD): 32.3 years (4.9) vs. 32.6 years (4.5) Prepregnancy BMI, mean (SD): 31.5 kg/m ² (6.0) vs. 32.0 kg/m ² (5.5) BMI at baseline, mean (SD): 32.2 kg/m ² (5.9) vs. 32.3 kg/m ² (5.4) Race: NR	Ahokas Foundation, Finnish Foundation for Cardiovascul ar Disease, Special State Subsidy for Health Science Research of Helsinki University Central Hospital, Samfundet Folkhälsan, Finnish Diabetes Research Foundation, State Provincial Office of Southern Finland, Social Insurance Institution of Finland	Fair
Huvinen et al., 2018 ¹¹² *Note: f/u of Koivusalo et al., 2016	Same as Koivusa lo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusal o et al., 2016

Author, Year			Population	Intervention	Total N			Population Characteristics		
Study	Study	Setting	BMI Category	Type; Intensity	A=Intervention	Included and Excluded Criteria	Estimated	A=Intervention	Funding	Quality Rating
Rono et al., 2018a ¹³⁷ *Note: separate sample from Koivusalo et al., 2016, so considered a unique study	Same as Koivusa lo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	N=128 A. n=65 B. n=63	Same as Koivusalo et al., 2016 *Included specific to Rono 2018a: planning pregnancy within 1 year	1x every 3 months before pregnancy (time NR), three 2- hour sessions	RADIEL: prepregnancy sample A vs. B Age, mean (SD): 32 years (5) vs. 32 years (4) BMI baseline, mean (SD): 30.5 kg/m ² (6.3) vs. 28.1 kg/m ² (5.7), p<0.05 BMI obese: 52% vs. 33%, p<0.05 Prior GDM: 78% vs. 87% Nulliparous: 9% vs. 10%	Same as Koivusalo et al., 2016	Same as Koivusal o et al., 2016
Rono et al., 2018b ¹³⁶ *Note: separate sample from Koivusalo et al., 2016, so considered a unique study	Same as Koivusa lo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	N=492 A. n=249 B. n=243	Same as Koivusalo et al., 2016 *Includes women <20 weeks' gestation *Not excluded if dx GDM <20 weeks' gestation	2 hour x3 sessions	RADIEL: normal + pathological OGTT sample A vs. B Age, mean (SD): 32.6 years (4.8) vs. 32.1 years (5) BMI baseline, mean (SD): 32.7 kg/m ² (5.7) vs. 32.6 kg/m ² (5.6) BMI obese: 73.5% vs. 74.9% Prior GDM: 40.6% vs. 40.3% Nulliparous: 38.3% vs. 39.1%	Same as Koivusalo et al., 2016	Same as Koivusal o et al., 2016

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Kunath et al., 2019 ¹¹⁵ GeliS *Note: associated with Rauh et al., 2013	Cluster RCT	Gynecologic and midwifery practices Bavaria, Germany	Mixed	Counseling; Moderate intensity	N=2,261 A. n=1,139 B. n=1,122	Included: Singleton, BMI 18.5-40 kg/m ² , <12 weeks' gestation, aged 18-43 years, sufficient German language skills Excluded: Multiple or complicated pregnancy, severe preexisting illness	4 sessions (30-45 min each; 3 prenatal, 1 postpartu m)	A vs. B Age, mean (SD): 30.2 years (4.4) vs. 30.4 years (4.7) BMI baseline, mean (SD): 24.4 kg/m ² (4.4) vs. 24.3 kg/m ² (4.6) BMI normal weight (<25 kg/m ²): 64.3% vs. 65.5% BMI overweight (25- 29.9): 23.8% vs. 22.2% BMI obese (30-40): 11.9% vs. 12.3% Nulliparous: 62% vs. 53% Prior cesarean: 10.2% vs. 11.5%	Else Kroner- Fresenius Centre for Nutritional Medicine, Competence Centre for Nutrition, Bavarian State Ministry of Food, Agriculture, and Forestry, Bavarian State Ministry of Health and Care, AOK Bayem, DEDIPAC consortium	Fair

Author,			Population	Intervention	Total N			Population Characteristics		
Study	Study	Catting	BMI	Type;	A=Intervention	Included and Evaluated Oritoria	Estimated	A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria	Time	B=Control	Source	Rating
Hoffman et	Same	Same as	Same as	Same as	N=1,998	Same as Kunath et al., 2019	Same as	A vs. B (for followup	Same as	Same as
al., 2019 ¹⁰⁹	as	Kunath et al.,	Kunath et	Kunath et al.,	A. n=1,003		Kunath et	population)	Kunath et	Kunath
*Note: f/u of	Kunath	2019	al., 2019	2019	B. n=995		al., 2019	Age, mean (SD): 30.2	al., 2019	et al.,
Kunath et	et al.,							years (4.3) vs. 30.5		2019
al., 2019	2019							years (4.6)		
								BMI baseline, mean		
								(SD): 24.4 kg/m ² (4.3)		
								vs. 24.3 kg/m ² (4.6)		
								BMI normal weight		
								(<25 kg/m ²): 64.3%		
								vs. 65.5%		
								BMI overweight (25-		
								29.9): 24.2% vs.		
								21.9%		
								BMI obese (30-40)		
								11.5% vs 12.6%		
								Primiparous: 61.8%		
								vs 53.2%		
								Prior cesarean		
								10 2% vs 11 5%		

Author,								Population		
Year			Population	Intervention	Total N			Characteristics		
Study	Study	O a tribu m	BMI	Туре;	A=Intervention	In shade down d Frankrade d Osiferia	Estimated	A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria		B=Control	Source	Rating
Lebianc et	RCI	Telephone	Overweight	Counseling;	N=320	Included: Ages 18-40 years, Bivil	30-40 min	A VS. B	NIDDK	Good
		Orogon and	and Obese	пıgn	A. 11=104 B. n=162	227 kg/m ² , not currently pregnant	initial	Age, mean (SD) . 31.0		
FREFARE		Washington			D. 11=102	vears: singleton pregnancies	20-30 min	years (3.5) vs. 50.9		
		washington				lasting >14 weeks (analytic cohort)	20-30 min	Prepregnancy RMI		
						Excluded: Conditions or on	weekly (6	34.9 kg/m^2 (6) vs		
						medications that would affect	months)	34.7 kg/m2 (5.5)		
						weight loss or study participation	and	BMI overweight (27-		
							monthly	29.9): 21.4% vs.		
							(up to 18	22.5%		
							months or	BMI Class I obese		
							until	(30-34.9): 38.2% vs.		
							pregnancy	38.8%		
							end)	BMI Class II obese		
								(≥35): 40.5% vs.		
								38.8%		
								Time from		
								randomization to		
								pregnancy (<6		
								months): 33.7% VS.		
								32.5%		
								(6-24 months): 56 2%		
								vs 45%		
								Time to pregnancy		
								(>24 months): 10.1%		
								vs. 22.5%		
								BMI overweight at		
								pregnancy onset:		
								30.7% vs. 26.2%		
								BMI obese at		
								pregnancy onset:		
								69.3% vs. 73.8%		
								White: 80.9% vs.		
								87.5%		
								Black: 5.6% vs. 2.5%		
								Hispanic: 6.7% vs.		
								VS. 22.5% BMI overweight at pregnancy onset: 30.7% vs. 26.2% BMI obese at pregnancy onset: 69.3% vs. 73.8% White: 80.9% vs. 87.5% Black: 5.6% vs. 2.5% Hispanic: 6.7% vs. 12.5%		

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Luoto et al., 2011 ¹¹⁷ NELLI	RCT	Primary health care center- affiliated maternity clinics, 14 municipalities , Finland	Mixed	Counseling; Moderate intensity	N=442 A. n=246 B. n=196	Included: singleton pregnancy, 8- 12 weeks' gestation, at least one of the following risk factors: BMI ≥25 kg/m ² ; GDM or any signs of glucose intolerance or newborn's macrosomia (≥4,500 g) in any earlier pregnancy; T1D or T2D in first- or second-degree relatives; age ≥40 years Excluded: At least one abnormal oral glucose tolerance test among three baseline measurements; prepregnant T1D or T2D; inability to speak Finnish; age <18 years; multiple pregnancy; physical restriction preventing physical activity; substance abuse; treatment or clinical history of psychiatric illness	One 2- hour PA session; one dietary counseling session; 3-4 booster sessions	A vs. B Age, mean (SD): 29.5 years (4.8) vs. 30.0 years (4.7) Prepregnancy BMI: 26.3 kg/m ² (4.9) vs. 26.4 kg/m ² (4.3) BMI >25 kg/m ² : 58.4% vs. 61.5%	Finnish Diabetes research fund, Pirkanmaa hospital district, Academy of Finland, Ministry of Education, Ministry of Social Affairs and Health	Good
Kinnunen et al., 2012 ¹¹³ *Note: f/u of Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Magriples et al., 2015 ¹¹⁸ Centering Pregnancy Plus	RCT	14 community health centers and hospitals, New York City, New York	Mixed	Counseling; Moderate intensity	N=984 A. n=495 B. n=489	Included: pregnant women aged 14-21 years attending prenatal care at a participating clinical site, <24 weeks gestation, no severe medical problems at time of enrollment, English or Spanish speaking, agreed to receive group prenatal care if offered at their site	10 sessions (120 mins each)	A vs. B Age, mean (SD): 18.7 years (1.8) vs. 18.6 years (1.7) BMI underweight: 11.7% vs. 11.5% BMI normal weight: 49.9% vs. 56.6% BMI overweight: 21.8% vs. 17.2% BMI obese: 16.6% vs. 14.7% Latina: 63.6% vs. 63.4% Black: 30.9% vs. 33.3% Other: 5.5% vs. 3.3%	NIH NIMH R01, Clinical Directors Network R01 One author founder of Centering Healthcare Institute and serves on Board of Directors	Fair
McCarthy et al., 2016 ¹¹⁹ FFF	RCT	One tertiary obstetric hospital, Melbourne, Australia	Overweight and obese	Counseling; Low intensity	N=382 A. n=190 B. n=192	Included: Overweight and obese (BMI ≥25.0), gestation <20 weeks, at least 18 years of age, singleton pregnancy, English speaking Excluded: Preexisting diabetes or known major fetal abnormality	30 mins x1 session	A vs. B Age, mean: 31.9 years vs. 31.8 years Pre/early pregnancy BMI, median: 30.5 kg/m ² vs. 30.1 kg/m ² BMI overweight (25- 29.9 kg/m ²): 46.8% vs. 46.9% BMI Class I obese (30-34.9): 27.4% vs. 26.6% BMI Class II obese (35-39.9): 14.7% vs. 16.1% BMI Class III obese (\geq 40): 11.1% vs. 10.4% Country of birth, Australia: 77.4% vs. 74.0%	Medical Research Foundation for Women and Babies and the Mercy Research Foundation	Fair

Author, Year			Population	Intervention	Total N			Population Characteristics		
Study	Study		BMI	Туре;	A=Intervention		Estimated	A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria	Time	B=Control	Source	Rating
McGiveron et al., 2015 ¹²⁰ Bumps and Beyond	ССТ	One antenatal clinic, Lincolnshire, UK	Obese pregnant women	Counseling; Moderate intensity	N=178 A. n=89 B. n=89	Pregnant women with BMI ≥35 kg/m ² , gestational age 16-18 weeks	8 sessions	A vs. B Age, mean (SD): 29.0 years (5.8) vs. 27.3 years (5.5), p=0.04 BMI, mean: 39.4 kg/m ² (4.1) vs. 38.4 kg/m ² (3.2) White: 97% vs. 97%	Public Health Lincolnshire County Council	Fair
Okesene- Gafa et al., 2019 ¹²¹ HUMBA	RCT	University, home-based visits South Auckland, Australia	Obese	Counseling; High intensity	N=230 A. n=116 B. n=114	Included: Singleton, 12 to 17 0/6 weeks gestation, BMI ≥30 kg/m ² Excluded: Preexisting diabetes, HbA1c ≥50 mmol/mol, known congenital abnormality, taking probiotics, prior bariatric surgery, severe hyperemesis, rx that alter glucose metabolism	4 sessions (1 at 1.5 hr, 3 at 30-60 min); text messages 3x per week	A vs. B (dietary intervention vs. usual care) Age, mean (SD): 29.8 years (5.7) vs. 27.8 years (5.5) BMI baseline, mean (SD): 39.2 kg/m^2 (6.2) vs. 37.9 kg/m ² (5.9) BMI Class I obese (30-34.9 kg/m ²): 30.2% vs. 33.3% BMI Class II or higher (\geq 35): 69.8% vs. 66.7% Primiparous: 25.9% vs. 37.7% See Table 2 for racial/ethnic backgrounds; ~75% indigenous or Asian- Pacific Islander	Cure Kids, Lottery Health Research Grants, University of Auckland, Counties Manukau Health, Mercia Barnes Trust, Nurture Foundation, Heart Foundation	Good

Author, Year Study	Study		Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Olson et al., 2018 ¹²² e-Moms	RCT	Online, Rochester, New York	Mixed	Counseling; Moderate intensity	N=1,689 A. n=563 B. n=563 C. n=563	Included and Excluded Criteria Included: Aged 18-35 years, gestational age <20 weeks, BMI 18.5-35 kg/m ² , with singleton pregnancies Excluded: BMI <18.5 and ≥35 kg/m ² , weight-affecting medical or psychiatric conditions, no email address	NR	B=Control A+B vs. C Age, 18-24.99 years: 32% vs. 30% Age, 25-29.99 years: 33% vs. 36% Age, 30-34.99 years: 36% vs. 34% BMI, median: 24.7 kg/m² vs. 24.7 kg/m² White: 64% vs. 65% Black: 24% vs. 21% Hispanic: 7% vs. 5% Other: 6% vs. 9%	Source NHLBI, National Institute of Child Health and Human Developmen t	<u>Kating</u> Fair
Peccei et al., 2017 ¹²³	RCT	One hospital- affiliated prenatal clinic, Revere, Massachuset ts	Overweight and obese	Counseling; Moderate intensity	N=272 A. n=180 B. n=92	Included: Singleton pregnancy, BMI 25-40 kg/m ² , aged 18-49 years, <16 weeks' gestation Excluded: Multiple pregnancy, prepregnancy diabetes, history of eating disorders, miscarriage or abortion in early pregnancy	60-90 mins initial session, 10-30 mins 2x per month	A vs. B Age: NR BMI overweight: 42.2% vs. 43.5% BMI obese: 57.8% vs. 56.5% White: 36.1% vs. 45.7% Black: 7.8% vs. 3.3% Hispanic: 48.9% vs. 43.5% Other: 7.2% vs. 7.6%	Department of Obstetrics and Gynecology at Massachuse tts General Hospital	Fair

Author, Year			Population	Intervention	Total N			Population Characteristics		
Study	Study	0.00	BMI	Туре;	A=Intervention		Estimated	A=Intervention	Funding	Quality
Name	Design	Setting	Category	Intensity	B=Control	Included and Excluded Criteria	Time	B=Control	Source	Rating
Pelaez et al., 2019 ¹²⁴	RCT	One university hospital, Madrid, Spain	Mixed	Active; High intensity	N=301 A. n=100 B. n=201	Included: Singleton, 8-10 weeks' gestation, uncomplicated, not participating in another exercise program, able to communicate in Spanish Excluded: Not planning to give birth at the hospital, contraindications to exercise	70-78 sessions (60-65 min 3x per week)	A vs. B Age, mean (SD): 31.1 years (3.2) vs. 31.5 years (4.7) BMI, mean (SD): 24.1 kg/m ² (4.4) vs. 23.5 kg/m ² (4) BMI underweight (<18.5 kg/m ²): 2% vs 6% BMI normal weight (18.5-24.9): 63% vs. 69.2% BMI overweight (25- 29.9): 26% vs. 17.9% BMI obese (>30): 9% vs. 7% Smoker: 29% vs. 39.3%	Universidad Politécnica de Madrid	Fair
Perales et al., 2015 ¹²⁵	RCT	One university hospital, Madrid, Spain	Overweight and obese	Active; High intensity	N=129 A. n=65 B. n=64	Included: Overweight and obese pregnant women without any complications, gestational age 8-11 weeks Excluded: NR	85 sessions (55-60 min)	A vs. B Age, mean (SD): 32.0 years (3.7) vs. 33.4 years (4) BMI, mean (SD): 27.9 kg/m ² (3.1) vs. 28.0 kg/m ² (2.6) Overweight: 80.8% vs. 83.3% Obese: 19.2% vs. 16.7% Race: NR	Universidad Politécnica de Madrid	Good

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Petrella et al., 2014 ¹²⁶	RCT	One hospital- based obstetrics unit, Modena, Italy	Overweight and obese	Counseling; Low intensity	N=63 A. n=33 B. n=30	Included: Pregnant women, aged >18 years, gestational age 12 weeks, singleton pregnancy, BMI ≥25 kg/m ² Excluded: chronic diseases (i.e. diabetes mellitus, hypertension, untreated thyroid diseases), GDM in previous pregnancy, smoking during pregnancy, previous bariatric surgery, women who engaged in regular exercise activity, dietary supplements or herbal supplements known to affect body weight, other conditions that affect body weight	4 sessions (initial session 60 min; remainder time NR)	A vs. B Age, mean: 31.5 years (4.2) vs. 32.4 years (5.9) BMI, mean: 32.1 kg/m ² (5) vs. 32.9 kg/m ² (6.2) White: 85% vs. 67% Maghreb: 12% vs. 20% Other: 3% vs. 13%	NR	Fair
Phelan et al., 2011 ¹²⁸ Fit For Delivery	RCT	Six obstetrics offices, Providence, Rhode Island	Mixed	Counseling; Moderate intensity	N=401 A. n=201 B. n=200	Included: Pregnant women age >18 years, gestational age 10-16 weeks, BMI 19.8-40 kg/m ² , nonsmoking, with singleton pregnancy, fluency in English Excluded: self-reported major health psychiatric diseases, weight loss during pregnancy, or history of ≥3 miscarriages	One in- person session, three 10- 15 min phone calls	A vs. B Age, mean (SD): 28.6 years (5.2) vs. 28.8 years (5.2) BMI, mean (SD): 26.3 kg/m ² (5.6) vs. 26.5 kg/m ² (5.9) White: 69% vs. 68% Hispanic: 20% vs. 20% Black: 7% vs. 10% Other: 5% vs. 3%	NIH	Fair
Phelan et al., 2014 ¹²⁷ *Note: f/u of Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011

Author, Year Study	Study		Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Phelan et al., 2018 ¹³⁰ Healthy Beginnings / Comienzo Saludables	RCT	Two hospitals, San Luis Obispo, California and Providence, Rhode Island	Overweight and obese	Active; High intensity	N=264 A. n=132 B. n=132	Included and Excluded Criteria Included: pregnant women aged ≥18 years, singleton, 9-16 weeks' gestation, BMI ≥25 kg/m ² , English or Spanish speaking Excluded: HbA1c ≥ 6.5, self- reported major health disease, current substance abuse, current tx for serious psychological disorder, hx of bariatric surgery, contraindications to exercise, not responsive during initial screening	Biweekly session (20 min) until 20 weeks' gestation, monthly session until delivery	A vs. B Age, mean (SD): 30.7 years (5.3) vs. 29.7 years (5.5) BMI baseline, mean (SD): 32.3 kg/m ² (5.2) vs. 32.6 kg/m ² (5.3) BMI overweight: 41.9% vs. 37.5% BMI obese: 58.1% vs. 62.5% White: 59.7% vs. 62.2% Hispanic: 41.1% vs. 42.2% Black: 6.2% vs. 5.4% Al/AN: 3.9% vs. 2.3% Native Hawaiian/PI: 2.3% vs. 2.3% Asian: 2.3% vs. 0.8% Primiparous: 29.9% vs. 24.6%	NIH (NHLBI)	Fair
Phelan et al., 2019 ¹²⁹ *Note: f/u to Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018
Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
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Polley et al., 2002 ¹³¹	RCT	One obstetric clinic, Pittsburgh, Pennsylvania	Mixed	Counseling; Low intensity	N=120 A. n=61 B. n=59	Included: Aged ≥18 years, normal or overweight/obese, without a high-risk pregnancy, <20 weeks gestation Excluded: Previous complications during pregnancy, underweight women	NR	A vs. B Age, mean: 25.5 years (4.8) (pooled) Prepregnancy BMI, normal weight, mean (SD): 22.8 kg/m ² (1.9) vs. 22.5 kg/m ² (2.0) Prepregnancy BMI, overweight/obese, mean: 31.4 kg/m ² (6.0) vs. 34.1 kg/m ² (7.2) White: 61% (pooled) Black: 39% (pooled)	Magee Women's Health Foundation	Fair
Rauh et al., 2013 ¹³² FeLIPO	RCT	Eight gynecology practices, Munich, Germany	Mixed	Counseling; Low intensity	N=250 A. n=167 B. n=83	Included: Aged >18 years, singleton pregnancies, <18 weeks gestation, BMI ≥18.5 kg/m ² Excluded: any condition preventing physical activity, T1D or T1D, uncontrolled chronic conditions	Two sessions (initial 60 min, second 30 min)	A vs. B Age, mean (SD): 32.2 years (4.4) vs. 30.8 years (4.9), p=0.01 Prepregnancy BMI, mean: 21.7 kg/m ² vs. 22.8 kg/m ² , p=0.003 BMI normal weight: 84% vs. 69%; p=0.009 BMI overweight: 12% vs. 18% BMI obese: 4% vs. 13% Race: NR	Else Kroener- Fresenius Foundation	Fair
Rauh et al., 2015 ¹³³ *Note: f/u to Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Redman et al., 2017 ¹³⁴ SmartMoms	RCT	Social media or community clinics, U.S.	Overweight and obese	Counseling; High intensity	N=54 A. n=18 B. n=19 C. n=17	Included: BMI 25-39.9 kg/m ² , aged 18-40 years, singleton pregnancy, first trimester Excluded: known fetal anomaly, HTN (systolic >160 / diastolic >90 mmHg), history or current psychotic or eating disorder, HIV, preexisting diabetes, or contraindications to exercise	18 lessons	A vs. B vs. C Age, mean (SD): 29.2 years (4.8) vs. 29 years (4.2) vs. 29 years (5.1) BMI overweight: 44% vs. 42% vs. 53% BMI obese: 56% vs. 58% vs. 47% White: 61% vs. 84% vs. 65% Black: 28% vs. 11% vs. 35% Other: 11% vs. 5% vs. 0%	NIH	Fair
Renault et al., 2014 ⁵⁸ TOP	RCT	Hospital- based clinic, Copenhagen, Denmark	Obese	Counseling; High intensity	N=425 A. n=142 B. n=142 C. n=141	Included: aged >18, singleton pregnancy, normal scan 11-14 weeks' gestation, gestational age <16 weeks, able to read and speak Danish Excluded: multiple pregnancy, pregestational diabetes, other serious diseases limiting physical activity, previous bariatric surgery, alcohol or drug abuse	11-13 biweekly sessions	A vs. B vs. C Age, mean (SD): 31.2 years (4.2) vs. 30.9 years (4.9) vs. 31.3 years (4.2) Prepregnancy BMI, mean (SD): 34.4 kg/m ² (4.2) vs. 34.1 kg/m ² (4.4) vs. 33.7 kg/m ² (3.5) White: 98% vs. 98% vs. 97%	Sygekassern es Helsefond and Broedrene Hartmann Fonden	Good

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Ronnberg et al., 2014 ¹³⁵	RCT	14 antenatal clinics, Örebro County, Sweden	Mixed	Counseling; Low intensity	N=445 A. n=221 B. n=224	Included: Pregnant women ≤16 weeks gestation, aged >18 years; singleton gestation, BMI >19 kg/m ² Excluded: previous medical history including treatment of eating disorder or earlier growth-restricted infant, chronic disease that required specialized care, inadequate knowledge of Swedish language	1 session	A vs. B Age, mean (SD): 29.9 years (4.5) vs. 29.8 years (4.8) BMI, mean (SD): 25.2 kg/m ² (4.9) vs. 25.3 kg/m ² (4.8) BMI 19-26.0 kg/m ² : 72% vs. 71% BMI 26.1-29.0: 12% vs. 12% BMI >29: 16% vs. 17% Race: NR	Research committee at Oregbro County Council	Fair
Ruiz et al., 2013 ¹³⁸	RCT	Three primary care medical centers, Madrid, Spain	Mixed	Active; High intensity	N=962 A. n=481 B. n=481	Included: Pregnant women at 5-6 weeks' gestation, singleton gestation, uncomplicated pregnancy, not at high risk of preterm delivery (no previous preterm delivery) Excluded: previous preterm delivery, women with any obstetrical contraindication to exercise	50-55 min exercise session 3x per week (planned 85 sessions)	A vs. B Age, mean (SD): 31.6 years (4) vs. 31.9 years (4) BMI, mean (SD): 23.7 kg/m ² (3.9) vs. 23.5 kg/m ² (4.2) BMI underweight (<18.5 kg/m ²): 2.3% vs. 5% BMI normal weight (18.5-24.9): 67.2% vs. 68.4% BMI overweight (25- 29.9): 23.1% vs. 19.1% BMI obese (≥30): 7.3% vs. 7.7%	Grants from Spanish industry of science and innovation	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Sagedal et al., 2017 ¹³⁹ Norwegian Fit For Delivery	RCT	Eight healthcare clinics, Norway	Mixed	Active; High intensity	N=606 A. n=303 B. n=303	Included: Nulliparous, ≥18 years old, singleton pregnancy, ≤20 weeks' gestation, prepregnancy BMI ≥19 kg/m², literate in Norwegian or English Excluded: Preexisting diabetes, disabilities precluding participation in a physical fitness program, continued substance abuse, planned relocation outside of study area before delivery	Two 20- min dietary counseling sessions, 60 mins recommen ded exercise sessions 2x per week	A vs. B Age, mean (SD): 27.9 years (4.2) vs. 28.1 years (4.5) Prepregnancy BMI, mean (SD): 23.8 kg/m ² (4.1) vs. 23.5 kg/m ² (3.7) BMI normal: 67.9% vs. 73.6% BMI overweight: 23.3% vs. 18.3% BMI obese: 8.1% vs. 7.1%	Norwegian South- Eastern Regional Health Authority, municipalitie s of Aust Agder and Vest Agder	Good
Sagedal et al., 2017b ¹⁴⁰ *Note: f/u to Sagedal et al., 2017	Same as Sageda I et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017
Seneviratne et al., 2016 ¹⁴¹	RCT	Home-based supervised exercise Auckland, New Zealand	Overweight and obese	Active; High intensity	N=75 A. n=38 B. n=37	Included: Women aged 18-40 years, BMI ≥25 kg/m², singleton pregnancy, <20 weeks' gestation Excluded: Ongoing smoking, multiple pregnancy, contraindication to exercise, living outside Auckland region.	15-30 min exercise 3-5x per week (planned 67 sessions, from 20- 35 weeks' gestation)	A vs. B Age, mean (SD): 31.6 years (4.6) vs. 31.1 years (5.2) BMI, mean (SD): 32.1 kg/m ² (4.4) vs. 34.1 kg/m ² (5.9) Nulliparous: 24% vs. 27% Pacific Islander: 29% vs. 29% Maori: 13% vs. 14% NZ European or other: 58% vs. 57%	Gravida National Centre for Growth and Developmen t	Good

Author, Year Study	Study	Ostilara	Population BMI	Intervention Type;	Total N A=Intervention		Estimated	Population Characteristics A=Intervention	Funding	Quality
Simmons et al., 2017 ¹⁴² DALI Lifestyle	RCT	Antenatal clinics across 11 centers in nine European countries (Austria, Belgium, Denmark, Ireland, Italy, Netherlands, Poland, Spain, UK)	Obese	Counseling; Moderate intensity	N=436 A. n=113 B. n=110 C. n=108 D. n=105	Included and Excluded Criteria Included: pregnant women with prepregnancy BMI ≥29 kg/m ² at ≤19 6/7 weeks gestation, singleton pregnancy, age ≥18 years Excluded: GDM, preexisting diabetes, chronic medical conditions, psychiatric disorders, inability to walk safely, requirement for complex diet, not fluent in major language of the country or unable to converse with language coach	5 in- person sessions (30-45 min); ≤4 telephone calls (≤20 min) or emails	A vs. B vs. C vs. D Age, mean (SD): 32.5 years (5.5) vs. 31.7 years (5.1) vs. 31.9 years (5.3) vs. 31.8 years (5.6) Prepregnancy BMI, mean (SD): 33.9 kg/m ² (4.4) vs. 33.7 kg/m ² (4.0) vs. 33.8 kg/m ² (3.9) vs. 33.4 kg/m ² (3.5) White: 84% vs. 86% vs. 88% vs. 90%	Source European Community's Seventh Framework Programme, Netherlands Organisation for health research, Odense University Free research fund, NIHR Clinical Research Network, CAIBER,	Good
Skouteris et al., 2016 ¹⁴³ HIPP	RCT	Two antenatal clinics, Melbourne, Australia	Mixed	Counseling; Moderate intensity	N=261 A. n=130 B. n=131	Included: Pregnant women age ≥18 years, with gestational age <18 weeks, English speaking, BMI >18.5 kg/m ² Excluded: NR	Initial in- person session (60 min at 18 weeks), followup session (30 min at 24 weeks), 2 phone calls (15 min)	A vs. B Age, mean (SD): 31.4 years (4.4) vs. 31.6 years (4.5) BMI underweight (<18.5 kg/m ²): 4% vs. 4% BMI normal weight (18.5-24.9): 55% vs. 57% BMI overweight (25- 29.9): 24% vs. 25% BMI obese (≥30): 17% vs. 14% Race: NR	National Health and Medical Research Council	Fair

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Smith et al., 2016 ¹⁴⁴	RCT	Online, U.S.	Mixed	Counseling; Moderate intensity	N=51 A. n=26 B. n=25	Included: Women with a history of participating in <3 sessions of exercise for ≥30 minutes per week for at least 6 months, aged 18 to 45 years, gestational age 10-14 weeks, speaking English, regular Internet access, and willing to walk 30 minutes on most days Excluded: History of gestational diabetes mellitus, preeclampsia, or chronic disease (e.g., T1D, heart disease, renal disease); BMI <18.5 kg/m ² ; smoking during pregnancy; and having a condition or using a medication known to influence overall metabolism	1 in- person training session	A vs. B Age, mean (SD): 29.7 years (4.1) vs. 29.4 years (4.9) Prepregnancy BMI, mean (SD): 27.3 kg/m ² (4.6) vs. 25.4 kg/m ² (4.5) White: 88.9% (pooled)	American Heart Association predoctoral fellowship	Fair
Thomson et al., 2016 ¹⁴⁸ Delta Healthy Sprouts	RCT	Homes, Lower Delta region, Mississippi	Mixed	Counseling; High intensity	N=105 A. n=54 B. n=51	Included: ≥18 years of age, <19 weeks pregnant with 1st, 2nd, or 3rd child, resident of certain Mississippi counties, singleton fetus Excluded: NR	Monthly home visits (interventi on 90-120 min; control 60- 90 min)	A vs. B Age, mean (SD): 22.7 years (4.7) vs. 23.3 years (4.6) BMI underweight (<18.5 kg/m ²): 8% vs. 9% BMI normal weight (18.5-24.9): 21% vs. 28% BMI overweight (25- 29.9): 26% vs. 21% BMI obese (≥30): 46% vs. 42% Black: 97% vs. 95% White: 3% vs. 5%	U.S. Department of Agriculture; Delta Health Alliance	Fair

Author, Year Study	Study	Catting	Population BMI	Intervention Type;	Total N A=Intervention	Included and Evaluated Oritoria	Estimated	Population Characteristics A=Intervention	Funding	Quality
Thomson et al., 2018 ¹⁴⁷ *Note: f/u of Thomson et al., 2016	Same as Thomso n et al., 2016	Same as Thomson et al., 2016	Same as Thomson et al., 2016	Same as Thomson et al., 2016	N=54 A. n=24 B. n=30	Same as Thomson et al., 2016	18 monthly visits (gestation al month 4 - postpartu m month 12; 90-120 min)	A vs. B Age, mean (SD): 23 years (5) vs. 24.1 years (4.7) BMI, mean (SD): 29.2 kg/m ² (7.7) vs. 28.6 kg/m ² (8.2) Black: 95.8% vs. 96.7% White: 4.2% vs. 3.3%	Source Same as Thomson et al., 2016	Same as Thomso n et al., 2016
Van Horn et al., 2018 ¹⁴⁹ MOMFIT	RCT	University hospital Chicago, Illinois	Overweight and obese	Counseling; High intensity	N=281 A. n=140 B. n=141	Included: pregnant women <16 weeks gestation, aged 18-45 years, singleton, BMI 25-40 kg/m ² , fluent in English, access to Internet and smartphone Excluded: preexisting diabetes, IVF, substance abuse, smoking, plans to terminate pregnancy or move out of area	3 individual visits (time NR), 9 telephone calls (time NR), six 30-min group sessions	A vs. B Age, mean (SD): 33 years (4) vs. 34 years (4) Prepregnancy BMI, mean (SD): 31 kg/m ² (4) vs. 31 kg/m ² (4) BMI obesity: 55% vs. 54.6% White: 54.4% vs. 70.2% Black: 24.3% vs. 14.2% Other: 19.3% vs. 15.6% Hispanic: 21.4% vs. 21.3% Nulliparous: 52.8% vs. 41.1%	NIH	Fair

Author, Year Study Name	Study	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention	Included and Excluded Criteria	Estimated	Population Characteristics A=Intervention B=Control	Funding	Quality
Vesco et al., 2014 ¹⁵⁰ Healthy Moms	RCT	One managed care organization, Oregon and Washington	Obese	Counseling; High intensity	N=118 A. n=58 B. n=60	Included: Pregnant women aged ≥18 years, gestational weeks ≤21, BMI ≥30 kg/m ² Excluded: diabetes mellitus, plans to leave the area within 1 year postpartum	2 individual sessions (time NR), 16 group sessions (90 min)	A vs. B Age, mean: 32.4 years (5.1) vs. 31.2 years (4.6) BMI, mean: 36.7 kg/m² (5.2) vs. 36.8 kg/m² (4.7) BMI Class I obese (30-34.9 kg/m²): 45% vs. 43% BMI Class II obese (35-39.9): 34% vs. 36% BMI Class III obese (≥40): 21% vs. 21% White: 88% vs. 85%	National Institute of Child Health and Human Developmen t	Good
Vesco et al., 2016 ¹⁵¹ *Note: f/u of Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014

Author, Year			Population	Intervention	Total N			Population Characteristics		
Study Name	Study Design	Setting	BMI Category	Type; Intensity	A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	A=Intervention B=Control	Funding Source	Quality Rating
Vinter et al., 2011 ⁵⁹ LiP	RCT	Two university hospitals, Denmark	Obese	Active; High intensity	N=360 A. n=180 B. n=180	Included: Women aged 18–40 years, 10–14 weeks' gestation, BMI 30–45 kg/m ² (prepregnancy weight or first measured weight in pregnancy) Excluded: Prior obstetric complications, chronic diseases, positive OGTT in early pregnancy, alcohol or drug abuse, non-Danish speaking, multiple pregnancy	4 sessions	A vs. B Age, mean (IQR): 29 years (27-32) vs. 29 years (26-31) BMI, median (IQR): 33.4 kg/m ² (31.7- 36.5) vs. 33.3 kg/m ² (31.7-36.9) BMI (30-34.9 kg/m ²): 63.3% vs. 66.2% BMI (35-39.9): 28.0% vs. 29.2% BMI (40-45): 8.7% vs. 4.6% White: 100%	Trygfonden, The Health Insurance Foundation (Helsefonde n), the Faculty of Health Sciences, University of Southern Denmark, the Danish Diabetes Association, Odense University Hospital, the NoVo Foundation, the Danish Medical Association Research Foundation, Aase og Ejnar Danielsens Fond, CMA Medico, and Ferrosan A/S.	Fair
*Note: f/u of Vinter et al., 2014 ¹⁵² *Note: f/u of Vinter et al., 2011	same as Vinter et al., 2011	Vinter et al., 2011	Vinter et al., 2011	Vinter et al., 2011	et al., 2011	Same as vinter et al., 2011	Same as Vinter et al., 2011	2011	Vinter et al., 2011	Same as Vinter et al., 2011

Author, Year Study Name	Study Design	Setting	Population BMI Category	Intervention Type; Intensity	Total N A=Intervention B=Control	Included and Excluded Criteria	Estimated Time	Population Characteristics A=Intervention B=Control	Funding Source	Quality Rating
Tanvig et al., 2014 ¹⁴⁶ *Note: f/u of Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Offspring of Vinter et al., 2011 sample	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011
Tanvig et al., 2015 ¹⁴⁵ *Note: f/u of Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Offspring of Vinter et al., 2011 sample	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011
Willcox et al., 2017 ¹⁵³ txt4two	RCT	Mobile devices, Melbourne, Australia	Overweight and obese	Counseling; High intensity	N=100 A. n=50 B. n=50	Included: singleton pregnancy, 10- 17 6/7 weeks' gestation, prepregnancy BMI >25 kg/m ² , speak, read, write in English, own a mobile phone Excluded: multiple pregnancy, aged <18 years, comorbidities requiring significant medical dietary management, discontinuation of care at the hospital	15 min introductio n meeting	A vs. B Age, mean (SD): 33 years (3.4) vs. 32 years (5.1) Prepregnancy BMI, mean (SD): 32.5 kg/m ² (5.8) vs. 29.6 kg/m ² (3.8) Birth country of Australia: 80% vs. 74%	Lord Mayors Charitable Foundation, Sidney Myer Health Scholarship, Queensland Health- Health Research Fellowship, National health and Medical Research Council Principal Research Fellowship	Fair
Wolff et al., 2008 ¹⁵⁴	RCT	Two hospitals, Denmark	Obese	Counseling; Moderate intensity	N=50 A. n=23 B. n=27	Included: BMI ≥30 kg/m ² , mean gestational age 15 weeks Excluded: smoking, age below 18 or above 45 years, multiple pregnancy, medical complications known to affect fetal growth or contraindicated weight gain limitation	Ten 60- min sessions	A vs. B Age, mean (SD): 28 years (4) vs. 30 years (5) BMI, mean (SD): 34.9 kg/m ² (4) vs. 34.6 kg/m ² (3) Race: NR	Private foundation	Fair

Note: Low intensity = 0-2 contacts during intervention; Moderate intensity = 3-11 contacts during intervention; High intensity = 12 or more contacts during intervention.

