Background

Systematic reviews and meta-analyses have identified that bariatric surgery is the most effective intervention for obesity, producing greater weight loss (mean difference -26kg), 95% confidence interval (-31 to -21) and a higher remission rate of diabetes (relative risk 22.1, 3.2 to 154.3), compared to non-surgical treatment (1) (based on two years follow up). However, surgery is not a panacea and weight regain and recurrence of complications e.g. diabetes, can and does occur (2-4). Consequently, there is an increasing focus on post-surgical lifestyle interventions, targeting physical activity [PA] to help patients to maintain the benefits of surgery (5).

PA is a behaviour, defined as "any bodily movement produced by skeletal muscles that uses energy" (6), and its benefits are well established; PA is protective against chronic conditions such as coronary heart disease and type 2 diabetes (7). Current recommendations are for at least 150 minutes of moderate to vigorous intensity physical activity [MVPA] per week for adults (7-9), although there are no specific guidelines for patients following bariatric surgery to optimise weight and health status beyond these (10). Despite this, there is some evidence that exercise (including strength training) following surgery may be beneficial in preserving non-fat mass (11), promote greater weight and fat mass loss, and improve physical fitness (12, 13).

Sedentary behaviour [SB], sits on the PA continuum and is a separate and distinct behaviour of interest. It is defined as "any waking behavior characterized by an energy expenditure ≤1.5 metabolic equivalents (METs), while in a sitting, reclining or lying posture" (14). This is different to inactivity, which occurs when an individual does not meet the PA guidelines. Thus it is possible to be both physically active and sedentary if one is able to achieve 150 minutes of MVPA per week through structured physical activity and also spends 'prolonged periods' of time sitting, e.g. due to a desk based job (15). SB is of increasing interest to research and clinical communities and warrants attention in this review as it is associated with chronic health conditions including cardiovascular disease, type 2 diabetes and some cancers (16). It is particularly relevant to this patient group who

are at increased risk of these conditions due to their obesity, which is likely to persist after bariatric surgery (17).

A recent systematic review (18) of prospective studies with at least 10 adults, ≥ 18 years undergoing bariatric surgery in which PA or physical function was measured pre and post-surgery, found an overall trend for PA to increase up-to 12 months following surgery. Step count increased between 3-6 months, but was accompanied with a reduction in objectively measured MVPA (18), meaning that 90% of patients were still not sufficiently active, according to the guidelines, and 24-29% (depending on the measure used to assess PA) became less active after surgery (6, 19). A recent meta-analysis of studies, which objectively measured SB found that patients were no less sedentary following bariatric surgery (20).

Given the potential benefits of increased PA and reduced SB, we aimed to synthesise the evidence for interventions that targeted either or both behaviours, in the context of bariatric surgery.

In behaviour change interventions (where specific behaviours such as PA and SB are targeted), behaviour change techniques (BCTs) are the 'active ingredients', defined as "observable, replicable and irreducible component of an intervention designed to alter or redirect causal processes that regulate behavior" (21). Therefore, we expected these to be included in studies in this review. An example of a BCT according to the BCT taxonomy v1 (BCTTv1) (21), is 'goal setting', defined as 'set or agree a goal defined in terms of the behaviour to be achieved' e.g. 'agree a daily walking goal (e.g. 3 miles) with the person and reach agreement about the goal' . As BCTs are the 'active ingredients' of behaviour change interventions, we decided to extract these as part of this review.

Studies were eligible for inclusion if they measured PA pre and post- intervention using either self-reported or objective tools. This was a pragmatic decision as an initial scoping search identified that both were used and we did not want to exclude relevant studies that might have offered valuable information regarding intervention conditions.

Objectives

The aim of our study was to identify interventions and components thereof that would be able to facilitate changes in these behaviours after bariatric surgery. This information would be particularly useful for clinicians who understand the benefits in changing these behaviours, but are unsure of how best to support patients with this.

Our specific objectives were to synthesise the efficacy of the interventions and their components: characteristics, mode of delivery (groups or individual), outcome measures and behaviour change techniques [BCTs]. The review followed a pre-registered protocol PROSPERO (CRD42019121372) and PRISMA guidelines see figure 1.

