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Does intensive multidisciplinary intervention for adults who elect bariatric surgery improve postoperative weight loss, comorbidities, and quality of life? A systematic review and meta-analysis

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Abstract (200 words)

This systematic review and meta-analysis of intervention studies aims to evaluate the effect of pre- and/or postoperative support for adults who elect bariatric surgery delivered by a multidisciplinary team (MDT) on postoperative body composition, mental health, comorbidities, quality of life, and side-effects. Six electronic databases were searched. Revman and GRADE were used to assess confidence in pooled effects. Included interventions (n=1,533 participants in total) focused on lifestyle-counselling (n=4 studies), psychology (n=4 studies), or exercise (n=10 studies); comparator groups were less intensive usual care. Intensive MDT interventions increased postoperative weight loss (SMD:-0.94 [95%CI:-1.27,-0.61]) if delivered postoperatively. Pre- and postoperative intensive interventions improved symptoms of depression and anxiety, quality of life, diastolic blood pressure, and resting heart rate but not lipids or glycaemic measures. Whilst usual MDT care is important preoperatively, this review conditionally recommends intensive MDT interventions for enhanced postoperative weight loss if delivered in the postoperative period, led by any health professional, based on moderate evidence. This review also conditionally recommends pre- and/or postoperative lifestyle, nutrition, or psychology counselling and/or physical activity for improved mental and physical health. Further randomised controlled trials are required which aim to specifically evaluate the best use of MDT resources.

Keywords: obesity; bariatric surgery; interdisciplinary research; weight loss

Introduction

The effectiveness of bariatric surgery for improvements in body composition and comorbidities in adults affected by obesity is well established, with some variability in outcomes between procedure types [1,2]. Compared with non-surgical procedures, bariatric surgery results in greater excess weight loss (EWL) and lower chance of weight regain [3]; however, there is still a substantial proportion of patients who have had bariatric surgery who fail to meet clinically-meaningful weight loss targets or experience weight regain even in the first 12-months post-surgery [1,4,5]. Although variations in patient response may be due to the surgical technique [6]; observational research suggests that patient characteristics and behavioural factors play a role. These factors fall into five domains: 1) presurgical factors, 2) postsurgical psychosocial variables, 3) postsurgical eating patterns, 4) postsurgical physical activity, and 5) follow-up at a postsurgical clinic [4,7].

Highlighting the importance of modifiable patient behaviours on bariatric surgery outcomes, the 2013 AACE/TOS/ASMS Clinical Practice Guideline recommends preoperative nutritional and psychosocial-behavioural assessment; and that postoperative follow-up should involve dietary change, physical activity, and behavioural modification implemented by a multidisciplinary team (MDT) [2]. An MDT is defined by three or more health professions committed to a shared purpose with complimentary but individual goals [8]. The management of both human behaviour and surgery is complex, and an MDT is ideal as it provides different perspectives, coordinated expertise and skills, and sufficient patient engagement [8]. However, despite the recognised importance of the MDT for preoperative and postoperative support in bariatric surgery, the focus of most bariatric surgery research has been on surgical outcomes or preoperative liver preparation [9,10], without examination of how MDT care is implemented [1,11-14].

Therefore, although pre- and postoperative support by an MDT is recommended as best practice, the effectiveness of the MDT in improving patient outcomes for bariatric surgery has not been reviewed systematically. Considering the need to balance the best possible level and type of patient support by an MDT against available health service resources, an examination of how an MDT for bariatric surgery should be composed, the types of interventions provided, and the time of commencement and duration of support, is required. This systematic review and meta-analysis of intervention studies aims to evaluate the effect of pre- and/or postoperative support for adults who elect bariatric surgery delivered by an MDT on postoperative body composition, mental health, comorbidities, quality of life, and side-effects.

Methods

This systematic literature review and meta-analysis was reported according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) statement [15] and registered prospectively with the International Prospective Register of Systematic Reviews (PROSPERO number: CRD42019111620).

Search strategy

Studies in any language were searched for in six electronic databases: Medline (Pubmed), CENTRAL, EMBASE, CINAHL, PsycINFO, and Web of Science, from database inception up until 19 July 2018. The search strategy used a combination of keywords and controlled vocabulary designed for Pubmed and translated to the other databases' controlled vocabulary using Polyglot [16]. Translated search terms were checked for accuracy prior to implementation and modified after sensitivity and specificity assessment post-implementation for each database. The final systematic search strategy is shown in Table S1. A snowball search of Google Scholar and key papers complemented the systematic search.

Eligibility criteria

Any study which prospectively compared a pre- and/or post-operative intervention delivered

by an MDT against a comparator group which had less engagement with the MDT or had no MDT follow-up in adults (≥18 years) was included if relevant outcomes were measured. Included study designs were RCTs, pseudo-RCTs (i.e. allocation by researchers does not follow a truly random sequence generation such as allocation by date of birth), or non-randomised controlled trials. Review, observational, single-group pre-test post-test, and cross-sectional studies were excluded, as were abstracts and non-peer reviewed papers. Studies which evaluated a "usual care" MDT service against a comparator group were considered observational or implementation studies and were excluded.

To be eligible for inclusion, the intervention had to be implemented by an MDT which was defined as a team with ≥3 health disciplines [8], including the surgeon and nurse. All studies were assumed to provide pre- and/or post-operative care by a surgeon and nurse, even if not specified, as it can be assumed this care is always provided. Intervention duration needed to be for ≥2-weeks if delivered pre-operatively, and ≥3-months if delivered post-operatively; therefore, single session interventions were excluded as were interventions targeting weight regain >1-year post-procedure. Post-operative interventions which commenced >12-months post-operatively were excluded. Studies which compared procedures, procedural techniques, types of diets, and/or types of exercise training rather than varying the intensity or delivery of MDT pre- and/or post-operative support were excluded. Bariatric procedures considered were any open, laparoscopic, or endoscopic procedure used to manage obesity. Procedures no longer in use were excluded, including jejunoileal bypass, vertical banded gastroplasty, vertical gastroplasty (unbanded), nonadjustable banded gastroplasty, banded gastric bypass, biliopancreatic diversion without duodenal switch.

Study screening

Duplicate records identified during the search strategy were removed using Systematic Review Assistant-Deduplication [17], and the records were screened for potentially eligible studies based

on title and abstract by two independent investigators (SM and [HM, EI, or CM]) using Covidence [18]. The full texts of potentially eligible papers were reviewed to confirm eligibility by two independent investigators (SM and [HM or CM]), with the final decision made by SM after discussion.

Outcomes and data extraction

The primary outcome was change in body weight as measured by direct weight loss (kg), total body weight loss (TBWL, %), EWL (%), Reinhold classification EWL, or body fat (kg). Secondary outcomes included other measures of body composition (such as muscle mass, abdominal fat mass, waist circumference), mental health (any validated tool), quality of life (any validated tool), weight-related comorbidity diagnoses and biomarkers, and adverse events including surgical, medical, or gastrointestinal. Outcomes were considered from baseline up until 2-years post-surgery; however, if outcomes for multiple follow-up time-points were available, the following were extracted: For preoperative interventions, the first postoperative timepoint was extracted; for postoperative interventions, the first post-intervention timepoint was extracted. The exception is adverse events data which were extracted for the full duration of the study period. Baseline, follow-up, and change data were extracted for relevant outcomes. For post-operative interventions, change values from the pre-operative timepoint were used when available. Data were extracted by SM and checked for accuracy by HM, IRM, or CM, who all received the same instructions for how to check data for accuracy. Where discrepancies were found, these discrepancies were confirmed prior to correction.

Review of study quality and confidence in the body of evidence

Studies were assessed for risk of bias using the Cochrane Risk of Bias tool [19], which evaluates the selection, performance, detection, attrition and reporting bias. Assessment of study quality was completed by two investigators independently (SM and [HM, IRM, or CM]), with disagreements managed by consensus. For all outcomes which were pooled via meta-analysis,

confidence across the body of evidence for the estimated effect was assessed using Grading of Recommendations, Assessment, Development and Evaluation (GRADE) [20]. Certainty for the estimated effect was graded as high (very confident), moderate (moderately confident), low (limited confidence) and very low (very little confidence) using GRADEpro [21]. The GRADE assessment was undertaken by SM. A GRADE Clinical recommendation was developed based on the findings as well as consideration of stakeholder values, risk of benefit and harm, and issues of access, equity, and feasibility.

Meta-analysis

Where an outcome with sufficient variance data was reported by more than one study, data were pooled using Revman [Review Manager 5, Version 5.3, 2014, Cochrane Informatics & Knowledge Management Department]. Pooling of binomial outcome data was used to generate odds ratios (OR) using the Mantel-Haenszel test. Pooling of continuous data used the inverse variance test to generate mean differences (MD) or standardised mean differences (SMD) if different tools or measurement units were reported by individual studies. SMD effect size interpretation was guided by the Cochrane Handbook of Systematic reviews: <0.4 small, 0.4 – 0.7 moderate, and >0.7 large [22]. Where SMD was generated, the effect size was re-expressed into the measurement unit of one of the included data collection tools by multiplying the standard deviation of the baseline assessment by the SMD [23]. Where continuous outcomes were measured on scales with opposite directions, one of the directions was multiplied by -1 [24]. To account for differences at baseline between groups, only mean change was pooled, and not final outcome variables. If mean change was not reported in a study, it was calculated, and the variance, when not reported by the study, was calculated using the Excel Calculator based on calculations provided in the Cochrane Handbook of Systematic Reviews [25]. As measures of body weight change can be reported in several ways in a single study, a hierarchy for which to include was excess weight loss (%), excess weight loss (kg), total body weight loss (%), total

body weight loss (kg), BMI change (kg/m^2), total body fat mass loss (%), total body fat mass loss (kg). The choice between fixed and random effects models was based on the inconsistency, whereby if I^2 >40% (moderate to considerable inconsistency [19]), a random effects model was used. Subgroup analyses were performed to identify differences in the types, duration, and intensity of multidisciplinary intervention as well as surgery performed. Where there were non-significant trends and/or substantial inconsistency (I^2 >40%) sensitivity analysis was applied by removing studies with high risk of bias, varied follow-up timeframes, or procedure and participant characteristics.

Results

The systematic search strategy across six databases identified 6,871 records (Figure 1). The systematic search approach identified 27 eligible publications, which reported on 18 intervention studies. A further seven publications were identified through snowball searching; however, these reported either the protocol or further results of the already identified 18 intervention studies. The main reason for study exclusion was ineligible study design, which was predominately composed of conference abstracts.

Participant characteristics

There were 1,533 participants (pre-attrition; n=770 in intervention groups; n=763 in comparator groups) in total across all studies (Table 1; detailed characteristics in Table S2). Intervention studies were mostly conducted in North America (n=9) and Europe (n=6). Samples comprised mostly mixed bariatric surgeries (n=10 samples) or roux en-Y gastric bypass (n=4 samples). The preoperative health of participants were poorly described, but generally comprised mixed comorbidities and no history of previous bariatric surgery (Table S1).

Intervention characteristics

Four interventions (n=6 publications) delivered lifestyle and nutrition counselling-focused MDT support, four interventions (n=7 publications) delivered psychology-focused MDT support, and 10 interventions (n=21 publications) delivered exercise-focused MDT support (Table 1). There were 5 interventions delivered preoperatively [26-30], 10 postoperatively [31-40], and 3 pre- and postoperatively [41-43] (Table 1; detailed characteristics in Table S2). Of the postoperative interventions, 7 were concluded within the first 6-months post-op [32-35,37,41,43], and 6 extended beyond or commenced after 6-months postoperatively [31,36,38-40,42].

Of the 18 intervention studies, 83% (n=15) modified the MDT by adding a new discipline, and 94% (n=17) modified the MDT by increasing the intensity of MDT support; where 78% (n=14) both added a new discipline and increased the intensity of support (Table 1). Although 94%

increased the intensity of MDT engagement in the intervention group, only 11 studies reported on participant attendance/participation in the intervention, which ranged from 31 to 92% attendance. Although the intervention was well reported by studies, very few described the MDT support given to the control group.

Interventionists tended to vary depending on the focus of the MDT support; where dietitians provided lifestyle and nutrition counselling, psychologists provided psychological therapy, and exercise professionals or physiotherapists supervised physical therapy. However, interventionists also included other disciplines including surgeons, psychiatrists, and general health behaviour professionals (Table 1).

Study quality

Of the participants who underwent bariatric surgery, nine studies reported attrition in one or both groups to be >20%. Risk of bias across studies was generally low for attrition bias and reporting bias (Figure 2; justifications in Online Supplementary Material Table S3). All studies had an unclear to high risk of performance bias, which is an inherent limitation of studies which provide counselling, therapy, and/or supervised exercise. Due to all studies having unclear to high risk of bias overall, subgroup analysis could not be performed according to study quality.

Reported effect of preoperative and postoperative multidisciplinary interventions

All included studies reported a measure of weight loss. The most commonly reported weight loss measure was total body weight loss. Secondary outcomes of interest including hemodynamics, mental health, and comorbidities were reported by one to six studies each.

Few studies reported a significant difference between groups for any outcome. Two studies (11% of included interventions) reported significantly greater weight loss in the intervention

compared to control group. Only one study (6% of included interventions) reported a greater improvement in the intervention group for depression (counselling intervention), quality of life (psychology intervention), and comorbidity incidence (psychology intervention) compared to the control group. No exercise-related interventions reported a significant difference between groups for any included outcome. Only four reported adverse events per group, which were 0 to 23%, and were not different between groups except for one study which reported five cases of nausea, vomiting, or dumping in the control group, but only one case in the intervention group [34]. Serious events were not related to the intervention.

Pooled effects of preoperative and postoperative intensive multidisciplinary interventions on postoperative weight loss

Due to clinical heterogeneity in the measurement of outcomes, SMDs were used to pool effects in all meta-analytical models. Using data from all 18 included intervention studies, preoperative and/or postoperative intensive MDT support for bariatric surgery improved weight loss compared to control with a weak effect size and substantial inconsistency (SMD -0.38 [95%CI: -0.71, -0.05], p=0.02, I^2=84%; Figure S1; GRADE: very low). Sensitivity analysis based on study quality did not result in any significant improvement in inconsistency. The funnel plot suggests no publication bias (Figure S2).

Subgroups by type of intervention (lifestyle and nutrition counselling, psychology, or exercise-focused) were not significantly different (p=0.76). However, timing of intervention (preoperative, postoperative, pre- and postoperative) subgroups were significantly different (p<0.00001; Figure 3). Preoperative intensive MDT interventions were found to reduce weight loss at postoperative follow-up compared with usual care with a small but significant effect size (SMD: 0.27 [95%CI: 0.05, 0.50] p=0.02, I^2=0%, n=315 (IG: n=162, CG: n=153) participants). Conversely, postoperative intensive MDT interventions were found to increase

weight loss at follow-up with a large significant effect size (SMD: -0.94 [95%CI: -1.27, -0.61], p<0.00001, I^2=59%, n=537 (IG: n=262, CG: n=275) participants). Pre- and postoperative intensive MDT interventions were found to increase weight loss at follow-up compared with usual care with a small effect size (SMD: -0.28 [95%CI: -0.52, -0.04], p=0.02, I^2=0%, n=276 (IG: n=142, CG: n=134) participants). The GRADE assessment indicated moderate confidence in the estimated effects reported in subgroup analysis by timing of intervention (Table S4).

Intensive MDT intervention duration (<6-months; ≥6-months) subgroups reported a moderate significant improvement for interventions with ≥6 months duration, and no significant improvement in weight loss for interventions <6-months duration. However, the test for a significant difference between these subgroups was not significant (p=0.22). Due to clinical heterogeneity relating to type of surgery in the majority of samples, meta-analysis by surgery type was not performed.

Pooled effects of preoperative and postoperative intensive multidisciplinary interventions on health-related postoperative outcomes

Two to six studies were able to be pooled to evaluate the impact of intensive pre- and/or postoperative MDT interventions on postoperative health-related outcomes (Table 3). Pooled estimates found that at post-op, the intervention group had significantly improved anxiety, depression, quality of life, diastolic blood pressure, and resting heart. No effect was found for all outcomes measuring blood lipids and glycaemic and insulin markers. The most common reason for downgrading confidence in the evidence (GRADE) was due to confidence intervals being wider than effect sizes, and small participant numbers which decreased confidence in the consistency of the pooled effect.

Discussion

The findings of this systematic review and meta-analysis suggest that providing intensive MDT support may confer additional postoperative health outcomes and increase the amount of weight loss compared to a minimal amount of contact provided during the usual care control groups. Small numbers of counselling and psychology-focused studies found that MDT interventions, whether pre- or postoperative, improved mental health outcomes and quality of life; and exercise-focused interventions improved cardiovascular function. However, interestingly exercise-focused interventions did not provide any additional benefit compared to usual care on blood lipids or glycaemic or insulin markers. Although these improvements in health-related outcomes suggest that intensive pre- or postoperative MDT support has some benefit, it is the meta-analysis of postoperative weight loss that gives answers as to who should be involved in the MDT, when it should be delivered, for how long, and what it should involve.

The primary meta-analytical model found a statistically significant increase in postoperative weight loss; however, the SMD effect size was small, imprecise and had high levels of clinical heterogeneity leading to very low confidence in the estimated effect. Subgroup analysis by the type of intervention found that there was no difference in postoperative weight loss between counselling, psychological, or exercise-focused; each of which were delivered by the relevant health professionals (dietitians, psychologists, exercise scientists respectively). However, subgroup analysis found that intensive preoperative MDT interventions, of any kind, led to decreased postoperative weight loss with small effect size. Postoperative intensive MDT interventions of any kind substantially improved postoperative weight loss with a large effect size and moderate statistical inconsistency. The effect size of enhanced weight loss for postoperative interventions was decreased to a small effect size if the intervention also involved a preoperative component. Further subgroup analysis by intervention duration suggests that

interventions were most effective if they were ≥6-months duration; however, the subgroup model was not significant. A systematic review and meta-analysis by Carretero-Ruiz et al [61] found that postoperative exercise training did not significantly improve weight loss; however, their meta-analytical model, which approached statistical significance (SMD: 0.15 95%CI: -0.02, 0.32), included studies with study durations of 4-weeks, which favoured the control arm. This suggests that study duration is important, where significant effects were found for the current review with interventions from 3-months or longer, and further research will reveal if the ideal intervention duration is 6-months or longer.

It should be highlighted that although preoperative interventions led to less postoperative weight loss, they improved patient-centered outcomes such as quality of life and mental health. Preoperative MDT support is essential for safe and effective preoperative care; however, this review suggests intensive MDT support such as supervised exercise sessions may be better suited to the postoperative phase. Although the use of intervention studies establishes a cause-and-effect relationship, it does not reveal the mechanisms by which intensive preoperative MDT support would lead to less postoperative weight loss, especially as pre-intervention weights were used as baseline to account for this source of bias in postoperative outcomes. One possible mechanism may be that intensive preoperative MDT interventions do not deliver behavioural skills which are relevant in the postoperative phase. Postoperative behavioural interventions are specialised to meet the unique side-effects and symptoms of bariatric surgery, such as dietary portion control, different dietary priorities, managing hydration, changing cognitive states, changing demographic and relationship characteristics which are triggered by the surgery, or managing physical activity whilst experiencing symptoms such as nausea or faintness [62-66]. Other possible contributors are psychosocial factors such as the stage of

readiness to change and body image, as well as facilitators and barriers which may vary pre- and postoperatively [67-70].

Limitations

Whilst this systematic review and meta-analysis has methodological strengths, the confidence in the body of evidence for the estimated effects ranged from moderate to very low due to limitations in the existing literature. Of importance, any conclusions about how MDT support should be provided should be made with a caution relating to the finding that although 18 unique intervention studies were included, none of these eligible studies aimed to determine the ideal provision of MDT support. Further, many of the disciplines providing care may not have worked collaboratively as a team; as this was poorly described across most papers. Rather included studies had other objectives related to specific health outcomes such as fitness or dietary change; suggesting that RCTs are required which aim to specifically evaluate the best use of MDT resources to provide detailed guidelines and inform service provision. Only four studies have investigated the impact of additional lifestyle and nutrition counselling or psychological interventions, respectively, on postoperative outcome, where the bulk of literature has been focused on providing intensive physical activity interventions. These exercise-focused interventions are largely conducted in the USA; where there were no studies found to be conducted in Asia or Oceania despite these continents having high rates of bariatric surgery [71,72]; cautions should therefore be made about the cultural relevance of the findings before translating to practice internationally. Due to clinical heterogeneity relating to the type of surgery used across included samples, conclusions cannot be drawn about the relative importance of pre- and postoperative care specific to surgery type.

Conclusion

Whilst usual MDT care is important preoperatively, this review conditionally recommends intensive MDT interventions for enhanced postoperative weight loss if delivered in the postoperative period, led by any health professional, based on moderate evidence. The literature suggests that these postoperative interventions may be more effective with durations ≥6-months. This review also conditionally recommends lifestyle and nutrition counselling or psychology intervention for improved mental health and quality of life at any pre- or postoperative stage, based on low to moderate evidence. Due to the very low to moderate confidence in the body of evidence for pooled effects, further research may strengthen or change these recommendations. Further RCTs are required to determine the level and method of postoperative engagement for the most cost-effective use of resources; these RCTs should use objective measures and consider outcomes beyond weight loss such as mental and physical health.

References

1. Colquitt JL, Pickett K, Loveman E, Frampton GK. Surgery for weight loss in adults. *The Cochrane Library.* 2014.
2. Mechanick JI, Youdim A, Jones DB, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient—2013 update: cosponsored by American Association of Clinical Endocrinologists, the Obesity Society, and American Society for Metabolic & Bariatric Surgery. *Obesity.* 2013;21(S1):S1-S27.
3. Loveman E, Frampton G, Shepherd J, et al. The clinical effectiveness and cost-effectiveness of long-term weight management schemes for adults: a systematic review. 2011.
4. Odom J, Zalesin KC, Washington TL, et al. Behavioral predictors of weight regain after bariatric surgery. *Obesity surgery.* 2010;20(3):349-356.
5. Magro DO, Geloneze B, Delfini R, Pareja BC, Callejas F, Pareja JC. Long-term weight regain after gastric bypass: a 5-year prospective study. *Obesity surgery.* 2008;18(6):648-651.
6. Yuval JB, Mintz Y, Cohen MJ, Rivkind AI, Elazary R. The effects of bougie caliber on leaks and excess weight loss following laparoscopic sleeve gastrectomy. Is there an ideal bougie size? *Obesity surgery.* 2013;23(10):1685-1691.
7. Robinson AH, Adler S, Stevens HB, Darcy AM, Morton JM, Safer DL. What variables are associated with successful weight loss outcomes for bariatric surgery after 1 year? *Surgery for Obesity and Related Diseases.* 2014;10(4):697-704.
8. Choi BC, Pak AW. Multidisciplinarity, interdisciplinarity and transdisciplinarity in health research, services, education and policy: 1. Definitions, objectives, and evidence of effectiveness. *Clinical and investigative medicine.* 2006;29(6):351.
9. Edholm D, Kullberg J, Haenni A, et al. Preoperative 4-Week Low-Calorie Diet Reduces Liver Volume and Intrahepatic Fat, and Facilitates Laparoscopic Gastric Bypass in Morbidly Obese. *Obesity Surgery.* 2011;21(3):345-350.
10. Faria SL, Faria OP, Cardeal MD, Ito MK. Effects of a very low calorie diet in the preoperative stage of bariatric surgery: a randomized trial. *Surgery for Obesity and Related Diseases.* 2015;11(1):230-237.
11. Bower G, Toma T, Harling L, et al. Bariatric surgery and non-alcoholic fatty liver disease: a systematic review of liver biochemistry and histology. *Obesity surgery.* 2015;25(12):2280-2289.
12. Maggard-Gibbons M, Maglione M, Livhits M, et al. Bariatric surgery for weight loss and glycemic control in nonmorbidly obese adults with diabetes: a systematic review. *Jama.* 2013;309(21):2250-2261.
13. Ricci C, Gaeta M, Rausa E, Macchitella Y, Bonavina L. Early impact of bariatric surgery on type II diabetes, hypertension, and hyperlipidemia: a systematic review, meta-analysis and meta-regression on 6,587 patients. *Obesity surgery.* 2014;24(4):522-528.
14. Sarkhosh K, Switzer NJ, El-Hadi M, Birch DW, Shi X, Karmali S. The impact of bariatric surgery on obstructive sleep apnea: a systematic review. *Obesity surgery.* 2013;23(3):414-423.
15. Moher D, Liberati A, Tetzlaff J, Altman DG, Group P. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *Int J Surg.* 2010;8(5):336-341.