Abbreviations: ACOG = American College of Obstetricians and Gynecologists; BMI = body mass index; CCT = controlled clinical trial; ESTEEM = Effect of Simple, Targeted Diet in Pregnant Women with Metabolic Risk Factors on Pregnancy Outcomes; ETIP = Exercise Training in Pregnancy; FPG = fasting plasma glucose; FPL = federal poverty level; GDM = gestational diabetes mellitus; GeliS = Gesund leben in der Schwangerschaft / Healthy Living in Pregnancy; HbA1c = hemoglobin A1c; HIV = human immunodeficiency virus; HTN = hypertension; HUMBA = Healthy Mums and Babies; IMD = Index of Multiple Deprivation; IQR = interquartile range; IVF = in vitro fertilization; LMP = lifestyle modification program; MMT = Mindful MAMAS Training; MOMFIT = Maternal Offspring Metabolics Family Intervention Trial; N = number; NR = not reported; OGTT = oral glucose tolerance test; OPTIMISE = not defined; PGL = plasma glucose level; POPS2 = Pregnancy Outcome Prediction Study; RCT = randomized controlled trial; SD = standard deviation; SES = socioeconomic status; SWEP = Study Water Exercise Pregnant; T1D or T2D = type 1 or type 2 diabetes; TOP = Treatment of Obese Pregnant Women.

	Description		
Author, Year Study Name	Intervention + usual prenatal care	Special Training	Intervention Instruments
Aguilar-Cordero et al., 2019 ⁷¹ SWEP	A. Intervention: supervised aquatic exercise classes from weeks 20 to 37. B. Comparison: usual prenatal care.	NR	EPDS (0-10, 0-9 no risk, 10-15 risk, 16+ severe risk); Borg Rating of Perceived Exertion scale
Al Wattar et al., 2019 ⁷² ESTEEM	 A. Intervention: in-person sessions; initial individual consultation with dietician, group sessions (20 weeks and 28 weeks), phone calls from team (24 weeks and 32 weeks). Provided mixed nuts (30 g/day walnuts, hazelnuts, almonds) and extra-virgin olive oil (0.5 L/week). Fact sheets on olive oil and mixed nuts, educational presentations, weekly individual food portion plan. B. Comparison: usual prenatal care. 	Trained dietician, research team	ESTEEM recipe book; individual weekly food portion plan; IPAQ; EQ-5D; ESTEEM Q
Altazan et al., 2019 ⁷³ Expecting Success / SmartMoms *Note: associated with Redman, 2017	 A. Intervention: in-person SmartMoms intervention, received dietary intake advice, exercise advice, weight graph created from dynamic GWG models to determine the trimester specific increase in energy intake required to adhere to the IOM recommendations. Structured intervention consisted of lessons and behavior modification counseling weekly (13-24 weeks), then biweekly (week 25 to delivery). B. Intervention: remote SmartMoms Intervention, same as above intervention, but delivered via intensity-matched phone app at least once weekly. C: Comparison: usual prenatal care. 	Trained interventionists	Personalized IOM 2009 GWG graph; wireless internet-connected bathroom scale; pedometer; Beck Depression Inventory II (0-63, 0 better mood / no symptoms); Rand 12-Item Short Form for mental and physical health (0-100 each, 0 worse health / quality of life)
Althuizen et al., 2013 ⁷⁴ New Life(style)	 A. Intervention: counseling modules on healthy lifestyle, personalized feedback on weight gain. B. Comparison: usual prenatal care. 	Counselors with a background in physical activity or remedial education; trained on specific modules	Problem Solving Treatment for primary care method for counselors; IPAQ – Short Form; Dutch Nutrition Centre questionnaire; Accelerometer and Short Questionnaire to Assess Health enhancing physical activity (SQUASH); Dutch Eating Behaviour Questionnaire
Asbee et al., 2009 ⁷⁵	 A. Intervention: counseling on healthy lifestyle, recommended physical activity, personalized feedback on weight gain. B. Comparison: usual prenatal care 	Registered dietician; training on lifestyle counseling	NR
Assaf-Balut et al., 2017 ⁷⁶	 A. Intervention: lifestyle guidance, emphasis on including healthy fats (olive oil and pistachio consumption). B. Comparison: usual prenatal care, emphasis on restricting fat. 	Dietician	Diabetes Nutrition and Complications Trial questionnaire; Mediterranean Diet Adherence Screener
Bacchi et al., 201877	 A. Intervention: aerobic and aquatic exercises per ACOG guidelines. B. Comparison: usual prenatal care. 	Qualified fitness specialist	Foam rubber balls; swimming accessories (e.g. floats); swimming mitts (for resistance); floating weights
Barakat et al., 2012 ⁷⁸	A. Intervention: aerobic and aquatic exercise.B. Comparison: usual prenatal care.	Qualified fitness specialist, obstetrician	Heart rate monitor; barbells or resistance bands; swimming accessories; swimming mitts (for resistance)

	Description		
Author, Year	Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Barakat et al., 201481	A. Intervention: aerobic exercise.	Qualified fitness specialist,	NR
	B. Comparison: usual prenatal care.	obstetrician	
Barakat et al., 201680	A. Intervention: aerobic exercise per ACOG guidelines.	Qualified fitness specialist,	Heart rate monitor; barbells or resistance bands
	B. Comparison: usual prenatal care.	obstetrician	
Barakat et al., 201879	A. Intervention: structured, supervised exercise classes from	Qualified fitness specialist,	Heart rate monitor; barbells; resistance bands;
	gestational week 9-11 to week 38-39.	obstetrician	Decision Algorithm; Borg Rating of Perceived
D	B. Comparison: usual prenatal care.		Exertion scale
Barakat et al., 2019 ⁸²	A. Intervention: structured, supervised exercise classes from	Physical activity or sport science	Heart rate monitor; fitness equipment; Borg Rating
	gestational week 8-10 to week 38-39; final motivational talk on	professional, obstetrician	of Perceived Exertion scale
	Importance of active pregnancy.		
Developte et al	B. Comparison: usual prenatal care.		Onially and a first Anniata Investory
Bogaerts et al.,	A. Intervention A: motivational lifestyle intervention sessions	Widwire trained in motivational	Spielberger State and Trait Anxiety Inventory;
201300	during programmy with information to limit oversative	mestyle miervention	Edinburg Depression Scale, 7-day lood diary
	during pregnancy, with mornation to innit excessive		
	B Intervention B: brochure only		
	C. Comparison: usual prenatal care		
Brownfoot et al	A Intervention: weight recording at each prenatal visit with	None	IOM guidelines for healthy weight gain displayed in
2016 ⁸⁴	IOM guidelines prominently displayed: discussion with clinician		intervention rooms
	about appropriate weight gain according to IOM guidelines.		
	B. Comparison: usual prenatal care, did not have access to		
	scales or weighing themselves as part of the visit.		
Bruno et al., 201785	A. Intervention: counselling session at enrollment with dietician	Dietician	Food frequency questionnaire; standard dietary
	for prescribed personalized dietary plan.		brochure; pedometer
	B. Comparison: counselling session at enrollment with dietitian		
	for general recommendations on diet and physical activity,		
	given basic nutrition booklet, plus usual prenatal care.		
Cahill et al., 2018 ⁸⁶	A. Intervention: PAT+Lifestyle curriculum, including biweekly	Trained parent educators	Parents as Teachers curriculum (a national home
PreGO	home visits by a parent educator with individualized		visiting organization curriculum)
	counseling on diet and exercise, behavior change,		
	reinforcement of lifestyle benaviors in postpartum period to		
	return to baseline weight, plus parenting strategies and social		
	Support postpartum.		
	b. Companison. FAT cumculum, including biweekly nome		
	support		
Haire-Joshu et al	A Same as Cahill et al. 2018: plus monthly visits from	Same as Cabill et al. 2018	Same as Cahill et al. 2018
2019 ¹⁰³	delivery to 12 months postpartum		
20.0	B. Same as Cahill et al., 2018: plus monthly visits from		
	delivery to 12 months postpartum.		

	Description		
Author, Year	Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Claesson et al., 2010 ⁸⁷	 A. Intervention: motivational interviewing during extra visits to midwife on weight control and counseling weekly; invitation to aqua aerobics class semiweekly. B. Comparison: usual prenatal care. 	Midwife	Beck Anxiety Inventory; Edinburgh Postnatal Depression Scale; Miller and Rollnick motivational interview guidelines
Daley et al., 2015 ⁸⁸	 A. Intervention: personalized feedback at each visit on weight gain, self-weighing, brief counseling on diet and exercise as needed based on weight gain. B. Comparison: usual prenatal care. 	Midwife; 1 hour training course	IOM weight gain chart (specific to patient's prepregnancy BMI category); self-report weight chart
Daley et al., 2019 ⁸⁹ POPS2	A. Intervention: personalized feedback at each visit on weight gain, self-weighing, brief counseling on diet and exercise as needed based on weight gain.B. Comparison: usual prenatal care.	Midwife; 1 hour training course	IOM weight gain chart (specific to patient's prepregnancy BMI category); self-report weight chart; HADS; Physical Activity in Pregnancy Questionnaire; Southampton Food Frequency Questionnaire
Daly et al., 2017 ⁹⁰ Healthy eating, Exercise and Lifestyle Trial	 A. Intervention: participation in medically supervised exercise classes during pregnancy and up to 6 weeks postpartum; personal goal setting; Facebook group. B. Comparison: usual prenatal care. 	Medically supervised exercise	ParMed-X form for assessing exercise contraindications; Facebook group for intervention participants; Borg Scale of Perceived Exertion
Dodd et al., 2014 ⁵⁶ LIMIT	A. Intervention: tailored dietary advice, recommendation for exercise, goal setting via in-person visits and phone calls.B. Comparison: usual prenatal care.	Research dietician	Workbook for goal setting
Dodd et al., 201891	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014
Dodd et al., 2019 ⁹² OPTIMISE	 A. Intervention: tailored dietary advice, recommendation for exercise, goal setting via in-person visits and phone calls. B. Comparison: usual prenatal care. 	Research dietician	Recipe book and example menu plans; individual diet and PA plan; Harvard Semi-quantitative Food Frequency Questionnaire; SQUASH; SF12 Health Survey Questionnaire; Short Form Spielberger State Trait Inventory; EPDS
Epel et al., 2019 ⁹³ MMT	 A. Intervention: Obesity-Related Behavioral Intervention Trials model, with sessions on mindful breathing, eating, and movement - nutritional and eating behavior, mindfulness-based eating awareness training, physical activity, and stress reduction. B. Comparison: treatment as usual group, comprised of women unable to attend group classes, or gestational age 20-23 weeks but otherwise would have been eligible for the intervention. 	Two practitioners with graduate degrees (MA, CNM, PhD) with additional training in mindfulness and MB-EAT	Laminated cards with program components; reading assignments; curricula components based on Mindful Motherhood, MBSR, and MB-EAT; Cohen's Perceived Stress Scale; Patient Health Questionnaire; Pregnancy-Related Anxiety Scale; Acceptance and Action Questionnaire-II; Dutch Eating Behavior Questionnaire; Yale Food Addiction Scale; Stanford Brief Activity Survey
Gallagher et al., 2018 ⁹⁴ LIFT	 A. Intervention: intensive counseling (individual and group) on behavior, nutrition, exercise; food and exercise logs; phone and email contact. B. Comparison: usual prenatal care, plus group education sessions on healthy lifestyle during pregnancy. 	Nutritionist trained on nutritional needs of pregnant women	Intervention program modified from Diabetes Prevention Program and Action for Health in Diabetes (with focus on GWG control, not weight loss); 2010 Healthy Eating Index; PeaPod system; QMR nonimaging technique

Author, Year	Description Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Garnaes et al., 2016 ⁹⁷ ETIP	 A. Intervention: supervised aerobic and strength exercise classes from gestational week 12-18 until delivery, recommended exercise at home, individualized IOM weight gain curve. B. Comparison: usual prenatal care. 	Physical therapist	Calibrate electronic scale (Seca, Medema, Norway), measure blood pressure with CASMED 740 MAXNIBP, air displacement plethysmography (BOD POD, COSMED), assessed insulin with ELISA (IBL International) using a DS2 ELISA processing system (Dynex Technologies); IOM recommended weight gain curve; Borg Rating of Perceived Exertion scale
Garnaes et al., 2017 ⁹⁸	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016
Garnaes et al., 2018 ⁹⁶	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016
Garneas et al., 2019 ⁹⁵	Same as Garnaes et al., 2016; for intervention group, well- being questionnaire administered at baseline (gestational week 12-18), late pregnancy (34-37 weeks), and 3 months postpartum.	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016; Psychological General Well-Being Index (0-110, with 110 being maximum positive wellbeing); EPDS (>10=depression); SF-36 Short Form Health Survey
Gesell et al., 2015 ⁹⁹ Madre Sana, Bebé Sano / Healthy Mother, Healthy Baby	 A. Intervention: group intervention sessions (8-10 women plus facilitator) at community recreation center for healthy lifestyle intervention; also received infant injury prevention intervention. B. Comparison: home visits on infant injury prevention. 	Curriculum developed by professional developer with input from focus group and community board; based on social learning theory, skills-based interventions	"A New Beginning" curriculum, portable stadiometer (Charder HM-200P Portstad)
Gray-Donald, et al., 2000 ¹⁰⁰	 A. Intervention: unclear; intervention based on social learning theory, administered by 2 nutritionists working with a team of health care workers, including a community nutritionist working in the Cree villages; frequency and type of contact not described. B. Comparison: no intervention. 	Nutritionists; training in cultural beliefs concerning diet	Food Processor II (Version 5.3) and the 1992 Canadian Nutrient Database File (ESHA Research, Salem, Ore)
Guelfi et al., 2016 ¹⁰¹	 A. Intervention: supervised home-based upright cycling, with progression to longer duration sessions depending on participant fitness. B. Comparison: usual prenatal care. 	Exercise therapist	Borg Rating of Perceived Exertion scale; upright cycle ergometer; EPDS; DASS; SPAS; Exercise Habit Strength Questionnaire
Haakstad et al., 2011 ¹⁰²	 A. Intervention: supervised sessions of aerobic dance exercises for at least 12 weeks; weekly self-imposed physical activity. B. Comparison: usual prenatal care. 	Certified aerobics instructors	Exercise program per AOCG guidelines; personal training diary
Harrison et al., 2013 ¹⁰⁴ HeLP-her	 A. Intervention: behavior change lifestyle intervention based on Social Cognitive Theory, including individualized dietary and PA advice, goal setting, self-monitoring. B. Comparison: educational control on general Australian dietary and PA guidelines. 	Health coach	NR

	Description		
Author, Year	Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Harrison et al., 2014 ¹⁰⁵	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013
Hawkins et al., 2014 ¹⁰⁶ Estudio Vida	 A. Intervention: Six-month lifestyle intervention tailored to Hispanic women, based on the Transtheoretical model and Social Cognitive Theory; telephone booster sessions. B. Comparison: usual prenatal care. 	Three-session training course for facilitators, with booster education	Pregnancy Physical Activity Questionnaire
Herring et al., 2016 ¹⁰⁸	A. Intervention: eHealth intervention based on the SocialEcological Model delivered over 12 weeks.B. Comparison: usual prenatal care.	NR	NR
Herring et al., 2017 ¹⁰⁷	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016
Hui et al., 2012 ¹¹⁰	 A. Intervention: exercise regimen (walking, mild-to-moderate aerobic, stretching and strength exercises), in groups and at home. Dietary interviews and counselling were provided twice to each participant in the intervention group by registered dietitians. B. Comparison: usual prenatal care. 	Licensed fitness trainers, registered dieticians	Self-report exercise diary; Food Choice Map assessment
Hui et al., 2014 ¹¹¹	 A. Intervention: community-based weekly exercise program, one-on-one private dietary consultation at baseline and 2 months later, used Food Choice Map software to assess dietary intake. B. Comparison: usual prenatal care. 	NR	Food Choice Map software for dietary intake
Koivusalo et al., 2016 ¹¹⁴ RADIEL	 A. Intervention: structured, individualized lifestyle counseling, dietary advice, and PA program, plus initial group visit with dietician and usual care. Counseling from study nurse. For prepregnancy BMI ≥30 kg/m², recommended no weight gain during first two trimesters. B. Comparison: usual prenatal care, information leaflets on healthy diet and exercise. 	Trained study nurses, dieticians	Food frequency questionnaire designed for study, including dietary index related to counseling topics; free access to local PA center; standard dietary brochure
Huvinen et al., 2018 ¹¹²	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016
Rono et al., 2018a ¹³⁷	Same as Koivusalo et al., 2016. *Specific to Rono 2018a: prepregnancy recommendation for 5- 10% weight loss prior to pregnancy for women BMI ≥25 kg/m ² .	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016
Rono et al., 2018b ¹³⁶	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016

Author Year	Description		
Study Name	Comparison	Special Training	Intervention Instruments
Kunath et al., 2019 ¹¹⁵ GeliS	 A. Intervention: individual prenatal and postpartum in-person counseling sessions; counseling on self-monitoring weight gains based on IOM recommendations, healthy nutrition and balanced diet based on Healthy Start guidelines, recommended physical activity. B. Comparison: usual prenatal care, general information leaflets on healthy lifestyle in pregnancy. 	Midwives, gynecologists, medical assistants	Presentation binder with counseling content and checklists; personalized IOM weight chart; list of local prenatal exercise programs; pedometer
Hoffman et al., 2019 ¹⁰⁹	Same as Kunath et al., 2019	Same as Kunath et al., 2019	Same as Kunath et al., 2019
LeBlanc et al., 2020 ¹¹⁶ PREPARE	 A. Intervention: prepregnancy counseling focused on losing weight; dietary counseling using DASH plan without sodium restriction, physical activity counseling with daily goals of 60 min moderate-intensity activity and walking at least 10,000 steps; during pregnancy counseling focused on adhering to GWG guidelines, logging weight, food, and exercise into study website. B. Comparison: usual prenatal care, information on having a healthy pregnancy. 	Health coach, trained behavioral interventionist	Dietary counseling using DASH plan without sodium restriction; project website
Luoto et al., 2011 ¹¹⁷ NELLI	 A. Intervention: physical activity counseling session, diet counseling session, physical activity boosters and diet boosters during visits, invitations to group meetings. B. Comparison: usual prenatal care. 	Trained study nurses	Counseling cards (for nurses); notebooks (for participants); 181-item food frequency questionnaire (FFQ); baseline leisure-time physical activity; 15-D for quality of life; RAND-36 and Beck's depression scale; maternal and fetal anthropometric measures
Kinnunen et al., 2012 ¹¹³	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011
Magriples et al., 2015 ¹¹⁸ Centering Pregnancy Plus	 A. Intervention: group prenatal care, standard clinical intake, then groups of 8-12 women at same gestational age facilitated by 2 health providers, manualized curriculum. B. Comparison: usual prenatal care. 	Health providers (physician or midwife) and an assistant	15-item version of Centers for Epidemiologic Study- Depression; 17-item Prenatal Distress Questionnaire, nutrition assessment with REAP (Rapid Eating Assessment for Patients); Physical activity with WAVE (weight, activity, variety, excess)
McCarthy et al., 2016 ¹¹⁹ FFF	A. Intervention: Serial self-weighing and simple dietary advice.B. Comparison: usual prenatal care	Research midwife	Written questionnaires on frequency of weighing at home and during antenatal consultations; WHOQOL-BREF
McGiveron et al., 2015 ¹²⁰ Bumps and Beyond	 A. Intervention: Bumps and Beyond intervention, including an educational booklet and one-on-one counseling sessions regarding diet, exercise, and healthy weight gain in pregnancy delivered approximately from 16 weeks until 6 weeks postpartum. B. Comparison: declined intervention. 	Midwife or healthy lifestyle advisor	Booklet of intervention information

	Description		
Author, Year	Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Okesene-Gafa et al., 2019 ¹²¹ HUMBA	 A. Intervention: individual, home-based education sessions including feedback on weight gain and SMARTER goals, HUMBA handbook with nutrition information, recipes, management of cravings, physical activity tips, motivational text messages worded as if from the baby regarding nutrition, plus probiotic or placebo capsules B. Comparison: usual prenatal care, NZ pamphlet on healthy eating and weight gain during pregnancy, plus probiotic or placebo capsules 	Certified community health worker trained in Health Conversations; dietician	HUMBA handbook; personalized weight gain chart; probiotic or placebo capsules; FF-SF; PA-SF; STAI- SF; Short Form Health Survey; EPDS
Olson et al., 2018 ¹²² e-Moms	 A. Intervention: intervention website, including weight gain tracker, a diet and exercise goal-setting tool, and health information, accessed through 6 weeks postpartum. B. Intervention: intervention website, weight gain tracker, a diet and exercise goal-setting tool, and health information, accessed until delivery only. C. Comparison: control website, including only health information. 	NA	Websites including weight gain tracker, a diet and exercise goal-setting tool, and health information,
Peccei et al., 2017 ¹²³	 A. Intervention: culturally appropriate, individualized meal plans and counseling on nutrition, exercise, reading food labels, shopping for food on a budget, and breastfeeding; weight tracking. B. Comparison: standard counseling on diet and exercise at randomization, and again at 6 weeks postpartum. 	Study dietician	"Gaining Weight During Pregnancy" brochure developed for study; "Thumbs Up for Healthy Food Choices" booklet; nutrition and exercise questionnaire
Pelaez et al., 2019 ¹²⁴	 A. Intervention: structured, supervised exercise from weeks 12 to 36; 60-65 min sessions 3x per week (planned 70-78 sessions). B. Comparison: usual prenatal care. 	Physical activity and sports science graduate student; midwife; obstetrician	Heart rate monitor, Borg Rating of Perceived Exertion Scale; barbells; elastic bands; fitball; exercise program per ACOG's guidelines
Perales et al., 2015 ¹²⁵	A. Intervention: exercise sessions planned for a total of 85 sessions.B. Comparison: usual prenatal care.	Qualified fitness specialist	Center for Epidemiological Studies Depression scale; heart rate monitors; Borg's scale rate of perceived exertion; exercise program per ACOG's guidelines
Petrella et al., 2014 ¹²⁶	 A. Intervention: Therapeutic Lifestyle Changes diet and exercise intervention, follow-up sessions to track adherence to program. B. Comparison: nutritional booklet, usual prenatal care. 	Dietician and gynecologist	Pedometer
Phelan et al., 2011 ¹²⁸ Fit For Delivery	 A. Intervention: in-person meeting plus phone calls following the Fit for Delivery behavioral intervention targeting diet and physical activity; women who were over or under guidelines received additional calls. B. Comparison: in-person meeting, usual prenatal care, study newsletters. 	Dietician	NR

	Description		
Author, Year	Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Phelan et al., 2014 ¹²⁷	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011
Phelan et al., 2018 ¹³⁰ Healthy Beginnings / Comienzo Saludables	 A. Intervention: biweekly in-person sessions until 20 weeks' gestation, then monthly until delivery, on appropriate weight gain, physical activity, behavioral strategies for daily self-monitoring; partial meal replacement plan; goal setting for postnatal period. B. Comparison: usual prenatal care, plus initial welcome visit, study newsletters. 	Dietitians or counselors with degrees in nutrition, community health, psychology, kinesiology, or a related field	Pedometer; body weight scales; study newsletters; meal replacement shakes and/or bars; Automated Self-Administered 24-Hour Recall website; Weight Control Strategies Scale
Phelan et al., 2019 ¹²⁹	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018
Polley et al., 2002 ¹³¹	 A. Intervention: written information on targeting appropriate weight gain in pregnancy, exercise, and diet; newsletters; personalized graph of weight gain; stepped care for with more structure for goals if weight exceeded recommendations; check-in phone calls. B. Comparison: usual prenatal care. 	Master's and doctoral-level staff with training in nutrition or clinical psychology	Block Food Frequency Questionnaire; Paffenbager Exercise Questionnaire
Rauh et al., 2013 ¹³² FeLIPO	 A. Intervention: individual counseling module intervention targeting healthy lifestyle information, self-monitoring of diet and physical activity, self-monitoring of weight gain, and setting personal behavioral goals. B. Comparison: usual prenatal care. 	Trained researchers	7-day dietary records; OptiDiet software; IPAQ
Rauh et al., 2015 ¹³³	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013
Redman et al., 2017 ¹³⁴ SmartMoms	 A. Intervention: in-person SmartMoms intervention, received dietary intake advice, exercise advice, weight graph for trimester-specific increase in energy intake for adherence to IOM recommendation. Structured intervention consisted of lessons and behavior modification counseling weekly (13-24 weeks), then biweekly (week 25 to delivery). B. Intervention: remote SmartMoms Intervention, same as above intervention, but delivered via intensity-matched phone app. C. Comparison: usual prenatal care. 	Trained interventionists	Wireless bathroom scale and pedometer; Fitbit Zip
Renault et al., 2014 ⁵⁸ TOP	 A. Intervention: PA plus D (physical activity and dietary intervention), with followup on dietary advice and encouragement to increase physical activity as assessed by pedometer. B. Intervention: PA (physical activity) only, encouraged to increase physical activity as assessed by pedometer. C. Comparison: usual prenatal care. 	Dietician	Pedometer

	Description		
Author, Year	Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Ronnberg et al., 2014 ¹³⁵	 A. Intervention: individual education on IOM guidelines for recommended GWG by BMI category, personalized graph to monitor with midwife, weight discussed at each visit, formalized prescription of PA (recommended daily moderate PA). B. Comparison: usual prenatal care. 	Midwives	NR
Ruiz et al., 2013 ¹³⁸	 A. Intervention: structured, supervised, light-to-moderate intensity exercise intervention program from week 9 to weeks 38/39. A mean of 85 training sessions were planned for each participant in the event of no preterm delivery. B. Comparison: usual prenatal care. 	Supervised exercise	Heart rate monitors; Borg conventional 6-20 point scale for the rate of perceived exertion; resistance equipment (barbells, elastic Thera bands)
Sagedal et al., 2017 ¹³⁹ Norwegian Fit For Delivery	 A. Intervention: dietary counseling sessions on awareness of food choices, access to exercise classes, lifestyle recommendations from booklets and trial website, cooking class. B. Comparison: usual prenatal care. 	Physical therapists or trained sports science students; clinical dieticians or trained public health graduate students	Ten recommendations to increase awareness of food choices; trial internet site; booklet on nutrition and PA; diet questionnaire corresponding to specific trial recommendations; IPAQ – Short Form
Sagedal et al., 2017b ¹⁴⁰	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017
Seneviratne et al., 2016 ¹⁴¹	 A. Intervention: written program prescribing frequency and duration of weekly moderate-intensity exercise using magnetic stationary bicycle. B. Comparison: usual prenatal care. 	Exercise physiologist	Heart rate monitor; stationary bicycle; Pregnancy Physical Activity Questionnaire; Foodworks software; WHO QUOL-BREF
Simmons et al., 2017 ¹⁴² DALI Lifestyle	 A. Intervention A: assigned healthy eating (HE) lifestyle coach, individual sessions on 7 messages promoting healthy eating, study toolkit. B. Intervention B: assigned physical activity (PA) lifestyle coach, 5 messages promoting aerobic and resistance PA, study toolkit. C. Intervention C: HE and PA interventions combined. D. Comparison: usual prenatal care. 	Coaches trained on intervention	Pregnancy Physical Activity Questionnaire; short food frequency questionnaire
Skouteris et al., 2016 ¹⁴³ HIPP	 A. Intervention: individual health coaching intervention, telephone followup sessions, and educational group sessions. B. Comparison: education group session for control. 	Trained health coaches	Readiness to change questionnaire; Edinburgh Postnatal Depression Scale; Depression, Anxiety, and Stress Scale; Ben-Tovim Walker Body Attitudes Questionnaire; COPE; Pittsburgh Sleep Quality Index

	Description		
Author, Year	Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Smith et al., 2016144	A. Intervention: web-based behavioral intervention including	No	3-day food diary
	exercise goal-setting modules, problem-solving modules,		
	journal, calendar to track all exercise until delivery, community		
	forum to interact with other participants in the intervention.		
	B. Comparison: usual prenatal care, plus access to the		
	website's general pages with information on recommended PA		
	and weight gain during pregnancy.		
Thomson et al.,	A. Intervention (PATE): home visits using PAT curriculum plus	Trained parent educators, PhD-level	Digital scale (model SR241, SR Instruments),
2016 ¹⁴⁸	culturally tailored maternal weight management and early	master trainers	maternal weight loss charts, infant growth charts,
Delta Healthy	childhood obesity prevention components. Based on DPP and		instructional DVDs, hands-on activities, Nutrition
Sprouts	inFANT trial, with emphasis placed on healthy eating and		Data System for Research software, Parents as
	weight control during pregnancy.		Teachers curriculum
	B. Comparison (PAT): home visits using PAT curriculum,		
	monthly group meetings, developmental screenings, and a		
	resource network for families.		
I homson et al.,	Same as Thomson et al., 2016	Same as Thomson et al., 2016	Same as Thomson et al., 2016
2018147			
Van Horn et al.,	A. Intervention: education on MAMA-DASH diet (modified	Registered dietician nutritionist,	LOSEIT! App; pedometer or smartphone tracking
	DASH diet for pregnancy), food intake tracking, PA guidelines,	certified lactation consultant	device; MOMFII website; Automated Self-
MOMFIT	individual emails, text messages, and phone calls using		Administered 24-Hour Recail website; SF-12; BDI-II
	motivational interviewing from registered dietician nurse,		
	emails with educational materials and resources, MOMFT		
	Recomparison usual property and breastleeding.		
	B. Comparison. usual prenatal care, access to MOMFT		
Vacao et al. 2014150	A later contine: individual equipabling accession, group accession	Distisions	Diarian to track dist and physical activity, and short
Healthy Mome	A. Intervention. Individual courseling session, group sessions,	Dieticialis	weight
	recommended daily moderate PA		weight
	B Comparison: usual prenatal care, with a single general		
	bealth education session as control		
Vesco et al., 2016 ¹⁵¹	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014
Vinter et al., 2011 ⁵⁹	A. Intervention: dietary counseling at 15, 20, 28, and 35	Trained dieticians, physiotherapists	None
LiP	weeks' destation, recommended daily moderate PA.		
	pedometer, free full-time membership in a fitness center for 6		
	months, closed individual and group training classes with		
	physiotherapists.		
	B. Comparison: access to a website with general advice about		
	dietary habits and PA in pregnancy.		
Vinter et al., 2014152	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011
Tanvig et al., 2014 ¹⁴⁶	Same as Vinter et al., 2011	Physician, research bioanalyst	DEXA scan (Lunar Prodigy Scanner)
Tanvig et al., 2015145	Same as Vinter et al., 2011	Same as Tanvig et al., 2014	Same as Tanvig et al., 2014

	Description		
Author, Year	Intervention + usual prenatal care		
Study Name	Comparison	Special Training	Intervention Instruments
Willcox et al.,	A. Intervention: multimodal, including face-to-face introduction,	Trained researcher, obstetrician,	Study booklet; tailored text messages based on
2017 ¹⁵³	text messages, website, video messages, chat room	dietician, physiotherapist	behavior change theories; study-specific website;
txt4two	interaction, all informed by Social Cognitive Theory and		study videos; private study Facebook page;
	CALO-RE taxonomy of behavior changes, emphasize daily		standard usual care brochure; food frequency
	moderate PA.		questionnaire; Pregnancy Physical Activity
	B. Comparison: usual prenatal care.		Questionnaire
Wolff et al., 2008154	A. Intervention: in-person visits with nutritionist on eating a	Dietician	7-day food records
	healthy diet; given energy restricted diet plan.		
	B. Comparison: usual prenatal care.		

Abbreviations: ACOG = American College of Obstetricians and Gynecologists; BDI-II = Beck Depression Inventory II; BMI = body mass index; CALO-RE = Coventry, Aberdeen, and London – Refined; COPE = COPE scale; DASH = Dietary Approaches to Stop Hypertension; DASS = Depression Anxiety Stress Scale; DPP = Diabetes Prevention Program; EPDS = Edinburgh Postnatal Depression Scale; EQ-5D = EuroQol 5D; ESTEEM = Effect of Simple, Targeted Diet in Pregnant Women with Metabolic Risk Factors on Pregnancy Outcomes; ETIP = Exercise Training in Pregnancy; FFQ = Food Frequency Questionnaire; GWG = gestational weight gain; HE = healthy eating; HUMBA = Healthy Mums and Babies; inFANT = Infant Feeding Activity and Nutrition Trial; IOM = Institute of Medicine; IPAQ = International Physical Activity Questionnaire; IVF = in vitro fertilization; LIFT = Lifestyle Interventions For Two; MAMA-DASH = modified DASH diet for pregnancy; MB-EAT = Mindfulness-based Eating Awareness Training; MBSR = Mindfulness-based Stress Reduction; MMT = Mindful MAMAS Training; MOMFIT = Maternal Offspring Metabolics Family Intervention Trial; NR= not reported; OPTIMISE = not defined; PA= physical activity; PAT = Parents As Teachers; PATE = Parents As Teachers Enhanced; POPS2 = Pregnancy Outcome Prediction Study; QMR = quantitative magnetic resonance; SPAS = Social Physique Anxiety Scale; SQUASH = Short Questionnaire to Assess Health-enhancing physical activity; STAI-SF = State Trait Anxiety Inventory-Short Form; SWEP = Study Water Exercise Pregnant; TOP = Treatment of Obese Pregnant Women; WHOQOL-BREF = World Health Organization Quality of Life abbreviated scale.