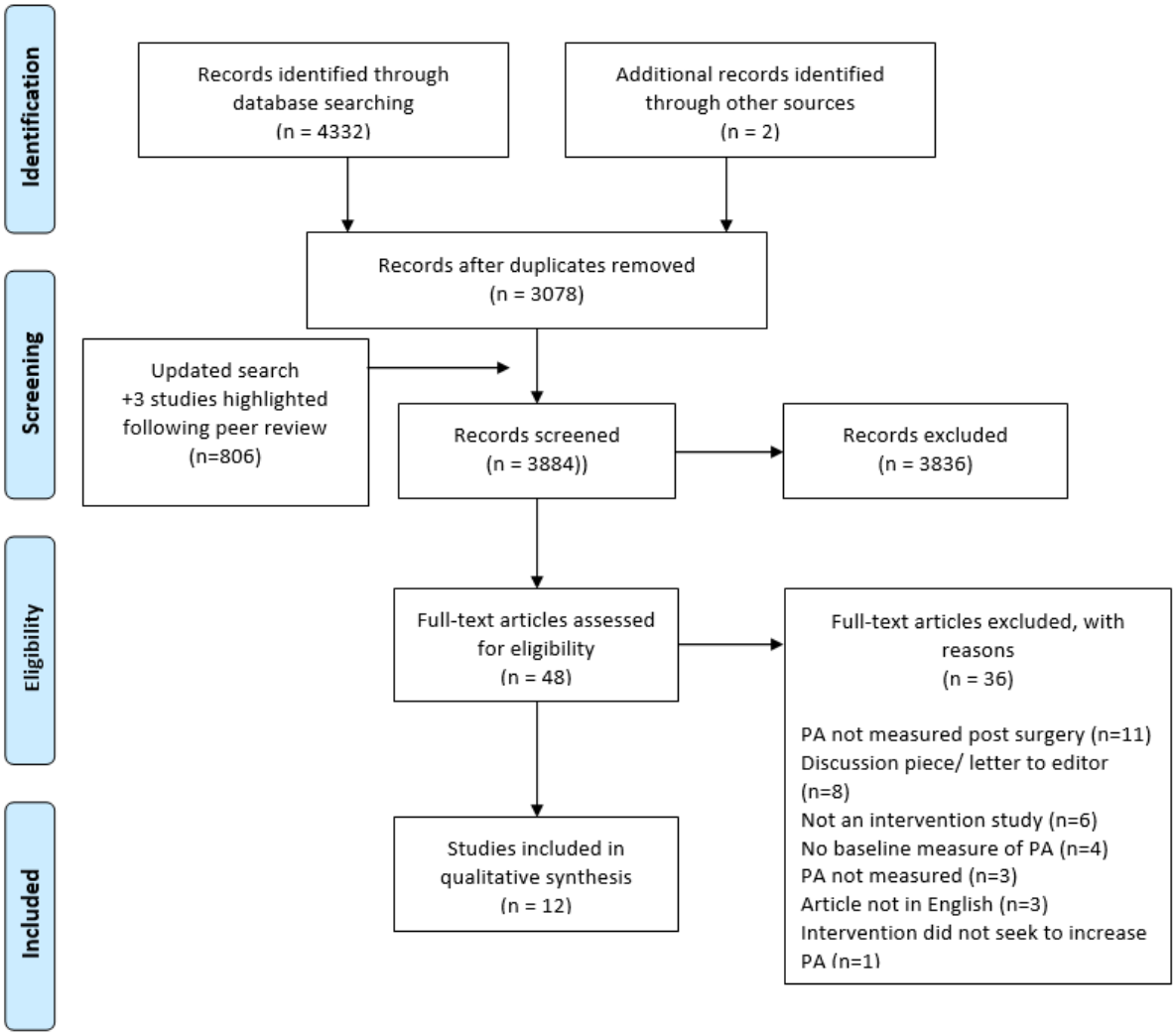

Figure 1 PRISMA Flow Diagram

Data sources

Four databases were searched; Medline, CINAHL, Scopus and PsychINFO with search terms that related to the population, intervention and outcome (date of searches 23/11/2018- 04/12/2018). In view of the time between searches and submission for publication, the same search strings were re-run in the databases for publications from 2018-2020 to update the review (final search 23/05/2020). Search terms included MeSH headings and key words based on bariatric surgery (such as bariatric, weight loss) and more specific terms that specified the surgery of interest and their synonyms (i.e. gastric bypass, roux-en y gastric bypass). Keywords associated with intervention and outcome such as programme, intervention and physical activity were searched after which the individual search strings were combined.

Two additional papers were identified during peer review. JJ screened all abstracts and titles, and VS a 10% random sample of these. All papers selected for full text review were independently screened for inclusion by JJ and VS who agreed on the papers to be included; reference lists of these were also reviewed for additional potential studies, which were subjected to the same processes.

Study selection

Any interventions that sought to increase PA or reduce SB were included, however, where the focus was principally on physiological effects, these were not, as these will be of less clinical value to clinicians whose focus is on how to support patients to change these behaviours.