16. *CREBP-SRA Polyglot Search Translator. [online]* [computer program]. Centre for Research in Evidence Based Practice; 2017.
17. Rathbone J, Carter M, Hoffmann T, Glasziou P. Better duplicate detection for systematic reviewers: evaluation of Systematic Review Assistant-Deduplication Module. *Systematic reviews.* 2015;4(1):6.
18. Innovation VH. Covidence systematic review software. In: Veritas Health Innovation Melbourne, Victoria Australia; 2017.
19. Cochrane Handbook for Systematic Reviews of Interventions. Version 5.1.0. 2011. http://handbook.cochrane.org/.
20. Guyatt GH, Oxman AD, Schünemann HJ, Tugwell P, Knottnerus A. GRADE guidelines: a new series of articles in the Journal of Clinical Epidemiology. *J Clin Epidemiol.* 2011;64(4):380-382.
21. *GRADEpro GDT: GRADEpro Guideline Development Tool [Software]* [computer program]. McMaster University; 2015.
22. Higgins, Julian, Green. 17.8.2 Study summaries using more than one patient-reported outcome. In: *Cochrane handbook for systematic reviews of interventions.*2011.
23. Higgins, Julian, Green. 12.6.4 Re-expresing SMD using a familiar instrument. In: *Cochrane handbook for systematic reviews of interventions.*2011.
24. Higgins, Julian, Green. 9.2.3.2 The standarized mean difference. In: *Cochrane handbook for systematic reviews of interventions.*2011.
25. *Finding SDs* [computer program]. Cochrane.org: Cochrane Collaboration and University of Portsmouth.
26. Baillot A, Vallée CA, Mampuya WM, et al. Effects of a Pre-surgery Supervised Exercise Training 1 Year After Bariatric Surgery: a Randomized Controlled Study. *Obesity Surgery.* 2018;28(4):955-962.
27. Bond D, Thomas J, Vithiananthan S, et al. Intervention-related increases in preoperative physical activity are maintained 6-months after Bariatric surgery: results from the bari-active trial. *International journal of obesity (2005).* 2017;41(3):467-470. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/318/CN-01447318/frame.html. Accessed Mar.
28. Parikh M, Chung M, Sheth S, et al. Randomized pilot trial of bariatric surgery versus intensive medical weight management on diabetes remission in type 2 diabetic patients who do NOT meet NIH criteria for surgery and the role of soluble RAGE as a novel biomarker of success. *Annals of surgery.* 2014;260(4):617-622; discussion 622-614. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/630/CN-01022630/frame.html. Accessed Oct.
29. Gade H, Friborg O, Rosenvinge J, Småstuen M, Hjelmesæth J. The Impact of a Preoperative Cognitive Behavioural Therapy (CBT) on Dysfunctional Eating Behaviours, Affective Symptoms and Body Weight 1 Year after Bariatric Surgery: a Randomised Controlled Trial. *Obesity surgery.* 2015;25(11):2112-2119. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/094/CN-01171094/frame.html. Accessed Nov.
30. Kalarchian M, Marcus M, Courcoulas A, Cheng Y, Levine M. Preoperative lifestyle intervention in bariatric surgery: initial results from a randomized, controlled trial. *Obesity (silver spring, md).* 2013;21(2):254-260. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/422/CN-00965422/frame.html. Accessed Feb.
31. Castello V, Simões R, Bassi D, Catai A, Arena R, Borghi-Silva A. Impact of aerobic exercise training on heart rate variability and functional capacity in obese women after

gastric bypass surgery. *Obesity surgery.* 2011;21(11):1739-1749. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/761/CN-00868761/frame.html. Accessed Nov.

32. Coen P, Tanner C, Helbling N, et al. Clinical trial demonstrates exercise following bariatric surgery improves insulin sensitivity. *Diabetes technology & therapeutics.* 2015;18:S83-s84. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/021/CN-01139021/frame.html.
33. Onofre T, Carlos R, Oliver N, et al. Effects of a Physical Activity Program on Cardiorespiratory Fitness and Pulmonary Function in Obese Women after Bariatric Surgery: a Pilot Study. *Obesity Surgery.* 2017;27(8):2026-2033.
34. Sarwer D, Moore R, Spitzer J, Wadden T, Raper S, Williams N. A pilot study investigating the efficacy of postoperative dietary counseling to improve outcomes after bariatric surgery. *Surgery for obesity and related diseases.* 2012;8(5):561-568. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/577/CN-00969577/frame.html. Accessed Sep-Oct.
35. Stegen S, Derave W, Calders P, Van Laethem C, Pattyn P. Physical fitness in morbidly obese patients: Effect of gastric bypass surgery and exercise training. *Obesity Surgery.* 2011;21(1):61-70.
36. Mundbjerg L, Stolberg C, Cecere S, et al. Supervised Physical Training Improves Weight Loss After Roux-en-Y Gastric Bypass Surgery: a Randomized Controlled Trial. *Obesity (silver spring, md).* 2018;(no pagination)(5):828-837. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/126/CN-01465126/frame.html.
37. Daniels P, Burns R, Brusseau T, et al. Effect of a randomised 12-week resistance training programme on muscular strength, cross-sectional area and muscle quality in women having undergone Roux-en-Y gastric bypass. *Journal of sports sciences.* 2018;36(5):529-535. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/726/CN-01458726/frame.html. Accessed Mar.
38. Huck CJ. Effects of supervised resistance training on fitness and functional strength in patients succeeding bariatric surgery *Journal of Strength & Conditioning Research* 2015;29(3):589-595.
39. Nijamkin M, Campa A, Sosa J, Baum M, Himburg S, Johnson P. Comprehensive nutrition and lifestyle education improves weight loss and physical activity in Hispanic Americans following gastric bypass surgery: a randomized controlled trial. *Journal of the academy of nutrition and dietetics.* 2012;112(3):382-390. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/319/CN-00903319/frame.html. Accessed Mar.
40. Galle F, Maida P, Cirella A, Giuliano E, Belfiore P, Liguori G. Does Post-operative Psychotherapy Contribute to Improved Comorbidities in Bariatric Patients with Borderline Personality Disorder Traits and Bulimia Tendencies? A Prospective Study. *Obesity surgery.* 2017;27(7):1872-1878. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/171/CN-01396171/frame.html.
41. Creel D, Schuh L, Reed C, et al. A randomized trial comparing two interventions to increase physical activity among patients undergoing bariatric surgery. *Obesity (silver spring, md).* 2016;24(8):1660-1668. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/008/CN-01177008/frame.html. Accessed Aug.
42. Lier H, Biringer E, Stubhaug B, Tangen T. The impact of preoperative counseling on postoperative treatment adherence in bariatric surgery patients: A randomized controlled trial. *Patient Education & Counseling.* 2012;87(3):336-342.

43. Ogden J, Hollywood A, Pring C. The impact of psychological support on weight loss post weight loss surgery: a randomised control trial. *Obes Surg.* 2015;25(3):500-505.
44. Kalarchian M, Marcus M, Courcoulas A, Cheng Y, Levine M. Preoperative lifestyle intervention in bariatric surgery: a randomized clinical trial. *Surgery for obesity and related diseases.* 2016;12(1):180-187. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/653/CN-01259653/frame.html. Accessed Jan.
45. Nijamkin MP, Campa A, Nijamkin SS, Sosa J. Comprehensive behavioral-motivational nutrition education improves depressive symptoms following bariatric surgery: A randomized, controlled trial of obese Hispanic Americans. *Journal of Nutrition Education and Behavior.* 2013;45(6):620-626.
46. Parikh M, Dasari M, McMacken M, Ren C, Fielding G, Ogedegbe G. Does a preoperative medically supervised weight loss program improve bariatric surgery outcomes? A pilot randomized study. *Surg Endosc.* 2012;26(3):853-861.
47. Gade H, Hjelmesæth J, Rosenvinge J, Friborg O. Effectiveness of a cognitive behavioral therapy for dysfunctional eating among patients admitted for bariatric surgery: a randomized controlled trial. *Journal of obesity.* 2014;2014:127936. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/302/CN-01114302/frame.html.
48. Hollywood A, Ogden J, Pring C. The impact of a bariatric rehabilitation service on weight loss and psychological adjustment--study protocol. *BMC Public Health.* 2012;12:275.
49. Hollywood A, Ogden J, Hashemi M. A randomised control trial assessing the impact of an investment based intervention on weight-loss, beliefs and behaviour after bariatric surgery: study protocol. *BMC obesity.* 2015;2(1) (no pagination). http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/174/CN-01374174/frame.html.
50. Baillot A, Mampuya WM, Comeau E, Méziat-Burdin A, Langlois MF. Feasibility and impacts of supervised exercise training in subjects with obesity awaiting bariatric surgery: A pilot study. *Obesity Surgery.* 2013;23(7):882-891.
51. Bond D, Vithiananthan S, Thomas J, et al. Bari-Active: a randomized controlled trial of a preoperative intervention to increase physical activity in bariatric surgery patients. *Surgery for obesity and related diseases.* 2015;11(1):169-177. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/957/CN-01068957/frame.html. Accessed Jan-Feb.
52. Bond D, Thomas J, King W, et al. Exercise improves quality of life in bariatric surgery candidates: results from the Bari-Active trial. *Obesity (silver spring, md).* 2015;23(3):536-542. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/075/CN-01069075/frame.html. Accessed Mar.
53. Bond D, Graham TJ, Vithiananthan S, et al. Changes in enjoyment, self-efficacy, and motivation during a randomized trial to promote habitual physical activity adoption in bariatric surgery patients. *Surgery for obesity and related diseases.* 2016;12(5):1072-1079. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/057/CN-01425057/frame.html. Accessed Jun.
54. Bond D, Raynor H, Thomas J, et al. Greater Adherence to Recommended Morning Physical Activity is Associated With Greater Total Intervention-Related Physical Activity Changes in Bariatric Surgery Patients. *Journal of physical activity & health.* 2017;14(6):492-498. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/606/CN-01440606/frame.html. Accessed Jun.

55. Coen PM, Menshikova EV, Distefano G, et al. Exercise and Weight Loss Improve Muscle Mitochondrial Respiration, Lipid Partitioning, and Insulin Sensitivity After Gastric Bypass Surgery. *Diabetes.* 2015;64(11):3737-3750.
56. Woodlief T, Carnero E, Standley R, et al. Dose response of exercise training following roux-en-Y gastric bypass surgery: a randomized trial. *Obesity (silver spring, md).* 2015;23(12):2454-2461. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/116/CN-01134116/frame.html. Accessed Dec.
57. Nunez Lopez YO, Coen PM, Goodpaster BH, Seyhan AA. Gastric bypass surgery with exercise alters plasma microRNAs that predict improvements in cardiometabolic risk. *Int J Obes (Lond).* 2017;41(7):1121-1130.
58. Mundbjerg LH, Stolberg CR, Bladbjerg EM, Funch-Jensen P, Juhl CB, Gram B. Effects of 6 months supervised physical training on muscle strength and aerobic capacity in patients undergoing Roux-en-Y gastric bypass surgery: a randomized controlled trial. *Clinical Obesity.* 2018;8(4):227-235.
59. Stolberg C, Mundbjerg L, Funch-Jensen P, Gram B, Juhl C, Bladbjerg E-M. Effects of gastric bypass followed by a randomized study of physical training on markers of coagulation activation, fibrin clot properties, and fibrinolysis. *Surgery for obesity and related diseases.* 2018;(no pagination). http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/020/CN-01608020/frame.html.
60. Stolberg CR, Mundbjerg LH, Funch-Jensen P, Gram B, Bladbjerg EM, Juhl CB. Effects of gastric bypass surgery followed by supervised physical training on inflammation and endothelial function: A randomized controlled trial. *Atherosclerosis.* 2018;273:37-44.
61. Carretero-Ruiz A, del Carmen Olvera-Porcel M, Cavero-Redondo I, et al. Effects of exercise training on weight loss in patients who have undergone bariatric surgery: a systematic review and meta-analysis of controlled trials. *Obesity surgery.* 2019:1-14.
62. Parrott J, Frank L, Rabena R, Craggs-Dino L, Isom KA, Greiman L. American Society for Metabolic and Bariatric Surgery integrated health nutritional guidelines for the surgical weight loss patient 2016 update: micronutrients. *Surgery for Obesity and Related Diseases.* 2017;13(5):727-741.
63. Ziegler O, Sirveaux M, Brunaud L, Reibel N, Quilliot D. Medical follow up after bariatric surgery: nutritional and drug issues General recommendations for the prevention and treatment of nutritional deficiencies. *Diabetes & metabolism.* 2009;35(6):544-557.
64. Heber D, Greenway FL, Kaplan LM, Livingston E, Salvador J, Still C. Endocrine and nutritional management of the post-bariatric surgery patient: an Endocrine Society Clinical Practice Guideline. *The Journal of Clinical Endocrinology & Metabolism.* 2010;95(11):4823-4843.
65. Bruze G, Holmin TE, Peltonen M, et al. Associations of bariatric surgery with changes in interpersonal relationship status: results from 2 Swedish cohort studies. *JAMA surgery.* 2018;153(7):654-661.
66. Applegate KL, Friedman KE. The impact of weight loss surgery on romantic relationships. *Bariatric Nursing and Surgical Patient Care.* 2008;3(2):135-141.
67. Marcus BH, Eaton CA, Rossi JS, Harlow LL. Self-Efficacy, Decision-Making, and Stages of Change: An Integrative Model of Physical Exercise 1. *Journal of applied social psychology.* 1994;24(6):489-508.
68. Sarwer DB, Wadden TA, Moore RH, Eisenberg MH, Raper SE, Williams NN. Changes in quality of life and body image after gastric bypass surgery. *Surgery for obesity and related diseases.* 2010;6(6):608-614.

69. Spörndly-Nees S, Igelström H, Lindberg E, Martin C, Åsenlöf P. Facilitators and barriers for eating behaviour changes in obstructive sleep apnoea and obesity–a qualitative content analysis. *Disability and rehabilitation.* 2014;36(1):74-81.
70. Kelly S, Martin S, Kuhn I, Cowan A, Brayne C, Lafortune L. Barriers and facilitators to the uptake and maintenance of healthy behaviours by people at mid-life: a rapid systematic review. *PloS one.* 2016;11(1):e0145074.
71. *Weight loss surgery in Australia 2014–15: Australian hospital statistics. Cat. no. HSE 186.* . Canberra: AIHW;2017.
72. Angrisani L, Santonicola A, Iovino P, et al. Bariatric surgery and endoluminal procedures: IFSO worldwide survey 2014. *Obesity surgery.* 2017;27(9):2279-2289.

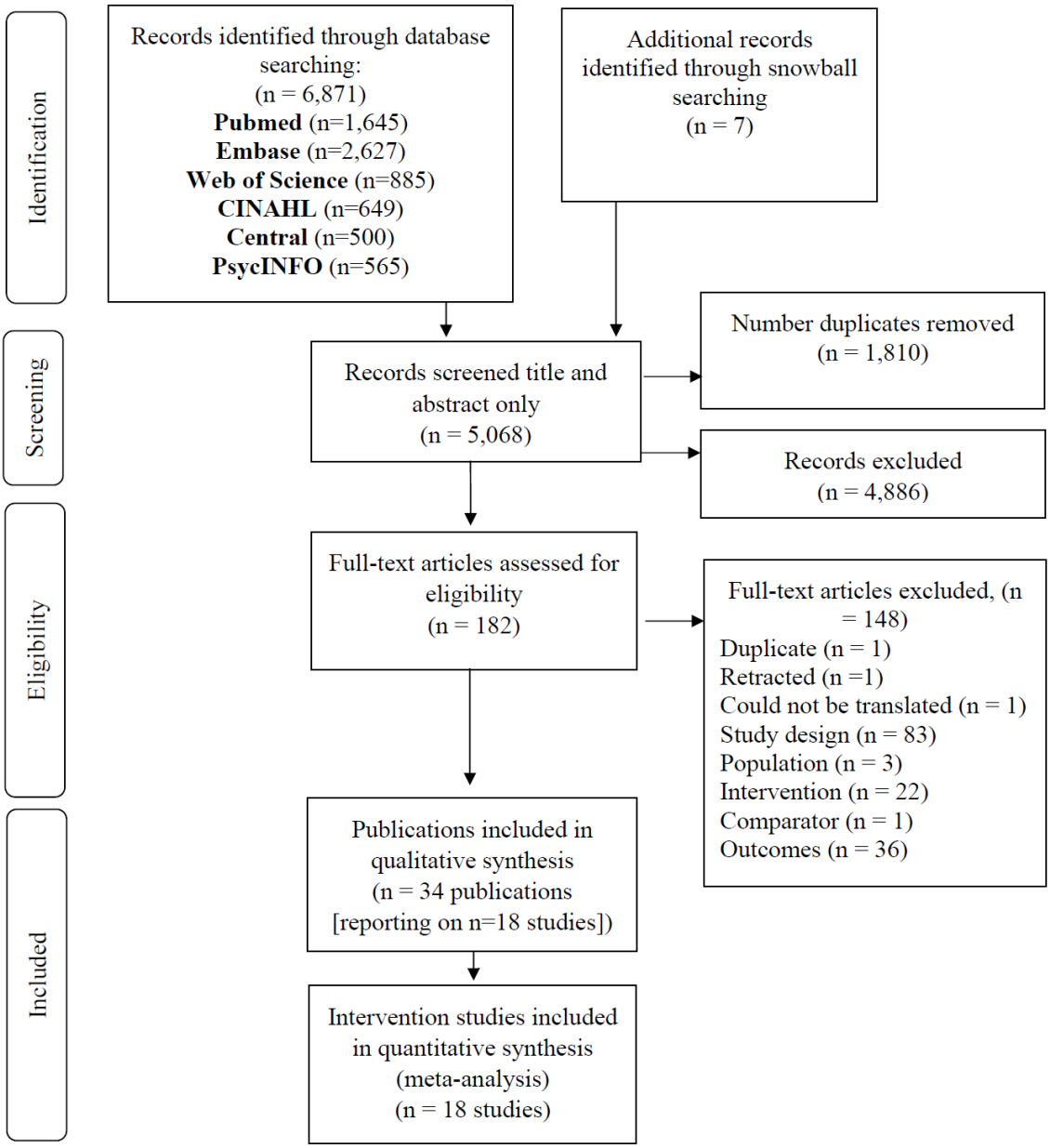


Figure 1: PRISMA flowchart of the search results and the included studies

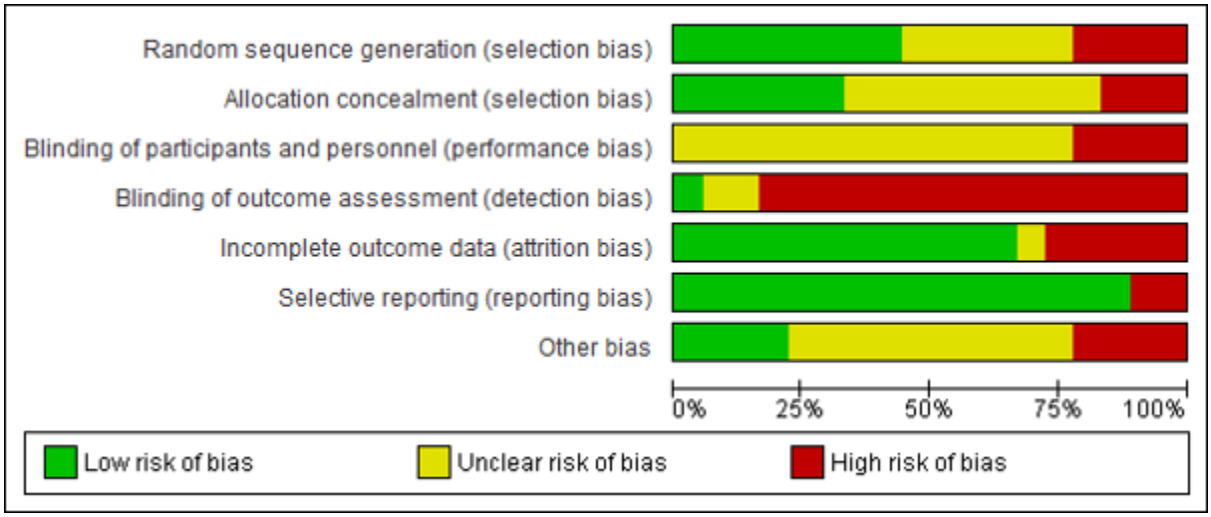


Figure 2: Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies

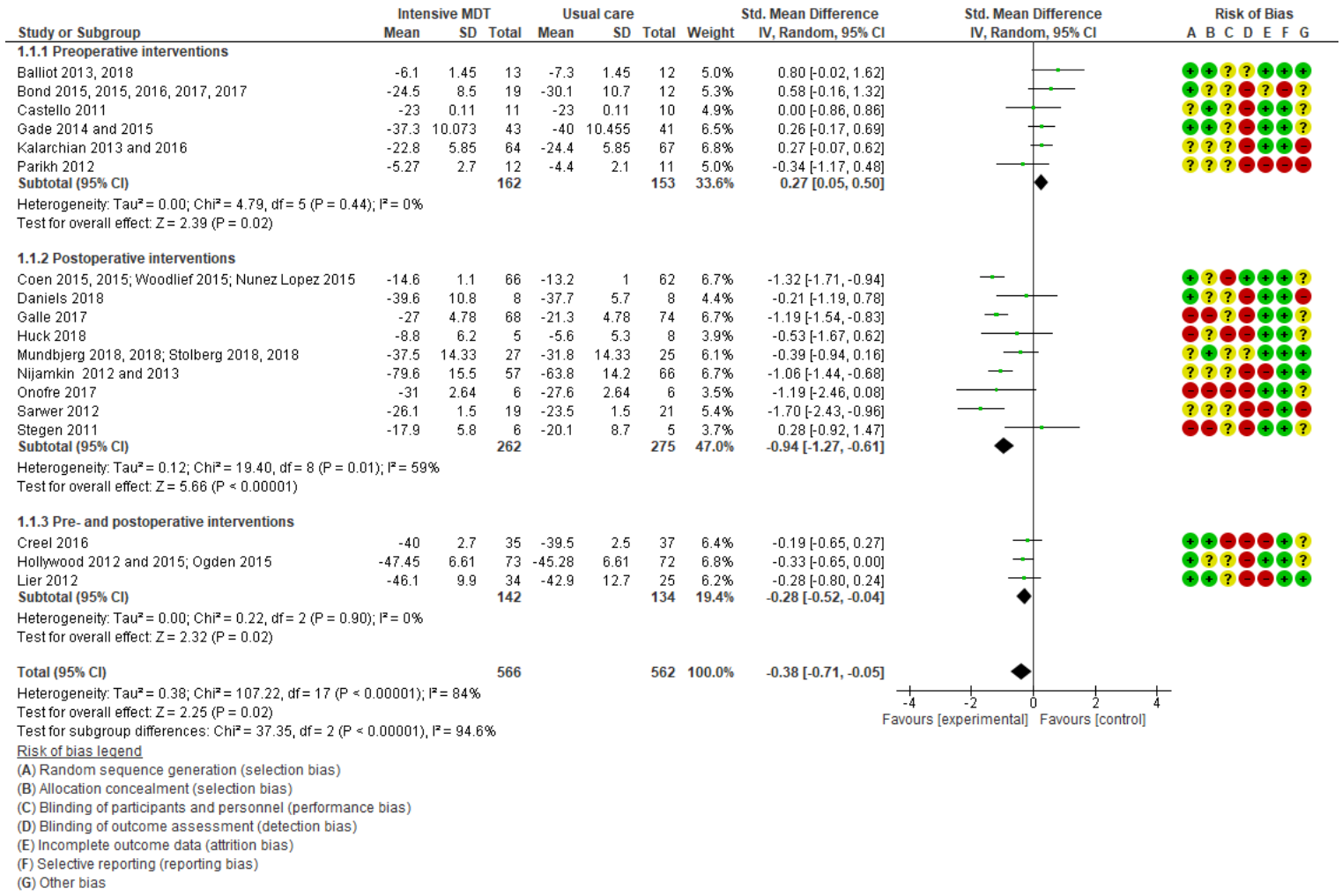


Figure 3: Forest plot comparison showing that compared with usual care, intensive preoperative multidisciplinary team interventions for bariatric surgery decreases postoperative weight loss; and postoperative or pre- and postoperative interventions increase postoperative weight loss.