Author, Year	Weight Assessment	Outcomes (Key Question 1)* A=Intervention	Outcomes (Key Question 2) A=Intervention	Outcomes (Key Question 3) A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Aguilar-Cordero et al., 2019 ⁷¹	36-Delivery	NR	A vs. B	A vs. B	>80%
SWEP			Maternal GWG, mean: 8.3 kg vs. 11.2 kg, p=NR	Maternal EPDS score (4-6 weeks postpartum), mean (SD): 6.41 (3.7) vs. 10.2 (2.4), p<0.001 EPDS score \geq 10: 21.5% vs. 59.4% p<0.001 EPDS score, normal BMI, mean (SD): 5.63 (3.4) vs. 8.36 (2.3), $p=0.047$ EPDS score, overweight BMI, mean (SD): 3.13	
				(4.1) vs. 10.23 (2.4), p<0.001	
				EPDS score, obese BMI, mean (SD): 7.88 (3.0) vs. 11.00	
				(1.9), p=0.001	

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Al Wattar et al.,	36-Delivery	A vs. B	A vs. B	No SAEs related to	74% attended
2019 ⁷²	-			intervention	at least one
ESTEEM		Maternal	Maternal		session.
		Antepartum	GWG, mean (SD): 6.8 kg (5.6) vs. 8.3 kg (6.4), aMD -1.2, 95% CI, -2.2 to -0.2,	A vs. B	
		hemorrhage (not	p=0.03		
		defined): 1.6%	GDM: 17.6% (84/477) vs. 24.9% (124/497), aOR 0.65, 95% CI, 0.47 to 0.91, p=0.01	SGA: 9.8% (52/531)	
		(9/548) vs. 2.2%	Preeclampsia: 6.2% (34/552) vs. 4.6% (27/585), aOR 1.43, 95% CI, 0.84 to 2.43,	vs. 12.2% (69/564);	
		(13/580), aOR 0.70,	p=0.19	aOR 0.78, 95% CI,	
		95% CI, 0.29 to 1.72,	Cesarean (not defined): 32.6% (175/539) vs. 30.8% (176/571), aOR 1.06, 95% CI,	0.53 to 1.15, p=0.21	
		p=0.44	0.8 to 1.37, p=0.65		
			Composite maternal outcome (GDM or PreE): 22.8% vs. 28.6%, aOR 0.76, 95% CI,		
		Infant	0.56 to 1.03, p=0.08		
		NICU: 9.2% (49/533)	ESTEEM Q score, mean (SD) [higher=better diet]: 7.2 (2.0) vs. 5.1 (2.0), aOR 2.0,		
		vs. 11.3% (64/565),	95% Cl, 1.7 to 2.3, p<0.001		
		aOR 0.79, 95% CI,	See Table 5 for obese vs. not obese on outcomes; p=NS for all		
		0.53 to 1.18, p=0.25			
		Stillbirth: 0.2%	Infant		
		(1/533) vs. 0.4%	LGA (>90th percentile): 11.1% (59/531) vs. 10.8% (61/564); aOR 1.01, 95% CI,		
		(2/566), aOR 0.49,	0.69 to 1.49, p=0.94		
		95% CI, 0.04 to 5.57,	Preterm birth (<37 weeks): 9.5% (52/545) vs. 11.1% (64/579); aOR 0.82, 95% Cl,		
		p=0.56	0.55 to 1.22, p=0.33		
		Neonatal death:	Preterm birth (<34 weeks): 4.2% (23/545) vs. 4.5% (26/579); aOR 0.92, 95% CI,		
		0.6% (3/532) vs.	0.51 to 1.67, p=0.79		
		0.2% (1/566), aOR	Composite offspring outcome (stillbirth, SGA, or NICU): 17.3% vs. 20.9%; aOR		
		3.93, 95% CI, 0.33 to	0.79, 95% CI, 0.58 to 1.08, p=0.14		
		46.10, p=0.28			
Altazan et al., 2019 ⁷³	34-36	NR	A vs. B	NR	NR
Expecting			GWG least squares men (SE): 8.7 kg (0.9) vs. 12.8 kg (1.5), $p=0.03$		
Success /			Excess GWG: 56.3% (18/32) vs. 81.8% (9/11) n=0.17		
SmartMoms					
*Note:					
associated with					
Redman, 2017					

Author, Year Study Name	Weight Assessment Timepoint	Outcomes (Key Question 1)* A=Intervention B=Control	Outcomes (Key Question 2) A=Intervention B=Control	Outcomes (Key Question 3) A=Intervention B=Control	Adherence
Althuizen et al., 2013 ⁷⁴ New Life(style)	34-36	NR	A vs. B, all p>0.05 Maternal GWG, mean (SD): 11.6 kg (4.1) vs. 11.1 kg (3.2); MD -0.05 kg, 95% Cl, -1.1 to 1.0 Excess GWG: 70.4% vs. 72.4%; OR 0.92, 95% Cl, 0.48 to 1.77 PPWR, mean (SD): -0.53 kg (5.5) vs1.75 kg (5.1); MD 0.94, 95% Cl, -2.41 to 0.53 Cesarean: 16% vs. 21%; OR 0.60, 95% Cl, 0.29 to 1.25 Infant Macrosomia: 19% vs. 14%; OR 1.6, 95% Cl, 0.76 to 3.41 Preterm birth (<37 weeks): 6% vs. 7%; OR 0.94, 95% Cl, 0.27 to 3.35	NR	83% of women attended all sessions. Intervention dose was moderate (45.8-60.3%), and dose of Problem Solving Treatment for primary care principles was low (17.3%); see p. 94.
Asbee et al., 2009 ⁷⁵	Delivery	NR	A vs. B Maternal GWG, mean (SD): 13.0 kg (5.7) vs. 16.1 kg (7.0), p=0.01 GWG, parous vs. nulliparous, mean (SD): 12.6 kg (5.8) vs. 16.6 kg (6.6), p<0.01 GWG within recommendations, parous vs. nulliparous: OR 6.2, 95% CI, 1.6 to 24.1, p=0.008 Excess GWG: 38.6% vs. 51.2%, p>0.05 Excess GWG by BMI <26 kg/m ² : 20% vs. 32%, p>0.05 Excess GWG by BMI <26 kg/m ² : 70% vs. 75%, p>0.05 Excess GWG by BMI 26-29 kg/m ² : 66.7% vs. 80%, p>0.05 Excess GWG by BMI >29 kg/m ² : 66.7% vs. 80%, p>0.05	NR	NR

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Assaf-Balut et	36-Delivery	A vs. B	A vs. B	A vs. B	Nutrition score
al., 2017 ⁷⁶					and Med Diet
		Maternal	Maternal	SGA: 1.2% vs. 5.7%,	score improved
		Perineal trauma:	GWG, mean (SD): 9.9 kg (4.7) vs. 9.4 kg (4.3), p>0.05	p=0.001; RR 0.21,	significantly,
		3.2% vs. 10.9%,	GWG by BMI <25 kg/m ² , mean (SD): 10.6 kg (4.0) vs. 9.9 kg (3.9), p>0.05	95% CI, 0.08 to 0.54,	both between
		p=0.001; RR 0.21,	GWG by BMI 25-29.9 kg/m ² , mean (SD): 8.3 kg (6.5) vs. 8.8 kg (4.5), p>0.05	p=0.001	groups and
		95% CI, 0.12 to 0.36,	GWG by BMI ≥30 kg/m ² , mean (SD): 7.2 kg (4.7) vs. 5.6 kg (5.6), p>0.05		within groups,
		p=0.001	GDM: 17.1% vs. 23.4%, p=0.01; RR 0.73, 95% CI, 0.56 to 0.97, p=0.02		as study
			HTN: 3.0% vs. 4.3%, p>0.05		continued.
		Infant	Preeclampsia: 1.6% vs. 2.5%, p>0.05		
		RDS: 0.7% vs. 0.9%,	Cesarean, elective: 13.8% vs. 13.6%, p>0.05		
		p>0.05	Cesarean, emergency: 15% vs. 51.7%, p=0.001; RR 0.30, 95% CI, 0.14 to 0.63,		
		Shoulder dystocia:	p=0.001		
		0% vs. 0.2%			
		NICU: 1.8% vs.	Infant		
		3.2%, p>0.05	Macrosomia: 0% vs. 0.5%		
			LGA: 0.9% vs. 4.1%, p=0.002; RR 0.19, 95% CI, 0.07 to 0.57, p=0.003		
			Preterm birth (<37 weeks): 1.2% vs. 3.8%, p=0.009; RR 0.29, 95% CI, 0.11 to 0.77,		
			[p=0.01		
Bacchi et al.,	36-Delivery	NR	A vs. B	A vs. B	>85%
201877			Meternel	Louisth use alst	
				Low birth weight	
			Exerce CWC: 24 5% vg 45 2% p=0.02; OB 0.20, 05% CL 0.17 to 0.80	(<2,500 g): 2% vs.	
			Excess GWG by BMI underweight: 10% vs. 20% G, 0.17 to 0.09	3.2%, p>0.05	
			Excess GWG by BMI normal weight: 15.2% vs. 27.7%		
			Excess GWG by BMI normal weight: 13.2% vs. 27.1%		
			Excess GWG by BMI obese: 44% vs. 51 7%		
			p=0.01 for all excess GWG BMI categories		
			Infant		
			Macrosomia: 8.2% vs. 14.5%, p>0.05		
			Preterm birth (<37 weeks): 4.1% vs. 4.8%, p>0.05		
Barakat et al.,	36-Delivery	NR	A vs. B, all p>0.05	NR	85%
2012			Maternal		
			GWG mean (SD): 12.5 kg (3.2) vs. 13.8 kg (3.1)		
			GDM (at least two abnormal tests): 0% vs. 7%		
			Cesarean: 30% vs. 14%		

	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Barakat et al., 2014 ⁸¹	Delivery	NR	A vs. B, all p>0.05 unless noted Maternal GWG, mean (SD): 11.72 kg (4.06) vs. 13.66 kg (9.62) Excess GWG: 21.2% vs. 35.6%, p=0.02 GDM: 4.7% vs. 5.6% Caesarean: 17.1% vs. 28.6% Infant	NR	94% (128/137) in the intervention group received the intervention.
			Preterm birth (<37 weeks): 3.8% vs. 4.4%		
Barakat et al., 2016 ⁸⁰	36-Delivery	NR	A vs. B	A vs. B	≥80%
			Maternal GWG, mean (SD): 12.1 kg (3.7) vs. 12.9 kg (4.5), p=0.01 Excess GWG: 26.4% vs. 34.2%, p=0.03; OR 1.47, 95% Cl, 1.06 to 2.03, p=0.02 GDM: 2.4% vs. 5.5%, p=0.03; OR 2.05, 95% Cl, 0.91 to 4.6, p>0.05 HTN: 2.1% vs. 5.7%, p=0.009; OR 2.96, 95% Cl, 1.29 to 6.81, p=0.01 Preeclampsia: 0.5% vs. 2.3%, p=0.03 Cesarean: 19.1% vs. 21.7%, p>0.05 Infant Macrosomia: 1.8% vs. 4.7%, p=0.03; OR: 2.53, 95% Cl, 1.03 to 6.20, p=0.04 Preterm birth (<37 weeks): 7.6% vs. 9.7%; OR 1.31, 95% Cl, 0.78 to 2.19, p>0.05	Low birth weight (<2,500 g): 4.2% vs. 6.5%; OR 1.6, 95% Cl, 0.83 to 3.09, p>0.05	
Barakat et al., 2018 ⁷⁹	36-Delivery	NR	A vs. B Maternal	NR	>80%
			Excess GWG: 20.7% (47/227) vs. 30.2% (61/202), p=0.02 Infant Macrosomia (>4 kg): 3.5% (8/227) vs. 6.9% (14/202) Preterm bitth (~37 weeks): 4.4% (10/227) vs. 3.5% (7/202)		

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Barakat et al., 2019 ⁸²	36-Delivery	NR	A vs. B	NR	>80%
			Maternal		
			GWG, mean (SD): 12.2 kg (3.7) vs. 13.3 kg (4.1), p=0.005		
			Excess GWG: 20.5% (48/234) vs. 30.2% (67/222); OR 0.60, 95% CI, 0.39 to 0.92,		
			p=0.02		
			GDM: 2.6% (6/234) vs. 6.8% (15/222); OR 0.36, 95% CI, 0.14 to 0.95, p=0.03		
			Cesarean (not defined): 20.5% (48/234) vs. 20.7% (46/222), p=0.41		
			Infant		
			Macrosomia: 3.4% (8/234) vs. 7.2% (16/222); OR 0.46, 95% CI, 0.19 to 1.09,		
			p=0.07		
			Preterm birth (<37 weeks): 4.3% (10/234) vs. 3.2% (7/222), p=0.53		
Bogaerts et al., 2013 ⁸³	Delivery	NR	A vs. B vs. C	A vs. B vs. C	NR
			Maternal	Maternal anxiety over	
			GWG, mean (SD): 10.6 kg (7) vs. 9.5 kg (6.8) vs. 13.5 kg (7.3), p=0.007	time multivariate	
			GWG <5 kg: 21.1% vs. 27.6% vs. 6.3%	analysis, B-estimate	
			GWG 5-8.0 kg: 17.1% vs. 19% vs. 22.2%	(SE)	
			GWG ≥9 kg: 61.8% vs. 53.4% vs. 71.4%	A: -2.12 (1.2), p>0.05	
			p=0.04 across GWG categories	B: 2.31 (1.4), p>0.05	
			GDM: 11.8% VS. 12.1% VS. 11.1%, p>0.05	C: 4.06 (1.5),	
			Pregnancy-induced HTN: 10.8% VS. 19.3% VS. 9.5%, p>0.05	p=0.008	
			Γ_{20} Γ		
			Caesarean, elective: 14 5% vs. 8 6% vs. 17 5%		
			p>0.05 across cesarean categories		
			GWG multivariate analysis, B-estimate (SE)		
			GWG, B vs. C: -2.45 (1.2), p=0.04		
			GWG, A vs. C: -2.89 (1.1), p=0.008		
			GWG, parity: -1.59 (0.46), p<0.001		
			GWG, GDM: -3.22 (1.4), p=0.02		

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Brownfoot et	34-36	A vs. B, all p>0.05	A vs. B, all p>0.05	None	NR
un, 2010		Maternal	Maternal		
		Postpartum	GWG under guidelines: 12 1% vs. 14 9%		
		hemorrhage: 19.5%	GWG within guidelines: 12.7% vs. 12.2%		
		vs. 19.4%: OR 1.01.	GWG within guidelines by BMI <18.5 kg/m ² : 20% vs. 33.3%		
		95% CL 0.70 to 1.45	GWG within guidelines by BMI 18.5-24.9 kg/m ² : 16.8% vs. 19.7%		
		Perineal tear (3 rd or	GWG within guidelines by BMI 24.9-29.9 kg/m ² : 7.7% vs. 6.5%		
		4 th degree): 2.4% vs.	GWG within guidelines by BMI \geq 30 kg/m ² : 7.1% vs. 8.1%		
		4%: OR 0.60. 95%	Excess GWG: 75.2% vs. 70.8%		
		Cl. 0.26 to 1.38	Excess GWG by BMI <18.5 kg/m ² : 60% vs. 50%		
		Maternal death: 0%	Excess GWG by BMI 18.5-24.9 kg/m ² : 63.2% vs. 68.9%		
		vs. 0.27%	Excess GWG by BMI 24.9-29.9 kg/m ² : 83.7% vs. 82.8%		
			Excess GWG by BMI ≥30 kg/m ² : 82.1% vs. 75.6%		
		Infant	Excess GWG by primiparous: 77.2% vs. 74.9%		
		RDS: 1.9% vs. 3.2%;	Excess GWG by multiparous: 72.8% vs. 63.8%		
		OR 0.57, 95% CI,	Excess GWG by age, <35 years: 77.9% vs. 73.4%		
		0.23 to 1.49	Excess GWG by age, ≥35 years: 67.4% vs. 64.7%		
		Shoulder dystocia:	GDM: 5.4% vs. 5.3%; OR 1.03, 95% Cl, 0.55 to 1.91		
		1.1% vs. 0%	HTN and preeclampsia: 4.6% vs. 4%; OR 1.16, 95% CI, 0.58 to 2.31		
		NICU: 11.7% vs.	Cesarean, emergency: 15.2% vs. 19.9%		
		14%; OR 0.81, 95%	Cesarean, elective: 10.2% vs. 11.6%		
		CI, 53 to 1.25			
		Perinatal death:	Infant		
		0.5% vs. 0.5%	LGA: 7.3% vs. 7.1%; OR 0.99, 95% CI, 0.57 to 1.71		
Bruno et al.,	34-36	A vs. B	A vs. B	A vs. B	Adherence to
2017 ⁸⁵					the diet was
		Infant	Maternal	SGA: 8.7% vs. 8.1%,	measured by
		Neonatal death: 0%	GWG, mean (SD): 10.1 kg (7.4) vs. 9.4 kg (6.8), p>0.05	p>0.05	FFQ score of
		vs. 3.2%, p=NR	GWG within guidelines: 71% vs. 78.7%, p=NR		2+; 57.9% in A
			GWG, obese vs. overweight women: 8.9 kg (7.2) vs. 12.4 kg (6.1), p=0.01		and 38.7% in B
			GDM: 18.8% vs. 37.1%, p=0.02		were adherent
			GDM, obese vs. overweight women: 33% vs. 11.8%, p=0.02		to the diet.
			HTN: 2.9% vs. 21%, p=0.001		
			Cesarean: 24.6% vs. 40.3%, p>0.05		
			Infant		
			Macrosomia: 2.9% vs. 11.3%, p>0.05		
			LGA: 1.4% vs. 11.3%, p=0.02		
			Preterm birth (weeks NR): 0% vs. 8.1%, p=0.02		

	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	Adharanaa
Study Name			B=Control	B=Control	Adnerence
	36-Delivery	A vs. B, all p>0.05	A vs. B, all p>0.05 unless noted	A VS. B	All participants
2010 ⁰⁰ PreGO		Infant	Maternal	SGA: 10.2% vs	the intervention
11600		RDS: 12% vs 8 2%	GWG mean (SD): 8.05 kg (5.6) vs. 9.64 kg (5.4) n=0.02	10.3%	received it
		NICU: 18.8% vs.	Excess GWG: 36.1% vs. 45.9%	10.070	
		14.3%	GDM: 8.3% vs. 9%		
		Neonatal death: 0%	HTN: 24.8% vs. 21.1%		
		vs. 0.8%	Cesarean: 41.1% vs. 36.7%		
			Infant		
			LGA: 8.6% vs. 4.8%		
		10	Preterm birth (<37 weeks): 14.1% vs. 9.5%		
Haire-Joshu et	34-36 (2019	NR	A vs. B	NR	75%
al., 2019 ¹⁰³	sample)		PPWP at 12 months, adjusted mean (SEM): 0.0 kg (6.9) vs. 4.2 kg (9.6), n=0.02		A: Median 17
			Change in body weight baseline to 12 months, adjusted mean (SEM): 2.5 kg (7.4)		21) mean 49.8
			v_{s} , 5.7 kg (8.8), p=0.01		min (10.3) per
			Return to baseline weight or less at 12 months: 38% vs. 21.8%, p=0.01; aRR 2.24.		visit
			95% CI, 1.17 to 4.29		B: Median 16
					visits (IQR 13-
			PPWR at 12 months, GWG within IOM recommendations vs. exceeding		20), mean 38.2
			recommendations, mean (SEM): 4.9 kg (7.7) vs. 7.6 kg (8.9), p=0.19		min (13) visits
			See Figure 2; actual values not reported		

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Claesson et al., 2010 ⁸⁷	34-36	NR	NR	A vs. B, all p>0.05	NR
				Depression: OR 0.67,	
				95% CI, 0.29 to 1.58,	
				p>0.05	
				Symptoms (sx) by	
				GWG <7 kg: 25% vs.	
				11.1%, p>0.05	
				Sx by GWG >7 kg:	
				17% vs. 20%, p>0.05	
				Sx at 11 weeks	
				postpartum, <7 kg:	
				6.2% VS. 12.5%	
				SX at 11 weeks	
				10.6% $10.6%$ $10.6%$ $10.6%$	
				10.0% vs. 7.0%	
				Anxiety: OR 0.74,	
				95% CI, 0.40 to 1.35	
				Symptoms (sx) by	
				GWG <7 kg: 24.4%	
				vs. 22.2%	
				Sx by $GVVG > 7$ kg:	
				22.7% VS. 21.6%	
				SX at 11 Weeks	
				postpartum, $GWG < 7$	
				Ky. 0.2% VS. 12.5%	
				SX at 11 Weeks	
				μ_{0} μ_{0	
				ky. 0.2% vs. 10%	

Author, Year	Weight Assessment	Outcomes (Key Question 1)* A=Intervention	Outcomes (Key Question 2) A=Intervention	Outcomes (Key Question 3) A=Intervention	
Daley et al., 2015 ⁸⁸	36-Delivery	NR	A vs. B, p=NR Maternal GWG, mean (SD): 12.0 kg (4.5) vs. 12.1 kg (5.9) GWG by BMI normal weight, mean (SD): 12.3 kg (4.0) vs. 12.6 kg (5.1) GWG by BMI overweight, mean (SD): 11.6 kg (5.1) vs. 11.6 kg (7.0) Excess GWG: 23.5% vs. 29.4% Excess GWG by BMI normal weight: 11.1% vs. 10.5% Excess GWG by BMI overweight: 37.5% vs. 53.3%	A vs. B, p=NR *Note: Hospital Anxiety and Depression Scale >11 indicates abnormal, <7 is normal HADS baseline, mean (SD): 7.9 (5) vs. 8.2 (5) HADS 38 weeks, mean (SD): 8.5 (4.6) vs. 11.1 (5.7) HADS postnatal, mean (SD): 7.6 (3.9) vs. 7.7 (4.9)	90% completed 72 hour weight; 89% completed 6-8 week postpartum weigh-in.
Daley et al., 2019 ⁸⁹ POPS2	36-Delivery	A vs. B Infant Shoulder dystocia: 1% (3/312) vs. 0.6% (2/314) NICU: 10% (26/261) vs. 8% (21/262) Stillbirth: 0 vs. 0.3% (1/316)	A vs. B, all p>0.05 Maternal GWG, mean (SD): 10.3 kg (5.9) vs. 10.7 kg (6.9), aMD -0.42 kg, 95% CI -1.49 to 0.64 GWG below guidelines: 40.9% (125/305) vs. 36.5% (114/311), aOR 1.26, 95% CI, 0.86 to 1.82 GWG within guidelines: 31.5% (96/305) vs. 34.6% (108/311), aOR 0.92, 95% CI, 0.63 to 1.32 Excess GWG: 27.6% (81/305) vs. 28.9% (90/311), aOR 0.84, 95% CI, 0.53 to 1.33 Excess GWG by BMI normal weight: 10.3% (15/148) vs. 13.5% (22/161), aOR 0.69, 95% CI, 0.22 to 2.21 Excess GWG by BMI overweight: 39.8% (38/95) vs. 36.6% (34/93), aOR 1.11, 95% CI, 0.60 to 2.04 Excess GWG by BMI obese: 50.3% (31.62) vs. 59.6% (34/57), aOR 0.69, 95% CI, 0.30 to 1.58 GDM: 3.8% (12/315) vs. 5.4% (17/317) Preeclampsia: 1.9% (6/315) vs. 22.8% (69/302) Infant Preterm birth (<37 weeks): 5.6% (17/304) vs. 4.6% (14/302)	A vs. B, p>0.05 HADS Anxiety baseline, mean (SD): 4.88 (3.5) vs. 5.15 (3.3) HADS Anxiety 38 weeks, mean (SD): 5.18 (3.1) vs. 5.89 (3.6); aMD -0.58, 95% Cl, -1.25 to 0.08, p>0.05 HADS Depression baseline, mean (SD): 3.29 (2.9) vs. 3.49 (3.3) HADS Depression 38 weeks, mean (SD): 3.93 (3.0) vs. 4.56 (3.0); aMD -0.60, 95% Cl, -1.24 to 0.05	50.9% weighed themselves five times or more

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Daly et al.,	34-36	A vs. B	A vs. B	A vs. B	64% in Group
201790		Infect	Matamat	Land birth and all t	A attended at
Healthy eating,				Low birth weight	least one class
Exercise and		NICU: 9.1% VS.	[GWG, mean (SD): 6.2 kg (16) vs. 7.9 kg (7.8), p>0.05	(<2,500 g): 0% vs.	per week, 41%
Lifestyle That		16.3%, p>0.05	EXCESS GVVG. 22.2% VS. 43.2%, $p<0.05$	2.3%, p>0.05	allended al
			FFWR (0 weeks), mean (3D)1.0 kg (1.2) vs. 0.2 kg (3.4)		
			Cesarean emergency: 18.2% vs. 20.9% n>0.05		2 weeks
			Cesarean, elective: 15.9% vs. 18.6% p>0.05		2 WEEK3.
			Infant		
			Macrosomia (>4,500 g): 2.3% vs. 0, p=0.51		
			LGA: 6.8% vs. 4.6%, p>0.05		
			Preterm birth (<37 weeks): 4.5% vs. 2.3%, p>0.05		
Dodd et al.,	36-Delivery	A vs. B, all p>0.05	A vs. B, all p>0.05 unless noted	None related to study	87% attended
2014 ⁵⁶				intervention	first session
LIMIT		Maternal	GWG, mean (SD): 9.4 kg (5.7) vs. 9.4 kg (5.8); aMD -0.04, 95% Cl, -0.55 to 0.48		with research
		Postpartum	GWG below guidelines: 25% vs. 24.9%; aMD 0.99, 95% CI, 0.84 to 1.15		dietician, 77%
		hemorrhage: 18%	GWG within guidelines: 32.7% vs. 32.8%; aMD 1.02, 95% CI, 0.89 to 1.17		attended
		vs. 17%; aMD 0.94,	Excess GWG: 42.4% vs. 42.3%; aMD 0.99, 95% CI, 0.89 to 1.10		second
		95% CI, 0.77 to 1.14	GDM: 14% VS. 11%; AMD 1.21, 95% CI, 0.96 to 1.52		session
		Ath dogroo): 29(vo	Provedemonaia: 50/ via 50/ : aMD 1.02, 95% CI, 0.01 (0 1.30		
		4 ^{er} degree). 5% vs.	Cesarean: 3/% vs. 3%, awd 1.03, 95% CI, 0.85 to 1.06		
		CL 0 77 to 2 40			
		01, 0.17 10 2.40	Infant		
		Infant	Macrosomia: 15% vs. 19%; aMD 0.82, 95% Cl. 0.68 to 0.99, p=0.04		
		Shoulder dystocia:	LGA: 19% vs. 21%; aMD 0.90, 95% CI, 0.77 to 1.07		
		4% vs. 3%; aMD	Preterm birth (<37 weeks): 6% vs. 8%; aMD 0.74, 95% CI, 0.54 to 1.02		
		1.25, 95% CI, 0.81 to			
		1.93			
		NICU: 37% vs. 36%;			
		aMD 1.00, 95% CI,			
		0.90 to 1.12			
		Neonatal death:			
	1	0.47% vs. 0.47%		1	

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Dodd et al.,	Same as	NR	A vs. B, all adjusted p>0.05	Same as Dodd et al.,	Same as Dodd
2018 ⁹¹	Dodd et al.,			2014	et al., 2014
	2014		Infant		
			Weight (6 months), mean (SD): 8.3 kg (1.3) vs. 8.3 kg (1.3)		
			BMI (6 months), mean (SD): 17.7 kg/m ² (1.8) vs. 17.7 kg/m ² (1.8)		

Dodd et al	36-Delivery	Ave B	Ave B	Ave B	ND
	30-Delivery	A VS. D		A VS. D	
2019 ⁹²				*Note: SF-12,	
OPTIMISE		Maternal	Maternal	100=highest health;	
		Postpartum	GWG mean (SD): 11.3 kg (4) vs 11.7 kg (3.8) aMD -0.37 95% CL -0.97 to 0.23	FPDS	
		homorrhago (>600	GWG, bolow quidelines; 50.7% (160/316) vs. 51.7% (162/313) 200 0.85 05% CI	12-obnormal: STAL	
		mL): 16.8% (53/316)	0.60 to 1.21	>15=abnormal	
		vs. 14.4% (45/313),	GWG within guidelines: 40.6% (128/316) vs. 35.2% (110/313)		
		aRR 1.16, 95% CI,	Excess GWG: 8.7% (28/316) vs. 13.2% (41/313), aOR 0.58, 95% CI, 0.32 to 1.04	Maternal	
		0.80 to 1.67	GDM: 12.4% (39/316) vs. 12.5% (39/313), aRR 1.02, 95% CL 0.66 to 1.59	SF-12 Mental Score.	
		Perineal tear all:	HTN: 1.6% (5/316) vc 1.3% (4/313) 3PD 1.87 95% CL 0.52 to 6.7	mean (SD)	
			$\begin{array}{c} 111111 \\ 1.006 \\ (0) \\ $	$\frac{116}{2}$	
		58.2% (184/316) VS.	Preeclampsia: 1.9% (6/316) Vs. 2.9% (9/313), aRR 0.7, 95% CI 0.25 to 1.96	Baseline: 41.3 (10.7)	
		60.3% (189/313),	Cesarean, all: 23.2% (73/316) vs. 23.8% (74/313), aRR 0.95, 95% CI, 0.72 to 1.26	vs. 41.6 (10.4); aMD	
		aRR 0.98, 95% CI,	Cesarean, emergency: 13% (41/316) vs. 14.5% (45/313), aRR 0.89, 95% CI, 0.6 to	-0.33, 95% Cl, -2.00	
		0.86 to 1.11	1.31	to 1.34	
		Perineal tear 3rd/1th		28 weeks: 16 3 (10 1)	
		d_{0}	Infont	20 Weeks. 40.0 (10.1)	
		degree. 2.9% (9/310)		vs. 45.1 (10), alviD	
		vs. 1.6% (5/313),	Macrosomia (>4 kg): 7.6% (24/316) vs. 8.3% (26/313), aRR 0.91, 95% CI, 0.54 to	1.23, 95% CI, -0.33	
		aRR 1.69, 95% CI,	1.55	to 2.80	
		0.57 to 4.97	Macrosomia (>4.5 kg): 0 vs. 0.6% (2/313)	36 weeks: 46.3 (9.9)	
			LGA: 7% (22/316) vs. 8% (25/313), aRR 0.88, 95% CI, 0.51 to 1.52	vs. 46.2 (9.5): aMD	
		Infant	Preterm hith (>37 weeks): 7.3% (23/316) vs. 6.4% (20/313) aRR 1.14, 95% CI	0.08 95% CL -1.41	
		Shouldor dystopic:		to 1 59	
			0.04 10 2.03		
		2.9% (9/316) vs.		EPDS Total Score,	
		4.2% (13/313), aRR		mean (SD)	
		0.69, 95% CI 0.30 to		Baseline: 5 (4.4) vs.	
		1.6		5.1 (4.4); aMD -0.05.	
		NICU admission:		95% CL -0.74 to 0.64	
		8.5% (27/316) vs		28 weeks: 5.6 (4.2)	
		10.0% (21/310) VS.		20 weeks. 3.0 (4.2)	
		10.9% (34/313), arr		VS. 6.1 (4.6), aiviD -	
		0.80, 95% CI 0.5 to		0.48; 95% CI, -1.18	
		1.3		to 0.23	
		Death: 0.6% (2/316)		36 weeks: 5.4 (4.2)	
		vs. 0		vs. 5.2 (4.5); aMD	
				0 21 95% CL -0 47	
				to 0.80	
				STAI Score, mean	
				(SD)	
				Baseline: 10.4 (3.5)	
				vs. 10.7 (3.7); aMD -	
				0.34, 95% CI0.90	
				to 0.23	
				28 wooks: 0.0 (2.5)	
				20 WEEKS. 9.9 (3.3)	
				vs. 10.4 (3.6); aMD -	
				0.50, 95% CI, -1.06	
				to 0.05	

	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
Author, Year	Assessment	A=Intervention B=Control	A=Intervention B=Control	A=Intervention B=Control	Adherence
				36 weeks: 9.9 (3.3) vs. 10.3 (3.7); aMD - 0.41, 95% CI, -0.95 to 0.13	
				Infant SGA: 6.7% (21/316) vs. 8% (25/313), aRR 0.84, 95% CI, 0.48 to 1.47	
				Low birth weight (<2,500 g): 6.3% (20/316) vs. 4.8% 915/313), aRR 1.32, 95% CI, 0.69 to 2.54	
Epel et al., 2019 ⁹³ MMT	36-Delivery	NR	NA	A vs. B Change from baseline to post- intervention, mean (SD) Perceived stress (0- 40): 15.6 (5.8) vs. 17 (7.4); -2.09, 95% Cl, - 4.04 to -0.14, p=0.04 Depressive symptoms (0-27): 4.5 (3.7) vs. 6.1 (4.5); - 1.95, 95% Cl, -3.35 to -0.55, p=0.007 Pregnancy anxiety (1-4): 2.0 (0.7) vs. 2.0 (0.6); 0.01, 95% Cl, - 0.17 to 0.19, p=0.9 See Table 2 for	Mean 5.7 sessions (median 7); 75% attended 5+ sessions.
	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
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Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Gallagher et al., 2018 ⁹⁴ LIFT	Delivery	NR	A vs. B Maternal GWG, mean (SD): 7.89 kg (4.07) vs. 9.67 kg (4.17), p=0.003 GWG by BMI overweight, mean (SD): 9.01 kg (3.55) vs. 10.33 kg (4.0), p>0.05 GWG by BMI obese, mean (SD): 6.07 kg (4.24) vs. 8.75 kg (4.27), p=0.007 Cesarean: 30% vs. 31%, p>0.05 Infant LGA: 10% vs. 6%, p>0.05 Preterm birth (<37 weeks): 5% vs. 7%, p>0.05	A vs. B SGA: 8% vs. 14%, p>0.05	Visits <27 weeks: 87.5% Visits up to delivery: 72% Food logs, <27 weeks: 67.5% Food logs, overall: 51.1% Exercise logs, <27 weeks: 52.5% Exercise logs, overall: 34.2% Exercise class attendance: 9.7%
Garnaes et al., 2016 ⁹⁷ ETIP	Delivery	NR	A vs. B, all p>0.05 unless noted Maternal GWG, mean (95% CI): 10.5 kg (8.9 to 12.0) vs. 9.2 kg (6.8 to 11.6); MD 1.29, 95% CI, -1.58 to 4.05 Excess GWG: 58.3% vs. 44.4%, OR 0.6, 95% CI, 0.23 to 1.45 GDM (2009 criteria): 6.1% vs. 27.3%, OR 0.1, 95% CI, 0.02 to 0.95, p=0.04 GDM (2013 criteria): 14.7% vs. 24.2%, OR 0.5, 95% CI, 0.13 to 2.35 HTN: 9.1% vs. 22.6%, OR 0.2, 95% CI, 0.02 to 1.98 Infant Preterm birth (<37 weeks): 2.2% vs. 2.2%	NR	50% fulfilled training intervention as described in study protocol.
Garnaes et al., 2017 ⁹⁸	Same as Garnaes et al., 2016	A vs. B Maternal Perineal tear (3rd or 4th degree): 18% vs. 10%; OR 0.7, 95% CI, 0.08 to 2.91, p>0.05	A vs. B, all p>0.05 Maternal Cesarean: 24% vs. 17%, OR 0.8, 95% Cl, 0.50 to 1.33 Infant Macrosomia: 35% vs. 53%, OR 1.4, 95% Cl, 0.88 to 2.36	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016

Author, Year Study Name	Weight Assessment Timepoint	Outcomes (Key Question 1)* A=Intervention B=Control	Outcomes (Key Question 2) A=Intervention B=Control	Outcomes (Key Question 3) A=Intervention B=Control	Adherence
Garnaes et al., 2018 ⁹⁶	Same as Garnaes et al., 2016	NR	A vs. B PPWR (vs. baseline), mean kg (95% CI): -0.8 (-2.7 to 1.1) vs1.6 (-3.5 to 0.3), p=0.54 PPWR (vs. self-report prepregnancy weight), mean kg (95% CI): 1.52 (-0.73 to 3.78) vs. 0.52 (-1.82 to 2.86), p=0.53 Association PPWR and GWG: p=0.79 Association PPWR and lactation: p=0.63	Same as Garnaes et al., 2016	54.3% in intervention group adhered to protocol; mean 31.7 supervised sessions and 19.2 home sessions.
Garnaes et al., 2019 ⁹⁵	Same as Garnaes et al., 2016	NR	NR	A vs. B PWBGI global score Baseline, mean (SD): 76.6 (11.1) vs. 76.2 (14.3) Late pregnancy (34- 37 weeks), mean (95% CI): 76.6 (72.2 to 81) vs. 74 (69.4 to 78.5); aMD 2.60, 95% CI, -3.77 to 8.97 3 months postpartum, mean (95% CI): 85.4 (81.9 to 88.8) vs. 84.6 (80.8 to 88.4); aMD 0.77, 95% CI, -4.42 to 5.95 EPSD, 3 months postpartum, mean (95% CI): 2.96 (1.7 to 4.2) vs. 3.48 (2.3 to 4.7)	Same as Garnaes et al., 2018