Unlike previous reviews, ours focused on two target behaviours (PA and SB) and intervention efficacy with regard to these, measured after bariatric surgery. We also considered components of the interventions – BCTs with a view to providing clinicians with the evidence for their use in addition to the effect on PA and SB.

Prospective primary research studies were included if they used either self-reported or objectively measured PA or SB, measured at baseline and at least one other time point after surgery; the

intervention may have commenced either prior to or following surgery. Single arm, pilot and feasibility studies were eligible for inclusion, as they may have offered valuable evidence to meet the objectives of this review. Where papers referenced earlier publications about the same study, these were retrieved and relevant data extracted.

There were no date limits to the search. Papers not published in English were excluded as were thesis and conference proceedings.

Data extraction and synthesis

A data extraction table was developed using the PICOD framework; it was piloted, reviewed and refined. Data extracted included study and participant characteristics, and intervention components e.g. supervised exercise. Other data extracted included mode of delivery, BCTs, duration, outcomes, and outcome measures; attendance, engagement and retention (as reported), intervention fidelity, and control group components. JJ and VS extracted data independently, after which they met to reach agreement without the need for intervention of a third reviewer. Study authors were contacted for additional information when required. JJ and WH independently extracted BCTs in all study arms using the BCCTv1 (21). The confidence for their presence was indicated with + (probably present) and ++ (definitely present), after which they met to discuss and agree final codes.

All studies were assessed using the Cochrane Risk of Bias 2 tool (22) which considers risk of bias [ROB] in randomised studies in five separate domains: randomisation, deviations from the intended interventions, missing outcome data, measurement of the outcome and selection of the reported result. In this tool, the domain with the highest ROB judgement dictates the overall risk. As one of the studies was a single arm non-randomised pilot, only four domains of this tool were relevant (23) . ROB was independently assessed by JJ and LB; and by JJ and VS for studies retrieved in the updated search and from peer review of the manuscript.

Results

From a total of 3884 identified articles, forty-eight were assessed for full text review. Thirty-six were excluded due to: no post-operative measures of PA (n=11), discussion paper or non-peer reviewed (n=8), not an intervention study (n=6), no baseline measures of PA (n=4), PA not measured (n=3), article not in English (n=3) and, intervention did not seek to increase PA (n=1).

Data was extracted from twelve unique interventions (see Fig. 1); seven from the original search, three from the updated search and two obtained as a result of peer review.

Eight of the studies were randomised trials (24-31), one was quasi-experimental (32), two were randomised feasibility studies (33, 34) and one was a single arm pilot study (23).

Eleven studies compared the intervention against a control group, the composition of which varied and included either generic PA input or advice (25, 26, 29-33), dietary focus (24, 34), or were not explicitly described (27, 28). Sample size ranged from 10 (23) to 259 participants (24) and all participants were either considering or had undergone surgery. Participants in nine studies were mostly female (57-92%) (25, 27-34); the final three comprised females only (23, 24, 26). Six of the studies had a mix of surgical procedures, the most common, were roux en-y-gastric bypass [RYGB] and sleeve gastrectomy (23, 27, 29, 30, 33, 34). Four of these included participants who had undergone gastric band surgery; this represented only a small proportion of the surgical types (27, 29, 33, 34). The remaining six studies comprised a single surgical type: RYGB (25, 28, 31, 35) sleeve gastrectomy (32) or vertical banded gastroplasty (26). See table 1 for study design and baseline characteristics.