Table 1: Characteristics of studies which provided preoperative or postoperative multidisciplinary team support to adults who have had bariatric surgery.

Study design	Participants	Intervention	Control	MDT
Lifestyle and nutrition focused interventions (n=4 studies; n=6 publications)				
▪ Kalarchian et al 2013 [1] and 2016 [2] ▪ Open-label 2-arm parallel RCT ▪ USA	IG: n=121; CG: n=119 ▪ µ45 (SD: 11) y; 85%F ▪ Baseline BMI: µ47.5 (SD: 6.4) kg/m^2 ▪ Type of Sx: mixed (gastric bypass, adjusted gastric banding)	▪ Preoperative; 6-mo duration ▪ Behavioural weight management program. ▪ Delivery: Education and counselling in person and telehealth	▪ Usual care. ▪ Delivery: In-person or small group sessions	▪ Physician or surgeon, nurse + interventionist. ▪ Interventionists: trained in behavioural and surgical management (type of health profession not described).
▪ Nijamkin et al 2012 [3] and 2013 [4] ▪ Open-label 2-arm parallel RCT ▪ USA	▪ IG: n=72; CG: n=72 ▪ µ45 (SD: 14) y; 83%F ▪ Baseline BMI: 34 (SD:4) kg/m^2 ▪ Type of Sx: RYGB.	▪ Postoperative intervention: 7.5mo; commenced 7mo post-op. ▪ Nutrition, lifestyle, behavioural-motivational intervention + pre-op and post-op usual care. ▪ Delivery: small group sessions	▪ Printed handout + pre-op and post-op usual care. ▪ Delivery: Printed handout.	▪ MDT: surgeon, dietitian, psychologist, others (not described) + interventionist. ▪ Interventionist: dietitian.
▪ Parikh 2012 [5] ▪ Open-label 2-arm parallel RCT ▪ USA	▪ IG: n=29 ; CG: n=26 ▪ µ46 (SD: 12) y; 84% F ▪ Baseline BMI: µ45 (SD: 7) kg/m^2 ▪ Type of Sx: LAGB.	▪ Preoperative intervention: 6mo. ▪ Medically supervised weight management program + usual care. ▪ Delivery: Two options: 1) 1-to-1 delivery; or 2) group program.	▪ Usual care + waitlist. ▪ Delivery: None.	▪ MDT: surgeon, psychologist, nutritionist + interventionists ▪ Interventionists: surgeon and dietitian.
▪ Sarwer 2012 [6] ▪ Open-label 2-arm parallel RCT ▪ USA ▪ .	▪ IG: n=41; CG: n=43 ▪ µ42 (SD: 10) y; 63%F ▪ Baseline BMI: µ51.6 (SD: 9.2) kg/m^2	▪ Postoperative intervention: 4mo; commencing immediately post-op ▪ Dietary counselling sessions + usual care. ▪ Delivery: counselling, in-person or telehealth	▪ Usual care. ▪ Delivery: as requested – patient initiated.	▪ MDT: support group, psychologist, surgeon + interventionist ▪ Interventionist: dietitian.

	▪ Type of Sx: mixed (RYGB and LAGB).			
Psychology focused interventions (n=4 studies; n=7 publications)				
▪ Lier et al 2012 [7] ▪ Open-label 2-arm parallel RCT ▪ Norway	▪ IG: n=49; CG: n=50 recruited ▪ µ42 (SD: 10) y; 73% F ▪ Baseline BMI: 45.2 (SD: 5.3) kg/m^2 ▪ Type of Sx: Gastric bypass	▪ Preoperative intervention: 1.5mo. ▪ Postoperative intervention: 2-years, commencing 6-months post-op[a]. ▪ Cognitive behavioural therapy. ▪ Delivery: small group session + 1-to-1 sessions.	▪ Usual care. ▪ Delivery: Educational seminars.	▪ MDT: dietitian, surgeon, patient representative, + interventionists. ▪ Interventionists: Psychiatrist, psychologist, and physiotherapist,
▪ Gade 2014 [8] and 2015 [9] ▪ Open-label 2-arm parallel RCT ▪ Norway	▪ IG: n=50; CG: n=52 ▪ µ44 (SD: 10) y; 69% F ▪ Baseline BMI µ43.7 (SD: 4.9) kg/m^2 ▪ Type of Sx: mixed (RYGB or LSG)	▪ Preoperative intervention: 2.5mo. ▪ Cognitive behavioural therapy. ▪ Delivery: in-person or telehealth	▪ Usual care. ▪ Delivery: individual consultation	▪ MDT: dietitian, medical doctor, nurse, physical therapist, + interventionist. ▪ Interventionist: Not described but assumed to be a psychologist.
▪ Galle et al 2017 [10] ▪ Open-label 2-arm parallel non-randomised controlled trial ▪ Italy	▪ IG: n=72; CG: n=82. ▪ µ33 (range: 18-63) y; 74% F ▪ Baseline BMI: Not reported. ▪ Type of Sx: mixed (LYRGB or LAGB).	▪ Postoperative intervention: 12-months, commenced 1mo post-op ▪ Dialectical behavioural psychotherapy + usual care. ▪ Delivery: 1-to-1 in person, training in groups + optional telehealth.	▪ Usual care. ▪ Delivery: Not described.	▪ MDT: medical doctor, psychology, surgeon, + interventionist. ▪ Interventionist: "primary therapist", assumed to be psychologist.
▪ Hollywood et al 2012 [11] and 2015 [12], Ogden et al 2015 [13] ▪ Open-label 2-arm parallel RCT ▪ United Kingdom	▪ IG: n=82; CG: n=80 ▪ µ45 (SD: 11) y; 75% F ▪ Baseline BMI: µ50.7 (SD: 7.8) kg/m^2 ▪ Type of Sx: mixed (RYGB, LAGB, LSG)	▪ Preoperative intervention: 0.5-months. ▪ Postoperative intervention: 3mo, commencing immediately post-op. ▪ Bariatric rehabilitation service + usual care. ▪ Delivery: in-person appointments.	▪ Usual care. ▪ Delivery: standard appointments: 3, 6, and 12mo post-op.	▪ MDT: dietitian and "multidisciplinary clinic" not further described, + interventionist. ▪ Interventionist: health psychologist,.
Exercise-focused interventions (n=10 studies; n=21 publications)				
▪ Baillot et al 2013 [14] and 2018 [15] ▪ Open-label 2-arm parallel RCT ▪ Canada	▪ IG: n=15; CG: n=15 n=15 ▪ µ43 (SD: 9) y; 80%F ▪ Baseline BMI: not reported. ▪ Type of Sx: mixed (RYGB, LSG)	▪ Preoperative intervention: >3mo (mean 8mo). ▪ Endurance and resistance exercise. ▪ Delivery: supervised exercise sessions	▪ Usual care. ▪ Delivery: Counselling sessions. ▪	▪ MDT: surgeon, nurse, dietitian, support group, interventionist. ▪ Interventionist: physical activity specialist

▪ Bond et al 2015 [16], 2015 [17], 2016 [18], 2017 [19], 2017 [20]. ▪ Open-label 2-arm parallel RCT ▪ USA	▪ IG: n= 42; CG: n= 38 ▪ µ47 (SD: 8) y; 86% F ▪ Baseline BMI: µ45.8 (SD: 7.1) kg/m^2 ▪ Type of Sx: mixed (RYGB, gastric banding, LSG).	▪ Preoperative intervention: 1.5mo. ▪ Behavioural physical activity. ▪ Delivery: counselling sessions, written resources, pedometer	▪ Usual care. ▪ Delivery: Clinical visits.	▪ MDT: surgeon, nurse, + interventions. ▪ Interventionist: behavioural health professional.
▪ Castello et al 2011 [21] ▪ Open-label 2-arm parallel RCT ▪ Brazil	▪ IG: n=16; CG: n=16 ▪ µ36-38 (SD: 4) y; 100%F ▪ Baseline BMI: µ45.6 (SD: 1.5) kg/m^2 ▪ Type of Sx: RYGB	▪ Postoperative intervention: 3-months, commenced 1-month post-op. ▪ Aerobic exercise training. ▪ Delivery: supervised exercise sessions	▪ Usual care. ▪ Delivery: Not stated	▪ MDT: surgeon, nurse + interventionist. Interventionist: physiotherapist.
▪ Coen et al 2015 [22] and 2015 [23], Woodlief 2015 [24], and Nunez Lopez 2017 [25]. ▪ Single-blinded (assessor) 2-arm parallel RCT ▪ USA	▪ IG: n=66; CG: n=62 ▪ µ41 (SD: 10) y; 83% F ▪ Baseline BMI: µ38.3-38.8 (SD: 6.9) kg/m^2 ▪ Type of Sx: RYGB	▪ Postoperative intervention: 6mo; commenced 1-3mo post-op Semi-supervised exercise sessions + health education. ▪ Delivery: supervised sessions	▪ Health education. ▪ Delivery: group sessions	▪ MDT: surgeon, nurse, interventionist ▪ Interventionist: exercise physiologist.
▪ Creel et al 2016 [26] ▪ Open-label 3-arm[b] parallel RCT ▪ USA ▪	▪ IG1: n=48; CG: n=50 ▪ µ45 (SD: 11) y; 90% F ▪ Baseline BMI: µ47.4 (SD: 8.3) kg/m^2 ▪ Type of Sx: mixed (RYGB, LSG, gastric bypass, DS)	▪ Preoperative intervention: Duration unclear, but ≥ 0.5mo. ▪ Postoperative intervention: 6.5omo; commenced immediately post-op. ▪ Exercise counselling. ▪ Delivery: counselling	▪ Usual care. ▪ Delivery: educational pamphlet.	▪ MDT: surgeon, dietitian, + interventionist. ▪ Interventionist: "exercise professional".
▪ Daniels 2018 [27] ▪ Open-label 2-arm parallel RCT ▪ USA	▪ CG: n=8; CG: n=8 ▪ µ45 (SD: 10) y; 100% F. ▪ Baseline BMI: not reported. ▪ Type of Sx: RYGB.	▪ Postoperative intervention: 3mo; commenced 2mo post-op. ▪ Resistance training. ▪ Delivery: supervised sessions.	▪ Usual care. ▪ Delivery: one off advice.	▪ MDT: Assumed surgeon, nurse + interventionist. ▪ Interventionist: suggested to be lead author, an exercise physiologist.
▪ Huck 2015 [28] ▪ Single-blind 2-arm parallel quasi-RCT ▪ USA	▪ IG: n=7; CG: n= 8 ▪ µ44-54 (SD: 10) y; 80% F ▪ Baseline BMI µ32.7 (SD: 4.2) and µ37.7 (SD: 6.3) kg/m^2 ▪ Type of Sx: mixed (RYGB, LSG, LAGB)	▪ Postoperative intervention: 3mo; commenced average of 5mo post-op. ▪ Resistance training. ▪ Delivery: small group supervised sessions	▪ Usual care. ▪ Delivery: not described.	▪ MDT: surgeon, nurse, dietitian, + interventionist. ▪ Interventionist: "certified strength and conditioning specialist".

▪ Mundbjerg et al 2018 [29], 2018 [30]; Stolberg et al 2018 [31], 2018 [32]. ▪ Open-label 2-arm parallel RCT ▪ Denmark	▪ IG: n=32; CG: n=28 ▪ µ42 (SD: 9) y; 70% F ▪ Baseline BMI µ43.0 (SD: 6.1) kg/m^2 ▪ Type of Sx: RYGB	▪ Postoperative intervention: 6mo; commencing 6mo post-op. ▪ Supervised physical training. ▪ Delivery: supervised sessions + free access to gym to do additional activity.	▪ Basic education. ▪ Delivery: not described.	▪ MDT: surgeon, nurse, suggests dietitian but unclear, + interventionist. ▪ Interventionist: physiotherapist.
▪ Onofre et al 2017 [33] ▪ Open-label 2-arm parallel non-randomised controlled trial ▪ Brazil	▪ IG: n= 6; CG: n= 6 ▪ µ39 (SD: 9) y; 100% F ▪ Baseline BMI (pre-op): 45.5 (SD: 7.7) kg/m^2 ▪ Type of Sx: Mixed (gastric bypass, LSG)	▪ Postoperative intervention: 3mo; commenced 3mo post-op. ▪ Physical exercise program. ▪ Delivery: supervised sessions.	▪ Basic education ▪ Delivery: not described.	▪ MDT: surgeon, nurse, + interventionist. ▪ Interventionist: physiotherapist.
▪ Stegen et al 2011 [34] ▪ Open-label 2-arm parallel non-randomised controlled trial ▪ Belgium	▪ IG: n=10; CG: n=9 ▪ µ40-43 (SD: 6-10) y; 73% F ▪ Baseline BMI µ40.4 (SD: 831) and µ45.3 (SD: 2.7) kg/m^2 ▪ Type of Sx: Gastric bypass	▪ Postoperative intervention: 3mo; commencing 1mo post-op. ▪ Exercise program. ▪ Delivery: Supervised sessions	▪ Usual care. ▪ Delivery: not described.	▪ MDT: surgeon, nurse, interventionist. ▪ Interventionist: exercise and rehabilitation professional.

BMI, body mass index; CVD, cardiovascular disease; d, day; DS, duodenal switch; F, female; IG, intervention group; CG, control/comparator group; kg, kilogram; LAGB, laparoscopic adjustable gastric banding; LSG, laparoscopic sleeve gastrectomy; m, meter; MDT, multidisciplinary team; min, minute; mo, month; op, operative; RCT, randomized controlled trial; RYGB, roux en-Y gastric bypass; SD, standard deviation; sx, surgery; wk, week; y, years.

a. Although the intervention extended from preoperatively to 2-years postoperatively; all outcomes were measured at 1-year postop; intervention beyond 1-year postop consisted of a single group session.

b. Only one intervention group was eligible for inclusion.

Table 2: Reported outcomes of 18 included intervention trials which provide preoperative or postoperative multidisciplinary support to patients who have had bariatric surgery.

Study and timepoint	**Body composition** Numerical data presented mean (SD)	**Haemodynamics** Numerical data presented mean (SD)	**Other eligible outcomes** Numerical data presented mean (SD)	**Adverse events**
Lifestyle and nutrition focused interventions (n=4 studies; n=6 publications)				
Kalarchian et al 2013 [1] and 2016 [2] Outcome at 6-months post-op.	▪ TBWL %: IG change: -22.8, CG change: -24.4; no difference between groups (p=0.12).	Not measured.	Not measured.	Reoperation: IG: 1/71; CG: 0/72.
Nijamkin et al 2012 [3] and 2013 [4] Outcomes at 12mo post-op.	▪ EWL%: change: -79.6 (15.5). CG change: -63.8 (14.2). **IG had a higher EWL% (p<0.001).** ▪ TBWL kg: IG baseline: 131.0 (28.0), follow-up: 77.2 (19.2), calculated change: -53.81. CG baseline: 136.5 (35.4), follow-up: 90.3 (21.9), calculated change: -46.2. **IG had lower body weight (p<0.001).** ▪ BMI kg/m^2: IG baseline: 35.4 (6.8), follow-up: 28.9 (6.5), calculated change: -6.5. CG baseline: 36.5 (7.0), follow-up: 32.9 (6.2), calculated change: -3.6. **IG had a lower BMI (p<0.001).**	Not measured.	**Mental health** ▪ Depression score[a]: IG baseline: 30 (41.7), follow-up: 10 (14.9), calculated change: -20. CG baseline: 27 (37.5), follow-up: 21 (31.8), calculated change: -6. **IG had a lower depression scores (p=0.04).**	Not reported.
Parikh 2012 [5] Outcomes at 6mo post-op.	▪ EWL %: No difference between groups (p>0.05); data not reported. ▪ BMI kg/m^2: IG baseline: 45.0 (5.7), follow-up: 39.7 (6.9), change: -5.27 (2.7); CG baseline: 45.0 (7.5), follow-up: 40.6 (7.7), change: -4.4 (2.1). No difference between groups (p=0.31).	Not measured.	Not measured.	Not reported.
Sarwer 2012 [6] Outcome at 6mo post-op.	▪ TBWL%: IG change: -26.1 (1.5). CG change: -23.5 (1.5). No difference between groups (p=0.08).	Not measured.	Not measured.	Nausea, vomiting, or dumping: IG 1/37, CG: 5/41.
Psychology focused interventions (n=4 studies; n=7 publications)				

Study and timepoint	**Body composition** Numerical data presented mean (SD)	**Haemodynamics** Numerical data presented mean (SD)	**Other eligible outcomes** Numerical data presented mean (SD)	**Adverse events**
Lier et al 2012 [7] Outcome at 12mo post-op.	▪ 50% EWL: IG follow-up: n=30/34 (91%). CG follow-up: n=23/30 (85%). No difference between groups (p=0.774). ▪ TBWL kg: IG change: -46.1 (9.9); CG change: -42.9 (12.7). No difference between groups (p=0.540).	Not measured.	Not measured.	Not reported.
Gade 2014 [8] and 2015 [9] Outcome at 12mo post-op.	▪ TBWL kg: IG change -37.3 (95%CI: -34.2, -40.4). CG change: -40.0 (95%CI: 36.7, -43.3). No difference between groups (p=0.816).	Not measured.	**Mental Health**[b] ▪ Anxiety score: IG baseline: 6.8 (95%CI: 5.7, 7.9), follow-up: 4.4 (95%CI: 3.4, 5.5), calculated change: -2.4. CG baseline: 6.3 (95%CI: 4.5, 6.2), follow-up: 5.7 (95%CI: 4.6, 6.8), calculated change: -0.6. No difference between groups (p>0.05). ▪ Depression score: IG baseline: 5.3 (95%CI: 4.5, 6.2), follow-up: 1.6 (95%CI: 0.7, 2.5), calculated change: -3.7. CG baseline: 4.2 (95%CI: 3.3, 5.1), follow-up: 1.7 (95%CI: 0.8, 2.6), calculated change: -2.5. No difference between groups (p>0.05).	Not reported.
Galle et al 2017 [10] Outcome at 13mo post-op	▪ TBWL%: IG change: -27 (range: -18.2, -35.1). CG change: -21.3 (range: -16.3, -27.6). **IG had greater weight loss (p<0.001).**	Not measured.	**Comorbidities** ▪ Hypertension resolution or improvement: Data not reported. **IG had greater resolution or improvement (p=0.02).** ▪ Obstructive sleep apnoea resolution or improvement: Data not reported. **IG had greater resolution or improvement (p=0.03).** ▪ Diabetes resolution or improvement: Data not reported. No difference between groups (p=0.68).	Not reported.

Study and timepoint	**Body composition** Numerical data presented mean (SD)	**Haemodynamics** Numerical data presented mean (SD)	**Other eligible outcomes** Numerical data presented mean (SD)	**Adverse events**
Hollywood et al 2012 [11] and 2015 [12], Ogden et al 2015 [13] Outcome at 12mo post-op.	▪ TBWL kg: IG change: -47.45. CG change: -45.28. No difference between groups p>0.05). ▪ BMI: IG baseline: 50.42 (7.31), follow-up: 33.8 (5.86), change: -16.6 (5.4). CG baseline: 50.89 (8.33), follow-up: 34.53 (6.4), change: -16.37 (5.6). No difference between groups (p=0.70).	Not measured.	**Mental health[c]** ▪ Anxiety: IG baseline: 2.8 (0.9), follow-up: 2.2 (0.9), calculated change -0.6. CG baseline: 2.9 (0.8), follow-up: 2.4 (0.9), calculated change: -0.5. No difference between groups (p>0.05). ▪ Depression: IG baseline: 2.32 (1.15), follow-up: 1.48 (0.7), calculated change -0.84. CG baseline: 2.09 (0.93), follow-up: 1.81 (0.8), calculated change: -0.28. No difference between groups (p>0.05). **Quality of life[d]** ▪ Score: IG baseline: 3.96 (0.77), follow-up: 4.38 (0.51), calculated change 0.42. CG baseline: 4.22 (0.58), follow-up: 4.20 (0.78), calculated change: -0.02. **IG had higher quality of life (p<0.05).**	Not measured.
Exercise-focused interventions (n=10 studies; n=21 publications)				
Baillot et al 2013 [14] and 2018 [14,15] and 2018 [15] Outcome at 3mo post-op.	▪ BMI kg/m^2: Unclear if difference between groups. Data not reported. ▪ Fat mass %: IG baseline: 49.3 (5.5), follow-up: 43.2 (8.4), calculated change: -6.1. CG baseline: 49.1 (4.8), follow-up: 41.8 (7.4), calculated change: -7.3. No difference between groups (p>0.05). ▪ FFM %: IG baseline: 63.5 (12.2), 3m follow-up: 56.6 (11.1), calculated change: -6.9. CG baseline: 65.6 (11.1), follow-up: 61.1 (10.7), calculated change: -4.5. CG lost less FFM (p=0.03).	▪ Resting HR bpm: IG baseline: 77.3 (9.8), follow-up: 70.3 (9.6), calculated change: -7. CG baseline: 80.2 (15.6), 3m follow-up: 74.9 (14.7), calculated change: -5.3. No difference between groups (p=0.58). ▪ SBP mmHg: IG baseline: 125.7 (15.7), follow-up: 115.8 (12.1), calculated change: -9.9. CG baseline: 119.7 (9.4), follow-up: 107.8 (17.5), calculated change: -11.9. No difference between groups (p=0.37). ▪ DBP mmHg: IG baseline: 75.7 (9.3), follow-up: 70.4 (9.7), calculated change: -5.3. CG baseline: 76.2 (9.9), follow-up: 75.0 (17.3), calculated	**Quality of life[e]** Score: IG baseline: Baseline: 66.0 (15.6), follow-up: 84.7 (8.0), calculated change: 18.7. CG baseline: 60.1 (18.8), follow-up: 74.6 (18.1), calculated change: 14.5. No difference between groups (p=0.81).	Not reported.