Author, Year	Weight Assessment	Outcomes (Key Question 1)* A=Intervention	Outcomes (Key Question 2) A=Intervention	Outcomes (Key Question 3) A=Intervention	
Gesell et al., 2015 ⁹⁹ Madre Sana, Bebé Sano / Healthy Mother, Healthy Baby	36-Delivery	NR	A vs. B Maternal GWG, mean (SD): 19.5 lbs (12.3) vs. 22.4 lbs (15.6), p>0.05 GWG within recommendations by BMI normal weight: 40% vs. 17.6%, p=0.04 GWG within recommendations by BMI overweight: 50% vs. 20%, p<0.05 GWG within recommendations by BMI obese: 26.7% vs. 45.5%, p<0.05 Excess GWG: 27.3% vs. 44.2%, p>0.05 Excess GWG by BMI normal weight: 6.7% vs. 47.1%, p=0.04 Excess GWG by BMI overweight: 28.6% vs. 40%, p>0.05 Excess GWG by BMI obese: 46.7% vs. 45.5%, p>0.05	NR	Adherence On average, attended 4.14 (3.85) of 12 sessions, 16 (23.5%) attended no sessions, 9 attended 1 session (13.2%), only 2 (2.9%) attended 12 sessions.
Gray-Donald, et al., 2000 ¹⁰⁰	Delivery	NR	A vs. B, all p=NR unless noted Maternal GWG, mean (SD): 12 kg (6.4) vs. 13.2 kg (8.3), p>0.05 GWG, BMI ≤29 kg/m ² vs. BMI >29 kg/m ² , mean (SD): 16.1 kg (17.4) vs. 9.5 kg (6) GDM (95% CI): 16.2% (9.2% to 23.3%) vs. 14.7% (7.6% to 21.8%) PPWR, mean (SD): 6.1 kg (6.7) vs. 7.4 kg (8.5) Cesarean: 14.2% vs. 12.6% Infant Macrosomia: 34.9% vs. 30.1%	A vs. B Low birth weight (<2,500 g): 2.8% vs. 1.9%	NR

		Outcomes	Outcomes	Outcomes	
Author Vear	Weight	(Key Question 1) [*]	(Key Question 2)	(Key Question 3)	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Guelfi et al., 2016 ¹⁰¹	Delivery	A vs. B, p=NR Maternal Postpartum hemorrhage: 2.4% (2/84) vs. 3.5% (3/85) Infant NICU: 9.4% (8/84) vs. 16.5% (14/85)	A vs. B, all p>0.05 Maternal GDM: 40.5% (34/84) vs. 40% (34/85), RR 1.01, 95% Cl, 0.70 to 1.46, p=0.95 Preeclampsia: 2.4% (2/84) vs. 1.2% (1/85) Cesarean, emergency: 11.9% (10/84) vs. 12.9% (11/85) Cesarean, elective: 29.8% (25/84) vs. 30.6% (26/85) Infant LGA: 14.2% (12/84) vs. 11.8% (10/85) Preterm birth (time NR): 3.6% (3/84) vs. 4.7% (4/85)	A vs. B, p=NR unless indicated Maternal EPDS baseline, score 12+: 5.9% (5/84) vs. 2.3% (2/85) EPDS, score 12+: 1.2% (1/84) vs. 3.5% (3/85) DASS-21 baseline, median (IQR): 6 (4- 12) vs. 8 (4-11) DASS-21, median (IQR): 6 (2-10) vs. 7 (4-11), p<0.05 SPAS total baseline, median (IQR): 32 (23-39.5) vs. 28.5 (18-37) SPAS total baseline, median (IQR): 29 (19-38) vs. 26 (18- 35) Infant SCA: 0 vs. 2.4%	Median 86% of sessions completed (IQR 79-95%).
Haakstad et al	36-Delivery	NR	A vs. B, p>0.05 for all comparisons	(2/85)	Attended ≥80%
2011 ¹⁰²	50-Delivery			intervention	of sessions:
			Maternal		40% Attended all
			Excess GWG: 33% vs. 38% PPWR (SD): 3.3 kg (3.9) vs. 3.3 kg (4.1)		sessions: 27%
			Infant Preterm birth (<37 weeks): 0% vs. 1.9%		

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	Adherence
Study Name					Adherence
	20 weeks	INR	A VS. D	INK	INK
Hel P-her			Maternal		
			$GWG_mean (SD)$: 6 kg (2.8) vs. 6.9 kg (3.3) p<0.05		
			GWG by BMI overweight mean (SD): 6 kg (2.2) vs. 7.8 kg (3.4) $p<0.05$		
			GWG by BMI obese, mean (SD): 5.2 kg (SD 2.6) vs. 5.9 kg (SD 3.5), p>0.05		
			GDM: 22.3% vs. 32.7%; RR 0.68, 95% Cl, 0.44 to 1.05, p<0.01		
Harrison et al.,	Same as	NR	A vs. B	NR	NR
2014 ¹⁰⁵	Harrison et				
	al., 2013		Maternal		
			PPWR (6 weeks), mean (SD): 0.51 kg (4.48) vs. 1.96 kg (5.74), p<0.05		
			PPVVR by Bivil overweight, mean (SD): 1.48 kg (3.9) vs. 3.3 kg (5.6), p <0.05		
			PrvvR by Divide Deset, mean (SD): -0.76 kg (4.9) vs0.22 kg (5.4), p >0.05		
			PPWR by GDM negative diagnosis, mean (SD): $-3.1 \text{ kg} (5.3) \text{ vs. } -1.9 \text{ kg} (3.5), p<0.03$		
			p>0.05		
Hawkins et al.,	Delivery	NR	A vs. B	NR	NR
2014106					
Estudio Vida			Maternal		
Horring of al	26 Dolivory	ND	GwG, mean (SD). 17.7 kg (1) vs. 17.9 kg (0.0), p>0.05	Ave B	Posponso to
2016 ¹⁰⁸	30-Delivery		A VS. D	A VS. D	text messages.
2010			Maternal	SGA: 8% vs. 7%	mean 65 2 (out
			GWG, mean (SD): 8.7 kg (6.6) vs. 12.3 kg (6.4) kg; aMD -3.1, 95% Cl, -6.2 to -0.1,	p>0.05	of 114 texts
			p<0.05		sent)
			GWG by BMI overweight, mean: 12.4 kg vs. 16.1 kg, p=NR		Responded to
			GWG by BMI obese, mean: 7.2 kg vs. 10.6 kg, p=NR		≥50% of texts:
			GWG within guidelines: 26% vs. 17%, p=0.03		70%
			Excess GWG: 37% vs. 66%, p=0.03; OR 0.3, 95% CI, 0.1 to 1.0, p<0.05		Mean coaching
			GDM: 4% VS. 4%, p>0.05		calls
			Uesalean. 40% vs. 30%, μ>0.00		during first 12
			Infant		weeks: 4 (out
			LGA: 4% vs. 0%, p>0.05		of 7 calls)
					Commented or
					liked Facebook
					posts: 11%

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Herring et al., 2017 ¹⁰⁷	Same as Herring et	NR	A vs. B	NR	NR
	al., 2010		Proportion at or below early pregnancy weight at 6 months postpartum: 56% vs.		
			29%, $p=0.04$, aOR 3.5, 95% OI, 1.0 to 11.6, $p=0.04$		
			38%, p>0.05		
Hui et al., 2012 ¹¹⁰	Delivery	NR	A vs. B, all p>0.05 unless noted	NR	NR
			Maternal		
			GWG, mean (SD): 14.1 kg (6.0) vs. 15.2 kg (5.9)		
			Excess GWG: 35.3% vs. 54.5%, p=0.008		
			GDM: 1.8% vs. 3.3%		
			Cesarean: 2% vs. 3.4%		
			Infant		
			LGA: 11.8% vs. 17%		
Hui et al.,	Delivery	NR	A vs. B, all p>0.05 unless noted	"None of the	100%
2014111			Netermed	participants	
			Maternal	discontinued during	
			GWG by BMI normal weight, mean (SD): 12.9 kg (3.7) vs. 10.2 kg (4.4), p=0.03	complaint to the	
			Excess GWG by BMI normal weight: 10% vs. 37% ($10/27$) n=0.03	program was	
			Excess GWG by BMI overweight: 67% vs. 69%	reported by the	
			GDM. BMI normal weight: 0% vs. 0%	participants."	
			GDM, BMI overweight: 4% vs. 10%		
			Cesarean, BMI normal weight: 0% vs. 0%		
			Cesarean, BMI overweight: 0% vs. 7%		
			Infant		
			LGA, BMI normal weight: 7% vs. 11%		
			LGA, BMI overweight: 15% vs. 3%		

	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Koivusalo et al., 2016 ¹¹⁴ RADIEL	Delivery	A vs. B Infant RDS: 4.9% vs. 5.6%, p>0.05	A vs. B, all p>0.05 unless noted Maternal GWG, mean (95% Cl): 7.6 kg (6.7 to 8.3) vs. 7.7 kg (7.1 to 8.4) GDM, mean (95% Cl): 13.9% (8.7 to 20.6) vs. 21.6% (14.7 to 29.8), adjusted p=0.04 HTN: 4.9% vs. 4.5% Preeclampsia: 4.9% vs. 2.4% Cesarean: 21.5% vs. 24.0% Infant Macrosomia: 4.2% vs. 4.0%	NR	PA only: 26% (A) and 23% (B) met PA goal in second trimester. Adjusted weight change in follow-up not significant.
Huvinen et al., 2018 ¹¹²	Same as Koivusalo et al., 2016	NR	A vs. B Maternal PPWR (6 weeks): Specific data NR, p>0.05 PPWR (12 months): Specific data NR, p>0.05 See Figure 3	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016
Rono et al., 2018a ¹³⁷	Same as Koivusalo et al., 2016	A vs. B Infant RDS: 5% (3/65) vs. 8% (4/63), p=0.85	A vs. B Maternal GWG, mean (95% Cl): 9.6 kg (7.8 to 11.5) vs. 9.2 kg (7.6 to 10.8), adjusted p=0.93 GDM: 60% (39/65) vs. 54% (34/63), adjusted p=0.61 Early GDM (mean 13.3 weeks): 64% (25/39) vs. 56% (19/34), p=0.47 Pregnancy-induced HTN: 6% (4/65) vs. 2% (3/63), p=0.36 Essential HTN: 5% (3/65) vs. 6% (5/63), p=0.35 Preeclampsia: 2% (1/65) vs. 2% (1/63), p=0.99	Same as Koivusalo et al., 2016	38% (A) and 52% (B) attended only one prepregnancy visit; mean duration baseline visit to conception 4.6 months (A) and 3.8 months (B).

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Rono et al.,	Same as	A vs. B	A vs. B	Same as Koivusalo	63.2% (A) and
2018b ¹³⁶	Koivusalo et			et al., 2016	59.3% (B)
	al., 2016	Infant	Maternal		returned both
		RDS: 6.8% (16/235)	GDM: 44.8% (107/239) vs. 48.1% (111/231), adjusted p=0.44; OR 0.88, 95% CI,		food diaries;
		vs. 5.7% (13/229),	0.61 to 1.26		44.8% (A) and
		p=0.62	Early GDM (<20 weeks): 37.7% (87/231) vs. 36.5% (72/197), p=0.81		46.3% (B)
			Gestational HTN: 7.7% (18/235) vs. 5.7% (13/229), p=0.39		returned both
			Essential HTN: 6.4% (15/235) vs. 3.9% (9/229), p=0.23		physical
			Preeclampsia: 6% (14/235) vs. 3.1% (7/229), p=0.13		activity diaries.
			Cesarean: 23.4% (55/235) vs. 25.8% (59/229), p=0.56		
			Infant		
			LGA: 3.4% (8/235) vs. 5.7% (13/229), p=0.24		
			Preterm birth (<37 weeks): 5.1% (12/235) vs. 3.1% (7/229), p=0.27		

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Kunath et al.,	NR	NR	A vs. B	A vs. B	87.6%
2019 ¹¹⁵					attended all
GeliS			Maternal	SGA: 8.7% (88/1013)	sessions;
			GWG, mean kg (SD): 14.1 (5.3) vs. 14.1 (5.2); aOR 0.09, 95% CI, -0.79 to 0.97,	vs. 8.4% (84/1003);	93.7%
			p=0.84	aOR 1.03, 95% CI,	attended the
			GWG, BMI normal, mean kg (SD): 14.6 (4.5) vs. 14.8 (4.6); aOR -0.10, 95% CI, -	0.82 to 1.31, p=0.78	postpartum
			0.93 to 0.72, p=0.81		session.
			GWG, BMI overweight, mean kg (SD): 14 (6) vs. 14.1 (5.5); aOR -0.26, 95% CI, -		
			1.14 to 0.63, p=0.57		
			GWG, BMI obese, mean kg (SD): 11.5 (6.8) vs. 10.6 (6.5); aOR 0.52, -1.05 to 2.09,		
			p=0.51		
			aMD, BMI groups: 0.1 kg, 95% CI, -0.8 to 1.0, p=0.84		
			GWG below IOM recommendations: 21.4% vs. 19.9% (n NR)		
			Excess GWG: 45.1% (427/946) vs. 45.7% (429/939); aOR 0.95, 95% CI, 0.66 to		
			1.38, p=0.79		
			Excess GWG, BMI normal: 34.2% (208/608) vs. 35.9% (224/624); aOR 0.92, 95%		
			$U_1, U_2, U_3, D_4, D_5, D_5, D_5, D_5, D_5, D_5, D_5, D_5$		
			EXCess GWG, Bivil overweight. 62.2% (150/230) vs. 69% (136/200), aOR 0.81,		
			95% CI, 0.51 10 1.29, μ =0.30 Excess CIVC RML choose 62.00/ (60/108) vp. 58.20/ (67/115): cOR 1.08, 050/ CI		
			EXCESS GVVG, BIVII ODESE. 03.9% (09/100) VS. 30.3% (07/113), aUK 1.00, 93% CI,		
			$D_{0.02}$ (0 1.07, p=0.79 DPW/P (6-8 weeks) mean kg (SD): 4 (4.8) vs 4.3 (4.8): aOP =0.10, 0.5% CL =1.01		
			10063 n=0.65 [10076 B n=03/1]		
			GDM: 10.8% (109/1008) vs 11.1% (106/954): aOR 0.84 0.41 to 1.71 n=0.62		
			HTN: 9.5% (99/1041) vs. 6.4% (66/1039); aOR 1.64, 95% CI 1.09 to 2.45, p=0.017		
			Preeclampsia: 1.4% (14/1006) vs. 1.3% (13/965)		
			Cesarean, emergency: 14.8% (150/1016) vs. 15.9% (159/1003); aOR 0.86, 95% Cl.		
			0.67 to 1.12, p=0.26		
			Cesarean, elective: 15.5% (157/1016) vs. 11.6% (117/1003); aOR 1.41, 95% CI,		
			1.08 to 1.85, p=0.02		
			Infant		
			Macrosomia: 1.3% (13/1015) vs. 0.6% (6/1003); aOR 2.28, 95% CI, 0.66 to 7.90,		
			p=0.20		
			LGA: 7.2% (73/1013) vs. 7.5% (75/1003); aOR 1.01, 95% CI, 0.86 to 1.20, p=0.86		
			Preterm birth (<37 weeks): 7.1% (72/1014) vs. 6% (60/1004); aOR 1.18, 95% CI,		
			0.78 to 1.79, p=0.44		

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Hoffman et al.,	Same as	Same as Kunath et	A vs. B	NR	NR
2019 ¹⁰⁹	Kunath et al.,	al., 2019			
	2019		Maternal		
			PPWR (6-8 weeks), mean (SD): 4 kg (4.8) vs. 4.3 kg (4.8); adjusted effect size -		
			0.14, 95% CI, -0.96 to 0.68, p=0.74		
			Women at or below prepregnancy weight: 11.3% ($110/9/3$) vs. 14.6% $136/934$),		
			p=0.04		
			0.74, 95% Cl, -1.55 to 0.07, p=0.08		
			Women at or below prepregnancy weight: 40.5% (341/843) vs. 40.1% (334/832),		
			p=0.82		
			Predictors of long-term PPWR		
			BMI overweight vs. BMI normal weight: adjusted effect size 1.01, 95% CI, 0.28 to		
			I.74, p=0.000 RML above vs. RML permat weight: adjusted effect size 0.44, 05% CL -0.82 to 1.70		
			BMI category overall, adjusted p=0.01		
			Excessive GWG vs. non-excessive GWG: adjusted effect size 2.25, 95% CI, 1.74 to		
			2.77. p<0.001		
			PPWR ≤5 kg vs. PPWR >5 kg: adjusted effect size, 3.82, 95% Cl, 3.36 to 4.28,		
			p<0.001		
			Exclusive breastfeeding vs. not exclusive breastfeeding: adjusted effect size -1.13,		
			95% Cl, -1.92 to -0.33, p=0.005		
LeBlanc et al.,	36-Delivery	NR	A vs. B	NR	70.9% for
2020116					weekly calls,
PREPARE					73.3% for
			Prepregnancy weight reduction, mean (SD): 3.7 kg (8.3) vs. 0.6 kg (8.1)		monthly calls
			(0.2) p_{c} (0.5) vs. 0.05 kg		
			Prepregnancy BMI reduction mean (SD): 1.32 kg/m ² (2.9) vs. 0.25 kg/m ² (2.9)		
			n = 0.02		
			GWG, mean (SD): 13.2 kg (8.2) vs. 10.3 kg (7.4), p=0.03		
			Excessive GWG: 66.7% (50/75) vs. 54.5% (36/66); OR 1.67, 95% CI, 0.84 to 3.30		

	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Luoto et al., 2011 ¹¹⁷ NELLI	36-Delivery	NR	A vs. B, all p>0.05 unless noted Maternal GWG, mean (SD): 13.8 kg (5.8) vs. 14.2 kg (5.1); aMD -0.43, 95% Cl, -1.52 to 0.67 GDM: 15.8% vs. 12.4% Preeclampsia: 6.5% vs. 5.9%; aOR 1.32, 95% Cl, 0.53 to 3.31	A vs. B SGA: 4.7% vs. 2.9%; aOR 1.89, 95% Cl, 0.56 to 6.37	24%, as reported in the editors' summary.
			Infant Macrosomia (>4,000 g): 17.2% vs. 20.8%; aOR 0.83, 95% CI, 0.47 to 1.47 Macrosomia (>4,500 g): 3.3% vs. 4.6%; aOR 0.65, 95% CI, 0.13 to 3.38 LGA: 12.1% vs. 19.7%; aOR 0.55, 95% CI, 0.30 to 0.98, p=0.04		
Kinnunen et al., 2012 ¹¹³	Same as Luoto et al., 2011	NR	A vs. B Maternal GWG updated, mean (SD): 13.7 kg (5.8) vs. 14.3 kg (5.0), p>0.05 GWG within recommendations: 25.9% vs. 27.8%, p=NR Excess GWG: 46.8% vs. 54.4%; adjusted OR 0.82, 95% CI, 0.53 to 1.26, p>0.05	NR	NR
Magriples et al., 2015 ¹¹⁸ Centering	Delivery	NR	A vs. B Maternal	NR	NR
Pregnancy Plus			Excess GWG: 48.8% vs. 51.6%, p>0.05		
McCarthy et al., 2016 ¹¹⁹ FFF	34-36	A vs. B, p=NR for all Maternal Postpartum hemorrhage (>1,000 mL): 7.9% vs. 7.8% Perineal tear (3 rd or 4 th degree): 3.4% vs. 2.7% Maternal death: 0% vs. 0% Infant Shoulder dystocia: 1.6% vs. 2.7%	A vs. B Maternal GWG, MD (95% CI): -0.88 kg (-2.0 to 0.25), p>0.05 GWG by BMI overweight, mean (SD): 9.86 kg (4.4) vs. 10.5 kg (4.2); MD -0.63 kg, 95% CI, -2.01 to 0.74, p>0.05 GWG by BMI obese, mean (SD): 7.40 kg (6.1) vs. 8.77 (6.6); MD -1.37 kg, 95% CI, -3.34 to 0.60, p>0.05 GWG within recommendation by BMI overweight: 39% vs. 48.6%, p>0.05 GWG within recommendation by BMI obese: 25.6% vs. 22.5%, p>0.05 GDM: 19.5% vs. 18.3%, p=NR HTN or preeclampsia: 9.1% vs. 10.3%, p=NR Caesarean, emergency: 19.3% vs. 22.2%, p=NR Caesarean, elective: 15.0% vs. 20.1%, p=NR	NR	Adherence of serial weighing: Full adherence (≥5 times: 43.2% (82/190) Partial adherence (2-4 times): 18.4% (35/190) Non-adherent (0-1 time): 19.5% (37/190) Unknown: 18.9% (36/190)

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
McGiveron et	34-36	A vs. B	A vs. B, p=NR unless noted	NR	97% (89/92)
al., 2015 ¹²⁰					attended all
Bumps and		Maternal	Maternal		sessions.
Beyond		Postpartum	GWG, mean (SD): 4.5 kg (4.6) vs. 10.3 kg (4.4), p<0.001		
		hemorrhage:	GDM: Specific data NR; aOR 1.08, 95% CI, 0.37 to 3.15		
		Specific data NR;	HTN: Specific data NR; aOR 0.05, 95% CI, 0.01 to 0.22		
		aOR 0.45, 95% Cl,	Preeclampsia: Specific data NR; aOR 0.10, 95% CI, 0.01 to 0.90		
		0.21 to 0.96, p=NR	Cesarean, emergency: Specific data NR; aOR 1.08, 95% CI, 0.53 to 2.22		
			Infont		
			Proterm hirth (37 weeks): Specific data NR: OR 0.78, 05% CL 0.18 to 3.38		
Okesene-Gafa	36-Delivery	Avs R		None related to	81% compliant
et al 2019 ¹²¹	So Derivery	/ V3. D	A V3. D	intervention	with dietary
HUMBA		Infant	Maternal		intervention
		NICU: 11.8%	GWG, mean kg (SD): 9.7 (6.6) vs. 11.4 (6.3): aMD -1.76, 95% CL -3.55 to 0.03.	A vs. B	
		(13/110) vs. 6.4%	p=0.05 [n=100 vs. 101]		
		(7/110); aRR 1.76,	Excess GWG per week (>0.27 kg/week): 73.8% (79/107) vs. 81.8% (90/110)	Maternal	
		95% CI, 0.72 to 4.31,	GDM: 31.3% (30/96) vs. 23% (23/100); aRR 1.31, 95% CI, 0.83 to 2.09, p=0.25	EPDS score, %	
		p=0.21	Pregnancy-induced HTN: 7.3% (8/110) vs. 9% (10/111); aRR 0.78, 95% CI, 0.32 to	abnormal: 10.8%	
		Stillbirth: 0.9%	1.90, p=0.58	(9/83) vs. 8.6%	
		(1/112) vs. 2.6%	Cesarean: 34.8% (39/112) vs. 31.6% (36/114); aRR 1.11, 95% CI, 0.63 to 1.95,	(7/81); aRR 1.25,	
		(3/114)	p=0.71	95% CI, 0.49 to 3.21,	
			Cesarean, emergency: 12.5% (14/112) vs. 16.7% (19/114); aRR 0.71, 95% CI, 0.34	p=0.64	
			to 1.51, p=0.37	STALSCORE, %	
			Infont	(7/95) va 2.9%	
			Initani I CA: 25.2% (29/111) vc. 22.5% (25/111) n=NP	(7/00) VS. 3.0%	
			Proterm hirth (~37 weeks): 0% (10/111) vs. 3.6% (1/111): aRR 2.50, 05% CL 0.85	(3/73), alt (2.17, 95% CL 0.58 to 8.10	
			to 7.90, p=0.10	p=0.25	
				Infant	
				111a11 SGΔ: 3.6% (4/111)	
				vs 3.6% (4/111)	
				p=0.89	

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Olson et al., 2018 ¹²²	36-Delivery	NR	A vs. B, p=NR unless noted	A vs. B	A and B vs. C
e-Moms			Maternal	Low birth weight	Engaged with
			GWG, mean (SD): 13.73 kg (0.46) vs. 13.73 kg (0.45); aMD 0.10, 95% Cl, -0.58 to	(<2,500 g) by BMI	website at
			0.77, p>0.05	normal weight: 3.5%	least once in
			Excess GWG, percentage (SD): 48.1% (2) vs. 46.2% (2.4); aRR 1.09, 95% CI, 0.98	vs. 4.6%	each 45-day
			to 1.20, p>0.05	Low birth weight	assessment
			HIN by BMI normal weight: 3.3% vs. 3.3%	(<2,500 g) by BMI	period: 46%
			HIN by BMI overweight and obese: 4.9% vs. 6.5%	overweight and	VS. 35%
			Preeclampsia by BMI normal weight and abase: 4.2% vs. 4.0%	0Dese: 5.2% VS.	iviedian
			Cesarean by BMI pormal weight: 21.8% vs. 15.8%	5.4 /0	days logged in:
			Cesarean by BMI normal weight and obese: 31 3% vs. 28 6%		5 6% vs 3 2%
					Completed
			Infant		satisfaction
			Macrosomia by BMI normal weight: 6.6% vs. 12%		survey: 69%
			Macrosomia by BMI overweight and obese: 11.1% vs. 11.3%		overall (no
			Preterm birth (<37 weeks) by BMI normal weight: 3.1% vs. 5.4%		difference
			Preterm birth (<37 weeks) by BMI overweight and obese: 6.7% vs. 7%		between
					groups)
Peccei et al., 2017 ¹²³	36-Delivery	A vs. B, all p>0.05	A vs. B, all p>0.05	A vs. B	NR
		Maternal	Maternal	SGA: 6.1% vs. 3.3%;	
		Postpartum	GWG, mean (SD): 24.7 lbs (1.7) vs. 26.9 lbs (1.4)	OR 1.9, 95% CI, 0.5	
		hemorrhage: 8.9%	GWG within recommendations: 34.2% vs. 27.5%; OR 1.4, 95% CI, 0.8 to 2.4	to 7.1	
		vs. 3.3%; OR 2.9,	GDM: 5.0% vs. 4.4%; OR 1.2, 95% CI, 0.3 to 3.9		
		95% CI, 0.8 to 10.2	HIN: 1.7% vs. 2.2%; OR 0.8, 95% CI, 0.1 to 4.6		
		Infont	Preeclampsia: 2.8% VS. 0%		
		Shouldor dystocia:	Cesarean. 24.0% vs. 21.0%, OR 1.2, 95% CI, 0.0 to 2.2		
		2 2% vs 2 2% OP	Infant		
		0.7 95% CL 0.1 to	I GA: 6 1% vs 13 0% OR 0.4 95% CL 0.2 to 1.0		
		3.1			
		NICU: 3.9% vs.			
		3.3%; OR 1.2, 95%			
		CI, 0.3 to 4.8			

Author, Year Study Name	Weight Assessment Timepoint	Outcomes (Key Question 1)* A=Intervention B=Control	Outcomes (Key Question 2) A=Intervention B=Control	Outcomes (Key Question 3) A=Intervention B=Control	Adherence
Pelaez et al., 2019 ¹²⁴	36-Delivery	NR	A vs. B Maternal GWG, mean (SD): 11.5 kg (3.5) vs. 13.7 kg (4.1), p=0.001; effect size 0.56 Excess GWG: 22% (22/100) vs. 34.3% (69/201), p=0.03 Excess GWG, baseline BMI \geq 25 kg/m2: 42.9% (15/35) vs. 80% (40/50), p=0.001 GDM: 3% (3/100) vs. 6.5% (13/201) GDM, GWG within recommendations: 3.8% (3/78) vs. 3% (4/132) GDM, excess GWG: 0 vs. 15.9% (11/69), p=0.04 Cesarean: 17% (17/100) vs. 23.9% (48/201), p=0.02 Cesarean, GWG within recommendations: 17.9% (14/78) vs. 15.2% (20/132) Cesarean, excess GWG: 13.6% (3/22) vs. 40.6% (28/69), p=0.03 Infant Macrosomia (>4 kg): 0 vs. 5% (10/201), p=0.02 Macrosomia, GWG within recommendations: 0 vs. 0.8% (1/132) Macrosomia, excess GWG: 0 vs. 13% (9/69), p=0.07	NR	95.6%

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Perales et al.,	Delivery	NR	A vs. B	None reported as	97.2% of those
2015 ¹²⁵				related to study	in Group A
			Maternal	intervention	attended at
			GWG within recommendation: 53.2% vs. 32.7%, p=0.03		least 80% of
			Excess GWG: 46.8% vs. 67.3%, p=0.03	A vs. B	sessions.
			Cesarean: 37.5% vs. 52%, p>0.05	Note: CES-D Scale	
				≥16 indicates	
				depression	
				Maternal depression	
				in third trimester:	
				17.8% vs. 47.2%,	
				p=0.002 (mean CES-	
				D 9.3 vs. 15.3); OR	
				0.24, 95% Cl, 0.09 to	
				0.61	
				Depression by	
				overweight: 16.2%	
				vs. 47.7%, p=0.003	
				(mean CES-D 9 vs.	
				15.1); OR 0.21, 95%	
				CI, 0.07 to 0.60	
				Depression by	
				0Dese: 25% vs.	
				44.4%, p>0.05	
				within	
				wiumi recommendation:	
				8 7% vs 62 5%	
				0.7 / 0 V3. 02.3 / 0,	
				95% CL 0.01 to 0.34	
				Depression by	
				excess GWG: 30%	
				vs. 42.9%, p>0.05	

Author, Year	Weight Assessment	Outcomes (Key Question 1)* A=Intervention	Outcomes (Key Question 2) A=Intervention B=Control	Outcomes (Key Question 3) A=Intervention B=Control	Adherence
Petrella et al., 2014 ¹²⁶	Delivery	NR	A vs. B Maternal GWG, mean (SD): 8.8 kg (6.5) vs. 10.4 kg (5.0), p>0.05 Excess GWG: 33.3% vs. 60.7%, adjusted p=0.01 GWG by BMI 25-29.9 kg/m ² , mean (SD): 11.3 kg (7.8) vs. 11.3 kg (3.0), p>0.05 GWG by BMI \geq 30 kg/m ² : 6.7 kg (4.3) vs. 10.1 kg (5.6), p=0.047 GWG within recommendations: 66.7% vs. 39.3%; p=0.03 GWG within recommendations by BMI 25-29.9 kg/m ² : 53% vs. 63%, p>0.05 GWG within recommendations by BMI \geq 30 kg/m ² : 78% vs. 30%, p=0.003 GDM: 23% vs. 57%, adjusted p=0.01 HTN: 3% vs. 25%, p=0.011 Cesarean: 33.1% vs. 32.1%, p>0.05 Infant Preterm birth (time NR): 0% vs. 36%, p=0.002	NR	NR

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Phelan et al.,	36-Delivery	NR	A vs. B	"The intervention had	NR
2011 ¹²⁸				no adverse effects on	
Fit For Delivery			Maternal	incidences of	
			GWG by BMI normal weight, mean (SD): 15.3 kg (4.4) vs. 16.2 kg (4.6)	pregnancy and birth	
			GWG by BMI overweight and obese, mean (SD): 14.7 kg (6.9) vs. 15.1 kg (7.5)	complications."	
			GWG within recommendations by BMI normal weight: 46% vs. 35%		
			GWG within recommendations by BMI Overweight and obese: 21% vs. 24%	A vs. B	
			Excess GWG by BMI normal weight: 40% vs. 52%; OR 0.8, 95% CI, 0.2 to 0.87,		
			p=0.003	Low birth weight	
			Excess GWG by BMI overweight and obese: 67% vs. 61%, p>0.05	(<2,500 g) by BMI	
			PPWR (6 months) by BMI normal weight, mean (SD): 2.1 kg (4.7) vs. 3.3 kg (3.5) ,	normal weight: 4%	
			P>0.05	VS. 5%, p>0.05	
			(6.2) proves (6 months) by Bivil overweight and obese, mean (5D): 3.7 kg (5.9) vs. 4.3 kg	Low birth weight	
			(0.2) , μ > 0.05	(<2,500 g) by Bivii	
			GDM by DMI normal weight and above: 12.6% vs. 8.1% p=NR		
			HTN by BMI pormal weight: 3% vs. 12% OR 0.21, 95% CL 0.05 to 0.96 p=0.003	0.00000000000000000000000000000000000	
			HTN by BMI normal weight, 5% vs. 12%, OK 0.21, 95% CI, 0.05 to 0.90, p=0.005	p>0.00	
			Preeclampsia by BMI normal weight: 3% vs. 7%, n–NR		
			Preeclampsia by BMI overweight and obese: 21% vs. 13% n–NR		
			Cesarean by BMI normal weight 27% vs. 27% n=NR		
			Cesarean by BMI overweight and obese: 41% vs. 49%, p=NR		
			Cesarean, normal weight vs. overweight and obese: OR 0.38, 95% Cl. 0.26 to 0.74.		
			p=0.004		
			Infant		
			Macrosomia by BMI normal weight: 7% vs. 3%, p>0.05		
			Macrosomia by BMI overweight and obese: 17% vs. 16%, p>0.05		
			Macrosomia, normal weight vs. overweight and obese: OR 0.26, 95% Cl, 0.06 to		
			0.99, p=0.05		
			Preterm birth (<36 weeks), BMI normal weight: 7% vs. 14%, p>0.05		
			Preterm birth (<36 weeks), BMI overweight and obese: 12% vs. 8%, p>0.05		
Phelan et al.,	Same as	Same as Phelan et	A vs. B	NR	NR
2014 ¹²⁷	Phelan et al.,	al., 2011			
	2011		Maternal		
			PPWR (12 months): 1.4 kg (6.3) vs. 3.0 kg (5.7), adjusted p>0.05		

	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
Author, Year Study Name	Assessment Timepoint	A=Intervention B=Control	A=Intervention B=Control	A=Intervention B=Control	Adherence
Phelan et al., 2018 ¹³⁰ Healthy Beginnings / Comienzo Saludables	34-36	NR	A vs. B Maternal GWG, mean (SD): 9.4 kg (6.9) vs. 11.2 kg (7.0), p=0.03 GWG within recommendations: 28.7% vs. 23.4%, adjusted OR 1.34, 95% CI, 0.75 to 2.39, p>0.05 Excess GWG: 41.1% vs. 53.9%, adjusted OR 0.57, 95% CI, 0.33 to 0.95, p=0.03 GDM: 17.8% vs. 18.8%, OR 0.9, 95% CI, 0.46 to 1.96, p>0.05 HTN: 4% vs. 5.6%, OR 0.67, 95% CI, 0.18 to 2.28, p>0.05 Preeclampsia: 8% vs. 6.4%, OR 1.29, 95% CI, 0.48 to 3.58, p>0.05 Cesarean: 36.8% vs. 31.2%, OR 1.24, 95% CI, 0.73 to 2.13, p>0.05 Infant Preterm birth (<36 weeks): 3.2% vs. 3.9%, OR 0.76, 95% CI, 0.18 to 2.98, p>0.05 Macrosomia: 7.4% vs. 7.8%, OR 0.95, 95% CI, 0.34 to 2.63, p>0.05	A vs. B Low birth weight (<2,500 g): 8.3% vs. 6.1%, OR 1.84, 95% Cl, 0.62 to 5.83, p>0.05	Attendance at sessions: mean (SD) 6.5 (2.5) visits.
Phelan et al., 2019 ¹²⁹	Same as Phelan et al., 2018	Same as Phelan et al., 2018	A vs. B Maternal PPWR (baseline pregnancy weight to 12 months), mean (95% Cl): 1.5 kg (0.3 to 2.6) vs. 1.4 kg (0.3 to 2.6), adjusted p=0.97 PPWR (prepregnancy weight to 12 months), mean (95% Cl): 3.1 kg (1.8 to 4.4) vs. 3.3 kg (2.0 to 4.6), adjusted p=0.82 At or below baseline pregnancy weight: 38% (49/129) vs. 39.1% (50/128), adjusted p=0.56 At or below prepregnancy weight: 31.8% (41/129) vs. 29.7% (38/128), adjusted p=0.98	NR	83.7% (215/257) attended 12- month visit.