Reference	Type of study	Research design	Total sample size	Control/ Intervention	% Female	Surgical type	BMI (kg/m²) at baseline
Baillot et al 2016, 2018 (30, 36)	Evaluation	RCT	30	Control	75%	RYGB 73% gastric sleeve 27%	47.8 (40.3-54.0)
				Intervention	85%	RYGB 62% gastric sleeve 38%	44.8 (42.1-53.0)
Bond et al 2017 (29)	Sub-sample of evaluation study	RCT	36	Control	79%	Total sample; RYGB n=18 (50%), gastric banding n=16 (44%), gastric sleeve n=2 (6%)	44.4 (7.1)
				Intervention	91%		46.7 (7.1)
Carnero et al 2017 (31)	Evaluation	RCT	128	Control	86%	All RYGB	44.4 (7.5)
				Intervention	91%		45.8 (7.4)
Coleman et al 2017 (33)	Feasibility	RCT	51	Control	84%	RYGB n=17 (68%), gastric sleeve n=7 (24%), lap band n=1 (4%)	33.1 (5.8)
				Intervention	85%	RYGB n=21 (81%), gastric sleeve n=4 (15%), lap band n=1 (4%)	32.7 (5.8)
Hanvold et al 2019 (28)	Evaluation	RCT	165	Control	76%	All RYGB	31.0 (4.8)
				Intervention	73%		30.8 (4.9)
Herring et al 2017 (27)	Evaluation	RCT	24	Control	92%	RYGB 33%, gastric sleeve 67%,	38.2 (6.1)
				Intervention	92%	RYGB 33%, gastric sleeve 58%, gastric band 8%	39.4 (4.3)
Jassil et al 2015(23)	Pilot	Single arm	10	Intervention	100%	Data provided for 8 participants only. RYGB n=2, gastric sleeve n=6	38.5 (7.2)
Jiménez-Loaisa et al 2020 (32)	Evaluation	Quasi-experimental	40	Control	73%	All sleeve gastrectomy	43.1 (4.5)
				Intervention	82%		43.8 (5.3)
Papalazarou et al 2010 (26)	Evaluation	RCT	30	Control	100%	All vertical banded gastroplasty	Whole sample 49.5 (7.5)
				Intervention			
Sellberg et al 2019 (24)	Evaluation	RCT	259	Control	100%	All RYBG	40.7 (4.6)
				Intervention			40.8 (4.5)
Shah et al 2011 (34)	Feasibility	RCT	33	Control	92%	GB 67%, RYGB 33%	41.0 (3.7)
				Intervention	90%	GB 71%, RYGB 29%	47.3 (10.0)
Stolberg et al 2018 (25)	Evaluation	RCT	60	Control	~75%	All RYGB	34.1 (5.4)
				Intervention	~65%		33.3 (6.2)

141 *Table 1 Study design and baseline characteristics.*
142 *GB Gastric band, RYGB Roux en y gastric bypass. BMI data, mean (standard deviation), BMI data Baillot et al 2016,2018; median (25^{th} and 75^{th} quartiles).*

All studies measured levels of PA after surgery. This was stated as an intervention aim or hypothesis in six studies (25, 26, 29, 30, 32, 33) and was measured in all twelve. SB was measured as an outcome in eight studies (24-28, 31-33) one of which hypothesised that SB would reduce as a result of the intervention (32). See table 2 for details of the intervention and control conditions.

Nine of the twelve interventions included supervised activity or exercise, which was delivered by: PA specialists (30), exercise physiologist (31), qualified gym instructor (27), physiotherapist and exercise specialist (23), exercise and sports science professionals (32), physiotherapists (25), clinical dietitian or masters students in clinical nutrition (28) or was unspecified (33, 34). The duration and frequency of supervised exercise sessions ranged from once weekly for up-to 60 minutes (23, 31, 34) to four times weekly for 90 minutes (32). This was delivered either on a one-to-one basis (27, 34), in groups (23, 28, 30, 32), a combination (25, 33) or was not reported (31). In these nine studies, participants were either expected or supported to change their PA behaviour outside of the sessions.

The final three interventions were counselling or discussion based; in two, participants were asked to increase MVPA and steps (29) or to increase their PA aiming for American College of Sports Medicine guidelines (150 mins of MVPA per week) (26). The final intervention involved participants discussing PA behaviours, focusing on the difficulties that might occur and how these might be managed in the future (35).

The duration of the intervention varied; the shortest was six weeks, delivered prior to surgery (29, 37), whilst the longest was three years and was delivered during standard follow up visits (26).

See table 2 for attendance, engagement and retention details.