Study and timepoint	**Body composition** Numerical data presented mean (SD)	**Haemodynamics** Numerical data presented mean (SD)	**Other eligible outcomes** Numerical data presented mean (SD)	**Adverse events**
		change: 1.2. No difference between groups (p=0.58).		
Bond et al 2015, 2015 [17], 2016 [18], 2017 [19], 2017 [20]. Outcome at 6mo post-op.	▪ TBWL %: IG follow-up: -24.5 (8.5). CG follow-up: -30.1 (10.7). No difference between groups (p=0.139).	Not measured.	Not measured.	Not reported.
Coen et al 2015 [22] and 2015 [23], Woodlief 2015 [24], and Nunez Lopez 2017 [25].[22] and 2015 [23], Woodlief 2015 [24], and Nunez Lopez 2017 [25]. Outcome at 6-9mo post-op.	▪ TBWL % (subgroup of completers): (n=19) IG follow-up: -14.6 (1.1), CG (n=42) follow-up -13.2 (1.0). ▪ BMI kg/m^2: IG baseline: 38.8 (6.0), follow-up: 30.6 (5.9), calculated change: -8.2. CG baseline: 38.3 (6.9), follow-up: 30.2 (5.6), calculated change: -8.1. No difference between groups (p=0.67). ▪ Fat mass kg: IG baseline: 51.6 (10.8), follow-up: 31.8 (11.3), calculated change: -19.8. CG baseline: 49.6 (14.9), follow-up: 30.6 (11.4), calculated change: -19.0. No difference between groups (p=0.57). ▪ FFM kg: IG baseline: 50.5 (7.7), follow-up: 49.4 (7.0), calculated change: -1.1. CG baseline: 50.1 (10.1), follow-up: 49.2 (10.2), calculated change: -0.9. No difference between groups (p=0.78).	▪ DBP mmHg: IG baseline: 75.4 (7.8), follow-up: 70.9 (8.4), calculated change: -4.5. CG baseline: 74.0 (9.2), follow-up: 71.3 (8.5), calculated change: -2.7. No difference between groups (p=0.40). ▪ SBP mmHg: IG baseline: 122.8 (14.3), follow-up: 115.5 (11.9), calculated change: -7.3. CG baseline: 121.5 (13.9), follow-up: 117.3 (12.8), calculated change: -4.2. No difference between groups (p=0.55).	**Glycaemia and insulinemia** ▪ FBG mg/dl: IG baseline: 86.0 (8.2), follow-up: 84.1 (7.9), calculated change: -1.9. CG baseline: 88.6 (12.0), follow-up: 85.6 (11.1), calculated change: -3.0. No difference between groups (p=0.53). ▪ FBI uIU/ml: IG baseline: 5.4 (2.0), follow-up: 3.9 (1.7), calculated change: -1.5. CG baseline: 6.3 (4.1), follow-up: 4.1 (2.4), calculated change: -2.2. No difference between groups (p=0.17). ▪ HOMA-IR: IG baseline: 1.1 (0.5), follow-up: 0.8 (0.4), calculated change: -0.3. CG baseline: 1.4 (1.1), follow-up: 0.9 (0.6), calculated change: -0.5. No difference between groups (p=0.21). **Blood lipids** ▪ Total cholesterol mm/dl: IG baseline: 150.9 (31.6), follow-up: 152.0 (31.5), calculated change: 1.1. CG baseline: 140.6 (28.6), follow-up: 144.6 (28.1),	IG: 0/66, CG: 0/62.

Study and timepoint	**Body composition** Numerical data presented mean (SD)	**Haemodynamics** Numerical data presented mean (SD)	**Other eligible outcomes** Numerical data presented mean (SD)	**Adverse events**
			calculated change: 4.0. No difference between groups (p=0.46). ▪ LDL cholesterol mm/dl: IG baseline: 92.5 (26.2), follow-up: 86.3 (24.7), calculated change: -6.2. CG baseline: 84.6 (22.9), follow-up: 80.3 (20.9), calculated change: -4.3. No difference between groups (p=0.53). ▪ HDL cholesterol mm/dl: IG baseline: 36.7 (10.0), follow-up: 48.6 (11.4), calculated change: 11.9. CG baseline: 35.6 (10.7), follow-up: 48.1 (11.0), calculated change: 12.5. No difference between groups (p=0.70). ▪ Triglycerides mm/dl: IG baseline: 108.8 (39.1), follow-up: 85.4 (35.6), calculated change: -23.4. CG baseline: 104.5 (33.0), follow-up: 80.6 (33.5), calculated change: -23.9. No difference between groups (p=0.89).	
Castello et al 2011 [21] Outcome at 4mo post-op.	▪ BMI kg/m^2: IG baseline: 45.6 (1.5), follow-up: 36.8 (1.3), calculated change: -8.8. CG baseline: 44.5 (1.0), follow-up: 35.7 (0.9), calculated change: -8.8. No difference between groups (p>0.05). ▪ TBWL kg: IG calculated change: -23.0. CG calculated change: -23.0. No difference between groups (p>0.05). ▪ Fat mass %: IG baseline: 45.8 (1.4), follow-up: 37.8 (1.2), calculated change: -8. CG baseline: 42.0 (1.5), follow-up: 36.0 (1.1), calculated change: -6. No difference between groups (p>0.05). ▪ Lean mass kg: IG baseline: 63.0 (3.4), follow-up: 58.0 (2.9), calculated change: -	▪ Resting HR bpm: IG baseline: 74.1 (2.4), follow-up: 63.7 (2.8), calculated change: -10.4. CG baseline: 76.4 (2.5), follow-up: 69.3 (3.1), calculated change: -7.1. No difference between groups (p>0.05). ▪ DBP mmHg: IG baseline: 90.5 (4.0), follow-up: 85.0 (3.0), calculated change: -5.5. CG baseline: 92.0 (2.4), follow-up: 88.8 (2.4), calculated change: -3.2. No difference between groups (p>0.05). ▪ SBP mmHg: IG baseline: 170.5 (5.2), follow-up: 146.6 (4.0), calculated change: -23.9. CG baseline: 171.0	Not measured.	IG: 0/16, CG: 0/16.

Study and timepoint	**Body composition** Numerical data presented mean (SD)	**Haemodynamics** Numerical data presented mean (SD)	**Other eligible outcomes** Numerical data presented mean (SD)	**Adverse events**
	5.0. CG baseline: 67.0 (1.7), follow-up: 60.0 (1.6), calculated change: -7.0. No difference between groups (p>0.05).	(7.1), follow-up: 150.0 (7.1), calculated change: -21. No difference between groups (p>0.05).		
Creel et al 2016 [26] Outcome at 6mo post-op.	▪ TBWL kg: IG change: -40.0 (2.7). CG change: -39.5 (2.5). No difference between groups (p>0.05).	Not measured.	Not measured.	Not reported
Daniels 2018 [27] Outcome at 5mo post-op.	▪ TBWL kg[f]: IG change: -39.6 (10.8). CG change: -37.7 (5.7). No difference between groups (p>0.05).	Not measured	Not measured	Not reported
Huck 2015 [28] Outcome at average of 8mo post-op.	▪ TBWL kg: IG baseline: 101.6 (19.8), change -8.8 (6.2). CG baseline: 92.5 (15.5), change: -5.6 (5.3). No difference between groups (p=0.286). ▪ BMI kg/m^2: IG baseline 37.7 (6.3), change: -3.3 (2.3). CG baseline 32.7 (4.2), change: -1.9 (1.9). No difference between groups (p=0.220). ▪ Fat mass kg: IG change: -7.0 (4.5). CG change: -4.0 (3.9). No difference between groups (p=0.191). ▪ Fat mass %: IG change: -3.1 (1.8). CG change: -2.45 (2.9). No difference between groups (p=0.621). ▪ FFM kg: IG change: -1.8 (2.1). CG change: -1.5 (2.6). No difference between groups (p=0.810). ▪ WC cm: IG change: -9.6 (7.6). CG change: 8.6 (8.1). No difference between groups (p=0.795).	▪ Resting HR bpm: IG change: -3.6 (5.5). CG change: -0.88 (9.4). No difference between groups (p=0.519). ▪ DBP mmHg: IG change: 1.4 (11.3). CG change: -1.75 (2.9). No difference between groups (p=0.493). ▪ SBP mm Hg: IG change: 6.9 (16.6). CG change: -0.25 (6.5). No difference between groups (p=0.321).	Not measured.	IG: n=0; not reported in CG.
Mundbjerg et al 2018 [29], 2018 [30]; Stolberg et al 2018 [31], 2018 [32].[29], 2018	▪ TBWL kg: IG baseline: 129.1 (19.9), follow-up 91.6 (18.0), calculated change: -37.5. CG baseline: 123.7 (22.0), follow-	▪ Resting HR bpm: IG baseline: 67.3 (13.0), follow-up: 57.0 (11.6), calculated change: -10.3. CG baseline: 61.4 (8.6), follow-up: 57.1 (6.8),	**Glycaemic and insulin markers** ▪ FBG mmol/L: IG baseline: 6.4 (1.8), follow-up: 5.3 (0.5), calculated change: -1.1. CG baseline: 6.0 (1.0), follow-up:	n=13; not reported per group, no difference

Study and timepoint	Body composition Numerical data presented mean (SD)	Haemodynamics Numerical data presented mean (SD)	Other eligible outcomes Numerical data presented mean (SD)	Adverse events
[30]; Stolberg et al 2018 [31], 2018 [32]. Outcome at 12mo post-op.	up: 91.9 (18.2), calculated change: -31.8. No difference between groups (p=0.158). ▪ BMI kg/m^2: IG baseline: 43.1 (6.7), follow-up: 30.6 (5.7), calculated change: -12.5. CG baseline: 42.8 (5.5), follow-up: 31.8 (5.0), calculated change: -11.0. No difference between groups (p=0.257). ▪ Abdominal fat volume mL: IG baseline: 920.2 (259.5), follow-up: 344.7 (131.6), calculated change: -575.5. CG baseline: 920.6 (374.2), follow-up: 411.1 (220.6), calculated change: -509.5. No difference between groups (p=0.137).	calculated change: -4.3. No difference between groups (p=0.331). ▪ DBP mmHg: IG baseline: 68.7 (10.0), follow-up: 70.6 (11.0), calculated change: 1.9. CG baseline: 68.2 (9.7), follow-up: 71.0 (11.9), calculated change: 2.8. No difference between groups (p=0.153). ▪ SBP mmHg: IG baseline: 130.0 (15.6), follow-up: 121.9 (14.4), calculated change: -8.1. CG baseline: 125.2 (14.2), follow-up: 122.0 (14.6), calculated change: -3.2. No difference between groups (p=0.291).	5.5 (1.0), calculated change: -0.5. No difference between groups (p=0.573). ▪ FBI pmol/L: IG baseline: 173.0 (101.8), follow-up: 57.3 (32.4), calculated change: -115.7. CG baseline: 143.4 (112.6), follow-up: 56.1 (36.1), calculated change: -87.3. No difference between groups (p=0.572). ▪ HbA1c mmol/L: IG baseline: 39.4 (11.1), follow-up: 34.0 (4.8), calculated change: -5.4. CG baseline: 37.1 (7.0), follow-up: 35.0 (5.9), calculated change: -2.1. No difference between groups (p=0.550). ▪ HOMA-IR: IG baseline: 6.91 (4.35), follow-up: 1.90 (1.19), calculated change: -5.01. CG baseline: 5.31 (4.49), follow-up: 1.89 (1.42), calculated change: -3.42. No difference between groups (p=0.703). **Blood lipids** ▪ Total cholesterol mmol/L: IG baseline: 4.8 (1.0), follow-up: 4.3 (0.6), calculated change: -0.5. CG baseline: 4.2 (0.9), follow-up: 3.9 (0.9), calculated change: -0.3. No difference between groups (p=0.897). ▪ LDL cholesterol mmol/L: IG baseline: 3.1 (0.9), follow-up: 2.4 (0.6), calculated change: -0.7. CG baseline: 2.7 (0.8), follow-up: 2.2 (0.8), calculated change: -0.5. No difference between groups (p=0.439). ▪ HDL cholesterol mmol/L: IG baseline: 1.1 (0.2), follow-up: 1.3 (0.3), calculated	between groups (p>0.1).

Study and timepoint	**Body composition** Numerical data presented mean (SD)	**Haemodynamics** Numerical data presented mean (SD)	**Other eligible outcomes** Numerical data presented mean (SD)	**Adverse events**
			change: 0.2. CG baseline: 1.0 (0.2), follow-up: 1.2 (0.2), calculated change: 0.2. **IG had greater improvement from pre-post intervention (p=0.034).** ▪ Triglycerides mmol/L: IG baseline: 1.4 (0.7), follow-up: 0.9 (0.4), calculated change: -0.5. CG baseline: 1.3 (0.5), follow-up: 0.9 (0.3), calculated change: -0.4. No difference between groups (p=0.861).	
Onofre et al 2017 [33] Outcome at 6mo post-op.	▪ TBWL kg: IG baseline: 118.4 (21.6), follow-up: 87.4 (11.7), calculated change: -31.0. CG baseline: 117.6 (7.2), follow-up: 90.0 (23.8), calculated change: -27.6. No difference between groups (p>0.05). ▪ BMI kg/m^2: IG baseline: 46.1 (7.0), follow-up: 33.5 (3.8), calculated change: -12.6. CG baseline: 44.9 (9.0), follow-up: 34.0 (8.8), calculated change: -10.9. No difference between groups (p>0.05). ▪ WC cm: IG baseline: 129.1 (10.3), follow-up: 108.2 (13.3), calculated change: -20.9. CG baseline: 122.3 (12.5), follow-up: 102.2 (17.2), calculated change: -20.1. No difference between groups (p>0.05). ▪ BAI %: IG baseline: 52.0 (6.8), follow-up: 40.3 (5.4), calculated change: -11.7. CG baseline: 49.5 (4.6), follow-up: 38.4 (5.9), calculated change: -11.1. No difference between groups (p>0.05).	▪ DBP mmHg: IG baseline: 101.6 (9.8), follow-up: 80.0 (10.0), calculated change: -21.6. CG baseline: 86.6 (10.3), follow-up: 82.5 (9.5), calculated change: -4.1. No difference between groups (p>0.05). ▪ SBP mmHg: IG baseline: 200.0 (30.9), follow-up: 160.0 (10.0), calculated change: -40.0. CG baseline: 170.8 (33.2), follow-up: 182.5 (15.0), calculated change: 11.7. No difference between groups (p>0.05).	Not measured.	IG: n=0; CG: n=0.
Stegen et al 2011 [34] Outcome at 4mo post-op.	▪ TBWL kg: IG baseline 130.8 (17.8), change: -22.7 (5.7). CG baseline: 126.5 (24.7), change: -26.6 (14.6). No difference between groups (p=0.511).	Not measured.	Not measured.	Not reported.

Study and timepoint	**Body composition** Numerical data presented mean (SD)	**Haemodynamics** Numerical data presented mean (SD)	**Other eligible outcomes** Numerical data presented mean (SD)	**Adverse events**
	▪ TBWL %: IG follow-up: -17.9 (5.8). CG follow-up: -20.1 (8.7). No difference between groups (p=0.511). ▪ BMI kg/m^2: IG baseline: 45.3 (2.7), change: -8.1 (2.5). CG baseline: 40.4 (8.1), change: -8.3 (4.1). No difference between groups (p=0.889) ▪ WC cm: IG baseline: 139.4 (11.8), change: -17.2 (8.1). CG baseline: 129.7 (20.1), change: -20.3 (11.6). No difference between groups (p=0.555) ▪ Fat mass kg: IG baseline: 66.7 (9.0), change: -17.3 (4.6). CG baseline: 57.5 (14.0), change: -19.0 (10.2). No difference between groups (p=0.689) ▪ FFM kg: IG baseline: 63.9 (14.2), change: -5.4 (2.6). CG baseline: 69.0 (13.5), change: -7.6 (4.7).			

BAI, body adiposity index; BMI, body mass index; bpm, beats per minute; DBP, diastolic blood pressure; FBG, fasting blood glucose; FBI, fasting blood insulin; FFM, fat free mass; HR, heart rate; IG, intervention group; CG, control/comparator group; kg, kilogram; m, meter; mo, month; op, operative; SBP, systolic blood pressure; SD, standard deviation; WC, waist circumference.

a. Becks Depression Inventory; BDI-II; higher score = higher depressive mood; scored 0-63.
b. Anxiety and depression scores measured by the Hospital Anxiety and Depression Scale (HADS). Higher scores indicate worse symptoms, with a range of 0 to 21 for anxiety and 0 to 21 for depression.
c. Assessed using the Profile of Mood States. Higher scores indicate worse symptoms, with the total range unclear.
d. Individualised quality of life measured by the SEIQoL. Higher scores indicate higher quality of life, with the total score ranging from 0 to 100.
e. Weight related quality of life measured by the Laval questionnaire; scores are a percentage of a maximum score; higher score indicates higher quality of life.
f. Change values calculated by review authors based on published data on individual participants.

Table 3: Pooled effects and confidence in the body of evidence of intensive pre- and postoperative multidisciplinary interventions on health-related outcomes post bariatric surgery.

Outcome	**Number of studies**	**Number of participants (IG/CG)**	**Types of interventions**	**Effect (95%CI)**	**Model**	**I^2 (%)**	**p-value**	**GRADE[a]**
Anxiety (Figure S3)	2	n=229 (IG: n=116, CG: n=113)	n=2 PsyF	SMD -0.37 (-0.63, -0.11)	FE	0	p=0.0006	Low
Depression (Figure S4)	3	n=352 (IG: n=173, CG: n=179)	n=1 LNCF, n=2 PsyF	SMD -0.37 (-0.58, -0.16)	FE	0	p=0.0006	Moderate
Quality of life (Figure S5)	2	n=170 (IG: n=86, CG: n=84)	n=1 PsyF, n=1 EF	SMD 0.31 (0.00, 0.61)	FE	0	p=0.05	Low
FBG (Figure S6)	2	n=180 (IG: n=93, CG: 87)	n=2 EF	MD 0.05 (-0.14, 0.24) mmol/L	FE	0	p=0.57	Low
FBI (Figure S7)	2	n=180 (IG: n=93, CG: 87)	n=2 EF	MD 4.88 (-2.09, 11.84) pmol/L	FE	0	p=0.17	Low
Total cholesterol (Figure S8)	2	n=180 (IG: n=93, CG: 87)	n=2 EF	MD: -0.08 (-0.26, 0.11) mmol/L	FE	0	p=0.42	Low
LDL cholesterol (Figure S9)	2	n=180 (IG: n=93, CG: 87)	n=2 EF	MD: -0.06 (-0.21, 0.09) mmol/L	FE	0	p=0.40	Low
HDL cholesterol (Figure S10)	2	n=180 (IG: n=93, CG: 87)	n=2 EF	MD: -0.00 (-0.01, 0.01) mmol/L	FE	0	p=0.94	Low
Triglycerides (Figure S11)	2	n=180 (IG: n=93, CG: 87)	n=2 EF	MD: 0.01 (-0.15, 0.16) mmol/L	FE	0	p=0.92	Low

Systolic blood pressure (Figure S12)	6 (5 with 1 outlier removed)	n=251 (IG: 128, CG: 123)	n=6 EF	MD: -1.59 (-3.74, 0.56) mmHg	FE	27	p=0.15	Very low
Diastolic blood pressure (Figure S13)	6	n=239 (IG: 122, CG: 117)	n=6 EF	MD: -1.31 (-2.33, -0.29) mmHg	FE	23	p=0.01	Very low
Resting heart rate (Figure S14)	4	n=111 (IG: 56, CG: 55)	n=4 EF	MD: -3.06 (-5.65, -0.47) bpm	FE	0	p=0.02	Very low

EF, exercise-focused; FBG, fasting blood glucose; FBI, fasting blood insulin; FE, fixed effects; LNCF, lifestyle and nutrition-counselling focused; PsyF, psychology-focused

a. Justifications shown in Table S4

Table S1: Search strategy implemented across six electronic databases and results of total records retrieved

Search Terms
MEDLINE (via PubMed) - searched 19 July 2018 using keywords (title and abstract) and MeSH Terms. Result = 1645 records
#1: (Bariatric Surgery[Mesh] OR Gastric Bypass[Mesh] OR Gastroplasty[Mesh] OR Bariatrics[Mesh] OR Bariatric Surgeries[Mesh] OR Bariatric Surgical Procedures[Mesh] OR Metabolic Surgery[Mesh] OR Stomach Stapling[Mesh] OR Bariatric*[tiab] OR "Gastric Bypass"[tiab] OR Gastroplast*[tiab] OR "Metabolic Surg*"[tiab] OR "Stomach Stapling"[tiab] OR LSG[tiab] OR ESG[tiab] OR gastrectom*[tiab] OR "Roux-en-y"[tiab] OR RYGB[tiab] OR LRYGB[tiab] OR "antiobesity surg*"[tiab]) #2 (Multidisciplinary Research[Mesh] OR Transdisciplinary Research[Mesh] OR Patient Care Team[Mesh] OR Interdisciplinary Health Team[Mesh Terms] OR Nutrition Therapy[Mesh] OR Medical Nutrition Therapy[Mesh] OR Weight Loss Diet[Mesh] OR Weight Reduction Diet[Mesh] OR Low-Calorie Diet[Mesh] OR Counseling[Mesh] OR Health Behavior[Mesh] OR Clinical Psychology[Mesh] OR Food addiction[Mesh] OR Feeding and Eating Disorders[Mesh] OR Exercise Therapy[Mesh] OR Exercise[Mesh] OR Counseling[tiab] OR "Health Behavior"[tiab] OR psychological[tiab] OR "Food addiction"[tiab] OR "Eating Disorder*"[tiab] OR Exercise[tiab] OR "nutrition intervention*"[tiab] or "nutritional intervention*"[tiab] OR "behavioral intervention*"[tiab] OR "behavioural intervention*"[tiab] OR "lifestyle intervention*"[tiab] or "physical activity"[tiab] or interdisciplin*[tiab] OR multidisciplin*[tiab]) AND (clinical study[pt] OR clinical trial[pt] OR controlled clinical trial[pt] OR observational study[pt] OR randomized controlled trial[pt] OR cohort studies[Mesh] OR Prospective Studies[Mesh]) #3: #1 AND #2
CINAHL (via Ebscohost) was searched on 19 July 2018 using keywords and CINAHL Headings. Results = 649 records
#1: ((MH "Bariatric Surgery+") OR (MH "Gastric Bypass+") OR (MH "Gastroplasty+") OR (MH "Bariatrics+") OR (MH "Bariatric Surgeries+") OR (MH "Bariatric Surgical Procedures+") OR (MH "Metabolic Surgery+") OR (MH "Stomach Stapling+") OR TI Bariatric* OR AB Bariatric* OR TI "Gastric Bypass" OR AB "Gastric Bypass" OR TI Gastroplast* OR AB Gastroplast* OR TI "Metabolic Surg*" OR AB "Metabolic Surg*" OR TI "Stomach Stapling" OR AB "Stomach Stapling" OR TI LSG OR AB LSG OR TI ESG OR AB ESG OR TI gastrectom* OR AB gastrectom* OR TI "Roux-en-y" OR AB "Roux-en-y" OR TI RYGB OR AB RYGB OR TI LRYGB OR AB LRYGB OR TI "antiobesity surg*" OR AB "antiobesity surg*") #2: (MH "Multidisciplinary Research+") OR (MH "Transdisciplinary Research+") OR (MH "Patient Care Team+") OR (MH "Interdisciplinary Health Team+") OR (MH "Nutrition Therapy+") OR (MH "Medical Nutrition Therapy+") OR (MH "Weight Loss Diet+") OR (MH "Weight Reduction Diet+") OR (MH "Low-Calorie Diet+") OR (MH "Counseling+") OR (MH "Health Behavior+") OR (MH "Clinical Psychology+") OR (MH "Food addiction+") OR Feeding AND (MH "Eating Disorders+") OR (MH "Exercise Therapy+") OR (MH "Exercise+") OR TI Counseling OR AB Counseling OR TI "Health Behavior" OR AB "Health Behavior" OR TI psychological OR AB psychological OR TI "Food addiction" OR AB "Food addiction" OR TI "Eating Disorder*" OR AB "Eating Disorder*" OR TI Exercise OR AB Exercise OR TI "nutrition intervention*" OR AB "nutrition intervention*" OR TI "nutritional intervention*" OR AB "nutritional intervention*" OR TI "behavioral intervention*" OR AB "behavioral intervention*" OR TI "behavioural intervention*" OR AB "behavioural intervention*" OR TI "lifestyle intervention*" OR AB "lifestyle intervention*" OR TI "physical activity" OR AB "physical activity" OR TI interdisciplin* OR AB interdisciplin* OR TI multidisciplin* OR AB multidisciplin*) #3: #1 AND #2