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Author, Year Study Name Polley et al., 2002 ¹³¹	Assessment <u>Timepoint</u> 36-Delivery	A=Intervention B=Control NR	A=Intervention B=Control A vs. B Maternal GWG by BMI normal weight, mean (SD): 15.4 kg (7.1) vs. 16.4 kg (4.8), p>0.05 GWG by BMI overweight and obese, mean (SD): 13.6 kg (7.2) vs. 10.1 kg (6.2), p<0.001 GWG by race, black vs. white: 14.3 kg vs. 14.1 kg, p>0.05 GWG within recommendations by BMI normal weight: 36.7% vs. 25.8%, p>0.05 GWG within recommendations by BMI normal weight: 36.7% vs. 25.8%, p>0.05 GWG within recommendations by BMI overweight and obese: 22.2% vs. 36.4%, p>0.05 Excess GWG by BMI normal weight: 33.3% vs. 58.1%, p<0.05 Excess GWG by BMI overweight and obese: 59.3% vs. 31.8%, p>0.05 PPWR (mean 8 weeks [7.1]) by BMI normal weight, mean (SD): 4.4 kg (5.4) vs. 6.2 kg (4.5), p>0.05 PPWR (mean 8 weeks [7.1]) by BMI overweight and obese, mean (SD): 3.6 kg (5.6) vs. 0.3 kg (7), p>0.05 PPWR by race, black vs. white: 4.3 kg vs. 3.3 kg, p>0.05 GDM by BMI normal weight: 0% vs. 6%, p=NR GDM by BMI normal weight: 7% vs. 13%, p=NR HTN by BMI normal weight: 7% vs. 13%, p=NR HTN by BMI normal weight: 7% vs. 13%, p=NR Preeclampsia by BMI normal weight: 0% vs. 0% Preeclampsia by BMI normal weight: 7% vs. 13%, p=NR Cesarean by BMI normal weight: 7% vs. 27%, p=NR	A=Intervention B=Control A vs. B Low birth weight (<2,500 g) by BMI normal weight: 13% vs. 10% Low birth weight (<2,500 g) by BMI overweight and obese: 4% vs. 9%	Adherence NR
			Infant, no <i>p</i> values calculated Macrosomia by BMI normal weight: 3% vs. 0% Macrosomia by BMI overweight and obese: 0% vs. 0% Preterm birth (<36 weeks) by BMI normal weight: 17% vs. 6% Preterm birth (<36 weeks) by BMI overweight and obese: 7% vs. 14%		

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Rauh et al., 2013 ¹³²	36-Delivery	NR	A vs. B, all p>0.05 unless noted	A vs. B	NR
FeLIPO			Maternal GWG, mean (SD): 14.1 kg (4.1) vs. 15.6 kg (5.8); aMD -1.7, 95% Cl, -3.0 to -0.3, adjusted p=0.049 Excess GWG: 38.2% vs. 59.5%; aOR 0.5, 95% Cl, 0.3 to 0.9, p=0.03 PPWR (4 months), mean (SD): 2.1 kg (4.3) vs. 3.3 kg (5.1); aMD -1.4, 95% Cl, -2.7 to -0.2 GDM: 5.4% vs. 12.2%; aOR 0.5, 95% Cl, 0.2 to 1.4 Cesarean: 30% vs. 42%; aOR 0.6, 95% Cl, 0.4 to 1.2 Infant LGA: 6.4% vs. 8.9%; aOR 0.8, 95% Cl, 0.3 to 2.3	SGA: 3.8% vs. 3.8%; aOR 1.0, 95% Cl, 0.2 to 4.9	
			Preterm birth (not defined): 2.6% vs. 6.3%; aOR 0.3, 95% CI, 0.1 to 1.2		
Rauh et al., 2015 ¹³³	Same as Rauh et al., 2013	Same as Rauh et al., 2013	A vs. B Maternal PPWR (12 months), mean (SD): 0.2 kg (3.6) vs. 0.8 kg (5.7), aMD -1.0, 95% Cl, - 3.2 to 1.2, p>0.05 Adjusted estimate of effect for 1 kg increase in GWG on weight retention at 12 months postpartum: 0.4 kg, 95% Cl, 0.2 to 0.5, p<0.001 Infant Weight (10th to 12th month), mean (SD): 9,382 g (931) vs. 9,736 g (999), aMD - 257, 95% Cl, (-578 to 65), p>0.05	NR	NR
Redman et al., 2017 ¹³⁴ SmartMoms	34-36	NR	A vs. B vs. C Maternal GWG, mean (SD): 8 kg (1.3) vs. 10 kg (1.3) vs. 12.8 kg (1.5), p=0.04 for A vs. C and A vs. B, p>0.05 for B vs. C Excess GWG: 56% vs. 58% vs. 84.6%, p=0.03 for A vs. C, p=0.04 for B vs. C	None	A: 60.8% (in person group) B: 76.5 (remote group) difference: p=0.049

Author, Year	Weight Assessment	Outcomes (Key Question 1)* A=Intervention	Outcomes (Key Question 2) A=Intervention	Outcomes (Key Question 3) A=Intervention	
Renault et al., 2014 ⁵⁸ TOP	36-Delivery	NR	A vs. B vs. C Maternal GWG, median (range): 8.6 kg (-9.6 to 34.1) vs. 9.4 kg (-3.4 to 28.2) vs. 10.9 kg (-4.4	A vs. B vs. C SGA: 5.4% vs. 3.2% vs. 1.5%, p>0.05	NR
			to 28.7); A+B vs. C, p=0.01, A vs. C, p=0.01, B vs. C, p=0.04, A vs. B, p>0.05 Excess GWG: 45% vs. 51% vs. 63%, p=0.01 GDM: 3.8% vs. 1.6% vs. 5.2%, p>0.05 HTN: 3.8% vs. 3.2% vs. 6.7%, p>0.05 Preeclampsia: 1.5% vs. 4% vs. 2.2%, p>0.05 Cesarean, emergency: 11% vs. 22% vs. 24%, p=0.02 Cesarean, planned: 14% vs. 19% vs. 14%, p>0.05 Infant		
			Macrosomia: 22% vs. 30% vs. 25%, p>0.05 LGA: 6.9% vs. 6.4% vs. 6.7%, p>0.05 Preterm birth (<37 weeks): 3.1% vs. 6.4% vs. 4.5%, p>0.05		
Ronnberg et al., 2014 ¹³⁵	Delivery	NA	A vs. B, all p>0.05 unless noted Maternal GWG, mean (SD): 14.2 kg (4.5) vs. 15.3 kg (5.4), p=0.03; MD 1.12, 95% Cl, 0.12 to 2.12 GWG below recommendations, multiparous only: 22% vs. 12%, p=0.03 GWG within recommendations: 40.1% vs. 33.5% Excess GWG: 41.1% vs. 50% Excess GWG by BMI normal weight: 35% vs. 42% Excess GWG by BMI overweight: 56% vs. 81% Excess GWG by BMI obese: 58% vs. 61%	NR	NR

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Ruiz et al., 2013 ¹³⁸	36-Delivery	NR	A vs. B	A vs. B vs. C	NR
			Maternal	Low birth weight	
			GWG, mean (SD): 11.9 kg (3.8) vs. 13.2 kg (4.3), adjusted p<0.001	(<2,500 g): 2% vs.	
			GWG by BMI normal weight, mean (SD): 12.3 kg (3.6 vs. 13.8 kg (4.1), adjusted	4.8%, p>0.05	
			p<0.001	Low birth weight by	
			GWG by BMI overweight and obese, mean (SD): 11.1 kg (4.3) vs. 11.6 kg (4.2),	BMI normal weight:	
			p>0.05	5.7% vs. 4.3%,	
			GWG within recommendation: 44.8% vs. 42.1%, p>0.05	p>0.05	
			GWG within recommendation by BMI normal weight: 46.4% vs. 46%, p>0.05	Low birth weight by	
				obese: 3.4% vs	
			Excess GWG: 23.8% vs. 32%; aOR 0.63, 95% CL 0.46 to 0.85, p=0.002	6 2% n>0 05	
			Excess GWG by BMI normal weight: 12.6% vs. 22.1%; aOR 0.51, 95% CI. 0.33 to	0.270, p>0.00	
			0.77, p=0.002		
			Excess GWG by BMI overweight and obese: 49.3% vs. 58.9%; aOR 0.65, 95% CI,		
			0.43 to 1.13, p>0.05		
			Excess GWG among high (university level) education: OR 6.9, 95% CI, 0.56 to		
			0.83, p<0.001		
			Excess GWG by maternal age: Specific data NR; p>0.05		
			GDM: 3.3% VS. 6.2%; aOR 0.52, 95% CI, 0.28 to 0.98, p=0.04		
			GDM by BMI normal weight and obsect 6.2% vs. 0.3% p>0.05		
			HTN: 2.7% vs. 6.2% aOR 0.41, 95% CL 0.21 to 0.79, p=0.008		
			HTN by BMI normal weight: 1.5% vs. 5.7%: aOR 0.24, 95% Cl. 0.09 to 0.65.		
			p=0.005		
			HTN by BMI overweight and obese: 5.5% vs. 7.8%, p>0.05		
			Cesarean: 19.3% vs. 19.6%, p>0.05		
			Cesarean by BMI normal weight: 16.5% vs. 18.7%, p>0.05		
			Cesarean by BMI overweight and obese: 25.9% vs. 22.1%		
			Infant		
			Macrosomia: 2.1% vs. 5%; aOR 0.35, 95% Cl, 0.17 to 0.75, p=0.007		
			Macrosomia by BMI normal weight: 2.4% vs. 4%, p>0.05		
			Macrosomia by BMI overweight and obese: 1.4% vs. 9.3%; aOR 0.14, 95% CI, 0.03		
			100.00, $p=0.01$		
			Preterm birth by BMI normal weight: 2.3% vs. 0.6% n>0.05		
			Preterm birth by BMI overweight and obese: 2.7% vs. 1.5% n>0.05		

Author, Year Study Name	Weight Assessment Timepoint	Outcomes (Key Question 1)* A=Intervention B=Control	Outcomes (Key Question 2) A=Intervention B=Control	Outcomes (Key Question 3) A=Intervention B=Control	Adherence
Sagedal et al., 2017 ¹³⁹ Norwegian Fit For Delivery	Delivery	A vs. B, all p>0.05 Maternal Postpartum hemorrhage (≥500 mL): 20.3% vs. 19.3%; OR 1.06, 95% CI, 0.71 to 1.59 Perineal tear (3 rd or 4 th degree): 3.5% vs. 3.5%; OR 1.0, 95% CI, 0.39 to 2.55 Infant Shoulder dystocia: 0.9% vs. 1.9% NICU: 12.8% vs. 12.9%; OR 0.99, 95% CI, 0.61 to 1.61	A vs. B Maternal GWG, mean (SD): 14.4 kg (6.2) vs. 15.8 kg (5.7), p=0.009 GWG by BMI normal weight, mean (SD): 14.7 kg (5.1) vs. 15.8 kg (5.4), p=0.04 GWG by BMI overweight, mean (SD): 15.3 kg (7.4) vs. 16.7 kg (7.1), p>0.05 GWG by BMI obese, mean (SD): 10.3 kg (9) vs. 13.4 kg (5.8), p>0.05 Excess GWG: 41.6% vs. 50.0%; OR 0.71, 95% CI, 0.51 to 1.0, p>0.05 GDM: 11.8% vs. 9.1%; OR 1.33, 95% CI, 0.77 to 2.32, p>0.05 Preeclampsia: 3.4% vs. 5.2%; OR 0.65, 95% CI, 0.29 to 1.47, p>0.05 Cesarean, emergency: 10.1% vs. 9.8%; OR 1.04, 95% CI, 0.61 to 1.78, p>0.05 Cesarean, elective: 2.7% vs. 2.4%; OR 1.03, 95% CI, 0.63 to 1.68, p>0.05 Infant Macrosomia: 11.8% vs. 14%; OR 0.82, 95% CI, 0.50 to 1.35, p>0.05 Preterm birth (34-37 weeks): 4.7% vs. 4.4%; OR 1.08, 95% CI, 0.50 to 2.33, p>0.05	A vs. B SGA: 10.5% vs. 9.2%; OR 1.16, 95% CI, 0.68 to 2.0, p>0.05	NR
Sagedal et al., 2017b ¹⁴⁰	Same as Sagedal et al., 2017	0.3% Same as Sagedal et al., 2017	A vs. B Maternal PPWR (12 months): 0.66 kg (5.5) vs. 1.42 kg (5), p>0.05	NR	NR

	Waight	Outcomes	Outcomes	Outcomes	
Author Voor	weight	(Key Question 1)"	(Key Question 2)	(Key Question 3)	
Study Name	Timenoint	B=Control	B=Control	B=Control	Adherence
Seneviratne et al., 2016 ¹⁴¹	36-Delivery	A vs. B, all p<0.05	A vs. B, all p<0.05	None related to intervention	33% completed
,		Maternal	Maternal		more than
		Severe postpartum	GWG, mean (SD): 12 kg (5.3) vs. 13.2 kg (5.8)	SGA: 11% (4/37) vs.	30/67 sessions
		hemorrhage: 8%	GDM: 11% (4/37) vs. 5% (2/37)	8% (3/37)	(range 0-85%,
		(3/37) vs. 14% (5/37)	Gestational HTN: 3% (1) vs. 0	Low birth weight	mean 572
		Perineal tear: 22%	Preeclampsia: 3% (1/37) vs. 3% (1/37)	(<2,500 g): 3% (1/37)	min); 52% of
		(6/27) vs. 35% (10/29)	Cesarean: 47% (18/37) vs. 35% (13/37)	vs. 3% (1/37)	exercise was at moderate
		. ,	Infant		intensity.
		Infant	Macrosomia (>4 kg): 26% (10/37) vs. 19% (7/37)		-
		RDS: 13% (5/37) vs.	LGA: 24% (9/37) vs. 11% (4/37)		
		5% (2/37)	Preterm birth (<37 weeks): 5% (2/37) vs. 3% (1/37)		
		NICU: 8% (3/37) vs.			
		8% (3/37)			
		Fetal death in utero:			
		3% (1/37) vs. 3% (1/37)			
Simmons et al., 2017 ¹⁴²	34-36	NR	A vs. B vs. C vs. D	A vs. B vs. C vs. D	NR
DALI Lifestyle			Maternal	SGA: 8% vs. 10% vs.	
,			GWG, mean (SD): 6.5 kg (3.8) vs. 8 kg (4.7) vs. 8.5 kg (5) vs. 8.8 kg (4.7); HE+PA	6% vs. 6%; aOR	
			vs. Control aMD -2.02, 95% Cl, -3.58 to -0.45, p<0.05	1.51, 95% CI, 0.46 to	
			GWG within recommendations: 40% vs. 28% vs. 28% vs. 24%; HE+PA vs. Control	4.94, p>0.05	
			aOR 2.13, 95% CI, 1.05 to 4.33, p<0.05		
			GDM: 32% vs. 44% vs. 34% vs. 37%; aOR 0.80, 95% Cl, 0.43 to 1.49, p>0.05		
			Infant		
			LGA: 9% vs. 15% vs. 14% vs. 18%; aOR 0.47, 95% Cl, 0.19 to 1.18, p>0.05		

		Outcomes	Outcomes	Outcomes	
	Weight	(Key Question 1)*	(Key Question 2)	(Key Question 3)	
Author, Year	Assessment	A=Intervention	A=Intervention	A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Skouteris et al., 2016 ¹⁴³	34-36	NR	A vs. B	A vs. B	NR
HIPP			Maternal	Note: EPDS >13	
			GWG, mean (SD): 12.8 kg (6.7) vs. 12.1 kg (6.8), p>0.05	indicates depression,	
			GWG by BMI under- or normal weight, mean (SD): 14.4 kg (4.0) vs. 13.5 kg (4.8),	DASS >5 indicates	
			p>0.05	anxiety	
			GWG by BMI overweight and obese, mean (SD): 10.5 kg (8.8) vs. 9.8 kg (8.6),		
			p>0.05	Depression (mean 33	
			GWG within recommendations: 36.9% vs. 33.6%, adjusted p>0.05	weeks), mean (SD):	
			Excess GWG: 40.8% vs. 36.3%, adjusted p>0.05	5.5 (4.2) vs. 6.3 (4.5);	
			Cesarean, emergency: 14.3% vs. 5.3%, p=NR	regression	
			Cesarean, elective: 4.8% vs. 12%, p=NR	coefficient -0.50, 95%	
			In face (CI, -1.5 to 0.5,	
			Iniant Distorm high /time NDV 2.19(vo. 1.59(n. ND	p>0.05	
			Preterm bitti (ume NR). 3.1% vs. 1.3%, $p=NR$	Anxiety (mean 33	
				$4 \ 8 \ (4 \ 9) \ ve \ 5 \ 5 \ (5 \ 2)$	
				regression coefficient	
				0.04 95% CL -1 12	
				to 1.2, $p > 0.05$	
Smith et al., 2016 ¹⁴⁴	34-36	NR	A vs. B, all p>0.05	NR	NR
			Maternal		
			GWG, mean (SD): 13.6 kg (5.6) vs. 11.7 kg (5.1)		
			GWG within recommendation: 27.3% vs. 33.3%		
			Excess GWG: 68.2% vs. 52.4%		
Thomson et al., 2016 ¹⁴⁸	Delivery	NR	A vs. B, all p>0.05	A vs. B	NR
Delta Healthy			Maternal	SGA: 20.8% vs. 6.7%	
Sprouts			GWG within recommendations: 10.3% vs. 25.6%	Low birth weight	
			Excess GWG: 61.5% vs. 53.5%	(<2,500 g): 20.8% vs.	
			HTN: 2.9% vs. 7.1%	6.7%	
			Preeclampsia: 0% vs. 2%		
			Cesarean, emergency: 16.7% vs. 10%		
			Cesarean, elective: 8.3% VS. 13.3%		
			Infant		
			Macrosomia: 8.3% vs. 6.7%		
			LGA: 12.5% vs. 6.7%		
			Preterm birth (<37 weeks): 8.3% vs. 16.7%, p=0.44		

Author, Year	Weight Assessment	Outcomes (Key Question 1)* A=Intervention	Outcomes (Key Question 2) A=Intervention	Outcomes (Key Question 3) A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Thomson et al., 2018 ¹⁴⁷	Same as Thomson et al., 2016	Same as Thomson et al., 2016	A vs. B Infant Overweight at 12 months: 75% (18/24) vs. 73.3% (22/30) Overweight survival time, median (95% CI): 3.6 months (1.3 to 10.7) vs. 2.9 months (1.4 to 6.4), p=0.82 Rapid infant weight gain: 75% (18/24) vs. 73.3% (22/30) RIWG survival time, median (95% CI): 6 months (3.6 to 10.2) vs. 7 months (3.9 to 8.8), p=0.68	NR	88% (A) and 83% (B) adherence; mean 10 postnatal visits.
Van Horn et al., 2018 ¹⁴⁹ MOMFIT	34-36	NR	A vs. B Maternal GWG, mean (SD): 10 kg (6) vs. 12 kg (6), adjusted p=0.02 GWG, BMI overweight, mean (SD): 26 lbs (12) vs. 27 lbs (11), p=0.49 GWG, BMI obese, mean (SD): 20 lbs (12) vs. 26 lbs (14), p=0.01 Excess GWG: 68.6% (96/140) vs. 84.4% (119/141), adjusted p=0.004 Excess GWG, BMI overweight: 79% (50/63) vs. 86% (55/64), p=0.33 Excess GWG, BMI obese: 60% (46/77) vs. 83% (64/77), p=0.001 GDM: 5.3% (7/133) vs. 7.1% (9/127), adjusted p=0.41 GDM, BMI overweight: 2% (1/50) vs. 0, p=0.99 GDM, BMI obese: 8% (6/75) vs. 13% (9/69), p=0.35 Cesarean: 39.6% (55/140) vs. 27% (37/137), adjusted p=0.01 Cesarean, BMI overweight: 33% (21/64) vs. 30% (18/60), p=0.60 Cesarean, BMI obese: 44% (34/77) vs. 25% (19/76), p=0.01 See Appendix 4 for cesarean indications Infant LGA: 5.8% (8/130) vs. 8.8% (12/121), adjusted p=0.51 LGA, BMI obese: 10% (8/80) vs. 15% (11/73), p=0.43 Preterm bitth (<37 weeks): 4.3% (6/139) vs. 8.8% (12/136), p=0.13 Preterm bitth, BMI overweight: 3% (267) vs. 11% (7/64), p=0.08 Preterm bitth, BMI obese: 5% (4/80) vs. 7% (5/71), p=0.70	A vs. B Infant SGA: 18% (25/130) vs. 19.9% (27/121), adjusted p=0.61 SGA, BMI overweight: 26% (16/62) vs. 21% (13/62), p=0.56 SGA, BMI obese: 12% (9/75) vs. 19% (14/74), p=0.23	70.1% reported weight weekly

Author Year	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Vesco et al., 2 2014 ¹⁵⁰	2 weeks postpartum	A vs. B	A vs. B, all p>0.05 unless noted	A vs. B	NR
Healthy Moms		Infant	Maternal	Infant	
		NICU: 4% vs. 11%,	GWG, mean (SD): 5.0 kg (4.1) vs. 8.4 kg (4.7), MD -3.4, 95% Cl, -5.1 to -1.8,	SGA: 5% vs. 7%; OR	
		p>0.05	p<0.001; Cohen's d 0.69	0.76, 95% CI, 0.11 to	
			Excess GWG by rate of weight gain per week: 44% vs. 82%	4.76	
			UNI: 11% VS. 12%, OR 0.87, 95% CI, 0.28 to 2.78		
			Cesarean: 38% vs. 45%: OR 0.74, 95% CL 0.59 to 3.34		
			Infant		
			Macrosomia: 11% vs. 22%; OR 0.42, 95% CI, 0.14 to 1.18		
			LGA: 9% vs. 26%; OR 0.28, 95% CI, 0.09 to 0.84, p=0.02		
			Preterm birth (<37 weeks): 7.1% vs. 3.4%		
Vesco et al., 2016 ¹⁵¹	Same as Vesco et al.,	Same as Vesco et al., 2014	A vs. B	NR	NR
2	2014		Maternal		
			PPWR (12 months): -1.4 kg vs0.9 kg; aMD -0.5 kg, 95% Cl, -4.0 to 3.1), p>0.05		
			Infant		
			Weight (12 months): 9.8 kg (0.9) vs. 10 kg (1.2); aMD 0.02, 95% CI, -0.37 to 0.41,		
			µ>0.00 Waight across time: aMD -0.2 kg, 95% CL -0.38 to -0.02, n=0.03		

	Weight	Outcomes (Key Question 1)*	Outcomes (Key Question 2)	Outcomes (Key Question 3)	
Author, Year Study Name	Assessment Timepoint	A=Intervention B=Control	A=Intervention B=Control	A=Intervention B=Control	Adherence
Vinter et al., 2011 ⁵⁹ LiP	34-36	A vs. B Infant NICU: 14% vs. 14.3%, p>0.05 Neonatal death: 1.3% vs. 0.65%, p>0.05	A vs. B, all p<0.05 unless noted Maternal GWG, median (range): 7.0 kg (4.7 to 10.6) vs. 8.6 kg (5.7 to 11.5), p=0.01 GWG within recommendations: 64.6% vs. 53.4% Excess GWG: 35.4% vs. 46.6% GDM: 6% vs. 5.2% HTN and preeclampsia: 15.4% vs. 18.2% Cesarean, emergency: 14.7% vs. 18.2% Cesarean, planned: 12% vs. 7.1% Infant Macrosomia: 32% vs. 25.3% LGA: 15.4% vs. 11.7%	NR	A: 92% attended all 4 dietary counseling sessions, 98% completed at least 3 Mean attendance at 20 aerobic sessions was 10.4 hours, and 56% attended at least half of the sessions. 77.5% undertook additional activities. B: 65% undertook "leisure time sporting activities"
Vinter et al., 2014 ¹⁵²	Same as Vinter et al., 2011	Same as Vinter et al., 2011	A vs. B Maternal PPWR (6 months), >0 kg: 46% vs. 57%, p>0.05 PPWR (6 months), >5 kg: 17% vs. 23%, p>0.05 PPWR, GWG within recommendations vs. excess GWG, median (IQR): -0.7 kg (- 3.3 to 2.3) vs. 1.5 (-0.6 to 5.9), p<0.001 PPWR, nulliparous vs. multiparous, median (IQR): 0.95 kg (-1.75 to 4.2) vs0.4 kg (-3.2 to 2.9), p=0.02	NR	NR

Author, Year	Weight Assessment	Outcomes (Key Question 1)* A=Intervention	Outcomes (Key Question 2) A=Intervention	Outcomes (Key Question 3) A=Intervention	
Study Name	Timepoint	B=Control	B=Control	B=Control	Adherence
Tanvig et al., 2014 ¹⁴⁶	Same as Vinter et al., 2011	NR	A vs. B, all p>0.05 Infant Weight (2.8 years), mean (95% CI): 14.7 kg (14.3 to 15.1) vs. 14.4 kg (14.1 to 14.8) BMI (2.8 years), mean (95% CI): 16.4 kg/m ² (16.1 to 16.7) vs. 16.1 kg/m ² (15.8 to 16.4) BMI z-score (2.8 years): 0.06 (0.17 to 0.29) vs0.18 (-0.43 to 0.05)	NR	NR
Tamuia at al	Como oo		BMI overweight and obese (2.8 years): 10.9% vs. 6.7%		ND
2015 ¹⁴⁵	Vinter et al., 2011		Infant Birth weight association with BMI z-score: adjusted regression coefficient 0.46, 95% CI, 0.31 to 0.59, p<0.001		
Willcox et al., 2017 ¹⁵³	34-36	NR	A vs. B	NR	96% responded to
txt4two			Maternal GWG, mean (SD): 11.0 kg (5.9) vs. 13.6 kg (5.6); adjusted coefficient -2.86, 95% CI, -5.58 to -0.14, p=0.039 Excess GWG: 47% vs. 61%, p>0.05		texts 31% joined Facebook page
Wolff et al., 2008 ¹⁵⁴	34-36	NR	A vs. B	NR	NR
			Maternal GWG, mean (SD): 6.6 kg (5.5) vs. 13.3 kg (7.5); MD 6.7, 95% Cl, 2.6 to 10.8 kg, p=0.002 GDM: 0% vs. 10%, p=NR PPWR (4 weeks): -4.5 kg vs. 2.4 kg; MD 6.9, 95% Cl, 2.5 to 11.2, p=0.003 HTN: 4% vs. 15%, p=NR Preeclampsia: 0% vs. 4%, p=NR Cesarean: 9% vs. 11%, p=NR		

* Outcomes abstracted into Key Question (KQ) 1-3 columns as specified by workplan. SGA and depression and anxiety reported as outcomes, not harms related to intervention, but included in KQ3 column per the finalized research workplan.

Abbreviations: aMD = adjusted mean difference; aOR = adjusted odds ratio; aRR = adjusted risk ratio; BDI-II = Beck Depression Inventory II; BMI = body mass index; CES-D = Center for Epidemiologic Studies Depression scale; CI = confidence interval; DASS = Depression Anxiety Stress Scale; EPDS = Edinburgh Postnatal Depression Scale; EGWG = excess gestational weight gain; ESTEEM = Effect of Simple, Targeted Diet in Pregnant Women with Metabolic Risk Factors on Pregnancy Outcomes; ETIP = Exercise Training in Pregnancy; FFQ = Food Frequency Questionnaire; GDM = gestational diabetes mellitus; GWG = gestational weight gain; HADS = Hospital Anxiety and Depression Scale; HE = healthy eating; HTN = hypertension; HUMBA = Healthy Mums and Babies; IQR = interquartile range; IOM = Institute of Medicine; LGA= large for gestational age; LIFT= Lifestyle Interventions For Two; MCS = Mental Component Summary; MD = mean difference; MMT = Mindful MAMAS Training; MOMFIT = Maternal Offspring Metabolics Family Intervention Trial; NA = not applicable; NICU = neonatal intensive care unit; NR = not reported; OPTIMISE = not defined; OR = odds ratio; PA = physical activity; PCS = Physical Component Summary; POPS2 = Pregnancy Outcome Prediction Study; PPWR = postpartum weight retention;

RDS = respiratory distress syndrome; RR = relative risk; SD = standard deviation; SE = standard error; SEM = standard error of the mean; SGA = small for gestational age; SPAS = Social Physique Anxiety Scale; STAI = State Trait Anxiety Index; SWEP = Study Water Exercise Pregnant; TOP = Treatment of Obese Pregnant Women.

Appendix C Table 1. Quality Assessment of Randomized, Controlled Trials

Author, Year Study Name	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Attrition and withdrawals reported?	Important loss to followup?	Analyze people in the groups in which they were randomized?	Funding source reported?	Quality Rating
Aguilar-Cordero et al., 2019 ⁷¹ SWEP	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Al Wattar et al., 2019 ⁷² ESTEEM	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Fair
Altazan et al., 2019 ⁷³ Expecting Success / SmartMoms	Unclear	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Fair
Althuizen et al., 2013 ⁷⁴ New Life (style)	Yes	Unclear	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Asbee et al., 2009 ⁷⁵	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Assaf-Balut et al., 2017 ⁷⁶	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Bacchi et al., 201877	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Fair
Barakat et al., 201278	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Barakat et al., 201481	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Barakat et al., 201680	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Barakat et al., 201879	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	No	Fair
Barakat et al., 201982	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	No	Fair
Bogaerts et al., 2013 ⁸³	Yes	Unclear	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Brownfoot et al., 2016 ⁸⁴	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Bruno et al., 2017 ⁸⁵	Yes	Yes	Unclear	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Fair
Cahill et al., 2018 ⁸⁶ PreGO	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Haire-Joshu et al., 2019 ¹⁰³	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Fair
Daley et al., 201588	Yes	Yes	No	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Daley et al., 2019 ⁸⁹ POPS2	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Fair

Appendix C Table 1. Quality Assessment of Randomized Controlled Trials

Author, Year Study Name	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Attrition and withdrawals reported?	Important loss to followup?	Analyze people in the groups in which they were randomized?	Funding source reported?	Quality Rating
Daly et al., 2017 ⁹⁰ Healthy eating, Exercise and Lifestyle Trial	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Fair
Dodd et al., 2014 ⁵⁶ LIMIT	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Dodd et al., 201891	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Dodd et al., 2019 ⁹² OPTIMISE	Yes	Unclear	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Gallagher et al., 2018 ⁹⁴ LIFT	Unclear	Unclear	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Fair
Garnaes et al., 2016 ⁹⁷ ETIP	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Garnaes et al., 2017 ⁹⁸	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Garnaes et al., 2018 ⁹⁶	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Garnaes et al., 2019 ⁹⁵	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Fair
Gesell et al., 2015 ⁹⁹ Madre Sana, Bebé Sano / Healthy Mother, Healthy Baby	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Fair
Guelfi et al., 2016 ¹⁰¹	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Haakstad et al., 2011 ¹⁰²	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	Yes	Yes	No	Fair
Harrison et al., 2013 ¹⁰⁴ HeLP-her	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Good
Harrison et al., 2014 ¹⁰⁵	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	Yes	Good

Author, Year Study Name	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Attrition and withdrawals reported?	Important loss to followup?	Analyze people in the groups in which they were randomized?	Funding source reported?	Quality Rating
Hawkins et al., 2014 ¹⁰⁶ Estudio Vida	Yes	Unclear	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Herring et al., 2016 ¹⁰⁸	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Herring et al., 2017 ¹⁰⁷	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Hui et al., 2012 ¹¹⁰	Yes	Unclear	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Fair
Hui et al., 2014 ¹¹¹	Yes	Unclear	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Koivusalo et al., 2016 ¹¹⁴ RADIEL	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Huvinen et al., 2018 ¹¹²	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Rono et al., 2018a ¹³⁷	Yes	Yes	Yes	Yes	Unclear	Unclear	Unclear	Yes	Yes	Yes	Yes	Fair
Rono et al., 2018b136	Yes	Yes	Yes	Yes	Unclear	Unclear	Unclear	Yes	No	Yes	Yes	Fair
Kunath et al., 2019 ¹¹⁵ GeliS	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Hoffman et al., 2019 ¹⁰⁹	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
LeBlanc et al., 2020 ¹¹⁶ PREPARE	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	No	Yes	Yes	Good
Luoto et al., 2011 ¹¹⁷ NELLI	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Good
Kinnunen et al., 2012 ¹¹³	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Good
Magriples et al., 2015 ¹¹⁸ Centering Pregnancy Plus	Yes	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Fair
McCarthy et al., 2016 ¹¹⁹ FFF	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	No	Unclear	Yes	Fair

Appendix C Table 1. Quality Assessment of Randomized Controlled Trials

Author, Year Study Name	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Attrition and withdrawals reported?	Important loss to followup?	Analyze people in the groups in which they were randomized?	Funding source reported?	Quality Rating
Okesene-Gafa et al., 2019 ¹²¹ HUMBA	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Good
Olson et al., 2018 ¹²² e-Moms	Yes	Unclear	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Fair
Peccei et al., 2017123	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Fair
Pelaez et al., 2019124	Yes	Unclear	Yes	Yes	No	No	No	Yes	Yes	No	Yes	Fair
Perales et al., 2015 ¹²⁵	Yes	Yes	Yes	Yes	No	Unclear	Unclear	Yes	No	Yes	Yes	Good
Petrella et al., 2014 ¹²⁶	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	No	Fair
Phelan et al., 2011 ¹²⁸ Fit For Delivery	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Fair
Phelan et al., 2014127	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Fair
Phelan et al., 2018 ¹³⁰ Healthy Beginnings / Comienzo Saludables	Yes	Unclear	Yes	Yes	Yes	No	No	Yes	No	No	Yes	Fair
Phelan et al., 2019129	Yes	No	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Fair
Polley et al., 2002131	Unclear	Unclear	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Rauh et al., 2013 ¹³² FeLIPO	Yes	Yes	No	Yes	No	No	No	Yes	No	Unclear	Yes	Fair
Rauh et al., 2015 ¹³³	Yes	Yes	No	Yes	No	No	No	Yes	No	Unclear	Yes	Fair
Redman et al., 2017 ¹³⁴ SmartMoms	Yes	No	Yes	Yes	No	No	No	No	NR	Yes	Yes	Fair
Renault et al., 2014 ⁵⁸ TOP	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Good
Ronnberg et al., 2014 ¹³⁵	Yes	Yes	Yes	Yes	No	No	No	Yes	Yes	Yes	Yes	Fair
Ruiz et al., 2013 ¹³⁸	Yes	Unclear	Yes	Yes	Unclear	No	No	Yes	Yes	Yes	Yes	Fair
Sagedal et al., 2017 ¹³⁹ Norwegian Fit For Delivery	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	No	Yes	Yes	Good

Author, Year Study Name	Randomization adequate?	Allocation concealment adequate?	Groups similar at baseline?	Eligibility criteria specified?	Outcome assessors masked?	Care provider masked?	Patient masked?	Attrition and withdrawals reported?	Important loss to followup?	Analyze people in the groups in which they were randomized?	Funding source reported?	Quality Rating
Sagedal et al., 2017b ¹⁴⁰	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	No	Yes	Yes	Good
Seneviratne et al., 2016 ¹⁴¹	Yes	Yes	Yes	Yes	No	No	No	Yes	No	Yes	Yes	Good
Simmons et al., 2017 ¹⁴² DALI Lifestyle	Yes	Yes	Yes	Yes	Yes	Unclear	No	Yes	No	Yes	Yes	Good
Skouteris et al., 2016 ¹⁴³ HIPP	Yes	Yes	Yes	Yes	Yes	Unclear	Unclear	Yes	Yes	Yes	Yes	Fair
Smith et al., 2016 ¹⁴⁴	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes	Fair
Thomson et al., 2016 ¹⁴⁸ Delta Healthy Sprouts	Yes	Unclear	Yes	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Thomson et al., 2018 ¹⁴⁷	Yes	Unclear	Yes	Yes	No	Unclear	No	Yes	Yes	Yes	Yes	Fair
Van Horn et al., 2018 ¹⁴⁹ MOMFIT	Yes	Yes	No	Yes	Yes	No	Unclear	Yes	No	Yes	Yes	Fair
Vesco et al., 2014 ¹⁵⁰ Healthy Moms	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Vesco et al., 2016 ¹⁵¹	Yes	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Good
Vinter et al., 2011 ⁵⁹ LiP	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes	Fair
Vinter et al., 2014152	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes	Fair
Tanvig et al., 2014146	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes	Fair
Tanvig et al., 2015145	Yes	Yes	Yes	Yes	No	No	No	Yes	No	No	Yes	Fair
Willcox et al., 2017 ¹⁵³ txt4two	Yes	Yes	Unclear	Yes	Unclear	No	No	Yes	No	Yes	Yes	Fair
Wolff et al., 2008154	Unclear	Unclear	Yes	Yes	Unclear	Yes	No	Yes	Yes	Yes	Yes	Fair

Appendix C Table 2. Quality Assessment of Controlled Clinical Trials

Author, Year Study Name	Random or consecutive patient enrollment?	Groups comparable at baseline?	Accurate methods to find potential confounders and outcomes?	Outcome assessors and/or data analysts blinded?	Reporting of attrition?	Appropriate statistical analyses on potential confounders?	Important loss to followup?	Outcomes pre-specified and defined?	Funding source reported?	Quality Rating
Claesson et al., 2010 ⁸³	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Yes	Fair
Epel et al., 2019 ⁸⁹ MMT	Yes	Yes	Yes	Unclear	Yes	Yes	No	Yes	Yes	Good
Gray-Donald et al. 200096	Yes	Yes	Yes	Unclear	Unclear	Yes	Unclear	Yes	Yes	Fair
McGiveron et al., 2015 ¹¹⁵ Bumps and Beyond	Yes	No	Yes	Unclear	Yes	Yes	No	Yes	Yes	Fair
Appendix D Figure 1. Meta-Analysis of Trials: Mean Gestational Weight Gain by Intervention Intensity

Intervention Intensity and Author, Year	Population	Outcome Assessment Timepoint	Intervention Type			Mean Difference (95% CI)	Treatment, N, Mean (SD)	Control, N, Mean (SD)
Low Polley, 2002 Asbee, 2009 Rauh, 2013 Petrella, 2014 Ronnberg, 2014 Daley, 2015 McCarthy, 2016 Assaf-Balut, 2017 Daley, 2019 (adjusted MD) Subgroup (I-squared = 48.4%)	Mixed population Mixed population Overweight/Obese Mixed population Mixed population Overweight/Obese Mixed population Mixed population	36 wks to delivery Delivery 36 wks to delivery Delivery 36 wks to delivery 34-36 wks 36 wks to delivery 36 wks to delivery 36 wks to delivery	Counseling Counseling Counseling Counseling Counseling Counseling Counseling Counseling		-	$\begin{array}{c} 0.76 \ (-1.60, 3.12) \\ -3.10 \ (-5.66, -0.54) \\ -1.50 \ (-2.89, -0.11) \\ -1.60 \ (-4.45, 1.25) \\ -1.12 \ (-2.12, -0.12) \\ -0.10 \ (-2.59, 2.39) \\ -1.01 \ (-2.23, 0.21) \\ 0.50 \ (-0.10, 1.10) \\ -0.42 \ (-1.48, 0.64) \\ -0.64 \ (-1.44, 0.02) \end{array}$	57, 14.55 (7.15) 57, 13.00 (5.70) 167, 14.10 (4.10) 33, 8.80 (6.50) 192, 14.19 (4.45) 34, 12.00 (4.50) 159, 8.59 (5.38) 434, 9.90 (4.70) 305, 10.30 (5.90)	53, 13,78 (5.43) 43, 16.10 (7.00) 83, 15.60 (5.80) 30, 10.40 (5.00) 182, 15.31 (5.38) 34, 12.10 (5.90) 154, 9.60 (5.59) 440, 9.40 (4.30) 311, 10.70 (6.90)
Moderate Wolff, 2008 Luoto, 2011 Phelan, 2011 Harrison, 2013 Bogaerts, 2013 Althuizen, 2013 Dodd, 2014 Hawkins, 2014 Koivusalo, 2016 Skouteris, 2016 Smith, 2016 Smith, 2016 Smith, 2017 Peccei, 2017 Dison, 2018 (adjusted MD) Dodd, 2019 (adjusted MD) Al Wattar, 2019 (adjusted MD) Kunath, 2019 (adjusted MD) Subgroup (I-squared = 17.6%)	Obese Overweight/Obese Mixed population Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Obese Mixed population Overweight/Obese Overweight/Obese Obese Mixed population Normal weight Mixed population Mixed population Mixed population	34-36 wks 36 wks to delivery 28 wks Delivery 34-36 wks 36 wks to delivery Delivery Delivery 24-36 wks 34-36 wks 34-36 wks 36 wks to delivery 34-36 wks 36 wks to delivery 36 wks to delivery 36 wks to delivery 36 wks to delivery NR	Counseling Counseling	╶╌┿╦╴╩┝╬╝╢┿┱┱╪╾	- -	$\begin{array}{l} \textbf{-6}, 70 \ (-10.31, -3.09) \\ \textbf{-0}, 40 \ (-1.47, 0.67) \\ \textbf{-0}, 65 \ (-1.88, 0.58) \\ \textbf{-0}, 80 \ (-1.62, 0.03) \\ \textbf{-0}, 142 \ \textbf{-0}, 162 \ \textbf{-1}, 120 \ \textbf{-0}, 238 \ \textbf{-0}, 238 \ \textbf{-1}, 200 \ \textbf{-0}, 238 \ \textbf{-1}, 32 \ \textbf{-0}, 232 \ \textbf{-0}, 088 \ \textbf{-1}, 132 \ \textbf{-0}, 232 \ \textbf{-0}, 088 \ \textbf{-1}, 120 \ (-2.22, -0.68) \ \textbf{-0}, 09 \ (-0.79, 0.97) \ \textbf{-0}, 32 \ \textbf{-0}, 071 \ \textbf{-0}, 044 \ \textbf{-0}, 144 \ \textbf{-0}, 144 \ \textbf{-0}, 144 \ \textbf{-0}, 144 \ \textbf{-0}, 120 \ \textbf{-0}, 120 \ \textbf{-0}, 232 \ \textbf{-0}, 171 \ \textbf{-0}, 044 \ \textbf{-0}, 144 \ $	$\begin{array}{c} 23, 6.60 \ (5.50) \\ 219, 13.80 \ (5.80) \\ 179, 15.01 \ (5.75) \\ 121, 5.96 \ (2.83) \\ 134, 10.12 \ (6.91) \\ 123, 11.60 \ (4.10) \\ 1080, 9.39 \ (5.74) \\ 130, 12.82 \ (6.66) \\ 130, 12.82 \ (6.66) \\ 130, 12.82 \ (6.66) \\ 24, 13.60 \ (5.60) \\ 659, 9.50 \ (6.40) \\ 180, 11.20 \ (10.46) \\ 1257, 7.67 \ (4.53) \\ 1126, 13.73 \ (15.44) \\ 316, 11.30 \ (5.60) \\ 946, 14.10 \ (5.30) \end{array}$	$\begin{array}{c} 27, 13.30 \ (7.50) \\ 180, 14.20 \ (5.10) \\ 184, 15.66 \ (6.19) \\ 107, 6.76 \ (3.44) \\ 63, 13.50 \ (7.30) \\ 123, 11.10 \ (3.20) \\ 1072, 9.44 \ (5.77) \\ 35, 17.87 \ (3.49) \\ 125, 7.70 \ (3.67) \\ 131, 12.07 \ (6.76) \\ 21, 11.20 \ (5.10) \\ 62, 9.10 \ (6.70) \\ 92, 12.20 \ (6.14) \\ 79, 8.80 \ (4.70) \\ 563, 13.73 \ (10.68) \\ 313, 11.70 \ (3.80) \\ 555 \ (8.30 \ (6.40) \\ 939, 14.10 \ (5.20) \end{array}$
High Vinter, 2011 Haakstad, 2011 Barakat, 2012 Hui, 2012 Ruiz, 2013 Renault, 2014 Vesco, 2014 Barakat, 2014 Hui, 2014 Gesell, 2015 Garnaes, 2016 Herring, 2016 (adjusted MD) Seneviratne, 2016 Barakat, 2016 Redman, 2017 Daly, 2017 Cahill, 2018 Gallagher, 2018 Phelan, 2018 Van Horn, 2018 Barakat, 2019 Aguilar-Cordero, 2019 Barakat, 2019 Pelaez, 2019 Subgroup (I-squared = 13.0%)	Obese Mixed population Mixed population Mixed population Obese Obese Mixed population Mixed population Mixed population Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Overweight/Obese Mixed population Mixed population Mixed population Mixed population Mixed population Mixed population	34-36 wks 36 wks to delivery 26 wks to delivery 36 wks to delivery 36 wks to delivery PP 2 wks Delivery Delivery 36 wks to delivery 36 wks to delivery 36 wks to delivery 36 wks to delivery 34-36 wks 34-36 wks 34-36 wks 34-36 wks 34-36 wks 34-36 wks 36 wks to delivery 36 wks to delivery 37 wks to delivery 38 wks to delivery	Active Active Active Active Counseling Counseling Active Active Active Active Counseling Active Counseling Active Counseling Active Counseling Active Counseling Active Counseling Active Active Counseling Active Counseling Active Counseling Active Counseling Active Counseling Active Active Counseling Active Active Counseling Active Active Counseling Active Active Counseling Active Active Counseling Active Active Counseling Active Active Active Active Counseling Active Active Counseling Active Ac	╼╪╪╪╪╪╪╪┿┿┿┿┿┿┿┿┿┿┿┿┿		$\begin{array}{l} -2.10 \left(-3.18, -1.02 \right) \\ -0.80 \left(-2.33, 0.73 \right) \\ -1.30 \left(-2.66, 0.06 \right) \\ -1.10 \left(-2.80, 0.60 \right) \\ -1.30 \left(-1.81, -0.79 \right) \\ -1.90 \left(-3.07, -0.73 \right) \\ -1.90 \left(-3.07, -0.73 \right) \\ -1.28 \left(-3.45, 0.88 \right) \\ -1.32 \left(-3.47, 0.83 \right) \\ -1.32 \left(-3.47, 0.83 \right) \\ -1.32 \left(-3.44, 0.88 \right) \\ -3.10 \left(-6.09, -0.11 \right) \\ -1.20 \left(-3.73, 1.33 \right) \\ -0.80 \left(-1.38, -0.22 \right) \\ -3.77 \left(-7.22, -0.32 \right) \\ -1.70 \left(-4.28, 0.88 \right) \\ -1.40 \left(-2.36, -0.44 \right) \\ -1.59 \left(-2.98, -0.20 \right) \\ -1.78 \left(-2.98, -0.20 \right) \\ -1.80 \left(-3.50, -0.10 \right) \\ -2.00 \left(-3.41, -0.59 \right) \\ -1.20 \left(-3.68, -1.12 \right) \\ -1.00 \left(-1.78, -0.27 \right) \\ -2.90 \left(-4.68, -1.12 \right) \\ -1.10 \left(-1.82, -0.38 \right) \\ -2.20 \left(-3.09, -1.31 \right) \\ -1.47 \left(-1.78, -1.22 \right) \\ \end{array}$	123, 7.00 (4.14) 52, 13.00 (4.00) 40, 12.50 (3.20) 102, 14, 10 (6.00) 481, 11.90 (3.80) 284, 9.00 (6.36) 55, 5.00 (4.10) 107, 11.72 (4.06) 57, 13.99 (5.82) 68, 8.85 (5.57) 46, 10.50 (5.22) 33, 8.70 (6.60) 37, 12.00 (5.30) 382, 12.10 (3.70) 37, 9.03 (5.59) 45, 7.80 (4.70) 33, 6.20 (6.00) 296, 14.40 (6.20) 119, 8.05 (5.60) 97, 7.89 (4.07) 129, 9.40 (6.90) 140, 10.00 (6.00) 70, 12.70 (2.60) 227, 12.30 (3.60) 100, 9.70 (6.60) 65, 8.30 (4.95) 234, 12.20 (3.70) 100, 11.50 (3.50)	$\begin{array}{c} 115. 9.10 \ (4.36) \\ 53, 13.80 \ (4.00) \\ 43, 13.80 \ (3.10) \\ 88, 15.20 \ (5.90) \\ 481, 13.20 \ (4.30) \\ 141, 10.90 \ (5.52) \\ 57, 8.40 \ (4.70) \\ 93, 13.66 \ (9.62) \\ 56, 15.28 \ (5.92) \\ 67, 10.17 \ (7.06) \\ 45, 9.20 \ (7.99) \\ 33, 12.30 \ (6.40) \\ 37, 13.20 \ (5.80) \\ 383, 12.30 \ (6.40) \\ 37, 13.20 \ (5.80) \\ 383, 12.30 \ (6.40) \\ 17, 12.80 \ (6.18) \\ 46, 9.70 \ (3.90) \\ 36, 7.90 \ (4.80) \\ 295, 15.80 \ (5.70) \\ 121, 9.64 \ (5.40) \\ 99, 9.67 \ (4.17) \\ 127, 11.20 \ (7.00) \\ 140, 12.00 \ (6.00) \\ 70, 13.90 \ (4.30) \\ 202, 13.30 \ (4.10) \\ 101, 11.40 \ (6.30) \\ 64, 11.20 \ (5.35) \\ 222, 13.30 \ (4.10) \\ 201, 13.70 \ (4.10) \\ \end{array}$
				-5 0	5			
				Favors Treatment	Favors Co	ntrol		



Appendix D Figure 2. Meta-Analysis of Trials: Mean Gestational Weight Gain by BMI Category

Population and Author, Year	Outcome Assessment Timepoint	Intervention Type	Intervention Intensity		Mean Difference (95% CI)	Treatment, N, Mean (SD)	Control, N, Mean (SD)
Obese				_			
Wolff, 2008	34-36 wks	Counseling	Moderate		-6.70 (-10.31, -3.09)	23, 6.60 (5.50)	27, 13.30 (7.50)
Vinter, 2011	34-36 wks	Active	High		-2.10 (-3.18, -1.02)	123, 7.00 (4.14)	115, 9.10 (4.36)
Sogaens, 2013	Delivery	Counseling	Moderate		-3.38 (-5.53, -1.23)	134, 10.12 (6.91)	63, 13.50 (7.30) 43, 6.20 (2.50)
Hamson, 2013	28 WKS	Counseling	Moderate		0.70 (-0.71, 2.11)	52, 5.90 (3.50)	43, 5.20 (3.50)
Petrella, 2014 Repault, 2014	Delivery 36 w/s to delivery	Counseling	LOW		-3.40 (-0.50, -0.24)	18, 6.70 (4.30)	20, 10.10 (5.60)
Kenault, 2014	36 WKS to delivery	Counseling	High		-1.90 (-3.07, -0.73)	264, 9.00 (6.36) EE E 00 (4.10)	F7 8 40 (4 70)
Herring 2016 (adjusted MD)	26 wks to delivery	Counseling	High		-3.40 (-6.72 -0.09)	22, 7, 20 (5, 46)	20 10 60 (5 52)
Kohuselo 2016	Delivery	Counseling	Moderate		-0.10 (-1.12, 0.02)	144 7 60 (4.86)	125 7 70 (3.67)
McCarthy 2016	24-26 wkm	Counseling	Low		-1.27 (-2.24, 0.60)	P2 7 40 (6 14)	90 9 77 (6 62)
Accaf.Balut 2017	36 wks to delivery	Counseling	Low		-0.20 (-2.66, 2.26)	20 4 00 (4 50)	22 4 20 (3 50)
Daly 2017	34-36 wks	Active	High		-1.70 (-4.28, 0.88)	33 6 20 (6 00)	36 7 90 (4 80)
Peccei 2017	36 wks to delivery	Counseling	Moderate		-0.12 (-2.70, 2.46)	104, 10,48 (10,40)	52 10.60 (5.99)
Sanedal 2017	Delivery	Active	High		-3 10 (-7 79 1 59)	21 10 30 (9 00)	18 13 40 (5 80)
Simmons 2017	34-36 w/ce	Counseling	Moderate		-1.13 (-2.32, 0.06)	225 7 67 (4 53)	79 8 80 (4 70)
Gellacher 2018	Delivery	Counseling	High		-2.68 (-4.57 -0.79)	37 6 07 (4 24)	41 8 75 (4 27)
Kupath 2010 (adjusted MD)	ND	Counseling	Moderate		0.52 (-1.04, 2.08)	109 11 50 (6.90)	115 10 60 (6 50)
Okesene-Gafa 2019 (adjusted MD)	36 weeks to delivery	Counseling	High		-1 76 (-3 54 0 02)	100, 970 (6.60)	101 11 40 (6 30)
Subgroup (I-squared = 63.0%)	So meens to delivery	counseiing	1 1911	•	-1.63 (-2.45, -0.91)	100, 5.10 (0.00)	101, 11.40 (0.00)
Overweight				_			
Harrison, 2013	28 wks	Counseling	Moderate		-1.80 (-2.78, -0.82)	69. 6.00 (2.20)	64, 7,80 (3,40)
Petrella, 2014	Delivery	Counseling	Low		0.00 (-4.36, 4.36)	15, 11, 30 (7, 80)	10, 11, 30 (3,00)
Daley, 2015	36 wks to delivery	Counseling	Low		0.00 (-4.34, 4.34)	16, 11,60 (5,10)	15, 11.60 (7.00)
Herring, 2016 (adjusted MD)	36 wks to delivery	Counseling	High		-3.70 (-10.89, 3.49)	11, 12,40 (9,41)	13, 16, 10 (8, 38)
McCarthy, 2016	34-36 wks	Counseling	Low		-0.64 (-2.01, 0.73)	77, 9.86 (4.42)	74, 10,50 (4,20)
Assaf-Balut, 2017	36 wks to delivery	Counseling	Low		-0.40 (-1.36, 0.56)	85, 4,70 (3,40)	88, 5, 10 (3.00)
Peccei, 2017	36 wks to delivery	Counseling	Moderate		-2.10 (-4.97, 0.77)	76, 12,20 (9.85)	40, 14,30 (5.88)
Sagedal, 2017	Delivery	Active	High	_	-1.40 (-4.10, 1.30)	63, 15,30 (7,40)	49, 16,70 (7,10)
Gallagher, 2018	Delivery	Counseling	High		-1.32 (-2.69, 0.05)	60, 9.01 (3.55)	58, 10.33 (4.00)
Kunath, 2019 (adjusted MD)	NR	Counseling	Moderate		-0.26 (-1.14, 0.62)	230, 14.00 (6.00)	200, 14, 10 (5,50)
Subgroup (I-squared = 15.5%)		oounoonig	moderate	<u> </u>	-0.89 (-1.54, -0.32)	1001 1100 (0.00)	200, 1110 (0100)
Overweight/Obese							
Polley, 2002	36 wks to delivery	Counseling	Low	· +	3.50 (-0.25, 7.25)	27, 13.60 (7.20)	22, 10.10 (6.20)
Luoto, 2011	36 wks to delivery	Counseling	Moderate		-0.40 (-1.47, 0.67)	219, 13.80 (5.80)	180, 14.20 (5.10)
Phelan, 2011	36 wks to delivery	Counseling	Moderate		-0.40 (-2.52, 1.72)	87, 14.70 (6.90)	90, 15.10 (7.50)
Harrison, 2013	28 wks	Counseling	Moderate	-84-1	-0.80 (-1.62, 0.03)	121, 5.96 (2.83)	107, 6,76 (3,44)
Dodd, 2014	36 wks to delivery	Counseling	Moderate	T	-0.05 (-0.54, 0.44)	1080, 9.39 (5.74)	1072, 9,44 (5,77)
Hawkins, 2014	Delivery	Counseling	Moderate		-0.14 (-2.42, 2.14)	33, 17,73 (5,74)	35. 17.87 (3.49)
Hui. 2014	Delivery	Active	High		0.82 (-3.00, 4.64)	27, 15,21 (7.50)	29, 14,39 (7,05)
Petrella, 2014	Delivery	Counseling	Low		-1.60 (-4.45, 1.25)	33, 8,80 (6,50)	30, 10,40 (5,00)
Garnaes, 2016	Delivery	Active	High		1.30 (-1.48, 4.08)	46, 10.50 (5.22)	45, 9,20 (7,99)
Herring, 2016 (adjusted MD)	36 wks to delivery	Counseling	High		-3.10 (-6.09, -0.11)	33, 8,70 (6,60)	33, 12, 30 (6, 40)
McCarthy 2016	34-36 wks	Counseling	Low		-1.01 (-2.23, 0.21)	159, 8 59 (5 38)	154, 9.60 (5.59)
Seneviratne 2016	36 weeks to delivery	Active	High		-1.20 (-3.73, 1.33)	37, 12,00 (5,30)	37, 13 20 (5 80)
Bruno 2017	34-36 wks	Counseling	Moderate		0.40 (-1.85, 2.65)	69, 9,50 (6,40)	62.9.10 (6.70)
Peccei 2017	36 wks to delivery	Counseling	Moderate		-1.00 (-2.98, 0.98)	180, 11 20 (10,46)	92, 12, 20 (6, 14)
Redman 2017	34-36 wks	Counseling	High		-3 77 (-7 22 -0 32)	37, 9,03 (5,59)	17 12 80 (6 18)
Willcox 2017	34-36 wks	Counseling	High		-1.90 (-3.68 -0.12)	45 7 80 (4 70)	46 9 70 (3 90)
Cabill 2018	36 whe to delivery	Counseling	High		-1 59 (-2 98 -0 20)	119 8 05 (5 60)	121 9 64 (5 40)
Gallagher 2018	Delivery	Counseling	High	-	1 78 (-2.93 -0.63)	97 7 89 (4 07)	00 0 67 (4 17)
Phelan 2018	34-36 w/cs	Active	High	- T	-1.80 (-3.50 -0.10)	129 9 40 (6 90)	127 11 20 (7 00)
Van Horn, 2018	34-36 wks	Counceling	High		-2.00 (-3.41 -0.50)	140, 10,00 (6,00)	140, 12:00 (6:00)
Subgroup (I-squared = 31.1%)	34-30 WKS	Counseiing	ngu		-0.90 (-1.38, -0.46)	140, 10.00 (0.00)	140, 12.00 (0.00)
Mixed population							
Polley 2002	36 wks to delivery	Counseling	Low		0.76 (-1.60, 3.12)	57.14.55 (7.15)	53, 13, 78 (5, 43)
Asbee, 2009	Delivery	Counseling	Low	[_] ⁻	-3.10 (-5.66, -0.54)	57, 13.00 (5.70)	43, 16, 10 (7,00)
Haakstad, 2011	36 wks to delivery	Active	High	- <u> </u>	-0.80 (-2.33, 0.73)	52, 13,00 (4,00)	53, 13,80 (4,00)
Phelan 2011	36 wks to delivery	Counseling	Moderate		-0.65 (-1.88, 0.58)	179, 15,01 (5,75)	184, 15,66 (6,19)
Barakat, 2012	36 wks to delivery	Active	High		-1.30 (-2.66, 0.06)	40. 12.50 (3.20)	43, 13,80 (3,10)
Hui 2012	Delivery	Active	High		-1 10 (-2 80, 0.60)	102 14 10 (6 00)	88 15 20 (5 90)
Althuizen 2013	34-36 wks	Counseling	Moderate		0.50 (-0.42, 1.42)	123 11 60 (4.10)	123 11 10 (3 20)
Raub. 2013	36 wks to delivery	Counseling	Low		-1.50 (-2.89, -0.11)	167, 14, 10 (4, 10)	83, 15.60 (5.80)
Ruiz 2013	36 wks to delivery	Active	High	-	-1.30 (-1.81, -0.79)	481, 11.90 (3.80)	481, 13, 20 (4, 30)
Barakat 2014	Delivery	Active	High		-1 94 (-4.04, 0.16)	107 11 72 (4 06)	93 13 66 (9 62)
Hui 2014	Delivery	Active	High		-1.24 (-4.04, 0.10)	57 13 00 /5 82)	56 15 28 (5 92)
Ronnbern 2014	Delivery	Counseling	Low		-1.12 (-2.12 -0.12)	102 14 10 (4 45)	182 15 31 (5 38)
Dalay 2015	36 wks to delivery	Courseling	Low		0.10 (-2.50. 2.30)	34, 12,00 (4,60)	34 12 10 (5 00)
Gesell 2015	36 wks to delivery	Active	Hinb		-1 32 (-3.47 0.82)	68 8 85 (5 57)	67 10 17 (7.06)
Barakat 2016	36 wire to delivery	Active	High		-0.80 (-1.38 -0.22)	382 12 10 (3 70)	383 12 90 (4 50)
Skouterie 2016	34-36 wke	Counseling	Moderate		0.75 (-0.88, 2.38)	130 12 82 (6.66)	131 12 07 (6 76)
Smith 2016	34-30 WKS	Counseling	Moderate	TT	2 40 (0 73 5 53)	130, 12.02 (0.00)	21 11 20 (5.10)
Annot Polyt 2017	34-36 WKS	Courseiing	woderate		2.40 (-0.73, 5.53)	24, 13.60 (5.60)	21, 11.20 (5.10)
Assar-Balut, 2017	Jo wks to delivery	Counseiing	LOW		0.50 (-0.10, 1.10)	434, 9.90 (4.70)	440, 9.40 (4.30) 205, 45.80 (5.70)
Sageual, 2017	Delivery	Active	nign		-1.40 (-2.35, -0.44)	290, 14.40 (0.20)	295, 15.80 (5.70)
Bacchi, 2018	30 WKS to delivery	Active	nigh		-1.20 (-2.38, -0.02)	70, 12.70 (2.60)	70, 13.90 (4.30)
Barakat, 2018	36 wks to delivery	Active	rligh	- - -	-1.00 (-1.73, -0.27)	227, 12.30 (3.60)	202, 13.30 (4.10)
Olson, 2018 (adjusted MD)	36 wks to delivery	Counseling	moderate		0.10 (-0.57, 0.77)	1126, 13.73 (15.44)	563, 13.73 (10.68)
Aguilar-Cordero, 2019	36 weeks to delivery	Active	High		-2.90 (-4.68, -1.12)	65, 8.30 (4.95)	64, 11.20 (5.35)
AI wattar, 2019 (adjusted MD)	36 weeks to delivery	Counseling	Moderate	-5-1	-1.20 (-2.22, -0.18)	553, 6.80 (5.60)	585, 8.30 (6.40)
Barakat, 2019	36 weeks to delivery	Active	High		-1.10 (-1.82, -0.38)	234, 12.20 (3.70)	222, 13.30 (4.10)
Daley, 2019 (adjusted MD)	36 wks to delivery	Counseling	Low		-0.42 (-1.48, 0.64)	305, 10.30 (5.90)	311, 10.70 (6.90)
Kunath, 2019 (adjusted MD)	NR	Counseling	Moderate	_ 1+	0.09 (-0.79, 0.97)	946, 14.10 (5.30)	939, 14.10 (5.20)
Pelaez, 2019	36 wks to delivery	Active	High	!	-2.20 (-3.09, -1.31)	100, 11.50 (3.50)	201, 13.70 (4.10)
Subgroup (I-squared = 60.7%)				•	-0.81 (-1.16, -0.46)		
				r			
				-5 0 5			
			I	Favors Treatment Favors C	Control		

Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; N = number; NR = not reported; SD = standard deviation.

Appendix D Figure 3. Meta-Analysis of Trials: Mean Gestational Weight Gain by Intervention Type

Active finter, 2011 łaakstad, 2011 iarakat, 2012 lui: 2012	Obese						
laakstad, 2011 Jarakat, 2012 Jui 2012	00030	34-36 wke	High		-2.10/-3.19 -1.02	123 7 00 /4 44	115 0 10 /4 26)
Jarakat, 2012	Mixed peoulation	34-30 WKS	High		-2.10 (-3.16, -1.02)	123, 7.00 (4.14)	F2 42 90 (4.00)
lui 2012	Mixed population	36 wks to delivery	High		-0.80 (-2.85, 0.75)	52, 13.00 (4.00)	42, 12,00 (4,00)
10 2012	Mixed population	36 wks to delivery	High		-1.30 (-2.66, 0.06)	40, 12.50 (3.20)	43, 13.80 (3.10)
101, 2012	Mixed population	Delivery	High		-1.10 (-2.80, 0.60)	102, 14.10 (6.00)	88, 15.20 (5.90)
luiz, 2013	Mixed population	36 wks to delivery	High		-1.30 (-1.81, -0.79)	481, 11.90 (3.80)	481, 13.20 (4.30)
arakat, 2014	Mixed population	Delivery	High		-1.94 (-4.04, 0.16)	107, 11.72 (4.06)	93, 13.66 (9.62)
lui, 2014	Mixed population	Delivery	High	_ _	-1.28 (-3.45, 0.88)	57, 13.99 (5.82)	56, 15.28 (5.92)
Jesell, 2015	Mixed population	36 wks to delivery	High	_ _	-1.32 (-3.47, 0.83)	68, 8.85 (5.57)	67, 10.17 (7.06)
Jarnaes, 2016	Overweight/Obese	Delivery	High	·	1.30 (-1.48, 4.08)	46, 10.50 (5.22)	45, 9.20 (7.99)
eneviratne, 2016	Overweight/Obese	36 wks to delivery	High		-1.20 (-3.73, 1.33)	37, 12,00 (5,30)	37, 13, 20 (5, 80)
karakat 2016	Mixed population	36 wks to delivery	High	74	-0.80 (-1.38 -0.22)	382 12 10 (3 70)	383 12 90 (4 50)
alu 2017	Obeco	34-36 wks	High		-1 70 (-4.28, 0.88)	33 6 20 (6 00)	36 7 90 (4 80)
agedel 2017	Mixed population	Delivery	High		1 40 (2 26, 0.00)	206 14 40 (6 20)	205 15 90 (5 70)
agedal, 2017	Mixed population	Delivery	nign		-1.40 (-2.30, -0.44)	290, 14.40 (0.20)	295, 15.60 (5.70)
nelan, 2018	Overweight/Obese	34-36 WKS	High		-1.80 (-3.50, -0.10)	129, 9.40 (6.90)	127, 11.20 (7.00)
acchi, 2018	Mixed population	36 wks to delivery	High		-1.20 (-2.38, -0.02)	70, 12.70 (2.60)	70, 13.90 (4.30)
arakat, 2018	Mixed population	36 wks to delivery	High		-1.00 (-1.73, -0.27)	227, 12.30 (3.60)	202, 13.30 (4.10)
guilar-Cordero, 2019	Mixed population	36 wks to delivery	High		-2.90 (-4.68, -1.12)	65, 8.30 (4.95)	64, 11.20 (5.35)
Jarakat, 2019	Mixed population	36 wks to delivery	High		-1.10 (-1.82, -0.38)	234, 12.20 (3.70)	222, 13.30 (4.10)
elaez, 2019	Mixed population	36 wks to delivery	High		-2.20 (-3.09, -1.31)	100, 11.50 (3.50)	201, 13,70 (4,10)
subgroup (I-squared = 2.2%)		,		•	-1.29 (-1.60, -1.04)	,	,
ounseling							50 40 70 45 40
olley, 2002	mixed population	36 WKS to delivery	LOW		0.76 (-1.60, 3.12)	57, 14.55 (7.15)	53, 13.78 (5.43)
Volff, 2008	Obese	34-36 wks	Moderate	- 1	-6.70 (-10.31, -3.09)	23, 6.60 (5.50)	27, 13.30 (7.50)
sbee, 2009	Mixed population	Delivery	Low —		-3.10 (-5.66, -0.54)	57, 13.00 (5.70)	43, 16.10 (7.00)
uoto, 2011	Overweight/Obese	36 wks to delivery	Moderate		-0.40 (-1.47, 0.67)	219, 13.80 (5.80)	180, 14.20 (5.10)
helan, 2011	Mixed population	36 wks to delivery	Moderate		-0.65 (-1.88, 0.58)	179, 15.01 (5.75)	184, 15,66 (6,19)
larrison, 2013	Overweight/Obese	28 wks	Moderate		-0.80 (-1.62, 0.03)	121, 5.96 (2.83)	107. 6.76 (3.44)
konserts 2013	Ohese	Delivery	Moderate		-3 38 (-5 53 -1 23)	134 10 12 (6 91)	63 13 50 (7 30)
Ithuizon 2013	Mixed population	24-26 wkc	Moderate		0.50 (0.42 1 42)	122 11 60 (4 10)	122 11 10 (2 20)
Jaub 2012	Mixed population	26 who to dolivery	low		1.50 (2.80, 0.11)	167 14 10 (4 10)	92 15 60 /5 90)
auri, 2013	Mixed population	36 wks to delivery	Madarata		-1.50 (-2.69, -0.11)	107, 14.10 (4.10)	4070 0 44 (5 77)
Jodd, 2014	Overweight/Obese	36 wks to delivery	Moderate		-0.05 (-0.54, 0.44)	1080, 9.39 (5.74)	1072, 9.44 (5.77)
lawkins, 2014	Overweight/Obese	Delivery	Moderate		-0.14 (-2.42, 2.14)	33, 17.73 (5.74)	35, 17.87 (3.49)
etrella, 2014	Overweight/Obese	Delivery	Low	_ ;	-1.60 (-4.45, 1.25)	33, 8.80 (6.50)	30, 10.40 (5.00)
tenault, 2014	Obese	36 wks to delivery	High		-1.90 (-3.07, -0.73)	284, 9.00 (6.36)	141, 10.90 (5.52)
/esco, 2014	Obese	PP 2 wks	High -		-3.40 (-5.03, -1.77)	55, 5.00 (4.10)	57, 8.40 (4.70)
connberg, 2014	Mixed population	Delivery	Low		-1.12 (-2.12, -0.12)	192, 14, 19 (4, 45)	182, 15.31 (5.38)
aley 2015	Mixed population	36 wks to delivery	Low		-0.10 (-2.59, 2.39)	34 12 00 (4 50)	34 12 10 (5 90)
erring, 2016 (adjusted MD)	Overweight/Obese	36 wks to delivery	High -		-3.10 (-6.09, -0.11)	33 8 70 (6 60)	33, 12, 30 (6, 40)
AcCarthy 2016	Overweight/Obese	34-36 wks	Low		-1.01 (-2.23, 0.21)	159 8 59 (5 38)	154 9 60 (5 59)
(eiuueele, 2016	Obeac	Delivery	Mederate		0.40 (4.42, 0.02)	144 7 60 (4 96)	105, 7, 70 (2, 67)
olvusalo, 2016	Obese	Delivery	Moderate		-0.10 (-1.12, 0.92)	144, 7.60 (4.66)	125, 7.70 (3.67)
kouleris, 2016	wixed population	34-36 WKS	woderate		0.75 (-0.88, 2.38)	130, 12.82 (6.66)	131, 12.07 (6.76)
mith, 2016	Mixed population	34-36 wks	Moderate	· · · · · · · · · · · · · · · · · · ·	2.40 (-0.73, 5.53)	24, 13.60 (5.60)	21, 11.20 (5.10)
iruno, 2017	Overweight/Obese	34-36 wks	Moderate		0.40 (-1.85, 2.65)	69, 9.50 (6.40)	62, 9.10 (6.70)
'eccei, 2017	Overweight/Obese	36 wks to delivery	Moderate	0	-1.00 (-2.98, 0.98)	180, 11.20 (10.46)	92, 12.20 (6.14)
tedman, 2017	Overweight/Obese	34-36 wks	High		-3.77 (-7.22, -0.32)	37, 9.03 (5.59)	17, 12.80 (6.18)
Villcox, 2017	Overweight/Obese	34-36 wks	High		-1.90 (-3.68, -0.12)	45, 7,80 (4,70)	46, 9,70 (3,90)
immons, 2017	Obese	34-36 wks	Moderate		-1.13 (-2.32, 0.06)	225, 7.67 (4.53)	79.8.80 (4.70)
ssaf-Balut 2017	Mixed nonulation	36 wks to delivery	low	7 🖿	0.50 (-0.10, 1.10)	434 9 90 (4 70)	440 9 40 (4 30)
abill 2019	Overweight/Obere	36 wks to delivery	High		-1.50 (-2.09 -0.20)	110 8 05 (5 60)	121 0 64 (5 40)
allin, 2018	Overweight/Obese	So wks to delivery	nigii Liak	- 1	-1.39 (-2.96, -0.20)	119, 8.05 (5.00)	121, 9.04 (5.40)
Janagher, 2018	Overweight/Obese	Delivery	nign	T	-1.78 (-2.93, -0.63)	97, 7.89 (4.07)	99, 9.67 (4.17)
an Horn, 2018	Overweight/Obese	34-36 Wks	High		-2.00 (-3.41, -0.59)	140, 10.00 (6.00)	140, 12.00 (6.00)
Ison, 2018 (adjusted MD)	Mixed population	36 wks to delivery	Moderate	_; 🖝	0.10 (-0.57, 0.77)	1126, 13.73 (15.44)	563, 13.73 (10.68)
kesene-Gafa, 2019 (adjusted MD)	Obese	36 wks to delivery	High		-1.76 (-3.54, 0.02)	100, 9.70 (6.60)	101, 11.40 (6.30)
odd, 2019 (adjusted MD)	Normal weight	36 wks to delivery	Moderate	<u> </u>	-0.37 (-0.97, 0.23)	316, 11.30 (4.00)	313, 11.70 (3.80)
Wattar, 2019 (adjusted MD)	Mixed population	36 wks to delivery	Moderate		-1.20 (-2.22, -0.18)	553, 6.80 (5.60)	585, 8,30 (6,40)
aley 2019 (adjusted MD)	Mixed population	36 wks to delivery	Low	4	-0.42 (-1.48, 0.64)	305 10 30 (5 90)	311 10 70 (6 90)
(unath 2019 (adjusted MD)	Mixed population	NR	Moderate	1	0.09 (-0.79, 0.97)	946 14 10 (5 30)	939 14 10 (5 20)
Subgroup (I-squared = 66.0%)	wixed population	1113	modelate	<u>ه</u> ۲	-0.86 (-1.27, -0.50)	340, 14.10 (3.30)	353, 14.10 (5.20)
ubgroup (I-squared = 66.0%)				•	-0.86 (-1.27, -0.50)		
			-5				
					a start		

Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; N = number; NR = not reported; SD = standard deviation.