The Cochrane Library was searched 19 July 2018 using keywords and MeSH Headings. Results = 500 records
#1: ([mh "Bariatric Surgery"] OR [mh "Gastric Bypass"] OR [mh Gastroplasty] OR [mh Bariatrics] OR [mh "Bariatric Surgeries"] OR [mh "Bariatric Surgical Procedures"] OR [mh "Metabolic Surgery"] OR [mh "Stomach Stapling"] OR Bariatric*:ti,ab OR "Gastric Bypass":ti,ab OR Gastroplast*:ti,ab OR "Metabolic Surg*":ti,ab OR "Stomach Stapling":ti,ab OR LSG:ti,ab OR ESG:ti,ab OR gastrectom*:ti,ab OR Roux-en-y:ti,ab OR RYGB:ti,ab OR LRYGB:ti,ab OR "antiobesity surg*":ti,ab) #2: ([mh "Multidisciplinary Research"] OR [mh "Transdisciplinary Research"] OR [mh "Patient Care Team"] OR [mh "Interdisciplinary Health Team"] OR [mh "Nutrition Therapy"] OR [mh "Medical Nutrition Therapy"] OR [mh "Weight Loss Diet"] OR [mh "Weight Reduction Diet"] OR [mh "Low-Calorie Diet"] OR [mh Counseling] OR [mh "Health Behavior"] OR [mh "Clinical Psychology"] OR [mh "Food addiction"] OR Feeding AND [mh "Eating Disorders"] OR [mh "Exercise Therapy"] OR [mh Exercise] OR Counseling:ti,ab OR "Health Behavior":ti,ab OR psychological:ti,ab OR "Food addiction":ti,ab OR "Eating Disorder*":ti,ab OR Exercise:ti,ab OR "nutrition intervention*":ti,ab OR "nutritional intervention*":ti,ab OR "behavioral intervention*":ti,ab OR "behavioural intervention*":ti,ab OR "lifestyle intervention*":ti,ab OR "physical activity":ti,ab OR interdisciplin*:ti,ab OR multidisciplin*:ti,ab) #3: #1 AND #2
EMBASE was searched 17 July 2018 for citations from Embase using keywords (abstract and title) and Emtree terms Results = 2627 records
#1: ('Bariatric Surgery'/exp/mj OR 'Gastric Bypass surgery'/exp/mj OR 'Roux-en-Y gastric bypass'/exp/mj OR 'Bypass surgery'/exp/mj OR 'gastric banding'/exp/mj OR 'sleeve gastrectomy'/exp/mj OR 'biliopancreatic bypass'/exp/mj OR 'Gastroplasty'/exp/mj OR 'Bariatrics'/exp/mj OR 'Metabolic Surgery'/exp OR 'Bariatric*':ti,ab,kw OR "Gastric Bypass":ti,ab,kw OR Gastroplast*:ti,ab,kw OR "Metabolic Surg*":ti,ab,kw OR "Stomach Stapling":ti,ab,kw OR LSG:ti,ab,kw OR ESG:ti,ab,kw OR gastrectom*:ti,ab,kw OR Roux-en-y:ti,ab,kw OR RYGB:ti,ab,kw OR LRYGB:ti,ab,kw OR "antiobesity surg*":ti,ab,kw) #2: ('Interdisciplinary Research'/exp/mj OR 'Diet Therapy'/exp/mj OR 'Medical Nutrition Therapy'/exp/mj OR 'Low Calorie Diet'/exp/mj OR 'Counseling'/exp/mj OR 'Health Behavior'/exp/mj OR 'Clinical Psychology'/exp/mj OR 'Food addiction'/exp/mj OR 'Eating Disorder'/exp/mj OR 'Physical activity, capacity and performance'/exp/mj OR 'Exercise'/exp/mj OR Counseling:ti,ab,kw OR "Health Behavior":ti,ab,kw OR psychological:ti,ab,kw OR "Food addiction":ti,ab,kw OR "Eating Disorder*":ti,ab,kw OR Exercise:ti,ab,kw OR "nutrition intervention*":ti,ab,kw OR "nutritional intervention*":ti,ab,kw OR "behavioral intervention*":ti,ab,kw OR "behavioural intervention*":ti,ab,kw OR "lifestyle intervention*":ti,ab,kw OR "physical activity":ti,ab,kw OR interdisciplin*:ti,ab,kw OR multidisciplin*:ti,ab,kw) #3: ('article'/it OR 'article in press'/it) AND ([adult]/lim OR [aged]/lim OR [middle aged]/lim OR [very elderly]/lim OR [young adult]/lim) #4: #1 AND #2 AND #3 AND #4
Web of Science was searched 19 July 2018 for the following keywords. Results = 885 records
#1: TOPIC: ("Bariatric Surger*" OR "Gastric Bypass" OR Gastroplasty OR Bariatric* OR "Metabolic Surger*" OR "Stomach Stapling" OR Gastroplast* OR LSG OR ESG OR gastrectom* OR "Roux-en-y" OR RYGB OR LRYGB OR "antiobesity surg*")

#2: TITLE: ("Bariatric Surger*" OR "Gastric Bypass" OR Gastroplasty OR Bariatric* OR "Metabolic Surger*" OR "Stomach Stapling" OR Gastroplast* OR LSG OR ESG OR gastrectom* OR "Roux-en-y" OR RYGB OR LRYGB OR "antiobesity surg*") #3: #1 OR #2 #4: TOPIC: ("Nutrition Therapy" OR "Medical Nutrition Therapy" OR "Weight Loss Diet" OR "Weight Reduction Diet" OR "Low-Calorie Diet" OR Counseling OR "Health Behavior" OR "Clinical Psychology" OR "Food addiction" OR "Eating Disorder*" OR " Exercise OR psychological OR "nutrition intervention*" OR "nutritional intervention*" OR "behavioral intervention*" OR "behavioural intervention*" OR "lifestyle intervention*" OR "physical activity" OR interdisciplin* OR multidisciplin*) #5: ("Nutrition Therapy" OR "Medical Nutrition Therapy" OR "Weight Loss Diet" OR "Weight Reduction Diet" OR "Low-Calorie Diet" OR Counseling OR "Health Behavior" OR "Clinical Psychology" OR "Food addiction" OR "Eating Disorder*" OR " Exercise OR psychological OR "nutrition intervention*" OR "nutritional intervention*" OR "behavioral intervention*" OR "behavioural intervention*" OR "lifestyle intervention*" OR "physical activity" OR interdisciplin* OR multidisciplin*) #6: #4 OR #5 #7: #6 AND #3	
PsycINFO was searched 19 July 2018 for the following keywords. Results = 565 records	
#1: (Bariatric Surgery.sh. OR Bariatric*.m_titl. OR Gastric Bypass.mp. OR Gastroplast*.mp. OR Metabolic Surg*.mp. OR LSG.mp. OR ESG.mp. OR gastrectom*.mp. OR Roux-en-y.mp. OR RYGB.mp. OR LRYGB.mp. OR antiobesity surg*.mp.) #2: (Interdisciplinary Treatment Approach.sh. OR Adjunctive Treatment.sh. OR Behavioral Medicine.sh. OR Integrated Service.sh. OR Interdisciplinary Research.sh. OR Multimodal Treatment Approach.sh. OR Behavior Modification.sh. OR Cognitive Techniques.sh. OR Multimodal Treatment Approach.sh. OR Counseling.sh. OR Health Care Delivery.sh. OR Posttreatment Followup.sh. OR Psychiatry.sh. OR Eating Behavior.sh. OR Eating Disorders.sh. OR Nutrition.sh. OR Aerobic exercise.sh. OR Exercise.sh. OR Physical Activity.sh. OR Counseling.mp. OR Health Behavior.mp. OR psychological.mp. OR Food addiction.mp. OR Eating Disorder*.mp. OR Exercise.mp. OR nutrition intervention*.mp. OR nutritional intervention*.mp. OR behavioral intervention*.mp. OR behavioural intervention*.mp. OR lifestyle intervention*.mp. OR physical activity.mp. OR interdisciplin*.mp. OR multidisciplin*.mp.) #3: #1 AND #2	
Total	***6871 records prior to deduplication***

Table S2: Characteristics of studies which provided preoperative or postoperative multidisciplinary team support to bariatric surgery patients.

Study design	Participants	Intervention	Control	MDT	Adherence / attendance
Lifestyle and nutrition focused interventions (n=4 studies; n=6 publications)					
▪ Kalarchian et al 2013 [1] and 2016 [2] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ NCT00623792 ▪ USA ▪ Pre-operative intervention: 6-mo duration	▪ IG: n=121 recruited; n=71 (58%) attended surgery; n=7 (10%) attrition. ▪ CG: n=119; n=72 (61%) attended surgery; n=5 (7%) attrition ▪ Mean 45 (SD: 11) y ▪ 85%F ▪ Baseline BMI (pre-op): 47.5 (SD: 6.4) kg/m^2 ▪ Health: No previous bariatric surgery, no exclusion of chronic diseases. ▪ Type of Sx: mixed (gastric bypass, adjusted gastric banding)	▪ Behavioural weight management program. ▪ Objective: decrease energy intake through diet and increased energy expenditure. ▪ Delivery: Education and counselling through 8 x weekly individual in-person 1hr sessions, then 1x in-person 1hr/mo with 3 x15-20min telehealth sessions per month, for 4mo; overall total of 12 x in-person sessions and 12 x telehealth sessions. ▪ Content: Focus on self-management of eating behaviours and mood, realistic expectations, goal of 1200-1400cal/d and 30min exercise 5d/wk.	▪ Usual care. ▪ Objective: Meet insurance requirements by completing non-standardized physician supervised diet and activity program. ▪ Delivery: In-person or small group sessions delivered 1/mo. ▪ Content: One-off synopsis of content delivered to IG + diet and activity program; not further described.	▪ Added MDT member: yes. ▪ Increased MDT engagement: yes. ▪ MDT: Physician or surgeon, nurse + interventionist. ▪ Interventionists: trained in behavioural and surgical management (type of health profession not described) .	IG: Mean attendance 80.8%. CG: n=58 attended all 6 sessions.
▪ Nijamkin et al 2012 [3] and 2013 [4] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ Not registered. ▪ USA ▪ Post-operative intervention: 7.5mo; commenced 7mo post-op.	▪ IG: n=72 recruited; n=72 (100%) attended surgery; n=15 (21%) attrition. ▪ CG: n=72; n=72 (100%) attended surgery; n=6 (8%) attrition. ▪ Mean 45 (SD: 14) y ▪ 83%F ▪ Baseline BMI (post-op): 34 (SD:4) kg/m^2	▪ Nutrition, lifestyle, behavioural-motivational intervention + pre-op and post-op usual care. ▪ Objective: Promote dietary dietary recommendations with practical behaviour modification strategies to deal with emotional difficulties encountered in the pursuit of healthy lifestyles.	▪ Printed handout + pre-op and post-op usual care. ▪ Objective: Not stated. ▪ Delivery: Printed handout. ▪ Content: healthy eating and exercise.	▪ Added MDT member: no. ▪ Increased MDT engagement: yes. ▪ MDT: surgeon, dietitian, psychologist, others (not described) + interventionist.	IG: Median session attendance 3/6 (64%). CG: not reported.

	▪ Health: No previous bariatric surgery, excluded kidney, adrenal, and heart disease. ▪ Type of Sx: RYGB.	▪ Delivery: 6x small group sessions, fortnightly, 90min/session, lecture style with PowerPoint. ▪ Content: meal planning, health eating education, establishing habits, eating problems, physical activity, diet goal was limited to 1-1.4MJ/d and 60-70g protein.		▪ Interventionist: dietitian.	
▪ Parikh 2012 [5] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ Not registered ▪ USA ▪ Pre-operative intervention: 6mo.	▪ IG: n=29 recruited; n=15 (52%) attended surgery; n=3 (19%) attrition. ▪ CG: n=26; n=16 (62%) attended surgery; n=5 (33%) attrition. ▪ Mean 46 (SD: 12) y ▪ 84% F ▪ Baseline BMI (pre-op): 45 (SD: 7) kg/m^2 ▪ Health: not described; no previous bariatric surgery, no exclusion of chronic diseases. ▪ Type of Sx: LAGB.	▪ Medically supervised weight management program + usual care. ▪ Objective: Not reported. ▪ Delivery: Two options: 1) 1-to-1 delivery of 6x monthly sessions with surgeon, and dietitian; or 2) group program of 1x 1-to-1 consult with surgeon then 5x monthly group sessions; session duration not reported for either option. ▪ Content: Medical evaluation, anthropometry measurement, diet and exercise monitoring, individualised behaviour modification, goal setting.	▪ Usual care + waitlist. ▪ Objective: None. ▪ Delivery: None. ▪ Content: None.	▪ Added MDT member: yes ▪ Increased MDT engagement: yes ▪ MDT: surgeon, psychologist, nutritionist + interventionists ▪ Interventionists: surgeon and dietitian.	IG: Mean session attendance was 2/6 (33%). CG: not reported.
▪ Sarwer 2012 [6] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ Trial registration: None reported ▪ USA ▪ Post-operative intervention: 4mo; commencing immediately post-op.	▪ IG: n=41 recruited; n= 37 (90%) attended surgery; 50% attrition for whole study (not reported per group). ▪ CG: n=43; n= 41 (95%) attended surgery. ▪ Mean 42 (SD: 10) y ▪ 63%F ▪ Baseline BMI (pre-op): 51.6 (SD: 9.2) kg/m^2 ▪ Health: Not described. ▪ Type of Sx: mixed (RYGB and LAGB).	▪ Dietary counselling sessions + usual care. ▪ Objective: assist transition through the phases of post-op texture modified diet + promote macronutrient balance + avoid dietary behaviours likely to cause adverse events (i.e. overeating, vomiting, etc). ▪ Delivery: fortnightly 15min consultations with dietitian in-person or via telephone; 8 x sessions in total. ▪ Content: counseling not further described.	▪ Usual care. ▪ Objective: general support. ▪ Delivery: as requested – patient initiated. ▪ Content: Not described.	▪ Added MDT member: No. ▪ Increased MDT engagement: Yes. ▪ MDT: support group, psychologist, surgeon + interventionist ▪ Interventionist: dietitian.	IG: Mean session attendance was 2.5/8 (31%). CG: not reported.
Psychology focused interventions (n=4 studies; n=7 publications)					

▪ Lier et al 2012 [7] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ Trial registration unclear, possibly: NCT00635011 ▪ Norway ▪ Pre-operative intervention: 1.5mo. ▪ Post-operative intervention: 2-years, commencing 6-months post-op[a].	▪ IG: n=49 recruited; n=44 (90%) attended surgery; n=10 (20%) attrition. ▪ CG: n=50 recruited; n=45 (90%) attended surgery; n=20 (40%) attrition. ▪ Mean 42 (SD: 10) y ▪ 73% F ▪ Baseline BMI (pre-op): 45.2 (SD: 5.3) kg/m^2 ▪ Health: No previous bariatric surgery, no exclusion of chronic diseases. ▪ Type of Sx: Gastric bypass	▪ Cognitive behavioural therapy. ▪ Objective: Achieve lifestyle changes and comorbid psychological problems to facilitate weight loss. ▪ Delivery: 1 x small group session/wk for 6wk pre-op plus 3 x post-op sessions at 6mo, 12mo, and 2y post-op. All sessions were 3hrs. ▪ Content: Cognitive therapy plus mindfulness training, addressed eating and activity behaviour change, problem solving skills, cognitive restructuring, stress reduction, diary keeping, self-monitoring, dietary and exercise targets.	▪ Usual care. ▪ Objective: Not stated. ▪ Delivery: 1x4hr pre-op educational seminar (mandatory), 1x4hr post-op educational seminar (non-mandatory). ▪ Content: Information about the surgery, diet and behaviour change strategies, patient experience.	▪ Added MDT member: yes. ▪ Increased MDT engagement: yes. ▪ MDT: dietitian, surgeon, patient representative, + interventionists. ▪ Interventionists: Psychiatrist, psychologist, and physiotherapist,	IG: n=35 (83%) attended 5 or more pre-op sessions; n=23 (55%) attended 2 or more post-op sessions. CG: n=45 attended pre-op session (mandatory), n=11 (25%) attended post-op session.
▪ Gade 2014 [8] and 2015 [9] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ NCT01403558 ▪ Norway ▪ Pre-operative intervention: 2.5mo.	▪ IG: n=50 recruited; n=49 (98%) attended surgery; n=6 (12%) attrition. ▪ CG: n=52 recruited; n=49 (94%) attended surgery; n=8 (16%) attrition. ▪ Mean 44 (SD: 10) y ▪ 69% F ▪ Baseline BMI (pre-op): 43.7 (SD: 4.9) kg/m^2 ▪ Health: not described. ▪ Type of Sx: mixed (RYGB or LSG)	▪ Cognitive behavioural therapy. ▪ Objective: Reduce disordered eating. ▪ Delivery: 10x weekly sessions, in-person or telephone of unspecified duration. ▪ Content: psychoeducation, affect-regulation, addressing behavioural eating, coping with triggers, reinforcement.	▪ Usual care. ▪ Objective: Not stated. ▪ Delivery: individual consultation; 3 appointments available, patient initiated. ▪ Content: individualized.	▪ Added MDT member: yes. ▪ Increased MDT engagement: yes. ▪ MDT: dietitian, medical doctor, nurse, physical therapist, + interventionist. ▪ Interventionist: Not described but assumed to be a psychologist.	Not reported.
▪ Galle et al 2017 [10] ▪ Open-label 2-arm (1IG, 1CG) parallel non-randomised controlled trial	▪ IG: n=72 recruited; n=72 (100%) attended surgery; n=4 (6%) attrition.	▪ Dialectical behavioural psychotherapy + usual care. ▪ Objective: Improve emotional regulation in patients with personality	▪ Usual care. ▪ Objective: Not described. ▪ Delivery: Not described.	▪ Added MDT member: yes. ▪ Increased MDT engagement: yes.	Not reported.

▪ Not registered. ▪ Italy ▪ Post-operative intervention: 12-months, commenced 1mo post-op	▪ CG: n=82 recruited; n=82 (100%) attended surgery; n=8 (10%) attrition. ▪ Mean 33 (range: 18-63) y ▪ 74% F ▪ Baseline BMI: Not reported. ▪ Health: No previous bariatric surgery, have ≥1 comorbidity, all had either borderline personality disorder or bulimia traits. ▪ Type of Sx: mixed (LYRGB or LAGB).	disorders and eating patterns in bulimia. ▪ Delivery: weekly sessions with therapist + 2-2.5hr weekly skills training in groups + optional telephone consultation. ▪ Content: behavioural capabilities, motivation for skillful behavior, gains to natural environment, structuring the treatment environment, enhancing motivation, education on nutrition.	▪ Content: Not described.	▪ MDT: medical doctor, psychology, surgeon, + interventionist. ▪ Interventionist: "primary therapist", assumed to be psychologist.	
▪ Hollywood et al 2012 [11] and 2015 [12], Ogden et al 2015 [13] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ NCT01264120. ▪ United Kingdom ▪ Pre-operative intervention: 0.5-months. ▪ Post-operative intervention: 3mo, commencing immediately post-op.	▪ IG: n=82 recruited; n= 82 (100%) attended surgery; n=9 (11%) attrition. ▪ CG: n=80 recruited; n=80 (100%) attended surgery; n=8 (10%) attrition. ▪ Mean 45 (SD: 11) y ▪ 75% F ▪ Baseline BMI (pre-op): 50.7 (SD: 7.8) kg/m^2 ▪ Health: not described. ▪ Type of Sx: mixed (RYGB, LAGB, LSG)	▪ Bariatric rehabilitation service + usual care. ▪ Objective: Improve weight loss and facilitate psychological changes including control, self-esteem, coping, emotional eating. ▪ Delivery: 3x 50min appts: 0.5m pre-op, immediately post-op, and 3mo post-op. All in-person + usual care appointments. ▪ Content: Semi-structured delivery targeting knowledge, beliefs, behaviours, coping strategies, and adjustment.	▪ Usual care. ▪ Objective: not described. ▪ Delivery: Pre-op standard care appointment, post-op standard appointments: 3, 6, and 12mo post-op. ▪ Content: Information about diet, texture modified diet progression.	▪ Added MDT member: yes. ▪ Increased MDT engagement: no. ▪ MDT: dietitian and "multidisciplinary clinic" not further described, + interventionist. ▪ Interventionist: health psychologist.	Not reported.
Exercise-focused interventions (n=10 studies; n=21 publications)					
▪ Baillot et al 2013 [14] and 2018 [15] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT	▪ IG: n=15 recruited; n=14 (93%) attended surgery; n=1 (7%) attrition. ▪ CG: n=15 recruited; n=15 (100%) attended surgery; n=3 (20%) attrition.	▪ Endurance and resistance exercise. ▪ Objective: improve physical fitness. ▪ Delivery: 3x80min sessions/wk + monthly aqua-sessions + usual are. ▪ Content: High variety of exercises.	▪ Usual care. ▪ Objective: Not stated. ▪ Delivery: Counselling sessions.	▪ Added MDT member: no. ▪ Increased MDT engagement: yes. ▪ MDT: surgeon, nurse, dietitian,	IG: median 70% attendance. CG: not reported.

▪ NCT01452230 (PreSet Study) ▪ Canada ▪ Pre-operative intervention: >3mo (mean 8mo).	▪ Mean 43 (SD: 9) years of age ▪ 80% female ▪ Baseline BMI: not reported. ▪ Health: mixed comorbidities; no previous bariatric surgery, no exclusion of chronic diseases ▪ Type of Sx: mixed (RYGB, LSG)		▪ Content: physical activity, nutrition, psychological issues.	support group, interventionist. ▪ Interventionist: physical activity specialist	
▪ Bond et al 2015 [16], 2015 [17], 2016 [18], 2017 [19], 2017 [20]. ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ NCT00962325 (Bari-Active Trial) ▪ USA ▪ Pre-operative intervention: 1.5mo.	▪ IG: n= 42 recruited; n= 22 (52%) attended surgery; 14% attrition across both groups. ▪ CG: n= 38 recruited; n= 14 (37%) attended surgery; 14% attrition across both groups. ▪ Mean 47 (SD: 8) y ▪ 86% F ▪ Baseline BMI (pre-op): 45.8 (SD: 7.1) kg/m^2 ▪ Health: mixed comorbidities; no disease-based exclusions. ▪ Type of Sx: mixed (RYGB, gastric banding, LSG).	▪ Behavioural physical activity. ▪ Objective: Increase physical activity. ▪ Delivery: 1x30-45min counselling sessions/week for 6wks, written resources, pedometer ▪ Content: Self-management resources to improve activity.	▪ Usual care. ▪ Objective: Not described. ▪ Delivery: Clinical visits. ▪ Content: Standard pre-surgical care.	▪ Added MDT member: Yes, behavioural health professional. ▪ Increased MDT engagement: yes ▪ MDT: surgeon, nurse, + interventions. ▪ Interventionist: behavioural health professional.	Not reported
▪ Castello et al 2011 [21] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ Brazil ▪ Post-operative intervention: 3-months, commenced 1-month post-op.	▪ IG: n=16 recruited; n=16 (100%) attended surgery; n=5 (31%) attrition. ▪ CG: n=16 recruited; n=16 (100%) attended surgery; n 6 (37.5%) attrition. ▪ Mean 36-38 (SD: 4) years of age ▪ 100% female ▪ Baseline BMI (pre-op): 45.6 (SD: 1.5) kg/m^2 ▪ Health: mixed comorbidities; CVD, COPD, diabetes, post-menopausal excluded ▪ Type of Sx: RYGB	▪ Aerobic exercise training. ▪ Objective: Improve functional capacity ▪ Delivery: 3x1hr sessions/wk. For 12wks, total of 36 sessions. ▪ Content: Supervised exercise on a treadmill ▪	▪ Usual care. ▪ Objective: Not stated. ▪ Delivery: Not stated ▪ Content: Not stated; all were sedentary. ▪	▪ Added MDT member: yes ▪ Increased MDT engagement: Yes. ▪ MDT: surgeon, nurse + interventionist. ▪ Interventionist: physiotherapist.	Not reported.