Appendix D Figure 4. Meta-Analysis of Trials: Mean Gestational Weight Gain by Intervention Quality

Quality Rating and Author, Year	Population	Outcome Assessment Timepoint	Intervention Type	Intervention Intensity		Mean Difference (95% CI)	Treatment, N, Mean (SD)	Control, N, Mean (SD)
Good Luoto, 2011	Overweight/Obese	36 wks to delivery	Counseling	Moderate	-	-0.40 (-1.47, 0.67)	219, 13.80 (5.80)	180, 14.20 (5.10)
Harrison, 2013	Overweight/Obese	28 wks	Counseling	Moderate		-0.80 (-1.62, 0.03)	121, 5.96 (2.83)	107, 6.76 (3.44)
Althuizen, 2013	Mixed population	34-36 wks	Counseling	Moderate		0.50 (-0.42, 1.42)	123, 11.60 (4.10)	123, 11.10 (3.20)
Dodd, 2014	Overweight/Obese	36 wks to delivery	Counseling	Moderate	1 . 	-0.05 (-0.54, 0.44)	1080, 9.39 (5.74)	1072, 9.44 (5.77)
Renault, 2014	Obese	36 wks to delivery	Counseling	High		-1.90 (-3.07, -0.73)	284, 9.00 (6.36)	141, 10.90 (5.52)
Vesco, 2014	Obese	PP 2 wks	Counseling	High		-3.40 (-5.03, -1.77)	55, 5.00 (4.10)	57, 8.40 (4.70)
McCarthy, 2016	Overweight/Obese	34-36 wks	Counseling	Low	-0+	-1.01 (-2.23, 0.21)	159, 8.59 (5.38)	154, 9.60 (5.59)
Seneviratne, 2016	Overweight/Obese	36 wks to delivery	Active	High	<u>_</u>	-1.20 (-3.73, 1.33)	37, 12.00 (5.30)	37, 13.20 (5.80)
Simmons, 2017	Obese	34-36 wks	Counseling	Moderate		-1.13 (-2.32, 0.06)	225, 7.67 (4.53)	79, 8.80 (4.70)
Assaf-Balut, 2017	Mixed population	36 wks to delivery	Counseling	Low		0.50 (-0.10, 1.10)	434, 9.90 (4.70)	440, 9.40 (4.30)
Sagedal, 2017	Mixed population	Delivery	Active	High		-1.40 (-2.36, -0.44)	296, 14.40 (6.20)	295, 15.80 (5.70)
Caniii, 2018	Overweight/Obese	36 WKs to delivery	Counseling	High	1	-1.59 (-2.98, -0.20)	119, 8.05 (5.60)	121, 9.64 (5.40)
Dedd, 2010 (editated MD)	Ubese Normal weight	36 wks to delivery	Counseling	High Mederate		-1.76 (-3.54, 0.02)	100, 9.70 (6.60)	101, 11.40 (0.30)
Subgroup (I-squared = 73.3%)	Normal weight	30 wks to delivery	Counseling	Moderate		-0.82 (-1.42, -0.31)	316, 11.30 (4.00)	313, 11.70 (3.60)
Fair								
Polley, 2002	Mixed population	36 wks to delivery	Counseling	Low	_ +=	0.76 (-1.60, 3.12)	57, 14.55 (7.15)	53, 13.78 (5.43)
/volff, 2008	Obese	34-36 wks	Counseling	Moderate		-6.70 (-10.31, -3.09)	23, 6.60 (5.50)	27, 13.30 (7.50)
Asbee, 2009	Mixed population	Delivery	Counseling	Low		-3.10 (-5.66, -0.54)	57, 13.00 (5.70)	43, 16.10 (7.00)
Vinter, 2011	ODese Mixed population	34-36 WKS	Active	High		-2.10 (-3.18, -1.02)	123, 7.00 (4.14)	115, 9.10 (4.36)
Delan 2011	Mixed population	36 wks to delivery	Counceling	nigh Moderate		-0.80 (-2.33, 0.73)	52, 13.00 (4.00) 170, 15.01 (5.75)	53, 13.80 (4.00) 184, 15.66 (6.40)
Phelan, 2011 Resekt 2012	Mixed population	30 wks to delivery	Active	Woderate		-0.05 (-1.00, 0.06)	179, 15.01 (5.75)	104, 10.00 (0.19)
Barakat, 2012	Mixed population	Delivery	Active	High		-1.30 (-2.80, 0.00)	40, 12.50 (3.20)	43, 13.80 (3.10) 88, 15.20 (5.90)
Rogaerts 2013	Ohese	Delivery	Counseling	Moderate		-3.38 (-5.53, -1.23)	134 10 12 (6 91)	63 13 50 (7 30)
Rauh, 2013	Mixed population	36 wks to delivery	Counseling	Low		-1.50 (-2.89, -0.11)	167, 14, 10 (4, 10)	83, 15.60 (5.80)
Ruiz, 2013	Mixed population	36 wks to delivery	Active	High		-1.30 (-1.81, -0.79)	481, 11.90 (3.80)	481, 13.20 (4.30)
Hawkins, 2014	Overweight/Obese	Delivery	Counseling	Moderate		-0.14 (-2.42, 2.14)	33, 17.73 (5.74)	35, 17.87 (3.49)
Petrella, 2014	Overweight/Obese	Delivery	Counseling	Low		-1.60 (-4.45, 1.25)	33, 8.80 (6.50)	30, 10.40 (5.00)
Barakat, 2014	Mixed population	Delivery	Active	High		-1.94 (-4.04, 0.16)	107, 11.72 (4.06)	93, 13.66 (9.62)
Hui, 2014	Mixed population	Delivery	Active	High		-1.28 (-3.45, 0.88)	57, 13.99 (5.82)	56, 15.28 (5.92)
Ronnberg, 2014	Mixed population	Delivery	Counseling	Low	-81-1	-1.12 (-2.12, -0.12)	192, 14.19 (4.45)	182, 15.31 (5.38)
Daley, 2015	Mixed population	36 wks to delivery	Counseling	Low		-0.10 (-2.59, 2.39)	34, 12.00 (4.50)	34, 12.10 (5.90)
Gesell, 2015	Mixed population	36 wks to delivery	Active	High		-1.32 (-3.47, 0.83)	68, 8.85 (5.57)	67, 10.17 (7.06)
Garnaes, 2016	Overweight/Obese	Delivery	Active	High		1.30 (-1.48, 4.08)	46, 10.50 (5.22)	45, 9.20 (7.99)
Herring, 2016 (adjusted MD)	Overweight/Obese	36 wks to delivery	Counseling	High		-3.10 (-6.09, -0.11)	33, 8.70 (6.60)	33, 12.30 (6.40)
Koivusalo, 2016	Obese	Delivery	Counseling	Moderate		-0.10 (-1.12, 0.92)	144, 7.60 (4.86)	125, 7.70 (3.67)
Barakat, 2016	Mixed population	36 wks to delivery	Active	High		-0.80 (-1.38, -0.22)	382, 12.10 (3.70)	383, 12.90 (4.50)
Skouteris, 2016	Mixed population	34-36 wks	Counseling	Moderate		0.75 (-0.88, 2.38)	130, 12.82 (6.66)	131, 12.07 (6.76)
Smith, 2016	Mixed population	34-36 WKS	Counseling	Moderate		2.40 (-0.73, 5.53)	24, 13.60 (5.60)	21, 11.20 (5.10)
Bruno, 2017	Overweight/Obese	34-36 WKS	Counseling	Moderate		0.40 (-1.85, 2.65)	69, 9.50 (6.40) 480, 44.20 (40,46)	62, 9.10 (6.70)
Peccel, 2017 Rodman, 2017	Overweight/Obese	30 wks to delivery	Counseling	High		-1.00 (-2.90, 0.90)	27 0.02 (5.60)	92, 12.20 (0.14)
Willow 2017	Overweight/Obese	34-30 WKS	Counseling	High		-3.77 (-7.22, -0.32)	37, 9.03 (5.59) 45, 7.90 (4.70)	46 9 70 (2 90)
Daly 2017	Obese	34-36 wks	Active	High		-1.20 (-3.00, -0.12)	33 6 20 (6 00)	36 7 90 (4 80)
Gallagher 2018	Overweight/Obese	Delivery	Counseling	High		-1.78 (-2.93 -0.63)	97 7 89 (4 07)	99, 9, 67 (4, 17)
Phelan, 2018	Overweight/Obese	34-36 wks	Active	High		-1.80 (-3.50, -0.10)	129. 9.40 (6.90)	127, 11,20 (7,00)
Van Horn, 2018	Overweight/Obese	34-36 wks	Counseling	High		-2.00 (-3.41, -0.59)	140, 10.00 (6.00)	140, 12.00 (6.00)
Bacchi, 2018	Mixed population	36 wks to delivery	Active	High		-1.20 (-2.38, -0.02)	70, 12.70 (2.60)	70, 13.90 (4.30)
Barakat, 2018	Mixed population	36 wks to delivery	Active	High		-1.00 (-1.73, -0.27)	227, 12.30 (3.60)	202, 13.30 (4.10)
Olson, 2018 (adjusted MD)	Mixed population	36 wks to delivery	Counseling	Moderate	7 4	0.10 (-0.57, 0.77)	1126, 13.73 (15.44)	563, 13.73 (10.68)
Aguilar-Cordero, 2019	Mixed population	36 wks to delivery	Active	High	 (T	-2.90 (-4.68, -1.12)	65, 8.30 (4.95)	64, 11.20 (5.35)
Al Wattar, 2019 (adjusted MD)	Mixed population	36 wks to delivery	Counseling	Moderate		-1.20 (-2.22, -0.18)	553, 6.80 (5.60)	585, 8.30 (6.40)
Barakat, 2019	Mixed population	36 wks to delivery	Active	High	₽	-1.10 (-1.82, -0.38)	234, 12.20 (3.70)	222, 13.30 (4.10)
Daley, 2019 (adjusted MD)	Mixed population	36 wks to delivery	Counseling	Low		-0.42 (-1.48, 0.64)	305, 10.30 (5.90)	311, 10.70 (6.90)
Kunath, 2019 (adjusted MD)	Mixed population	NR	Counseling	Moderate		0.09 (-0.79, 0.97)	946, 14.10 (5.30)	939, 14.10 (5.20)
Pelaez, 2019	Mixed population	36 wks to delivery	Active	High		-2.20 (-3.09, -1.31)	100, 11.50 (3.50)	201, 13.70 (4.10)
Subgroup (I-squared = 45.7%)					•	-1.11 (-1.42, -0.81)		
						1		
					-5	5		
					Favors Treatment	avors Control		



Appendix D Figure 5. Meta-Analysis of Trials: Mean Gestational Weight Gain by Outcome Assessment Timepoint

Outcome Assessment Timepoint and Author, Year	Population	Intervention Type	Intervention Intensity	Mean Difference (95% CI)	Treatment, N, Mean (SD)	Control, N, Mean (SD)
28 wks Harrison, 2013 Subgroup (I-squared =NA)	Overweight/Obese	Counseling	Moderate 🗲	-0.80 (-1.62, 0.03) -0.80 (-1.62, 0.03)	121, 5.96 (2.83)	107, 6.76 (3.44)
34-36 wks Wolff, 2008 Vinter, 2011 Althuizen, 2013 McCarthy, 2016 Skouteris, 2016 Bruno, 2017 Redman, 2017 Willcox, 2017 Daly, 2017 Simmons, 2017 Phelan, 2018 Van Horn, 2018 Subgroup (I-squared = 66.9%)	Obese Obese Mixed population Overweight/Obese Mixed population Mixed population Overweight/Obese Overweight/Obese Obese Obese Obese Overweight/Obese Overweight/Obese	Counseling Active Counseling Counseling Counseling Counseling Counseling Active Counseling Active Counseling	Moderate	-6.70 (-10.31, -3.09) -2.10 (-3.18, -1.02) 0.50 (-0.42, 1.42) -1.01 (-2.23, 0.21) 0.75 (-0.88, 2.38) -240 (-0.73, 5.53) 0.40 (-1.85, 2.65) -3.77 (-7.22, -0.32) -1.90 (-3.68, 0.12) -1.70 (-4.28, 0.88) -1.13 (-2.32, 0.06) -1.80 (-3.50, -0.10) -2.00 (-3.41, -0.59) -1.16 (-2.13, -0.29)	$\begin{array}{c} 23, 6.60 \ (5.50) \\ 123, 7.00 \ (4.14) \\ 123, 11.60 \ (4.10) \\ 159, 8.59 \ (5.38) \\ 130, 12.82 \ (6.66) \\ 24, 13.60 \ (5.60) \\ 69, 9.50 \ (6.40) \\ 37, 9.03 \ (5.59) \\ 45, 7.80 \ (4.70) \\ 33, 6.20 \ (6.00) \\ 225, 7.67 \ (4.53) \\ 129, 9.40 \ (6.90) \\ 140, 10.00 \ (6.00) \end{array}$	$\begin{array}{c} 27,13.30(7.50)\\ 115,9.10(4.36)\\ 123,11.10(3.20)\\ 154,9.60(5.59)\\ 131,12.07(6.76)\\ 211,11.20(6.76)\\ 211,11.20(6.18)\\ 46,9.70(3.90)\\ 36,7.90(4.80)\\ 36,7.90(4.80)\\ 179,8.80(4.70)\\ 127,11.20(7.00)\\ 140,12.00(6.00)\\ \end{array}$
36 wks to delivery Polley, 2002 Luoto, 2011 Haakstad, 2011 Phelan, 2011 Barakat, 2012 Rauh, 2013 Dodd, 2014 Renault, 2014 Daley, 2015 Gesell, 2015 Herring, 2016 (adjusted MD) Seneviratne, 2016 Barakat, 2016 Barakat, 2017 Cahill, 2018 Bachi, 2018 Barakat, 2018 Barakat, 2018 Barakat, 2018 Barakat, 2018 Barakat, 2018 Dison, 2018 (adjusted MD) Dodd, 2019 (adjusted MD) Dodd, 2019 (adjusted MD) Barakat, 2019 Ai Wattar, 2019 (adjusted MD) Barakat, 2019 Daley, 2019 (adjusted MD) Palaez, 2019 Subgroup (I-squared = 59.9%)	Mixed population Overweight/Obese Mixed population Mixed population Mixed population Mixed population Overweight/Obese Obese Mixed population Overweight/Obese Mixed population Overweight/Obese Mixed population Overweight/Obese Mixed population Mixed population	Counseling Counseling Active Counseling Active Counseling Active Counseling Counseling Counseling Active Counseling Counseling Active Counseling Active Counseling Counseling Active	Low Moderate High Low High	$\begin{array}{c} 0.76 \left(-1.60, 3.12\right) \\ -0.40 \left(-1.47, 0.67\right) \\ -0.80 \left(-2.33, 0.73\right) \\ -0.65 \left(-1.88, 0.58\right) \\ -1.50 \left(-2.89, -0.11\right) \\ -1.30 \left(-1.81, -0.79\right) \\ -0.05 \left(-0.54, 0.44\right) \\ -1.90 \left(-307, -0.73\right) \\ -0.10 \left(-2.59, 2.39\right) \\ -1.32 \left(-347, 0.83\right) \\ -3.10 \left(-6.09, -0.11\right) \\ -1.20 \left(-3.73, 1.33\right) \\ -0.80 \left(-1.38, -0.22\right) \\ -1.00 \left(-2.98, 0.98\right) \\ 0.50 \left(-0.10, 1.10\right) \\ -1.59 \left(-2.98, -0.20\right) \\ -1.50 \left(-2.98, -0.20\right) \\ -1.50 \left(-2.98, -0.20\right) \\ -1.50 \left(-2.98, -0.20\right) \\ -1.50 \left(-2.98, -0.20\right) \\ -1.20 \left(-2.88, -0.02\right) \\ -1.56 \left(-2.86, -1.12\right) \\ -2.56 \left(-4.86, -1.12\right) \\ -2.56 \left(-4.86, -1.12\right) \\ -1.20 \left(-2.22, -0.18\right) \\ -1.10 \left(-1.22, -0.38\right) \\ -0.42 \left(-1.44, 0.64\right) \\ -2.20 \left(-3.09, -1.31\right) \\ -0.58 \left(-1.24, -0.58\right) \\ \end{array}$	$\begin{array}{c} 57,14.55(7.15)\\ 219,13.80(5.80)\\ 52,13.00(4.00)\\ 179,15.01(5.75)\\ 40,12.50(3.20)\\ 167,14.10(4.10)\\ 481,11.90(3.80)\\ 1080,9.39(5.74)\\ 284,9.00(6.36)\\ 34,12.00(4.50)\\ 638,885(5.57)\\ 33,8.70(6.60)\\ 37,12.00(5.30)\\ 382,12.10(3.70)\\ 180,1120(10.46)\\ 434,9.90(4.70)\\ 119,8.05(5.60)\\ 70,12.70(2.60)\\ 227,12.30(3.60)\\ 1128,13.73(15.44)\\ 100,9.70(6.80)\\ 316,11.30(4.00)\\ 55,8.30(4.95)\\ 55,6.80(5.90)\\ 234,12.20(3.70)\\ 305,(0.30(5.90)\\ 100,17.0(3.50)\\ \end{array}$	$\begin{array}{c} 53,13.78(5.43)\\ 180,14.20(5.10)\\ 184,15.66(6.19)\\ 43,13.80(3.10)\\ 83,15.60(5.80)\\ 481,13.20(4.30)\\ 1072,9.44(5.77)\\ 141,10.90(5.52)\\ 34,12.10(5.50)\\ 37,13.20(6.40)\\ 37,13.20(6.40)\\ 37,13.20(6.41)\\ 440,9.40(4.30)\\ 121,9.64(5.40)\\ 70,13.90(4.50)\\ 70,13.90(4.30)\\ 121,9.64(5.40)\\ 70,13.90(4.30)\\ 121,9.64(5.40)\\ 70,13.90(4.30)\\ 131,11.70(3.80)\\ 64,11.20(5.35)\\ 555,8.30(6.40)\\ 222,13.30(4.10)\\ 231,11.70(3.90)\\ 211,13.70(4.10)\\ 201,$
Delivery Asbee, 2009 Hui, 2012 Bogaerts, 2013 Hawkins, 2014 Petrella, 2014 Barakat, 2014 Hui, 2014 Ronnberg, 2014 Garnaes, 2016 Koivusalo, 2016 Sagedal, 2017 Gallagher, 2018 Subgroup (I-squared = 17.5%) PP 2 wks	Mixed population Mixed population Overweight/Obese Overweight/Obese Mixed population Mixed population Mixed population Overweight/Obese Obese Mixed population Overweight/Obese	Counseling Active Counseling Counseling Active Active Counseling Active Counseling Active Counseling Active	Low High Moderate Low Low High High High High High	-3.10 (-5.66, -0.54) -1.10 (-2.80, 0.60) -3.38 (-5.53, -1.23) -0.14 (-2.42, 2.14) -1.60 (-4.45, 1.25) -1.94 (-4.04, 0.16) -1.28 (-3.45, 0.88) -1.12 (-2.12, -0.12) 1.30 (-1.48, 4.08) -0.10 (-1.12, 0.92) -1.40 (-3.36, -0.44) -1.78 (-2.93, -0.63) -1.22 (-1.83, -0.69)	57, 13.00 (5.70) 102, 14.10 (6.00) 134, 10.12 (6.91) 33, 17.73 (5.74) 33, 8.80 (6.50) 107, 11.72 (4.06) 57, 13.99 (5.82) 192, 14.19 (4.45) 46, 10.50 (5.22) 144, 7.60 (4.86) 296, 14.40 (6.20) 97, 7.89 (4.07)	43, 16.10 (7.00) 48, 15.20 (5.90) 63, 13.50 (7.30) 35, 17.87 (3.49) 30, 10.40 (5.00) 93, 13.66 (9.62) 56, 15.28 (5.92) 182, 15.31 (5.38) 45, 9.20 (7.99) 125, 7.70 (3.67) 295, 15.80 (5.70) 99, 9.67 (4.17)
Vesco, 2014 Subgroup (I-squared = NA)	Obese	Counseling	High	-3.40 (-5.03, -1.77) - 3.40 (-5.03, -1.77)	55, 5.00 (4.10)	57, 8.40 (4.70)
NK Kunath, 2019 (adjusted MD) Subgroup (I-squared = NA)	Mixed population	Counseling	Moderate	0.09 (-0.79, 0.97) 0.09 (-0.79, 0.97)	946, 14.10 (5.30)	939, 14.10 (5.20)
			-5 0 5 Favors Treatment Favors	Control		

Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; N = number; NA = not applicable; NR = not reported; SD = standard deviation.

Appendix D Figure 6. Meta-Analysis of Trials: Mean Postpartum Weight Retention by BMI – Less Than 6 Months

Population and	Intervention	n Intervention		Mean Difference	Treatment, N,	Control, N,
Author, Year	Туре	Intensity		(95% CI)	Mean (SD)	Mean (SD)
Mixed population						
Polley, 2002	Counseling	Low -	<u>+</u>	0.27 (-1.82, 2.36)	57, 4.02 (5.50)	53, 3.75 (5.67)
Haakstad, 2011	Active	High	- -	0.00 (-1.53, 1.53)	52, 3.30 (3.90)	53, 3.30 (4.10)
Rauh, 2013	Counseling	Low -		-1.20 (-2.48, 0.08)	167, 2.10 (4.30)	83, 3.30 (5.10)
Hoffman, 2019 (adj MD)	Counseling	Moderate	+	-0.19 (-1.01, 0.63)	976, 4.00 (4.80)	934, 4.30 (4.80)
Subgroup (I-squared = 0.0	%)		4	-0.35 (-1.06, 0.35)		
Obese						
Wolff, 2008	Counseling	Moderate		-6.90 (-9.72, -4.08)	16, -4.50 (3.52)	19, 2.40 (4.96)
Harrison, 2014	Counseling	Moderate	•	-0.54 (-2.42, 1.34)	66, -0.76 (4.91)	53, -0.22 (5.40)
Huvinen, 2018	Counseling	Moderate	+	0.00 (-1.92, 1.92)	110, 0.00 (7.02)	90, 0.00 (6.79)
Subgroup (I-squared = 88.	5%)	\triangleleft	\rightarrow	-2.30 (-7.35, 2.49)		
Overweight						
Harrison, 2014	Counseling	Moderate -	н	-1.85 (-3.65, -0.05)	55, 1.48 (3.86)	54, 3.33 (5.56)
Subgroup (I-squared = NA	.)			-1.85 (-3.65, -0.05)		
Overweight/Obese						
Polley, 2002	Counseling	Low	+	3.30 (-0.31, 6.91)	27, 3.60 (5.60)	22, 0.30 (7.00)
Harrison, 2014	Counseling	Moderate -	⊷¦:	-1.45 (-2.80, -0.10)	121, 0.51 (4.48)	107, 1.96 (5.74)
Garnaes, 2018	Active	High	•	0.80 (0.41, 1.19)	46, -0.80 (0.94)	45, -1.60 (0.94)
Subgroup (I-squared = 83.	3%)		(0.32 (-1.97, 3.34)		
				1		
		-10 -5	U 5	10 vora Control		
		ravors treatment	Fai	vors Control		

Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; NA = not applicable.



Appendix D Figure 7. Meta-Analysis of Trials: Mean Postpartum Weight Retention by BMI - 6 Months

Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate; NA = not applicable.

Appendix D Figure 8. Meta-Analysis of Trials: Mean Postpartum Weight Retention by BMI – 12 Months

Population and Author, Year	Intervention Type	Intervention Intensity			Mean Difference (95% CI)	Treatment, N, Mean (SD)	Control, N, Mean (SD)
Mixed population							
Althuzien, 2013 (adj MD)	Counseling	Moderate	;∔∎		0.94 (-0.53, 2.41)	123, -0.53 (5.50)	123, -1.75 (5.10)
Phelan, 2014	Counseling	Moderate	- -		-1.60 (-2.90, -0.30)	164, 1.40 (6.30)	167, 3.00 (5.70)
Rauh, 2015 (adj MD)	Counseling	Low			-1.00 (-3.20, 1.20)	148, 0.20 (3.60)	65, 0.80 (5.70)
Sagedal, 2017 (adj MD)	Active	High	- .		-0.75 (-1.70, 0.20)	303, 0.66 (5.48)	303, 1.42 (4.96)
Hoffman, 2019 (adj MD)	Counseling	Moderate	+		-0.74 (-1.55, 0.07)	902, -0.20 (4.80)	881, 0.60 (5.20)
Subgroup (I-squared = 4	0.5%)		•		-0.69 (-1.39, 0.11)		
Obese							
Vesco, 2016 (adj MD)	Counseling	High	_		-0.47 (-4.02, 3.08)	56, -1.30 (7.63)	58, -0.90 (7.91)
Huvinen, 2018	Counseling	Moderate			0.00 (-2.03, 2.03)	110, -1.00 (7.42)	90, -1.00 (7.20)
Subgroup (I-squared = 0	.0%)		-		-0.12 (-2.35, 1.98)		
Overweight/Obese							
Herring, 2017	Counseling	High	_ _		-2.20 (-5.08, 0.68)	33, 2.90 (6.09)	33, 5.10 (5.86)
Haire-Joshu, 2019	Counseling	High			-3.30 (-5.53, -1.07)	92, 0.90 (6.80)	93, 4.20 (8.60)
Phelan, 2019	Active	High			0.10 (-0.06, 0.26)	103, 1.50 (0.58)	110, 1.40 (0.58)
Subgroup (I-squared = 8	2.2%)				-1.38 (-4.26, 0.88)		
Overall (I-squared = 65.5	%)		•		-0.63 (-1.44, -0.01)		
		-10	-5 0	5 10			
		Favors Treatme	ent	Favors Co	ontrol		

Abbreviations: CI = confidence interval; I-squared = test for heterogeneity using profile-likelihood estimate.

Author, Year Study	Study Design		Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight		Quality
Aquilar-	RCT	One	Mixed	Active: High	1 hour	A. Intervention: supervised	Outcomes	Outcomes	X	Harms X	Fair
Cordero et	N=140	university-		intensity	classes 3x	aquatic exercise classes from					
al., 2019 ⁷¹		affiliated			per week	weeks 20 to 37.					
SWEP		aquatic			(planned	B. Comparison: usual prenatal					
		facility			54 classes)	care.					
		Spain			weeks 20-						
		•po			37						
Al Wattar et	RCT	5 inner-city	Mixed	Counseling;	3 in-person	A. Intervention: in-person	Х	Х	Х	Х	Fair
al., 2019 ⁷²	N=1,21	maternity		Moderate	sessions, 2	sessions; initial individual					
ESTEEM	8	units		intensity	phone	consultation with dietician,					
		London			calls	group sessions (20 weeks and					
		Birmingha				team (24 weeks and 32					
		m. UK				weeks). Provided mixed nuts					
		, -				(30 g/day walnuts, hazelnuts,					
						almonds) and extra-virgin					
						olive oil (0.5 L/week). Fact					
						sheets on olive oil and mixed					
						nuts, educational					
						individual food portion plan					
						B. Comparison: usual prenatal					
						care.					

Author,											
Year	Study		Population	Intervention		Description	Maternal	Infant			
Study	Design	0.00	BMI	Туре;	Estimated	Intervention	Health	Health	Weight		Quality
Name	N	Setting	Category	Intensity	Time	Comparison	Outcomes	Outcomes	Outcomes	Harms	Rating
Altazan et	RCT	Clinic or	Overweight	Counseling;	18 lessons	A. Intervention: in-person			Х		Fair
al., 2019 ⁷³	N=54	smartphon	and obese	High intensity	(time NR)	SmartMoms intervention,					
Expecting		e				received dietary intake advice,					
Success /		Baton				exercise advice, weight graph					
SmartMom		Rouge, LA				created from dynamic GWG					
S						models to determine the					
						trimester specific increase in					
						energy intake required to					
						adhere to the IOM					
						recommendations. Structured					
						medification counceling					
						wookly (12.24 wooks) then					
						hiwookly (wook 25 to					
						delivery)					
						B Intervention: remote					
						SmartMoms Intervention					
						same as above intervention					
						but delivered via intensity-					
						matched phone app at least					
						once weekly.					
						C: Comparison: usual prenatal					
						care.					
Althuizen et	RCT	Eight	Mixed	Counseling;	30-min	A. Intervention: counseling	Х	Х	Х		Good
al., 2013 ⁷⁴	N=246	midwifery		Moderate	phone call;	modules on healthy lifestyle,					
New		clinics,		intensity	three 15-	personalized feedback on					
Life(style)		Netherland		-	min in	weight gain.					
		s			person;	B. Comparison: usual prenatal					
					one 15-min	care.					
					phone call						
Asbee et	RCT	One	Mixed	Counseling;	NR - one	A. Intervention: counseling on	Х		Х		Fair
al., 2009 ⁷⁵	N=144	prenatal		Low intensity	initial study	healthy lifestyle,					
		care			visit	recommended physical					
		center,				activity, personalized					
		Charlotte,				feedback on weight gain.					
		North				B. Comparison: usual prenatal					
		Carolina				care					

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Assaf-Balut et al., 2017 ⁷⁶	RCT N=1,00 0	One hospital- affiliated clinic, Madrid, Spain	Mixed	Counseling; Low intensity	1 hour initial study visit	 A. Intervention: lifestyle guidance, emphasis on including healthy fats (olive oil and pistachio consumption). B. Comparison: usual prenatal care, emphasis on restricting fat. 	X	X	X	X	Good
Bacchi et al., 2018 ⁷⁷	RCT N=140	One primary care obstetric clinic, Buenos Aires, Argentina	Mixed	Active; High intensity	55-60 min 3x per week	 A. Intervention: aerobic and aquatic exercises per ACOG guidelines. B. Comparison: usual prenatal care. 		X	X	X	Fair
Barakat et al., 2012 ⁷⁸	RCT N=100	One primary care obstetric clinic, Madrid, Spain	Mixed	Active; High intensity	35-45 min 3x per week	A. Intervention: aerobic and aquatic exercise.B. Comparison: usual prenatal care.	X		X		Fair
Barakat et al., 2014 ⁸¹	RCT N=251	One maternity care hospital, Madrid, Spain	Mixed	Active; High intensity	55-60 min 3x per week	 A. Intervention: aerobic exercise. B. Comparison: usual prenatal care. 	X	X	X		Fair
Barakat et al., 2016 ⁸⁰	RCT N=840	One hospital, Madrid, Spain	Mixed	Active; High intensity	55-60 min 3x per week	 A. Intervention: aerobic exercise per ACOG guidelines. B. Comparison: usual prenatal care. 	Х	Х	Х	Х	Fair
Barakat et al., 2018 ⁷⁹	RCT N=429	2 primary care medical centers Madrid, Spain	Mixed	Active; High intensity	55-60 min 3x per week	 A. Intervention: structured, supervised exercise classes from gestational week 9-11 to week 38-39. B. Comparison: usual prenatal care. 		X	X		Fair

Author, Year Study	Study Design		Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight		Quality
Name	N	Setting	Category	Intensity	Time	Comparison	Outcomes	Outcomes	Outcomes	Harms	Rating
Barakat et al., 2019 ⁸²	RCT N=456	2 tertiary care hospitals Madrid, Spain	Mixed	Active; High intensity	55-60 min 3x per week	 A. Intervention: structured, supervised exercise classes from gestational week 8-10 to week 38-39; final motivational talk on importance of active pregnancy. B. Comparison: usual prenatal care. 	X	X	X		Fair
Bogaerts et al., 2013 ⁸³	RCT N=205	Three hospital- based antenatal units, Belgium	Obese	Counseling; Moderate intensity	Four 1.5-2 hour in person groups	 A. Intervention A: motivational lifestyle intervention sessions and brochure about nutritional advice and physical activity during pregnancy, with information to limit excessive gestational weight gain. B. Intervention B: brochure only. C. Comparison: usual prenatal care. 	X		X	X	Fair
Brownfoot et al., 2016 ⁸⁴	RCT N=782	One tertiary obstetric hospital, Melbourne, Australia	Mixed	Counseling; Low intensity	NR – during visits	A. Intervention: weight recording at each prenatal visit with IOM guidelines prominently displayed; discussion with clinician about appropriate weight gain according to IOM guidelines. B. Comparison: usual prenatal care, did not have access to scales or weighing themselves as part of the visit.	X	X	X	X	Fair

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Bruno et al., 2017 ⁸⁵	RCT N=191	One university hospital, Modena, Italy	Overweight and obese	Counseling; Moderate intensity	1 hour initial study visit; four follow-up visits (time NR)	A. Intervention: counselling session at enrollment with dietician for prescribed personalized dietary plan. B. Comparison: counselling session at enrollment with dietitian for general recommendations on diet and physical activity, given basic nutrition booklet, plus usual prenatal care.	X	X	X	X	Fair
Cahill et al., 2018 ⁸⁶ PreGO	RCT N=240	One university hospital, St. Louis, Missouri	Overweight and obese	Counseling; High intensity	10 biweekly 1- hour visits	A. Intervention: PAT+Lifestyle curriculum, including biweekly home visits by a parent educator with individualized counseling on diet and exercise, behavior change, reinforcement of lifestyle behaviors in postpartum period to return to baseline weight, plus parenting strategies and social support postpartum. B. Comparison: PAT curriculum, including biweekly home visits by a parent educator with parenting strategies and social support.	X	X	X	X	Good
Haire- Joshu et al., 2019 ¹⁰³	Same as Cahill et al., 2018 N=185	Same as Cahill et al., 2018	Same as Cahill et al., 2018	Same as Cahill et al., 2018	10 prenatal biweekly visits, 12 monthly postpartum visits (1 hour)	A. Same as Cahill et al., 2018; plus monthly visits from delivery to 12 months postpartum. B. Same as Cahill et al., 2018; plus monthly visits from delivery to 12 months postpartum.			X		Fair

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Claesson et al., 2010 ⁸⁷	CCT N=348	Multiple antenatal care clinics, Sweden	Obese	Active; High intensity	Weekly 30- min in person; 1- 2x per week exercise class (time NR), 3 follow-up visits (time NR)	A. Intervention: motivational interviewing during extra visits to midwife on weight control and counseling weekly; invitation to aqua aerobics class semiweekly. B. Comparison: usual prenatal care.			X	X	Fair
Daley et al., 2015 ⁸⁸	RCT N=76	One community midwifery clinic, Birmingha m, UK	Mixed	Counseling; Low intensity	NR - during visits	 A. Intervention: personalized feedback at each visit on weight gain, self-weighing, brief counseling on diet and exercise as needed based on weight gain. B. Comparison: usual prenatal care. 			X	Х	Fair
Daley et al., 2019 ⁸⁹ POPS2	RCT N=616	Four maternity centers, England	Mixed	Counseling; Low intensity	NR – during visits	 A. Intervention: personalized feedback at each visit on weight gain, self-weighing, brief counseling on diet and exercise as needed based on weight gain. B. Comparison: usual prenatal care. 	X	X	X	X	Fair
Daly et al., 2017 ⁹⁰ Healthy eating, Exercise and Lifestyle Trial	RCT N=88	One university hospital, Dublin, Ireland	Obese	Active; High intensity	50-60 min 3x per week	 A. Intervention: participation in medically supervised exercise classes during pregnancy and up to 6 weeks postpartum; personal goal setting; Facebook group. B. Comparison: usual prenatal care. 	X	X	X	X	Fair

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Dodd et al., 2014 ⁵⁶ LIMIT	RCT N=2,21 2	Three maternity hospitals, Adelaide, Australia	Overweight and obese	Counseling; Moderate intensity	3 in-person visits; 3 phone calls (time NR)	 A. Intervention: tailored dietary advice, recommendation for exercise, goal setting via in-person visits and phone calls. B. Comparison: usual prenatal care. 	X	X	Х	X	Good
Dodd et al., 2018 ⁹¹	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014	Same as Dodd et al., 2014		Х			Same as Dodd et al., 2014
Dodd et al., 2019 ⁹² OPTIMISE	RCT N=633	One hospital Adelaide, Australia	Normal	Counseling; Moderate intensity	3 in-person visits; 3 phone calls (time NR)	 A. Intervention: tailored dietary advice, recommendation for exercise, goal setting via in-person visits and phone calls. B. Comparison: usual prenatal care. 	X	X	Х	X	Good
Epel et al., 2019 ⁹³ MMT	Prospe ctive cohort N=215	Hospital and community health centers San Francisco, CA	Overweight and obese	Counseling; High intensity	1 initial session, 8 group classes (2 hours 1x/wk), 2 phone calls (time NR), 1 postpartum group session	 A. Intervention: Obesity- Related Behavioral Intervention Trials model, with sessions on mindful breathing, eating, and movement - nutritional and eating behavior, mindfulness-based eating awareness training, physical activity, and stress reduction. B. Comparison: treatment as usual group, comprised of women unable to attend group classes, or gestational age 20-23 weeks but otherwise would have been eligible for the intervention. 					Good