▪ Coen et al 2015 [22] and 2015 [23], Woodlief 2015 [24], and Nunez Lopez 2017 [25]. ▪ Single-blinded (assessor) 2-arm (1IG, 1CG) parallel RCT ▪ NCT00692367 ▪ USA ▪ Post-operative intervention: 6mo; commenced 1-3mo post-op	▪ IG: n=66 recruited; n=66 (100%) attended surgery; n=22 (33%) attrition (ITT n=66). ▪ CG: n=62 recruited; n=62 (100%) attended surgery; n=6 (10%) attrition. (ITT n=62) ▪ Mean 41 (SD: 10) y ▪ 83% F ▪ Baseline BMI (post-op): 38.3-38.8 (SD: 6.9) kg/m^2 ▪ Health: mixed comorbidities; chronic disease excluded. ▪ Type of Sx: RYGB	▪ Semi-supervised exercise sessions + health education. ▪ Objective: Not specified. ▪ Delivery: 3-5 sessions/wk, >210min/wk total, for 6mo; + education sessions as per CG. ▪ Content: Cycling or walking	▪ Health education. ▪ Objective: Not specified. ▪ Delivery: 1x monthly group session over 6mo (6 sessions in total) ▪ Content: medications, nutrition, stretching.	▪ Added MDT member: yes ▪ Increased MDT engagement: yes ▪ MDT: surgeon, nurse, interventionist ▪ Interventionist: exercise physiologist.	IG: mean 3.5 sessions/ week. CG: not reported.
▪ Creel et al 2016 [26] ▪ Open-label 3-arm (2IG, 1CG)[b] parallel RCT ▪ NCT01722357 ▪ USA ▪ Pre-operative intervention: Duration unclear, but ≥ 0.5mo. ▪ Post-operative intervention: 6.5omo; commenced immediately post-op.	▪ IG1: n=48 recruited; n attended surgery unclear (96% for whole group); n=23 (48%) attrition. ITT 35. ▪ CG: n=50 recruited; n attended surgery unclear (96% for whole group); n=17 (34%) attrition. ITT 37. ▪ Mean 45 (SD: 11) y ▪ 90% F ▪ Baseline BMI (pre-op): 47.4 (SD: 8.3) kg/m^2 ▪ Health: not described; 6% had previous bariatric Sx. ▪ Type of Sx: mixed (RYGB, LSG, gastric bypass, DS)	▪ Exercise counselling. ▪ Objective: increase physical activity. ▪ Delivery: counseling provided at bariatric centre alongside usual care appointments; unclear but appears to be eight appointments in total. ▪ Content: Used self-determination theory and complementary motivational interviewing techniques; collaborative goal setting, individualized protocol, journal keeping, pedometer provision and use.	▪ Usual care. ▪ Objective: not stated. ▪ Delivery: educational pamphlet. ▪ Content: physical activity information.	▪ Added MDT member: yes ▪ Increased MDT engagement: yes ▪ MDT: surgeon, dietitian, + interventionist. ▪ Interventionist: “exercise professional”.	IG: Unclear; appears all who remained in the study attended the appointments CG: not reported.
▪ Daniels 2018 [27] ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ Not registered ▪ USA	▪ CG: n=8 recruited; n=8 (100%) attended surgery; n=0 (0%) attrition. ▪ CG: n=8 recruited; n=8 (100%) attended surgery; n=0 (0%) attrition.	▪ Resistance training. ▪ Objective: build muscle mass, quality, and strength. ▪ Delivery: 60-80min x 3 session/wk, for 12wks.	▪ Usual care. ▪ Objective: not stated. ▪ Delivery: one off advice. ▪ Content: maintain usual activity.	▪ Added MDT member: yes. ▪ Increased MDT engagement: yes.	Not described.

▪ Post-operative intervention: 3mo; commenced 2mo post-op.	▪ Mean 45 (SD: 10) y ▪ 100% F. ▪ Baseline BMI: not reported. ▪ Health: not reported. ▪ Type of Sx: RYGB.	▪ Content: Supervised training with progression in three phases.		▪ MDT: Assumed surgeon, nurse + interventionist. ▪ Interventionist: suggested to be lead author, an exercise physiologist.	
▪ Huck 2015 [28] ▪ Single-blind 2-arm (1IG, 1CG) parallel quasi-RCT ▪ Not registered. ▪ USA ▪ Post-operative intervention: 3mo; commenced average of 5mo post-op.	▪ IG: n=7 recruited; n=7 (100%) attended surgery; n=2 (29%) attrition. ▪ CG: n= 8 recruited; n=8 (100%) attended surgery; n=0 (0%) attrition. ▪ Mean 44-54 (SD: 10) y ▪ 80% F ▪ Baseline BMI (pre-op): 32.7 (SD: 4.2) and 37.7 (SD: 6.3) kg/m^2 ▪ Health: mixed comorbidities. CVD, asthma, cancer history, excluded. ▪ Type of Sx: mixed (RYGB, LSG, LAGB)	▪ Resistance training. ▪ Objective: Improve functional strength, cardiorespiratory fitness, body composition, and flexibility. ▪ Delivery: 60min small group sessions; 2x session/wk for 6wks, then 3x session/wk for 6wks; 30x sessions in total. ▪ Content: supervised sessions, variety of resistance-based activities.	▪ Usual care. ▪ Objective: not described. ▪ Delivery: not described. ▪ Content: not described.	▪ Added MDT member: yes. ▪ Increased MDT engagement: yes. ▪ MDT: surgeon, nurse, dietitian, + interventionist. ▪ Interventionist: "certified strength and conditioning specialist".	IG: 92% attendance of completers.
▪ Mundbjerg et al 2018 [29], 2018 [30]; Stolberg et al 2018 [31], 2018 [32]. ▪ Open-label 2-arm (1IG, 1CG) parallel RCT ▪ NCT01690728 ▪ Denmark ▪ Post-operative intervention: 6mo;	▪ IG: n=32 recruited; n=32 (100%) attended surgery; n=5 (16%) attrition. ▪ CG: n=28 recruited; n=28 (100%) attended surgery; n=3 (11%) attrition. ▪ Mean 42 (SD: 9) y ▪ 70% F ▪ Baseline BMI (pre-op): 43.0 (SD: 6.1) kg/m^2 ▪ Health: mixed cormorbidities. No disease related exclusions.	▪ Supervised physical training. ▪ Objective: improve weight loss. ▪ Delivery: 2x40min sessions/wk for 26wks + free access to gym to do additional activity. ▪ Content: Usual care + aerobic and resistance exercise.	▪ Basic education. ▪ Objective: not described. ▪ Delivery: not described. ▪ Content: standard dietary recommendations with a focus on protein and vitamin intake; information on importance of exercise.	▪ Added MDT member: yes ▪ Increased MDT engagement: yes ▪ MDT: surgeon, nurse, suggests dietitian but unclear, interventionist. ▪ Interventionist: physiotherapist.	IG: 59% attended ≥50% of supervised sessions. CG: not reported.

commencing 6mo post-op.	▪ Type of Sx: RYGB				
▪ Onofre et al 2017 [33] ▪ Open-label 2-arm (1IG, 1CG) parallel non-randomised controlled trial ▪ RBR-7m2756 ▪ Brazil ▪ Post-operative intervention: 3mo; commenced 3mo post-op.	▪ IG: n= 6 recruited; n= 6 (100%) attended surgery; n= 0 (0%) attrition. ▪ CG: n= 6 recruited; n= 6 (100%) attended surgery; n= 0 (0%) attrition. ▪ Mean 39 (SD: 9) y ▪ 100% F ▪ Baseline BMI (pre-op): 45.5 (SD: 7.7) kg/m^2 ▪ Health: mixed comorbidities; kidney, cardiovascular, and pulmonary disease excluded. ▪ Type of Sx: Mixed (gastric bypass, LSG)	▪ Supervised, individualized physical exercise program. ▪ Objective: improve cardiopulmonary fitness and pulmonary function. ▪ Delivery: 3x 60min sessions/wk for 12wks ▪ Content: continuous heart rate monitoring, structured program, aerobic and resistance exercise.	▪ Basic education ▪ Objective: not described ▪ Delivery: not described. ▪ Content: general guidelines regarding importance of physical activity. ▪ MDT: Not described, assumed to include surgeon and nurse at minimum.	▪ Added MDT member: yes. ▪ Increased MDT engagement: yes. ▪ MDT: surgeon, nurse, interventionist ▪ Interventionist: physiotherapist.	IG: 100% completed the protocol. CG: not reported.
▪ Stegen et al 2011 [34] ▪ Open-label 2-arm (1IG, 1CG) parallel non-randomised controlled trial ▪ No trial registration ▪ Belgium ▪ Post-operative intervention: 3mo; commencing 1mo post-op.	▪ IG: n=10 recruited; n=8 (%) attended surgery; n=2 (20%) attrition. ▪ CG: n=9 recruited; n=7 (%) attended surgery; n=2 (22%) attrition. ▪ Mean 40-43 (SD: 6-10) y ▪ 73% F ▪ Baseline BMI (pre-op): 40.4 (SD: 831) and 45.3 (SD: 2.7) kg/m^2 ▪ Health: not described; n=4 had previous bariatric surgery; diabetes, CVD, musculoskeletal disease excluded. ▪ Type of Sx: Gastric bypass	▪ Supervised exercise program. ▪ Objective: Improve aerobic capacity and prevent loss of lean muscle. ▪ Delivery: 3x75min sessions/wk for 12wks ▪ Content: Combination of aerobic and resistance exercise.	▪ Usual care. ▪ Objective: not described. ▪ Delivery: not described. ▪ Content: not described.	▪ Added MDT member: yes. ▪ Increased MDT engagement: yes. ▪ MDT: surgeon, nurse, interventionist. ▪ Interventionist: exercise and rehabilitation professional.	Not reported.

BMI, body mass index; CVD, cardiovascular disease; d, day; DS, duodenal switch; F, female; IG, intervention group; CG, control/comparator group; kg, kilogram; LAGB, laparoscopic adjustable gastric banding; LSG, laparoscopic sleeve gastrectomy; m, meter; MDT, multidisciplinary team; min, minute; mo, month; op, operative; RCT, randomized controlled trial; RYGB, roux en-Y gastric bypass; SD, standard deviation; sx, surgery; wk, week; y, years.

a. Although the intervention extended from preoperatively to 2-years postoperatively; all outcomes were measured at 1-year postop; intervention beyond 1-year postop consisted of a single group session.

b. Only one intervention group was eligible for inclusion.

Table S3: Justification for risk of bias assessment

	Study	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Rating	Baillot 2018	Low risk of bias	Low risk of bias	Unclear	Unclear	Low risk of bias	Low risk of bias	Low risk of bias
Evidence		"The trial was a randomized controlled study using an allocation list generated by a computer random sequence, stratified by sex and maximal aerobic capacity (> or ≤ 7 metabolic equivalent of task (MET)) and kept in sealed envelopes"	"The trial was a randomized controlled study using an allocation list generated by a computer random sequence, stratified by sex and maximal aerobic capacity (> or ≤ 7 metabolic equivalent of task (MET)) and kept in sealed envelopes"	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was higher as a % in the CG; but overall numbers were very low and not due to the study. ITT was used.	None detected	MDT reported well; attendance/adherence to intervention was decent.
Rating	Bond et al 2017 (and 2015 protocol)	Low risk of bias	Unclear	Unclear	High risk of bias	Unclear	High risk of bias	Unclear
Evidence		"Participants were then randomly assigned 1:1 to 6 weeks of PAI or SC using a computergenerated random-permuted blocking procedure"	No description of allocation concealment prior to baseline assessments.	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was equal between groups, and at a low rate (14%), but not described specifically per group. No difference between those lost to follow-up and completers.	6-month outcome data was incompltely reported for each group.	No description of attendance/participation in intervention. MDT rvery poorly reported.

Rating	Castello et al 2011	Unclear	Low risk of bias	Unclear	High risk of bias	Low risk of bias	Low risk of bias	Unclear
Evidence		Randomised, but sequence generation not described.	"One month after GBS, the patients were randomized by using sequentially numbered, sealed, opaque envelopes into two groups: training group (TG) and control group (CG)"	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was between 30-40% in both groups, but higher in the CG. All withdrawals in the IG were related to the study; but given the intensity and committement requried attrition in IG not considered a high source of bias.	None detected	No description of attendance/participation in intervention. MDT very poorly reported.
Rating	Coen 2015 and 2015, Woodlief 2015, and Nunez Lopez 2015	Low risk of bias	Unclear	High risk of bias	Low risk of bias	Low risk of bias	Low risk of bias	Unclear
Evidence		"permuted-blocks approach was used, with subjects stratified by gender. Blocks of random sizes of 4 and/or greater were used to achieve the goal sample size in each group between both study sites. The study clinical coordinator at Pittsburgh conducted randomization for both sites. The study was single blind, with assessors for all outcomes blinded to participant group assignment"	No description of allocation concealment prior to baseline assessments.	"permuted-blocks approach was used, with subjects stratified by gender. Blocks of random sizes of 4 and/or greater were used to achieve the goal sample size in each group between both study	"permuted-blocks approach was used, with subjects stratified by gender. Blocks of random sizes of 4 and/or greater were used to achieve the goal sample size in each group between both study sites. The study clinical coordinator at Pittsburgh conducted randomization for	Attrition was low in both groups and ITT analysis performed	None detected	MDT poorly reported

				sites. The study clinical coordinator at Pittsburgh conducted randomization for both sites. The study was single blind, with assessors for all outcomes blinded to participant group assignment"	both sites. The study was single blind, with assessors for all outcomes blinded to participant group assignment"			
Rating	Creel et al 2016	Low risk of bias	Low risk of bias	High risk of bias	High risk of bias	High risk of bias	Unclear	Unclear
Evidence		"e randomized in a simple 1:1:1 ratio to a standard care (SC), pedometer use (P), or exercise counseling group (C). The random allocation sequence was kept by study staff not involved in baseline assessments"	"e randomized in a simple 1:1:1 ratio to a standard care (SC), pedometer use (P), or exercise counseling group (C). The random allocation sequence was kept by study staff not involved in baseline assessments"	Blinding of participants not described, likely not performed as assumed cannot blind from counselling.	"Study assessors were not blinded to participants' group assignment."	Attrition was high across all groups; but reasons per group not described. N=25 participants were lost to follow-up due to not returning calls, other reasons (n=1 to 6) were for reasons not related to the study.	ITT analysis used; data variables reported in full.- however, there was limited comparison of groups over time.	No description of attendance/participation in intervention.
Rating		Low risk of bias	Unclear	Unclear	High risk of bias	Low risk of bias	Low risk of bias	High risk of bias

Evidence	Daniels et al 2018	"At study commencement, the patients were linked to a study identification number and were then randomly assigned to either an intervention group (IG, n = 8) or control group (CG, n = 8) using a random number generator"	No description of allocation concealment prior to baseline assessments.	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	No attrition in any group	None detected	No description of attendance/participation in intervention. MDT very poorly reported. Convenience sampling.
Rating	Gade et al 2014 and 2015	Low risk of bias	Low risk of bias	Unclear	High risk of bias	Low risk of bias	Low risk of bias	Unclear
Evidence		"A block randomisation procedure (http://www.randomizer.org) was employed (with blocks of 4) to ensure balance between the groups. Two research assistants at the treatment centre with no affiliation to the study had access to the randomisation file. "	" After having read and signed the informed consent letter and completed the baseline measurements, the patients as well as the first author were informed about the allocated treatment arm. The allocation ratio was 1:1"	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was equal between groups, and at a low rate.	None detected	No description of attendance/participation in intervention. MDT reported somewhat vaguely.
Rating	Galle et al 2017	High risk of bias	High risk of bias	Unclear	High risk of bias	Low risk of bias	Low risk of bias	Unclear
Evidence		" patients were not included randomly in the two study groups"	Not randomised or concealed	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	<10% attrition for both groups; No reasons related to the study.	None detected	No description of attendance/participation in intervention.

Rating	Hollywood 2012 and 2015, Ogden 2015	Low risk of bias	Unclear	Unclear	High risk of bias	Low risk of bias	Low risk of bias	Unclear
Evidence		"Once a patient has consented the researcher will reference the third party blinded randomization, which will be provided by the clinical trial unit at Surrey University, to indicate whether they are allocated to either the BRS or usual care"	No description of allocation concealment prior to baseline assessments.	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was equal between groups, and at a low rate.	None detected	No description of attendance/participation in intervention. MDT reported somewhat vaguely.
Rating	Huck et al 2015	High risk of bias	Unclear	High risk of bias	Low risk of bias	Low risk of bias	Low risk of bias	Unclear
Evidence		"The study design was initially developed as a single-blinded randomized controlled trial; however, it was later deemed impractical to randomize the selection process of patients within a free-living community setting. Subsequently, a single-blinded quasi-experimental design was adopted"	No description of allocation concealment prior to baseline assessments.	"a single-blinded quasi-experimental design was adopted"	"a single-blinded quasi-experimental design was adopted"	Although attrition was higher in the IG, it was only 2 participants who withdrew for reasons unrelated to the study.	None detected	No description of the control condition.
Rating	Kalarchian	Unclear	Unclear	Unclear	High risk of bias	Low risk of bias	Low risk of bias	High risk of bias

Evidence	2013 and 2016	No description of sequence generation: "After completing the baseline assessment, participants were block randomized to behavioral lifestyle intervention (LIFESTYLE, n ¼ 121) or usual preoperative care (USUAL CARE, n ¼ 119), with stratification by BMI."	Allocation not described.	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	<10% attrition for both groups; No reasons related to the study.	Data not withheld but acknowledged to be reported in such a way that allows full interpretation of results be the reader	Poor reporting of the multidisciplinary team and their involvement.
Rating	Lier 2012	Low risk of bias	Low risk of bias	Unclear	High risk of bias	High risk of bias	Low risk of bias	Low risk of bias
Evidence		"Patients in the Intervention group were randomized by concealed randomization at an external research site by blocked randomization of block size ten. Comparison groups (Treatment group and Control group) were determined to a ratio of 1:1. The randomization yielded no significant differences in demographic and clinical characteristics."	"Patients in the Intervention group were randomized by concealed randomization at an external research site by blocked randomization of block size ten. Comparison groups (Treatment group and Control group) were determined to a ratio of 1:1. The randomization yielded no significant differences in demographic and clinical characteristics."	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was 20% higher in the CG; possibly due to the effect of the intervention (i.e. less engagement of CG)	Data not withheld but acknowledged to be reported in such a way that allows full interpretation of results be the reader	MDT reported well

Rating	Nijamkin 2012 and 2013	Unclear	Unclear	Unclear	High risk of bias	Low risk of bias	Low risk of bias	Low risk of bias
Evidence		No description of sequence generation.	Allocation not described.	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was higher in IG; but all analyses were ITT	None detected	MDT reported well
Rating	Onofre 2017	High risk of bias	High risk of bias	High risk of bias	High risk of bias	Low risk of bias	Low risk of bias	Unclear
Evidence		" patients were able to choose between two groups according to their availability: CG-control group (n = 6) or IG-intervention group (n = 6)"	" patients were able to choose between two groups according to their availability: CG-control group (n = 6) or IG-intervention group (n = 6)"	" patients were able to choose between two groups according to their availability: CG-control group (n = 6) or IG-intervention group (n = 6)"	No description of blinding personnel; outcomes are not objective.	Appears to have had no attrition in either group	None detected	Says that all IG participants completed intervention; however, it is unclear if they attended 100% of the sessions; very poor description of MDT input.
Rating	Parikj 2012	Unclear	Unclear	Unclear	High risk of bias	High risk of bias	High risk of bias	High risk of bias

Evidence		No description of sequence generation.	Allocation not described.	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was very high in both groups; ITT was used. However, due to the very low adherence to intervention and the hypothesis by authors is that the intervention would lead to no benefit, i.e. no need for pre-op lifestyle intervention which delays surgery - it seems as if the authors have a vested interest in the finding of a null effect which may have lead to very low engagement causing the low attendance of intervention.	There appeared to be multiple errors in data reporting, e.g. text stating all participants are female, but tables reporting a mix of male and female participants. EWL data was not reported, only described as non significant. Low confidence in the accuracy of data which is reported.	Poor reporting of multidsciplinary team and their involvement; extremely poor attendence/adherence to the intervention.
Rating	Sarwer 2012	Unclear	Unclear	Unclear	High risk of bias	High risk of bias	Low risk of bias	High risk of bias

Evidence		No description of sequence generation.	Allocation not described.	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Attrition was very high (50%) for the study, and the loss-to-follow-up was not reported per group nor explained/justified.	None detected	Extremely poor attendence/adherence to the intervention.
Rating	Stegen 2011	High risk of bias	High risk of bias	Unclear	High risk of bias	Low risk of bias	Low risk of bias	Unclear
Evidence		"All patients were able to make the choice between the intervention group (exercise program after gastric bypass "GB+E," "the trained patients") or the control group (only gastric bypass "GB," "the untrained patients")"	"All patients were able to make the choice between the intervention group (exercise program after gastric bypass "GB+E," "the trained patients") or the control group (only gastric bypass "GB," "the untrained patients")"	Blinding of participants or personnel not described, likely not performed.	Blinding of outcome assessment not blinded nor objective.	Equal between groups; low rate for intensive intervention.	None detected	Attendance/adherence to the intervention not reported; poor reporting of the multidispclinary team.
Rating	Stolberg 2018, 2018, and Mundbjerg 2018 and 2018.	Unclear	Low risk of bias	Unclear	Unclear	Low risk of bias	Low risk of bias	Low risk of bias
Evidence		No description of code generation	"Randomization was conducted by the sealed-envelope method in blocks to ensure an equal distribution of people with type 2 diabetes (T2D) in both study groups and was performed by the trial	Blinding of participants or personnel not described, likely not performed.	No description of blinding personnel; most outcomes are objective but not all	Low attrition and balanced between groups; explanations provided	None detected	None detected

			investigators CRS and LHM."					

Table S4: Certainty assessment of the body of evidence for outcomes evaluating the effect of intensive versus usual care multidisciplinary team support

Certainty assessment							Certainty
No of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	
Weight loss							
18	randomised trials	serious [a]	very serious [b]	not serious	serious [c]	none	⊕◯◯◯ VERY LOW
Weight loss: Subgroup by duration of intervention							
18	randomised trials	serious [a]	serious [d]	not serious	not serious	strong association	⊕⊕⊕◯ MODERATE
Anxiety							
2	randomised trials	not serious	not serious	not serious	very serious [c,e]	none	⊕⊕◯◯ LOW
Depression							
2	randomised trials	not serious	not serious	not serious	serious [e]	none	⊕⊕⊕◯ MODERATE
Quality of life							
2	randomised trials	not serious	not serious	not serious	very serious [c,e]	none	⊕⊕◯◯ LOW
Fasting blood glucose							
2	randomised trials	not serious	not serious	not serious	very serious [c,e]	none	⊕⊕◯◯ LOW
Fasting blood insulin							
2	randomised trials	not serious	not serious	not serious	very serious [c,e]	none	⊕⊕◯◯ LOW
Total cholesterol							

Certainty assessment							Certainty
No of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	
2	randomised trials	not serious	not serious	not serious	very serious [c,e]	none	⨁⨁◯◯ LOW
LDL cholesterol							
2	randomised trials	not serious	not serious	not serious	very serious [c,e]	none	⨁⨁◯◯ LOW
HDL cholesterol							
2	randomised trials	not serious	not serious	not serious	very serious [c,e]	none	⨁⨁◯◯ LOW
Triglycerides							
2	randomised trials	not serious	not serious	not serious	very serious [c,e]	none	⨁⨁◯◯ LOW
Systolic blood pressure							
5	randomised trials	serious [a]	not serious	not serious	very serious [c,e]	none	⨁◯◯◯ VERY LOW
Diastolic blood pressure							
6	randomised trials	serious [a]	not serious	not serious	very serious [c,e]	none	⨁◯◯◯ VERY LOW
Resting heart rate							
4	randomised trials	serious [a]	not serious	not serious	very serious [c,e]	none	⨁◯◯◯ VERY LOW

a. Studies included those with low, unclear, and high risk of bias

b. There was high statistical heterogeneity; total number of participants were >1000.

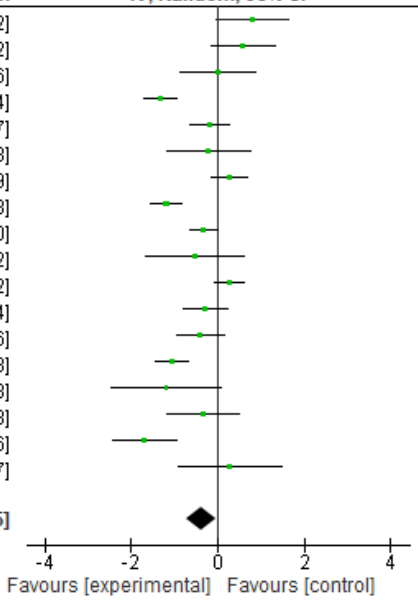
c. Wide confidence intervals were estimated.

d. There was moderate statistical heterogeneity in one study subgroup; however, the others did not have statistical heterogeneity. The total number of study participants were >1000.

e. There were less than 400 participants

Study or Subgroup	Intensive MDT Mean	SD	Total	Usual care Mean	SD	Total	Weight	Std. Mean Difference IV, Random, 95% CI	Risk of Bias A B C D E F G
Balliot 2013, 2018	-6.1	1.45	13	-7.3	1.45	12	5.0%	0.80 [-0.02, 1.62]	+ + ? ? + + +
Bond 2015, 2015, 2016, 2017, 2017	-24.5	8.5	19	-30.1	10.7	12	5.3%	0.58 [-0.16, 1.32]	+ ? ? - ? - ?
Castello 2011	-23	0.11	11	-23	0.11	10	4.9%	0.00 [-0.86, 0.86]	? + ? - + + ?
Coen 2015, 2015; Woodlief 2015; Nunez Lopez 2015	-14.6	1.1	66	-13.2	1	62	6.7%	-1.32 [-1.71, -0.94]	+ ? - + + + ?
Creel 2016	-40	2.7	35	-39.5	2.5	37	6.4%	-0.19 [-0.65, 0.27]	+ + - - - + ?
Daniels 2018	-39.6	10.8	8	-37.7	5.7	8	4.4%	-0.21 [-1.19, 0.78]	+ ? ? - + + -
Gade 2014 and 2015	-37.3	10.073	43	-40	10.455	41	6.5%	0.26 [-0.17, 0.69]	+ + ? - + + ?
Galle 2017	-27	4.78	68	-21.3	4.78	74	6.7%	-1.19 [-1.54, -0.83]	- - ? - + + ?
Hollywood 2012 and 2015; Ogden 2015	-47.45	6.61	73	-45.28	6.61	72	6.8%	-0.33 [-0.65, 0.00]	+ ? ? - + + ?
Huck 2018	-8.8	6.2	5	-5.6	5.3	8	3.9%	-0.53 [-1.67, 0.62]	- ? - - + + ?
Kalarchian 2013 and 2016	-22.8	5.85	64	-24.4	5.85	67	6.8%	0.27 [-0.07, 0.62]	? ? ? - + + -
Lier 2012	-46.1	9.9	34	-42.9	12.7	25	6.2%	-0.28 [-0.80, 0.24]	+ + ? - - + +
Mundbjerg 2018, 2018; Stolberg 2018, 2018	-37.5	14.33	27	-31.8	14.33	25	6.1%	-0.39 [-0.94, 0.16]	? + ? ? + + +
Nijamkin 2012 and 2013	-79.6	15.5	57	-63.8	14.2	66	6.7%	-1.06 [-1.44, -0.68]	? ? ? - - + +
Onofre 2017	-31	2.64	6	-27.6	2.64	6	3.5%	-1.19 [-2.46, 0.08]	- - - - + + ?
Parikh 2012	-5.27	2.7	12	-4.4	2.1	11	5.0%	-0.34 [-1.17, 0.48]	? ? ? - - - -
Sarwer 2012	-26.1	1.5	19	-23.5	1.5	21	5.4%	-1.70 [-2.43, -0.96]	? ? ? - - + -
Stegen 2011	-17.9	5.8	6	-20.1	8.7	5	3.7%	0.28 [-0.92, 1.47]	- - ? - + + ?
Total (95% CI)			**566**			**562**	**100.0%**	**-0.38 [-0.71, -0.05]**	

Heterogeneity: Tau² = 0.38; Chi² = 107.22, df = 17 (P < 0.00001); I² = 84%
Test for overall effect: Z = 2.25 (P = 0.02)



Risk of bias legend
(**A**) Random sequence generation (selection bias)
(**B**) Allocation concealment (selection bias)
(**C**) Blinding of participants and personnel (performance bias)
(**D**) Blinding of outcome assessment (detection bias)
(**E**) Incomplete outcome data (attrition bias)
(**F**) Selective reporting (reporting bias)
(**G**) Other bias

Figure S1: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative multidisciplinary team support for bariatric surgery has a weak positive effect compared with usual care (SMD -0.38 [95%CI: -0.71, -0.05], p=0.03, n=1,128 (IG: n=566, CG: n=562) participants, I^2 = 84%)

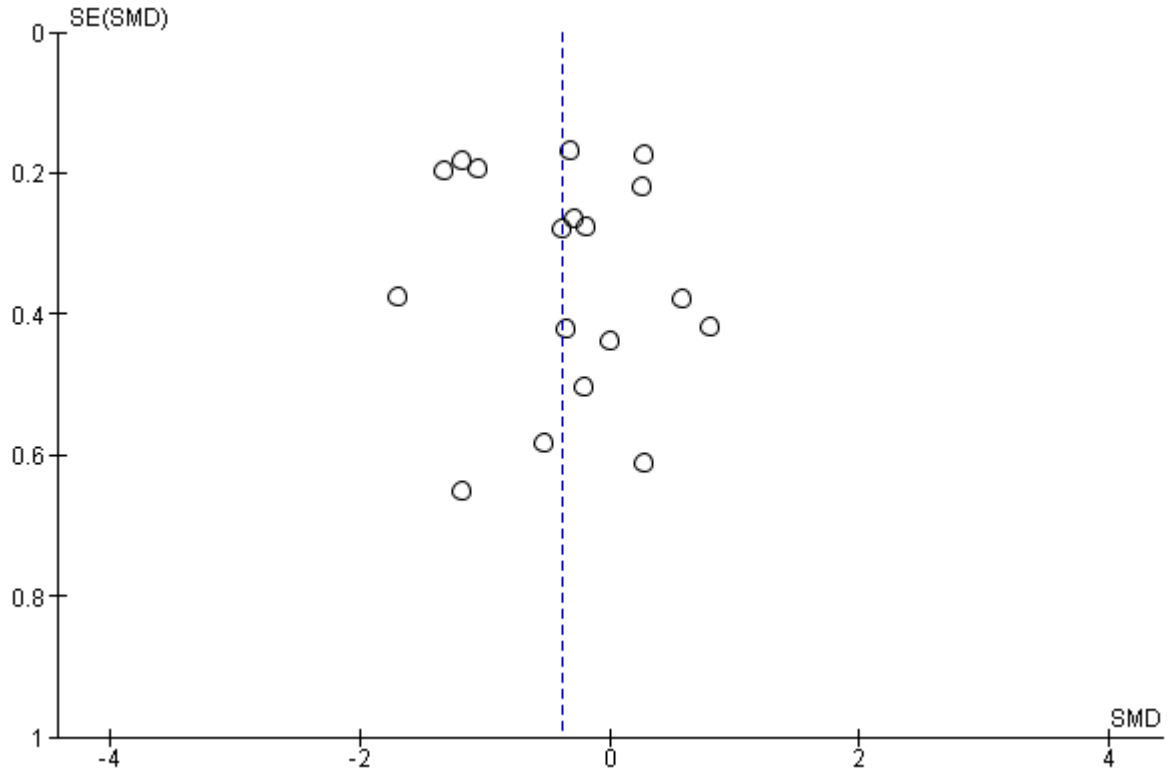


Figure S2: Funnel plot of the comparison of intensive preoperative and/or postoperative multidisciplinary team support for bariatric surgery versus usual care.

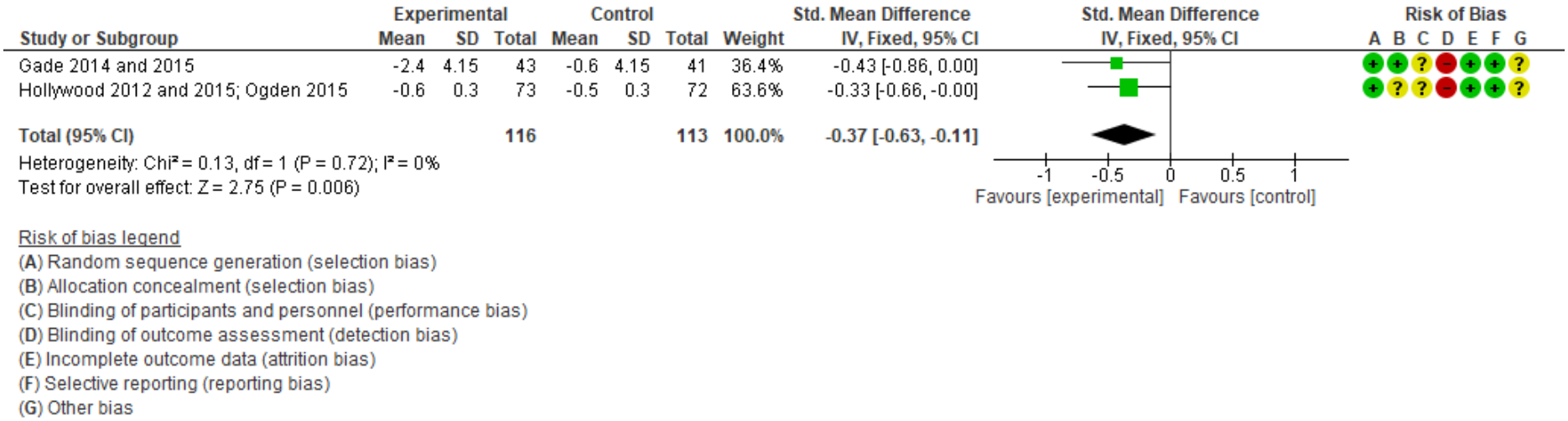


Figure S3: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative psychology-focussed interventions decreased postoperative anxiety (SMD: -0.37 [95%CI: -0.63, -0.11], p=0.0006, I^2=0%, n=229 (IG: n=116, CG: n=113) participants).

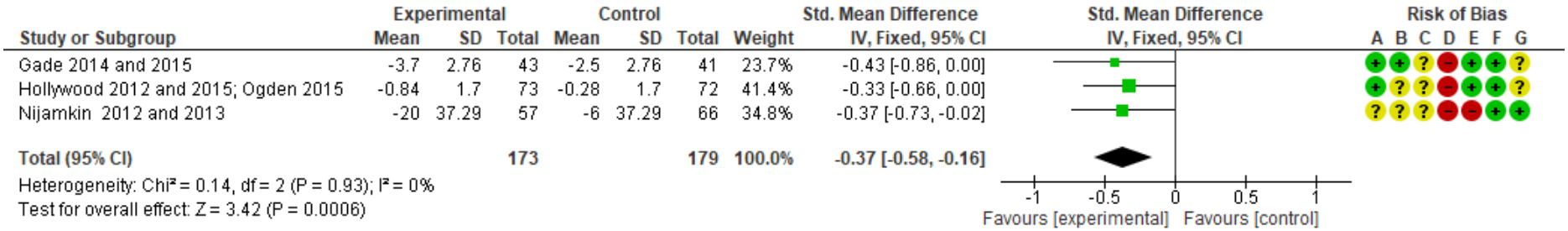


Figure S4: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative lifestyle, nutrition, and psychology-focussed interventions decreased postoperative depression (SMD: -0.37 [95%CI: -0.58, -0.16], p=0.0006, I^2=0%, n=352 (IG: n=173, CG: n=179) participants).

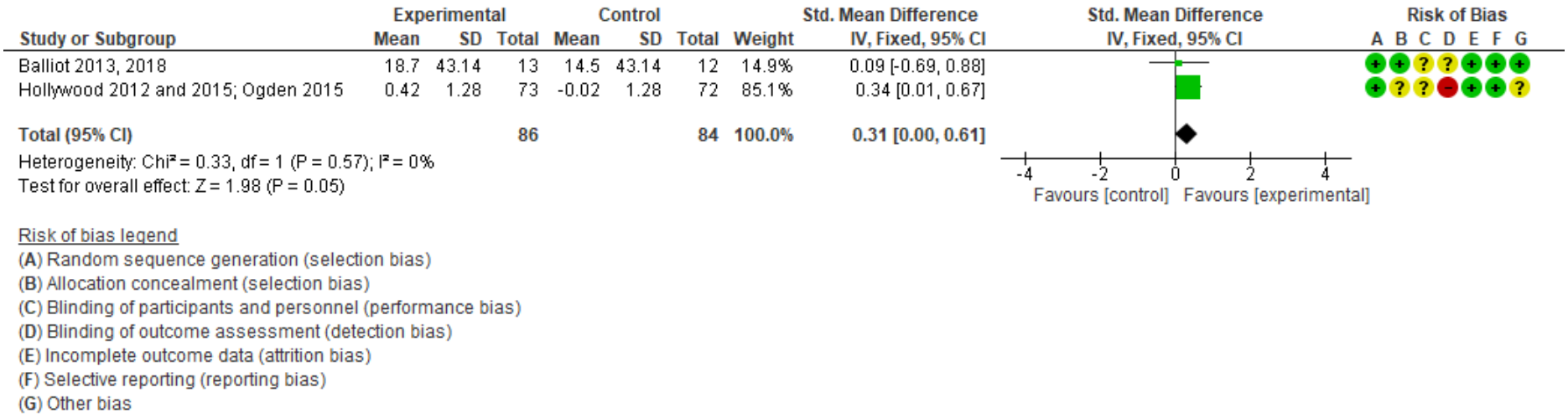


Figure S5: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative lifestyle, nutrition, and psychology-focussed interventions decreased postoperative quality of life (SMD: 0.31 [95%CI: 0.00, 0.61], p=0.05, I^2=0%, n=170 (IG: n=86, CG: n=84) participants).

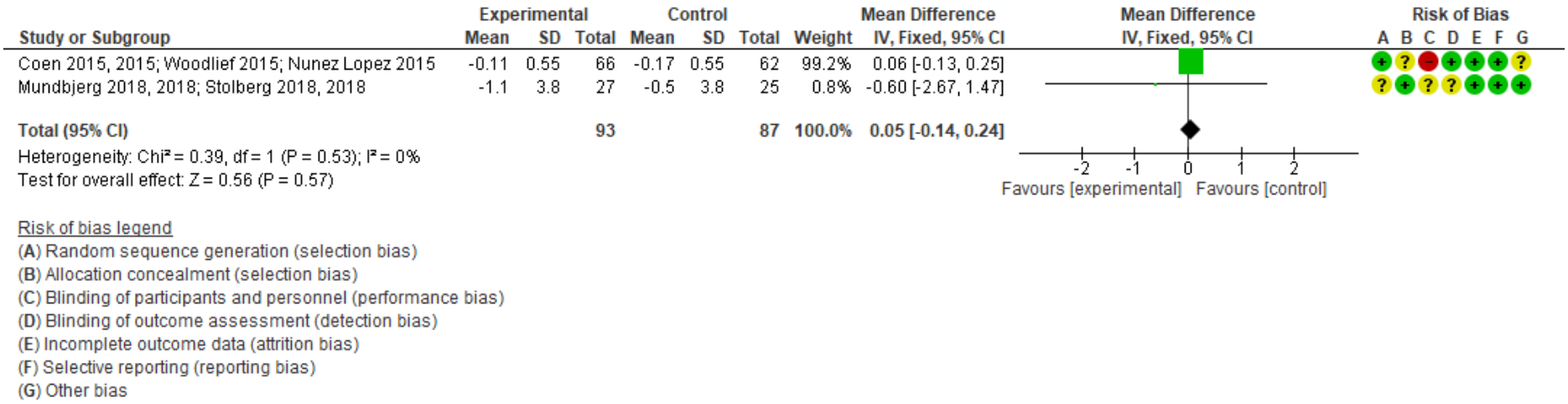


Figure S6: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions decreased postoperative fasting blood glucose (MD: 0.05 [95%CI: -0.14, 0.24] mmol/L, p=0.57, I^2=0%, n=180 (IG: n=93, CG: n=87) participants).

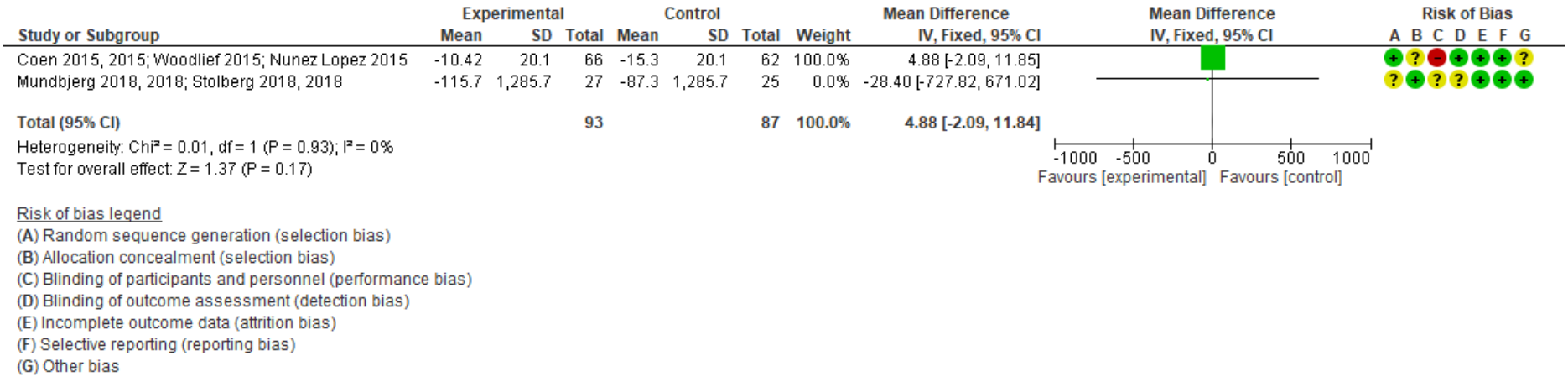


Figure S7: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions decreased postoperative fasting blood insulin (MD: 4.88 [95%CI: -2.09, 11.84] pmol/L, p=0.17, I^2=0%, n=180 (IG: n=93, CG: n=87) participants).

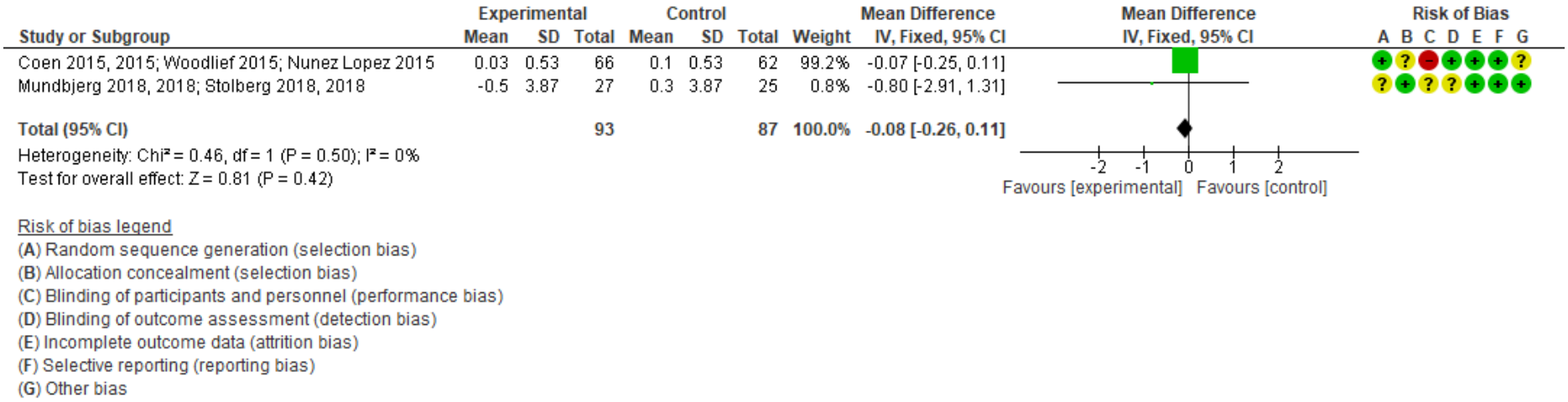


Figure S8: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions have no effect on total cholesterol (MD: -0.08 [95%CI: -0.26, 0.11] mmol/L, p=0.42, I^2=0%, n=180 (IG: n=93, CG: n=87) participants).