Author, Year Study	Study Design		Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight		Quality
Name	N	Setting	Category	Intensity	Time	Comparison	Outcomes	Outcomes	Outcomes	Harms	Rating
Gallagher et al., 2018 ⁹⁴ LIFT	N=210	Multiple hospital- affiliated clinics, U.S.	and obese	Counseling; High intensity	3 VISITS	 A. Intervention: intensive counseling (individual and group) on behavior, nutrition, exercise; food and exercise logs; phone and email contact. B. Comparison: usual prenatal care, plus group education sessions on healthy lifestyle during pregnancy. 	X	X	X	X	Fair
Garnaes et al., 2016 ⁹⁷ ETIP	RCT N=91	One university hospital, Trondheim, Norway	Overweight and obese	Active; High intensity	60 mins sessions 3x per week	A. Intervention: supervised aerobic and strength exercise classes from gestational week 12-18 until delivery, recommended exercise at home, individualized IOM weight gain curve. B. Comparison: usual prenatal care.	X	X	X		Fair
Garnaes et al., 2017 ⁹⁸	Same as Garnae s et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Х	X	Х		Same as Garnae s et al., 2016
Garnaes et al., 2018 ⁹⁶	Same as Garnae s et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Garnaes et al., 2016	Same as Garnaes et al., 2016			Х		Good
Garnaes et al., 2019 ⁹⁵	Same as Garnae s et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016	Same as Garnaes et al., 2016				X	Fair

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Gesell et al., 2015 ⁹⁹ Madre Sana, Bebé Sano / Healthy Mother, Healthy Baby	RCT N=135	Community center, Nashville, Tennessee	Mixed	Active; High intensity	12 weekly 90-min group sessions	 A. Intervention: group intervention sessions (8-10 women plus facilitator) at community recreation center for healthy lifestyle intervention; also received infant injury prevention intervention. B. Comparison: home visits on infant injury prevention. 			X		Fair
Gray- Donald, et al., 2000 ¹⁰⁰	CCT N=219	Community -based prenatal clinics in Cree villages, Quebec	Mixed	Counseling; Moderate intensity	NR	A. Intervention: unclear; intervention based on social learning theory, administered by 2 nutritionists working with a team of health care workers, including a community nutritionist working in the Cree villages; frequency and type of contact not described. B. Comparison: no intervention.	X	X	X	x	Fair
Guelfi et al., 2016 ¹⁰¹	RCT N=172	Home- based supervised exercise Perth, Australia	Mixed	Active; High intensity	3 sessions per week (20-60 min) from weeks 14 to 28	 A. Intervention: supervised home-based upright cycling, with progression to longer duration sessions depending on participant fitness. B. Comparison: usual prenatal care. 	X	X	X	X	Fair
Haakstad et al., 2011 ¹⁰²	RCT N=105	Community location, Oslo, Norway	Mixed	Active; High intensity	60 mins 2x week for 12 weeks	 A. Intervention: supervised sessions of aerobic dance exercises for at least 12 weeks; weekly self-imposed physical activity. B. Comparison: usual prenatal care. 		X	X		Fair

Author, Year Study	Study Design		Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight		Quality
Name	Ν	Setting	Category	Intensity	Time	Comparison	Outcomes	Outcomes	Outcomes	Harms	Rating
Harrison et al., 2013 ¹⁰⁴ HeLP-her	RCT N=228	Three teaching hospitals, Victoria, Australia	Overweight and obese	Counseling; Moderate intensity	4 sessions	 A. Intervention: behavior change lifestyle intervention based on Social Cognitive Theory, including individualized dietary and PA advice, goal setting, self- monitoring. B. Comparison: educational control on general Australian dietary and PA guidelines. 	X		X		Good
Harrison et al., 2014 ¹⁰⁵	Same as Harriso n et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison et al., 2013	Same as Harrison, 2013	Same as Harrison et al., 2013			Х		Same as Harriso n et al., 2013
Hawkins et al., 2014 ¹⁰⁶ Estudio Vida	RCT N=68	Two medical centers, Massachus etts	Overweight and obese	Counseling; Moderate intensity	1 in-person session per month for 6 months, 5 phone booster sessions	 A. Intervention: Six-month lifestyle intervention tailored to Hispanic women, based on the Transtheoretical model and Social Cognitive Theory; telephone booster sessions. B. Comparison: usual prenatal care. 			X		Fair
Herring et al., 2016 ¹⁰⁸	RCT N=66	Two hospital- affiliated obstetric clinics, Philadelphi a, Pennsylva nia	Overweight and obese	Counseling; High intensity	1 in-person session, 7 calls over 12 weeks	A. Intervention: eHealth intervention based on the Social Ecological Model delivered over 12 weeks. B. Comparison: usual prenatal care.	X	X	X	X	Fair
Herring et al., 2017 ¹⁰⁷	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016	Same as Herring et al., 2016			X		Same as Herring et al., 2016

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Hui et al., 2012 ¹¹⁰	RCT N=224	One prenatal clinic, Winnipeg, Manitoba	Mixed	Active; High intensity	30-45 mins per session 3- 5x per week	A. Intervention: exercise regimen (walking, mild-to- moderate aerobic, stretching and strength exercises), in groups and at home. Dietary interviews and counselling were provided twice to each participant in the intervention group by registered dietitians. B. Comparison: usual prenatal care.	X	X	X		Fair
Hui et al., 2014 ¹¹¹	RCT N=113	Community location, Winnipeg, Manitoba	Mixed	Active; High intensity	30-45 mins per session 3- 5x per week	A. Intervention: community- based weekly exercise program, one-on-one private dietary consultation at baseline and 2 months later, used Food Choice Map software to assess dietary intake. B. Comparison: usual prenatal care.	X	X	X		Fair
Koivusalo et al., 2016 ¹¹⁴ RADIEL	RCT N=293	Four maternity hospitals, Finland	Obese	Counseling; Moderate intensity	Three 2- hour sessions	A. Intervention: structured, individualized lifestyle counseling, dietary advice, and PA program, plus initial group visit with dietician and usual care. Counseling from study nurse. For prepregnancy BMI ≥30 kg/m ² , recommended no weight gain during first two trimesters. B. Comparison: usual prenatal care, information leaflets on healthy diet and exercise.	X	X	X		Fair
Huvinen et al., 2018 ¹⁰⁸	Same as Koivusa lo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016			X		Same as Koivus alo et al., 2016

Author, Year Study	Study Design		Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight		Quality
Name	Ν	Setting	Category	Intensity	Time	Comparison	Outcomes	Outcomes	Outcomes	Harms	Rating
Rono et al., 2018a ¹³⁷	Same as Koivusa lo et al., 2016 N=128	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	1x every 3 months before pregnancy (time NR), three 2- hour sessions	Same as Koivusalo et al., 2016. *Specific to Rono 2018a: prepregnancy recommendation for 5-10% weight loss prior to pregnancy for women BMI ≥25 kg/m ² .	X	X	X		Fair
Rono et al., 2018b ¹³⁶	Same as Koivusa lo et al., 2016 N=492	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	Same as Koivusalo et al., 2016	2 hour x3 sessions	Same as Koivusalo et al., 2016	X	X	X		Fair
Kunath et al., 2019 ¹¹⁵ GeliS	Cluster RCT N=2,26 1	Gynecologi c and midwifery practices Bavaria, Germany	Mixed	Counseling; Moderate intensity	4 sessions (30-45 min each; 3 prenatal, 1 postpartum)	 A. Intervention: individual prenatal and postpartum inperson counseling sessions; counseling on self-monitoring weight gains based on IOM recommendations, healthy nutrition and balanced diet based on Healthy Start guidelines, recommended physical activity. B. Comparison: usual prenatal care, general information leaflets on healthy lifestyle in pregnancy. 	X	X	X	X	Fair
Hoffman et al., 2019 ¹⁰⁹	Same as Kunath et al., 2019	Same as Kunath et al., 2019 N=1,998	Same as Kunath et al., 2019	Same as Kunath et al., 2019	Same as Kunath et al., 2019	Same as Kunath et al., 2019			X		Same as Kunath et al., 2019

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
LeBlanc et al., 2020 ¹¹⁶ PREPARE	RCT N=326	Telephone and online, Oregon and Washingto n	Overweight and Obese	Counseling; High	30-40 min initial session, 20-30 min session weekly (6 months) and monthly (up to 18 months or until pregnancy end)	 A. Intervention: prepregnancy counseling focused on losing weight (dietary [DASH] and physical activity counseling); during pregnancy counseling focused on adhering to GWG guidelines, logging weight, food, and exercise into study website. B. Comparison: usual prenatal care, information on having a healthy pregnancy. 			X		Good
Luoto et al., 2011 ¹¹⁷ NELLI	RCT N=442	Primary health care center- affiliated maternity clinics, 14 municipaliti es, Finland	Mixed	Counseling; Moderate intensity	One 2- hour PA session; one dietary counseling session; 3- 4 booster sessions	 A. Intervention: physical activity counseling session, diet counseling session, physical activity boosters and diet boosters during visits, invitations to group meetings. B. Comparison: usual prenatal care. 	X	X	X	X	Good
Kinnunen et al., 2012 ¹¹³	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011	Same as Luoto et al., 2011			Х		Same as Luoto et al., 2011
Magriples et al., 2015 ¹¹⁸ Centering Pregnancy Plus	RCT N=984	14 community health centers and hospitals, New York City, New York	Mixed	Counseling; Moderate intensity	10 sessions (120 mins each)	 A. Intervention: group prenatal care, standard clinical intake, then groups of 8-12 women at same gestational age facilitated by 2 health providers, manualized curriculum. B. Comparison: usual prenatal care. 			X		Fair

Author, Year Study	Study Design	Sotting	Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight	Hormo	Quality
McCarthy et al., 2016 ¹¹⁹ FFF	RCT N=382	One tertiary obstetric hospital, Melbourne, Australia	Overweight and obese	Counseling; Low intensity	30 mins x1 session	A. Intervention: Serial self- weighing and simple dietary advice. B. Comparison: usual prenatal care	X	X	X	X	Fair
McGiveron et al., 2015 ¹²⁰ Bumps and Beyond	CCT N=178	One antenatal clinic, Lincolnshir e, UK	Obese	Counseling; Moderate intensity	8 sessions	 A. Intervention: Bumps and Beyond intervention, including an educational booklet and one-on-one counseling sessions regarding diet, exercise, and healthy weight gain in pregnancy delivered approximately from 16 weeks until 6 weeks postpartum. B. Comparison: declined intervention. 	X	X	X		Fair
Okesene- Gafa et al., 2019 ¹²¹ HUMBA	RCT N=230	University, home- based visits South Auckland, Australia	Obese	Counseling; High intensity	4 sessions (1 at 1.5 hr, 3 at 30- 60 min); text messages 3x per week	A. Intervention: individual, home-based education sessions including feedback on weight gain and SMARTER goals, HUMBA handbook with nutrition information, recipes, management of cravings, physical activity tips, motivational text messages worded as if from the baby regarding nutrition, plus probiotic or placebo capsules B. Comparison: usual prenatal care, NZ pamphlet on healthy eating and weight gain during pregnancy, plus probiotic or placebo capsules	X	X	X	X	Good

Name Olson et al. 2018/22 e-MomsRCT N=1,6Onle Rochester, New YorkNiced MixedCourseling: Moderate intensityNR Moderate Moderate intensityA. Intervention: intervention website, including weight gain tracker, a diet and exercise goal-setting tool, and health information, accessed through 6 weeks postpartum. B. Intervention: intervention website, weight gain tracker, a diet and exercise goal-setting tool, and health information, accessed through et al. 2017 ¹²³ NRXXXXFairPeccel et al., 2017 ¹²³ RCT nospital- ettsOne hospital- definited prenatal clinic, Revere, Massachus ettsOverweight and obeseCourseling: food labels, shopping frod on a budget, and session.A. Intervention: culturally accessed until delivery only. C. Comparison: control website, including only health information.XXXXXFairPeccel et al., 2017 ¹²³ RCT nospital- ettsOverweight and obeseCourseling: noteseGo-90 mins initial session, 2X per monthA. Intervention: culturally and obeseXXXXXFairPelaez et al., 2019 ¹²⁴ RCT nospital, SpainOne MixedActive; High intensity70-78 sessionsA. Intervention: structured, sessionsXXXXXFairPelaez et al., 2019 ¹²⁴ RCT nospital, SpainOne weekActive; High intensity70-78 sessionsA. Intervention: structured, sessionsXX<	Author, Year Study	Study Design	Sotting	Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight	Harme	Quality
2018/22 e-MomsN=1.68 9Rochester, New YorkMixedOutbound Moderate intensityMark of a deversise goal-setting tool, and health information, accessed through 6 weeks postpartum.XX<		RCT	Online	Mixed	Counseling:	NR	A Intervention: intervention	X	X	X	X	Fair
e-Moms e-Moms9New YorkIntensity<	2018 ¹²²	N=1 68	Rochester	MIXEO	Moderate		website including weight gain	~	~	~	Λ	
Peccei et al., 2017 ¹²³ RCT one hospital- affiliated prenatal clinic, Revere, Massachus ettsOverweight and obeseCounseling; normal oneGo-90 mins nice normal one not cliables, weight gain tracker, a diet and exercise goal-setting tool, and health information, accessed fundion; comparison: control website, including only health information, accessed until delivery only. C. Comparison: control website, including only health information, accessed until delivery only. C. Comparison: control website, including only health information, exercise, reading 2x, per monthXXXXFairPeccei et al., 2017 ¹²³ N=272 N=272One hospital- affiliated prenatal clinic, Revere, Massachus ettsCounseling; moderate intensityGo-90 mins of 06-90 mins on and counseling on propriate, individualized meal plans and counseling on on a budget, and breastfeeding; weight tracking. B. Comparison: standard counseling on diet and exercise at randomization, and again at 6 weeks postpartum.XXXXXPelaez et al., 2019 ¹²⁴ RCT N=301One hospital, Madrid, SpainMixed Active; High intensity70-78 sessions & per week week)Active; Bit propriate, individualized meal plans and counseling on on a budget, and breastfeeding; weight tracking. B. Comparison: standard counseling on diet and exercise at randomization, and again at 6 weeks postpartum.XXXXXXPelaez et al., 2019 ¹²⁴ RCT N-spital, Madrid, SpainOneOne week <t< td=""><td>e-Moms</td><td>9</td><td>New York</td><td></td><td>intensity</td><td></td><td>tracker, a diet and exercise</td><td></td><td></td><td></td><td></td><td></td></t<>	e-Moms	9	New York		intensity		tracker, a diet and exercise					
Peccei et al., 2017 ^{1/23} RCT N=272One hospital- clinic, Revere, MassachusOverweight and obeseCounseling; clourseling; hospital- and obeseCounseling; clourseling; monthA. Intervention: culturally appropriate, individualized appropriate, individualized appropriate, individualized prenatal clinic, Revere, Massachus ettsXX <th< td=""><td></td><td>-</td><td></td><td></td><td></td><td></td><td>goal-setting tool, and health</td><td></td><td></td><td></td><td></td><td></td></th<>		-					goal-setting tool, and health					
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Perales et RCT One Overweight Active; High 85 A. Intervention: exercise X X X Good							care.					
	Perales et	RCT	One	Overweight	Active; High	85	A. Intervention: exercise	Х		Х	Х	Good
al., 2015 ¹²⁵ N=129 university and obese intensity sessions sessions planned for a total of	al., 2015 ¹²⁵	N=129	university	and obese	intensity	sessions	sessions planned for a total of					
hospital, (55-60 85 sessions.			hospital,			(55-60	85 sessions.					
Miadrid min) B. Comparison: usual prenatal			Madrid			min)	B. Comparison: usual prenatal					

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Petrella et al., 2014 ¹²⁶	RCT N=63	One hospital- based obstetrics unit, Modena, Italy	Overweight and obese	Counseling; Low intensity	4 sessions (initial session 60 min; remainder time NR)	 A. Intervention: Therapeutic Lifestyle Changes diet and exercise intervention, follow- up sessions to track adherence to program. B. Comparison: nutritional booklet, usual prenatal care. 	X	X	X		Fair
Phelan et al., 2011 ¹²⁸ Fit For Delivery	RCT N=401	Six obstetrics offices, Providence , Rhode Island	Mixed	Counseling; Moderate intensity	One in- person session, three 10- 15 min phone calls	A. Intervention: in-person meeting plus phone calls following the Fit for Delivery behavioral intervention targeting diet and physical activity; women who were over or under guidelines received additional calls. B. Comparison: in-person meeting, usual prenatal care, study newsletters.	X	X	X	X	Fair
Phelan et al., 2014 ¹²⁷	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011	Same as Phelan et al., 2011			Х		Same as Phelan et al., 2011
Phelan et al., 2018 ¹³⁰ Healthy Beginnings / Comienzo Saludables	RCT N=264	Two hospitals, San Luis Obispo, California and Providence , Rhode Island	Overweight and obese	Active; High intensity	Biweekly session (20 min) until 20 weeks' gestation, monthly session until delivery	 A. Intervention: biweekly inperson sessions until 20 weeks' gestation, then monthly until delivery, on appropriate weight gain, physical activity, behavioral strategies for daily self-monitoring; partial meal replacement plan; goal setting for postnatal period. B. Comparison: usual prenatal care, plus initial welcome visit, study newsletters. 	X	X	X	X	Fair

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight	Harms	Quality Rating
Phelan et al., 2019 ¹²⁹	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018	Same as Phelan et al., 2018			X		Fair
Polley et al., 2002 ¹³¹	RCT N=120	One obstetric clinic, Pittsburgh, Pennsylva nia	Mixed	Counseling; Low intensity	NR	A. Intervention: written information on targeting appropriate weight gain in pregnancy, exercise, and diet; newsletters; personalized graph of weight gain; stepped care for with more structure for goals if weight exceeded recommendations; check-in phone calls. B. Comparison: usual prenatal care.	X	X	X	x	Fair
Rauh et al., 2013 ¹³² FeLIPO	RCT N=250	Eight gynecology practices, Munich, Germany	Mixed	Counseling; Low intensity	Two sessions (initial 60 min, second 30 min)	A. Intervention: individual counseling module intervention targeting healthy lifestyle information, self- monitoring of diet and physical activity, self-monitoring of weight gain, and setting personal behavioral goals. B. Comparison: usual prenatal care.	X	X	X	X	Fair
Rauh et al., 2015 ¹³³	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013	Same as Rauh et al., 2013		X	X		Same as Rauh et al., 2013

Author,	Otershe		Demulation			Description		lu fan t			
Year	Study		Population	Intervention	Estimated	Description	Maternal	Hoalth	Woight		Quality
Name	N	Setting	Category	Intensity	Time	Comparison	Outcomes	Outcomes	Outcomes	Harms	Rating
Redman et	RCT	Social	Overweight	Counseling;	18 lessons	A. Intervention: in-person			Х		Fair
al., 2017 ¹³⁴	N=54	media or	and obese	High intensity		SmartMoms intervention,					
SmartMom		community				received dietary intake advice,					
S		clinics,				exercise advice, weight graph					
		U.S.				for trimester-specific increase					
						in energy intake for adherence					
						to IOM recommendation.					
						Structured intervention					
						consisted of lessons and					
						behavior modification					
						counseling weekly (13-24					
						Weeks), then biweekly (week					
						25 to delivery).					
						SmartMome Intervention					
						same as above intervention					
						but delivered via intensity-					
						matched phone app					
						C. Comparison: usual prenatal					
						care.					
Renault et	RCT	Hospital-	Obese	Counselina:	11-13	A. Intervention: PA plus D	Х	Х	Х	Х	Good
al., 2014 ⁵⁸	N=425	based		High intensity	biweekly	(physical activity and dietary					
TOP		clinic,		0 ,	sessions	intervention), with followup on					
		Copenhag				dietary advice and					
		en,				encouragement to increase					
		Denmark				physical activity as assessed					
						by pedometer.					
						B. Intervention: PA (physical					
						activity) only, encouraged to					
						increase physical activity as					
						assessed by pedometer.					
						C. Comparison: usual prenatal					
						care.					

Author, Year Study	Study Design	0	Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight		Quality
Name Ronnberg et al., 2014 ¹³⁵	RCT N=445	14 antenatal clinics, Örebro County, Sweden	Mixed	Counseling; Low intensity	1 session	A. Intervention: individual education on IOM guidelines for recommended GWG by BMI category, personalized graph to monitor with midwife, weight discussed at each visit, formalized prescription of PA (recommended daily moderate PA). B. Comparison: usual prenatal care	Outcomes	Outcomes	X	Harms	Fair
Ruiz et al., 2013 ¹³⁸	RCT N=962	Three primary care medical centers, Madrid, Spain	Mixed	Active; High intensity	50-55 min exercise session 3x per week (planned 85 sessions)	 A. Intervention: structured, supervised, light-to-moderate intensity exercise intervention program from week 9 to weeks 38/39. A mean of 85 training sessions were planned for each participant in the event of no preterm delivery. B. Comparison: usual prenatal care. 	X	X	X	X	Fair
Sagedal et al., 2017 ¹³⁹ Norwegian Fit For Delivery	RCT N=606	Eight healthcare clinics, Norway	Mixed	Active; High intensity	Two 20- min dietary counseling sessions, 60 mins recommen ded exercise sessions 2x per week	 A. Intervention: dietary counseling sessions on awareness of food choices, access to exercise classes, lifestyle recommendations from booklets and trial website, cooking class. B. Comparison: usual prenatal care. 	X	X	X	X	Good
Sagedal et al., 2017b ¹⁴⁰	Same as Sageda I et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017	Same as Sagedal et al., 2017			X		Same as Sageda I et al., 2017

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Seneviratne et al., 2016 ¹³⁶	RCT N=75	Home- based supervised exercise Auckland, New Zealand	Overweight and obese	Active; High intensity	15-30 min exercise 3- 5x per week (planned 67 sessions, from 20-35 weeks' gestation)	 A. Intervention: written program prescribing frequency and duration of weekly moderate-intensity exercise using magnetic stationary bicycle. B. Comparison: usual prenatal care. 	X	X	X	X	Good
Simmons et al., 2017 ¹⁴² DALI Lifestyle	RCT N=436	Antenatal clinics across 11 centers in nine European countries (Austria, Belgium, Denmark, Ireland, Italy, Netherland s, Poland, Spain, UK)	Obese	Counseling; Moderate intensity	5 in-person sessions (30-45 min); ≤4 telephone calls (≤20 min) or emails	A. Intervention A: assigned healthy eating (HE) lifestyle coach, individual sessions on 7 messages promoting healthy eating, study toolkit. B. Intervention B: assigned physical activity (PA) lifestyle coach, 5 messages promoting aerobic and resistance PA, study toolkit. C. Intervention C: HE and PA interventions combined. D. Comparison: usual prenatal care.	X	X	X	X	Good
Skouteris et al., 2016 ¹⁴³ HIPP	RCT N=261	Two antenatal clinics, Melbourne, Australia	Mixed	Counseling; Moderate intensity	Initial in- person session (60 min at 18 weeks), followup session (30 min at 24 weeks), 2 phone calls (15 min)	 A. Intervention: individual health coaching intervention, telephone followup sessions, and educational group sessions. B. Comparison: education group session for control. 	X	X	X	X	Fair

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
2016 ¹⁴⁴	N=51	U.S.	Mixed	Moderate intensity	training session	A. Intervention. web-based behavioral intervention including exercise goal-setting modules, problem-solving modules, journal, calendar to track all exercise until delivery, community forum to interact with other participants in the intervention. B. Comparison: usual prenatal care, plus access to the website's general pages with information on recommended PA and weight gain during pregnancy.			~		raii
Thomson et al., 2016 ¹⁴⁸ Delta Healthy Sprouts	RCT N=105	Homes, Lower Delta region, Mississippi	Mixed	Counseling; High intensity	Monthly home visits (interventio n 90-120 min; control 60- 90 min)	A. Intervention (PATE): home visits using PAT curriculum plus culturally tailored maternal weight management and early childhood obesity prevention components. Based on DPP and inFANT trial, with emphasis placed on healthy eating and weight control during pregnancy. B. Comparison (PAT): home visits using PAT curriculum, monthly group meetings, developmental screenings, and a resource network for families.	X	X	X	X	Fair
Thomson et al., 2018 ¹⁴⁷	Same as Thoms on et al., 2016 N=54	Same as Thomson et al., 2016	Same as Thomson et al., 2016	Same as Thomson et al., 2016	18 monthly visits (gestationa I month 4 - postpartum month 12; 90-120 min)	Same as Thomson et al., 2016		X			Fair

Author, Year Study	Study Design	Cotting	Population BMI	Intervention Type;	Estimated	Description Intervention	Maternal Health	Infant Health	Weight		Quality
Van Horn et al., 2018 ¹⁴⁹ MOMFIT	RCT N=281	University hospital Chicago, Illinois	Overweight and obese	Counseling; High intensity	3 individual visits (time NR), 9 telephone calls (time NR), six 30-min group sessions	A. Intervention: education on MAMA-DASH diet (modified DASH diet for pregnancy), food intake tracking, PA guidelines, individual emails, text messages, and phone calls using motivational interviewing from registered dietician nurse, emails with educational materials and resources, MOMFIT website, group sessions on lifestyle and breastfeeding. B. Comparison: usual prenatal care, access to MOMFIT website with general dietary and pregnancy care information.	X	X	X	X	Fair
Vesco et al., 2014 ¹⁵⁰ Healthy Moms	RCT N=118	One managed care organizatio n, Oregon and Washingto n	Obese	Counseling; High intensity	2 individual sessions (time NR), 16 group sessions (90 min)	 A. Intervention: individual counseling session, group sessions, diet and exercise intervention, with diet based on DASH and recommended daily moderate PA. B. Comparison: usual prenatal care, with a single general health education session as control. 	X	X	X	X	Good
Vesco et al., 2016 ¹⁵¹	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014	Same as Vesco et al., 2014		X	X		Same as Vesco et al., 2014

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Vinter et al., 2011 ⁵⁹ LiP	RCT N=360	Two university hospitals, Denmark	Obese	Active; High intensity	4 sessions	A. Intervention: dietary counseling at 15, 20, 28, and 35 weeks' gestation, recommended daily moderate PA, pedometer, free full-time membership in a fitness center for 6 months, closed individual and group training classes with physiotherapists. B. Comparison: access to a website with general advice about dietary habits and PA in pregnancy.	X	X	X	X	Fair
Vinter et al., 2014 ¹⁵²	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011			X		Same as Vinter et al., 2011
Tanvig et al., 2014 ¹⁴⁶	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Offspring of women with obesity	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011		X			Same as Vinter et al., 2011
Tanvig et al., 2015 ¹⁴⁵	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Offspring of women with obesity	Same as Vinter et al., 2011	Same as Vinter et al., 2011	Same as Vinter et al., 2011		X			Same as Vinter et al., 2011
Willcox et al., 2017 ¹⁵³ txt4two	RCT N=100	Mobile devices, Melbourne, Australia	Overweight and obese	Counseling; High intensity	15 min introductio n meeting	 A. Intervention: multimodal, including face-to-face introduction, text messages, website, video messages, chat room interaction, all informed by Social Cognitive Theory and CALO-RE taxonomy of behavior changes, emphasize daily moderate PA. B. Comparison: usual prenatal care. 			X		Fair

Author, Year Study Name	Study Design N	Setting	Population BMI Category	Intervention Type; Intensity	Estimated Time	Description Intervention Comparison	Maternal Health Outcomes	Infant Health Outcomes	Weight Outcomes	Harms	Quality Rating
Wolff et al.,	RCT	Two	Obese	Counseling;	Ten 60-	A. Intervention: in-person	Х		Х		Fair
2008 ¹⁵⁴	N=50	hospitals,		Moderate	min	visits with nutritionist on eating					
		Denmark		intensity	sessions	a healthy diet; given energy					
						restricted diet plan.					
						B. Comparison: usual prenatal					
						care.					

Note: Low intensity = 0-2 contacts during intervention; Moderate intensity = 3-11 contacts during intervention; High intensity = 12 or more contacts during intervention.

Abbreviations: ACOG = American College of Obstetricians and Gynecologists; BMI = body mass index; CALO-RE = Coventry, Aberdeen, and London-Refined; CCT = controlled clinical trial; DASH = Dietary Approaches to Stopping Hypertension; DPP = Diabetes Prevention Program; ESTEEM = Effect of Simple, Targeted Diet in Pregnant Women with Metabolic Risk Factors on Pregnancy Outcomes; ETIP = Exercise Training in Pregnancy; GWG = gestational weight gain; HE = healthy eating; HUMBA = Healthy Mums and Babies; inFANT = infant Feeding Activity and Nutrition Trial; IOM = Institute of Medicine; LIFT = Lifestyle Interventions For Two; MMT = Mindful MAMAS Training; MOMFIT = Maternal Offspring Metabolics Family Intervention Trial; NR = not reported; PA = physical activity; PAT = Parents As Teachers; RCT = randomized clinical trial; SWEP = Study Water Exercise Pregnant; TOP = Treatment of Obese Pregnant Women.

Appendix E Table 2. Behavioral and Counseling Intervention Implementation Table: Summary and Examples of Included Interventions for Healthy Weight and Weight Gain During Pregnancy

Primary Population	Pregnant women with normal, overweight, or obese BMI.
Primary outcomes	Pregnancy weight-related intermediate outcomes; maternal health outcomes including maternal mortality, maternal
	morbidity, and health outcomes; infant outcomes, including infant mortality, infant, and infant health outcomes.
Study Findings	Counseling and active behavioral interventions to limit GWG in pregnant women are associated with modest
	reductions in weight gain and decreased likelihood of exceeding IOM recommendations for GWG. Effects of these
	Interventions on mean GWG are slightly more pronounced for high intensity interventions. GWG interventions are also
	associated with a modestly decreased lisk of GDM, macrosomia, large for gestational age, and reduced postpartum
Debewier ebenne	weight retention at 12 months
denavior change	A variety of the apeluic approaches to help participants limit excess GwG through courseling, active interventions, of
techniques	a combination. Counseling included education regarding reality det and/or physical activity during pregnancy in
techniques	person, online, or via telephone. Active interventions included structured medically-supervised exercise classes of partial meal replacement. Behavior change techniques included goal setting, active use of self-monitoring, and
	addressing barriers related to bealthy lifestyle adoption and maintenance
Intervention	The majority of interventions began at the end of the first trimester or beginning of second trimester, and concluded
duration and	prior to or at delivery. Intensity was defined as high (12 or more contacts beyond usual care during the intervention
Intensity	period), moderate (3-11 contacts), or low (fewer than 2 contacts).
Settings of studies	Primary care or primary care-referable settings, and routine prenatal care settings including obstetric and gynecology
	or midwifery clinics, and hospitals.
To whom is	Most of the effective interventions were targeted to women with obesity or combined obesity or overweight
intervention	prepregnancy BMI. Much of the available evidence is for interventions beginning after the first trimester and ending in
targeted?	the third trimester. Evidence for women of advanced maternal age or adolescence and those planning pregnancy was
	limited, as was evidence for effects of interventions reported out by women identifying as socioeconomic, racial or
	ethnic minority, or other populations experiencing health disparities.

Appendix E Table 2. Behavioral and Counseling Intervention Implementation Table: Summary and Examples of Included Interventions for Healthy Weight and Weight Gain During Pregnancy

	Effective interventions defined by type and intensity of intervention									
EXAMPLE INTERVENTIONS TO LIMIT EXCESS	Active / Supervised Exercise		Counseling							
GWG*†	High Intensity k=22	High Intensity k=13	Moderate Intensity k=23	Low Intensity k=10						
Mode and intensity of delivery*†	Structured, supervised exercise classes one to three time per week (average 45-60 minutes). Classes included aerobic, resistance, and flexibility exercises based on American College of Obstetricians and Gynecology recommendations for exercise during pregnancy. Intervention participants generally used free weights and/or resistance equipment.	Individual or group counseling in person, online, or over the phone. Sessions ranged from once a week to once a month, lasting from 30 minutes to 2 hours. Counseling focused on nutrition, goal- setting, physical activity, behavioral and social support strategies. Few interventions followed evidence-based, structured curricula. Interventions may have included phone call or email followups one to two times per week; eHealth interventions offered online or text message support.	Individual or group counseling in person or over the phone. Sessions ranged from once a month to once a trimester, lasting from 15 to 45 minutes. Counseling focused on recommendations for healthy eating and/or or physical activity based on ACOG guidelines. Interventions may have included phone call 'booster' sessions and toolkits with educational materials or physical activity accessories for participants.	Individual sessions as part of usual antenatal care, or one to two brief extra sessions. Counseling focused on maintaining healthy weight, and often included personalized graphs with weight gain guidance based on IOM recommendations.						
Example interventions*†	Bacchi 2018 Barakat 2014 Barakat 2016 Barakat 2018 Barakat 2019 Pelaez 2019 Phelan 2018 (Healthy Beginnings) Ruiz 2013 Sagedal 2017 (Norwegian Fit for Delivery) Seneviratne 2016 Vinter 2011 (LiP)	Altazan 2019 (Expecting Success / SmartMoms) Cahill 2018 (PreGO) Gallagher 2018 (LIFT) Renault 2014 (TOP) Van Horn 2018 (MOMFIT) Vesco 2014 (Healthy Moms) Willcox 2017 (txt4two)	Al Wattar 2019 (ESTEEM) Bogaerts 2013 Bruno 2017 Phelan 2011 (Fit for Delivery)	Assaf-Balut 2017 Rauh 2013 (FeLIPO) Ronnberg 2014						

Appendix E Table 2. Behavioral and Counseling Intervention Implementation Table: Summary and Examples of Included Interventions for Healthy Weight and Weight Gain During Pregnancy

Materials and practice§	https://lifemoms.bsc.gwu.e du/ https://www.acog.org/- /media/Committee- Opinions/Committee-on- Obstetric- Practice/co650.pdf?dmc=1 &ts=20191118T220431848 5	https://www.nhlbi.nih.gov/h ealth-topics/dash-eating- plan https://www.webcitation.org /6QR3k6uaM https://www.ncbi.nlm.nih.go v/pmc/articles/PMC635235 2/bin/12884_2019_2196_M OESM1_ESM.docx	https://www.ncbi.nlm.nih.go v/pmc/articles/PMC665004 5/bin/pmed.1002857.s005. docx https://www.ncbi.nlm.nih.go v/pmc/articles/PMC665004 5/bin/pmed.1002857.s006. docx https://www.ncbi.nlm.nih.go v/pmc/articles/PMC665004 5/bin/pmed.1002857.s007.	https://oldwayspt.org/traditi onal-diets/mediterranean- diet http://resources.nationalac ademies.org/Pregnancy/W hatToGain.html
			docx	
Evidence of effect modification	Evidence that providing these excess gestational weight ga gestational diabetes mellitus gestational weight gain and i of intervention, or study quali and gestational hypertension intervention type and gestation weight assessment at 12 mo	e specific counseling or active in, particularly among women and risk of emergency cesare ntervention intensity. No associ ity. Evidence of association with perineal trauma, macrosomia onal hypertension and exceeding onths postpartum and postparture	interventions was more effective with overweight or obesity; and an delivery. Evidence of association with BMI group, weight a th BMI subgroup for perineal transformer a, exceeding GWG recommendations. E arm weight retention.	ve than usual care in limiting d in reducing rates of iation between mean assessment timepoint, type auma; intervention intensity dations, and SGA; and vidence of association with
Comparison group	Minimal weight loss intervent lifestyle during pregnancy, di	tion or usual care consisting of et and physical activity change	generic print or web-based mass, or limiting excess gestation	aterials focused on healthy al weight gain.
Interventionist and training required	Midwives, health educators, Interventionists had profession and/or training on standard s	physical therapists, fitness spe onal certification in their respec tudy curricula.	ecialists, or clinical and register ctive fields, education regarding	ed dieticians. g study goals and processes,
Reported intervention adherence	9.7% to 100% of intervention	participants completed the ful	Il intervention in studies reporti	ng adherence.

Note: Low intensity = 0-2 contacts during intervention; Moderate intensity = 3-11 contacts during intervention; High intensity = 12 or more contacts during intervention.

* Examples selected from good- or fair-quality[‡] RCTs with low risk of bias, statistically significant effect on outcomes in meta-analysis (mean or excess GWG, reducing rates of GDM), n>100, transparent access to intervention details (e.g., public website or protocol paper). See Appendix B for intervention details and practice materials (where applicable). † Included of studies is for example purposes only and does not indicate endorsement by the USPSTF.

‡ As assessed using criteria developed by the USPSTF to rate the quality of each study as good, fair, or poor.

§ Materials and Practice sources were identified by examining published studies and public resources.