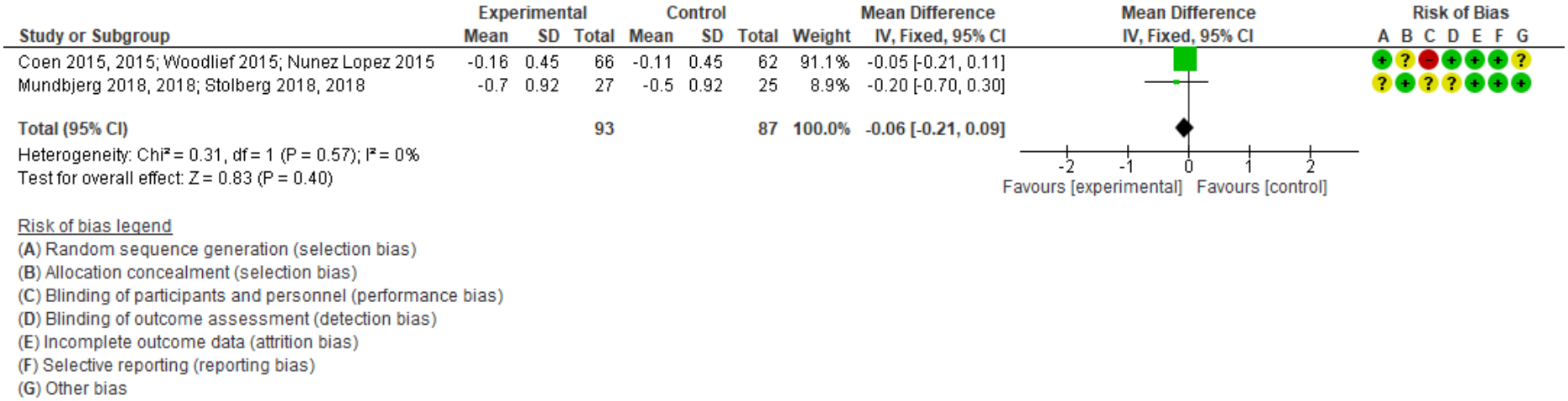


Figure S9: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions have no effect on LDL cholesterol (MD: -0.06 [95%CI: -0.21, 0.09] mmol/L, p=0.40, I^2=0%, n=180 (IG: n=93, CG: n=87) participants).

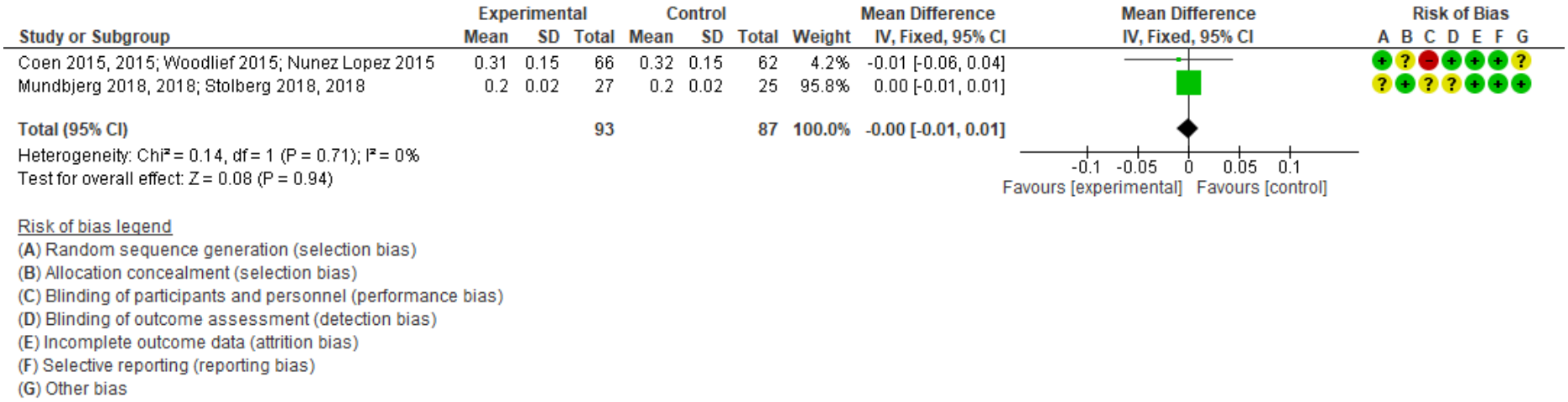


Figure S10: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions have no effect on HDL cholesterol (MD: -0.00 [95%CI: -0.01, 0.01] mmol/L, p=0.94, I^2=0%, n=180 (IG: n=93, CG: n=87) participants).

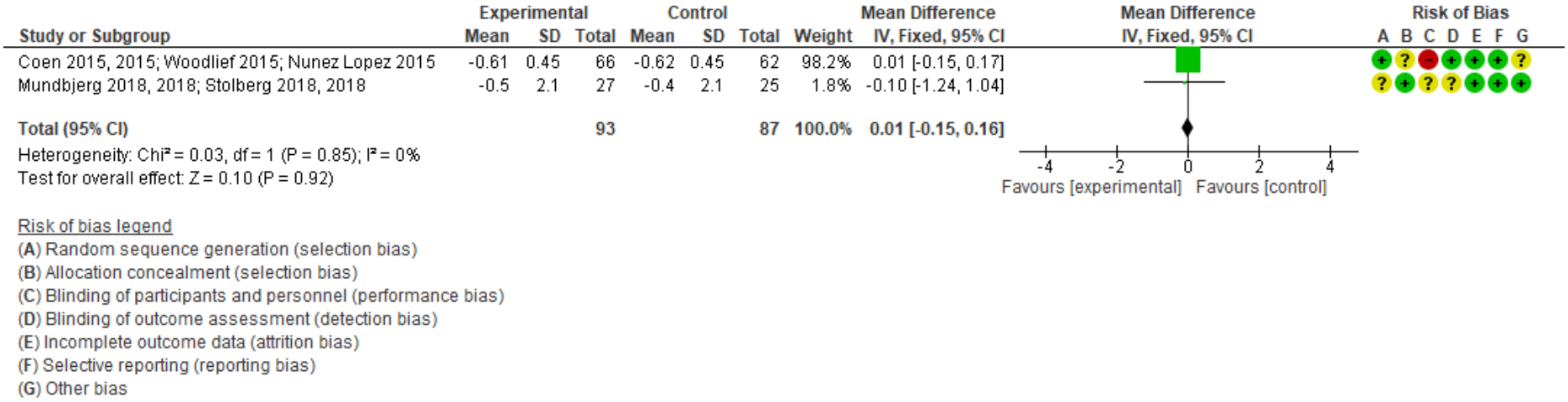


Figure S11: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions have no effect on triglycerides (MD: 0.01 [95%CI: -0.15, 0.16] mmol/L, p=0.92, I^2=0%, n=180 (IG: n=93, CG: n=87) participants).

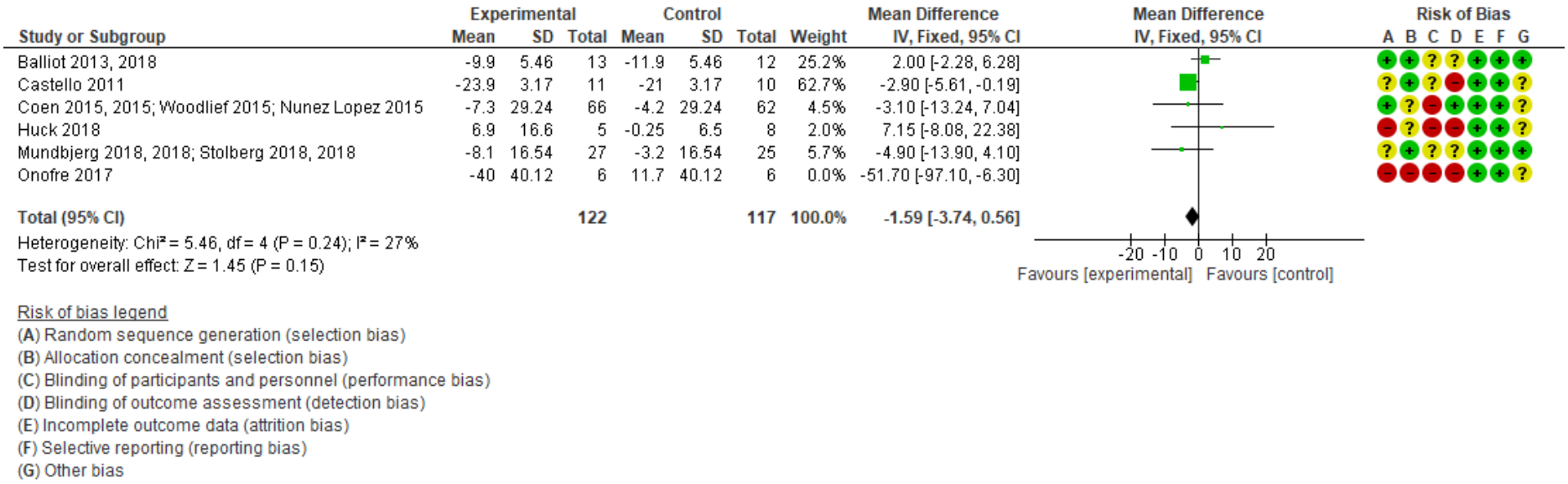


Figure S12: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions have no effect on systolic blood pressure (MD: -1.59 [95%CI: -3.74, 0.56] mmHg, p=0.15, I^2=27%, n=239 (IG: n=122, CG: n=117) participants); with one outlier removed from analysis.

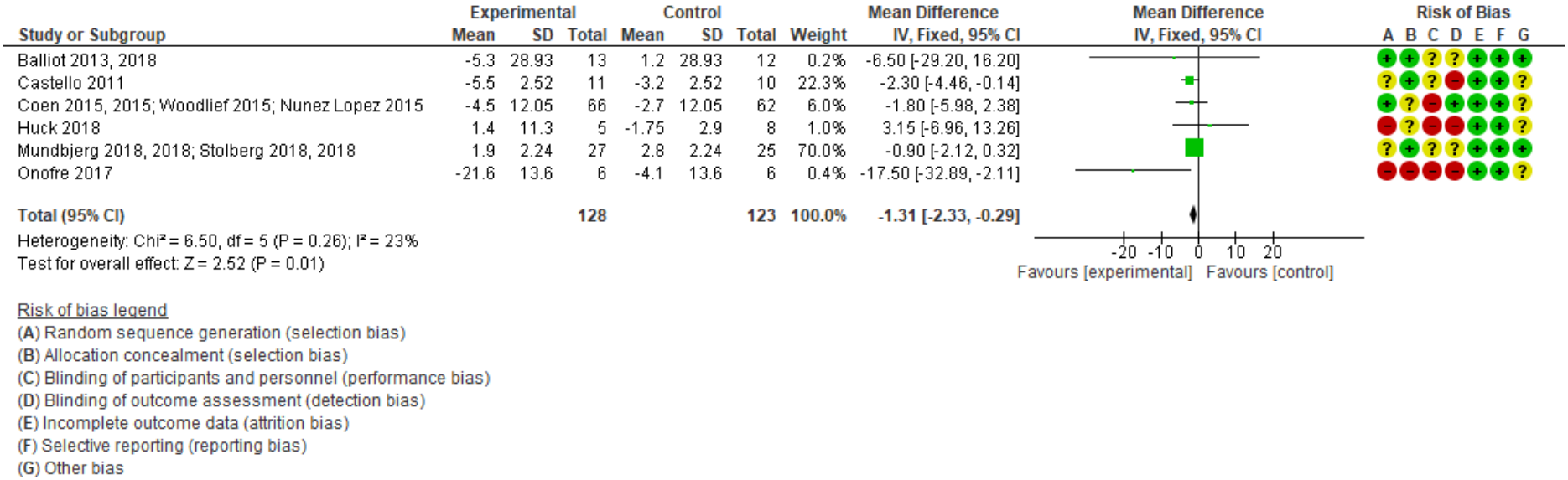


Figure S13: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions decreased diastolic blood pressure (MD: -1.31 [95%CI: -2.33, -0.29] mmHg, p=0.01, I^2=23%, n=251 (IG: n=128, CG: n=123) participants).

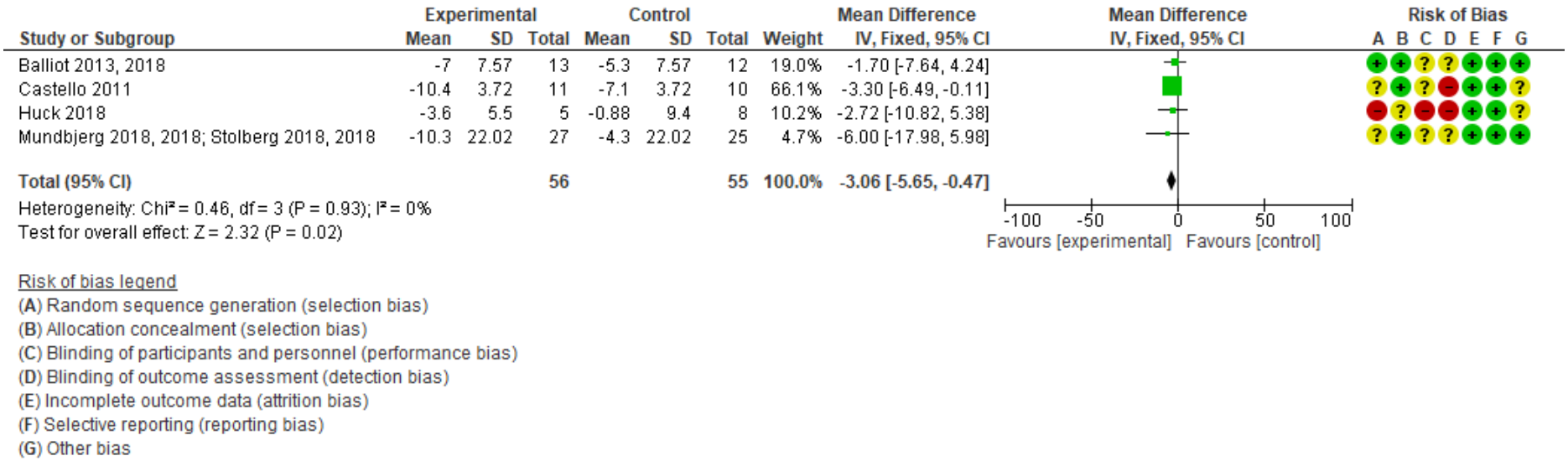


Figure S13: Forest plot comparison showing that compared with usual care, intensive preoperative and/or postoperative exercise-focussed interventions decreased resting heart rate (MD: -3.06 [95%CI: -5.65, -0.47] bpm, p=0.02, I^2=0%, n=111 (IG: n=56, CG: n=55) participants).

1. Kalarchian M, Marcus M, Courcoulas A, Cheng Y, Levine M. Preoperative lifestyle intervention in bariatric surgery: initial results from a randomized, controlled trial. *Obesity (silver spring, md).* 2013;21(2):254-260. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/422/CN-00965422/frame.html. Accessed Feb.
2. Kalarchian M, Marcus M, Courcoulas A, Cheng Y, Levine M. Preoperative lifestyle intervention in bariatric surgery: a randomized clinical trial. *Surgery for obesity and related diseases.* 2016;12(1):180-187. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/653/CN-01259653/frame.html. Accessed Jan.
3. Nijamkin M, Campa A, Sosa J, Baum M, Himburg S, Johnson P. Comprehensive nutrition and lifestyle education improves weight loss and physical activity in Hispanic Americans following gastric bypass surgery: a randomized controlled trial. *Journal of the academy of nutrition and dietetics.* 2012;112(3):382-390. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/319/CN-00903319/frame.html. Accessed Mar.
4. Nijamkin MP, Campa A, Nijamkin SS, Sosa J. Comprehensive behavioral-motivational nutrition education improves depressive symptoms following bariatric surgery: A randomized, controlled trial of obese Hispanic Americans. *Journal of Nutrition Education and Behavior.* 2013;45(6):620-626.
5. Parikh M, Dasari M, McMacken M, Ren C, Fielding G, Ogedegbe G. Does a preoperative medically supervised weight loss program improve bariatric surgery outcomes? A pilot randomized study. *Surg Endosc.* 2012;26(3):853-861.
6. Sarwer D, Moore R, Spitzer J, Wadden T, Raper S, Williams N. A pilot study investigating the efficacy of postoperative dietary counseling to improve outcomes after bariatric surgery. *Surgery for obesity and related diseases.* 2012;8(5):561-568. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/577/CN-00969577/frame.html. Accessed Sep-Oct.
7. Lier H, Biringer E, Stubhaug B, Tangen T. The impact of preoperative counseling on postoperative treatment adherence in bariatric surgery patients: A randomized controlled trial. *Patient Education & Counseling.* 2012;87(3):336-342.
8. Gade H, Hjelmesæth J, Rosenvinge J, Friborg O. Effectiveness of a cognitive behavioral therapy for dysfunctional eating among patients admitted for bariatric surgery: a randomized controlled trial. *Journal of obesity.* 2014;2014:127936. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/302/CN-01114302/frame.html.
9. Gade H, Friborg O, Rosenvinge J, Småstuen M, Hjelmesæth J. The Impact of a Preoperative Cognitive Behavioural Therapy (CBT) on Dysfunctional Eating Behaviours, Affective Symptoms and Body Weight 1 Year after Bariatric Surgery: a Randomised Controlled Trial. *Obesity surgery.* 2015;25(11):2112-2119. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/094/CN-01171094/frame.html. Accessed Nov.
10. Galle F, Maida P, Cirella A, Giuliano E, Belfiore P, Liguori G. Does Post-operative Psychotherapy Contribute to Improved Comorbidities in Bariatric Patients with Borderline Personality Disorder Traits and Bulimia Tendencies? A Prospective Study. *Obesity surgery.* 2017;27(7):1872-1878. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/171/CN-01396171/frame.html.

11. Hollywood A, Ogden J, Pring C. The impact of a bariatric rehabilitation service on weight loss and psychological adjustment--study protocol. *BMC Public Health.* 2012;12:275.
12. Hollywood A, Ogden J, Hashemi M. A randomised control trial assessing the impact of an investment based intervention on weight-loss, beliefs and behaviour after bariatric surgery: study protocol. *BMC obesity.* 2015;2(1) (no pagination). http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/174/CN-01374174/frame.html.
13. Ogden J, Hollywood A, Pring C. The impact of psychological support on weight loss post weight loss surgery: a randomised control trial. *Obes Surg.* 2015;25(3):500-505.
14. Baillot A, Mampuya WM, Comeau E, Méziat-Burdin A, Langlois MF. Feasibility and impacts of supervised exercise training in subjects with obesity awaiting bariatric surgery: A pilot study. *Obesity Surgery.* 2013;23(7):882-891.
15. Baillot A, Vallée CA, Mampuya WM, et al. Effects of a Pre-surgery Supervised Exercise Training 1 Year After Bariatric Surgery: a Randomized Controlled Study. *Obesity Surgery.* 2018;28(4):955-962.
16. Bond D, Vithiananthan S, Thomas J, et al. Bari-Active: a randomized controlled trial of a preoperative intervention to increase physical activity in bariatric surgery patients. *Surgery for obesity and related diseases.* 2015;11(1):169-177. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/957/CN-01068957/frame.html. Accessed Jan-Feb.
17. Bond D, Thomas J, King W, et al. Exercise improves quality of life in bariatric surgery candidates: results from the Bari-Active trial. *Obesity (silver spring, md).* 2015;23(3):536-542. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/075/CN-01069075/frame.html. Accessed Mar.
18. Bond D, Graham TJ, Vithiananthan S, et al. Changes in enjoyment, self-efficacy, and motivation during a randomized trial to promote habitual physical activity adoption in bariatric surgery patients. *Surgery for obesity and related diseases.* 2016;12(5):1072-1079. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/057/CN-01425057/frame.html. Accessed Jun.
19. Bond D, Thomas J, Vithiananthan S, et al. Intervention-related increases in preoperative physical activity are maintained 6-months after Bariatric surgery: results from the bari-active trial. *International journal of obesity (2005).* 2017;41(3):467-470. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/318/CN-01447318/frame.html. Accessed Mar.
20. Bond D, Raynor H, Thomas J, et al. Greater Adherence to Recommended Morning Physical Activity is Associated With Greater Total Intervention-Related Physical Activity Changes in Bariatric Surgery Patients. *Journal of physical activity & health.* 2017;14(6):492-498. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/606/CN-01440606/frame.html. Accessed Jun.
21. Castello V, Simões R, Bassi D, Catai A, Arena R, Borghi-Silva A. Impact of aerobic exercise training on heart rate variability and functional capacity in obese women after gastric bypass surgery. *Obesity surgery.* 2011;21(11):1739-1749. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/761/CN-00868761/frame.html. Accessed Nov.
22. Coen PM, Menshikova EV, Distefano G, et al. Exercise and Weight Loss Improve Muscle Mitochondrial Respiration, Lipid Partitioning, and Insulin Sensitivity After Gastric Bypass Surgery. *Diabetes.* 2015;64(11):3737-3750.

23. Coen P, Tanner C, Helbling N, et al. Clinical trial demonstrates exercise following bariatric surgery improves insulin sensitivity. *Diabetes technology & therapeutics.* 2015;18:S83-s84. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/021/CN-01139021/frame.html.
24. Woodlief T, Carnero E, Standley R, et al. Dose response of exercise training following roux-en-Y gastric bypass surgery: a randomized trial. *Obesity (silver spring, md).* 2015;23(12):2454-2461. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/116/CN-01134116/frame.html. Accessed Dec.
25. Nunez Lopez YO, Coen PM, Goodpaster BH, Seyhan AA. Gastric bypass surgery with exercise alters plasma microRNAs that predict improvements in cardiometabolic risk. *Int J Obes (Lond).* 2017;41(7):1121-1130.
26. Creel D, Schuh L, Reed C, et al. A randomized trial comparing two interventions to increase physical activity among patients undergoing bariatric surgery. *Obesity (silver spring, md).* 2016;24(8):1660-1668. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/008/CN-01177008/frame.html. Accessed Aug.
27. Daniels P, Burns R, Brusseau T, et al. Effect of a randomised 12-week resistance training programme on muscular strength, cross-sectional area and muscle quality in women having undergone Roux-en-Y gastric bypass. *Journal of sports sciences.* 2018;36(5):529-535. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/726/CN-01458726/frame.html. Accessed Mar.
28. Huck CJ. Effects of supervised resistance training on fitness and functional strength in patients succeeding bariatric surgery *Journal of Strength & Conditioning Research* 2015;29(3):589-595.
29. Mundbjerg LH, Stolberg CR, Bladbjerg EM, Funch-Jensen P, Juhl CB, Gram B. Effects of 6 months supervised physical training on muscle strength and aerobic capacity in patients undergoing Roux-en-Y gastric bypass surgery: a randomized controlled trial. *Clinical Obesity.* 2018;8(4):227-235.
30. Mundbjerg L, Stolberg C, Cecere S, et al. Supervised Physical Training Improves Weight Loss After Roux-en-Y Gastric Bypass Surgery: a Randomized Controlled Trial. *Obesity (silver spring, md).* 2018;(no pagination)(5):828-837. http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/126/CN-01465126/frame.html.
31. Stolberg C, Mundbjerg L, Funch-Jensen P, Gram B, Juhl C, Bladbjerg E-M. Effects of gastric bypass followed by a randomized study of physical training on markers of coagulation activation, fibrin clot properties, and fibrinolysis. *Surgery for obesity and related diseases.* 2018;(no pagination). http://cochranelibrary-wiley.com/o/cochrane/clcentral/articles/020/CN-01608020/frame.html.
32. Stolberg CR, Mundbjerg LH, Funch-Jensen P, Gram B, Bladbjerg EM, Juhl CB. Effects of gastric bypass surgery followed by supervised physical training on inflammation and endothelial function: A randomized controlled trial. *Atherosclerosis.* 2018;273:37-44.
33. Onofre T, Carlos R, Oliver N, et al. Effects of a Physical Activity Program on Cardiorespiratory Fitness and Pulmonary Function in Obese Women after Bariatric Surgery: a Pilot Study. *Obesity Surgery.* 2017;27(8):2026-2033.
34. Stegen S, Derave W, Calders P, Van Laethem C, Pattyn P. Physical fitness in morbidly obese patients: Effect of gastric bypass surgery and exercise training. *Obesity Surgery.* 2011;21(1):61-70.