Reference	Timing relative to surgery	Control	Intervention	Duration	Attendance, engagement and retention (as reported)
Baillot et al 2018 (30)	Pre	Individual counselling every 6-8 weeks pre-surgery for at least 6 months, and post-surgery at months 3, 6, 9, and 12 with a dietitian and PA specialist. Plus, optional access to an educational group for PA, nutrition and psychological input related to weight management.	Three weekly 80-min sessions: 10 mins of warm-up, 30 mins of endurance activity (at 55 to 85% of the heart reserve), 20 to 30 min of strength exercises with small equipment (dumbbells, elastic bands, medicine balls and sticks) and 10 min of a cool-down period, with monthly aqua gym session, until 2 weeks before surgery.	32.6 ± 8.0 weeks before surgery (range 27– 51 weeks).	Intervention participants attended a median of 70 (45–90%) of the total recommended exercise sessions (3×/week) from the baseline of the PreSET until 2 weeks before surgery. Of the 30 participants randomised to either the intervention or control, 25 completed the study.
Bond et al 2017 (29)	Pre	Participants were advised to begin exercising but did not receive any specific PA prescription, recommendations or strategies to facilitate this.	Six consecutive weekly individual face to face counselling sessions. PA was logged, monitored and a pedometer provided. Goals were set to increase bout-related walking minutes and steps per day relative to baseline. Counselling sessions reviewed self-monitoring records, goal progression, problem solving, teaching behaviour change strategies and developing action plans.	6 weeks.	80 participants were randomised, 36 had surgery from which 31 (86.1%) completed post-operative follow up.
Carnero et al 2017 (31)	Post	Participants received health education in 6 session, held once monthly which included lectures, discussion and information on topics including medication, nutrition and upper body stretching. Participants reported their PA habits at these sessions.	Participants received the same information as the control group, plus intervention. Weeks 1-4 participants exercise for as long as feasible (10-15 mins) at 60-70% of maximal heart rate. This progressed over 3 months to 120mins/week for the final three months of the intervention. Exercises included cycling or walking at home (stationary bike or treadmill or outdoors). Participants were encouraged to exercise for 30 minutes per day.	6 months	128 participants randomised: 66 to the intervention group and 62 to the control group. Retention was 91% (n=54) in the intervention group and 95% (n=59) in the control group. From a total of 96 participants, 23 were excluded from analysis due to insufficient PA data.
Coleman et al 2017 (33)	Post	Weight assessment and phone calls which comprised counselling to encourage regular MVPA, although	There were 2 phases; intervention and maintenance. The intervention phase comprised twice weekly 60-min group	12 months	Participation in the intervention was limited for ten out of the 25 (40%) assigned to the group due to a pre-

		this did not contain and standardized recommendations. Phone calls and monitoring took place within the first two weeks post operatively, then at 2 and 6 months, and annually thereafter.	exercise classes comprising strength, flexibility and aerobic activities, plus at least 3 days per week of self-directed exercise. Daily pedometer with recording of steps and activities and weekly telephone counselling. The 6 months maintenance phase comprise once weekly exercise classes and once monthly telephone counselling.		existing condition. Of the remaining participants, 44% developed a condition during the programme which limited their participation with the intervention. Of 51 participants randomised to either the intervention or control, 43 completed the 12 months follow up
Hanvold et al 2019 (28)	Post	Three follow up consultations in the first year with a dietitian or doctor, with an annual review thereafter for the next four years.	Sixteen group meetings comprising 12-15 participants lasting 2 hours. Participants were advised to reduce their sedentary time and to undertake ≥ 75 min/week higher intensity activity. Sessions included a 30-minute PA session with various activities including Nordic walking, climbing stairs, and strength training (weather dependent). An activity coach guided participants in 'the use of Nordic walking and use of pedometer.	24 months	Attendance at the intervention varied from 35-84%, with the average number of sessions being attended was 8 ±4 (out of a possible 16). Eight participants withdrew from the intervention group (n=85), and fifteen withdrew from the control group (n=80). Of 165 participants randomised, 142 completed the 24 months follow up.
Herring et al 2017 (27)	Post	Participants in the control group continued with usual follow-up care. After their 12-week assessment, the control group also received the discharge advice session discussing the same topics. All participants were given an example exercise programme and progression (for example, home-based exercise, walking, swimming), along with the diet information sheet	Three sixty-minute gym sessions/week, of moderate intensity aerobic and resistance training for 12 weeks. Aerobic exercise training typically lasted 45 min; the first exercise programme was 35 mins with a longer warm-up period and progressed to 45 min by the end of week 2. The warm up period reduced as participants fitness improved. Exercise sessions were progressive and personalised.	12 weeks	Participants in the intervention group attended a mean of 34.2 ±2.5 sessions (out of a possible 36), equating to a 95% adherence. Of 24 participants randomised, 21 completed follow up.
Jassil et al 2015 (23)	Post	No control group	Eight weekly sessions comprising 60 minutes of exercise followed by a 60-minute group discussion on lifestyle education and nutritional-behavioural change sessions.	8 weeks	Two patients attended all the sessions and the other patients attended seven (n= 1), six (n = 1), five (n= 2), four (n= 1), and three sessions (n= 1), respectively. The

			The intervention was designed and delivered by a physiotherapist and exercise specialist and intensity of exercise varied according to individual functional capacity and increased progressively each week. Participants were encouraged to exercise to BORG 13 based on Borg's Rate of Perceived Exertion scale.		median number of sessions attended was six. Eight out of 10 patients completed follow up.
Jimenez-Loasisa et al 2020 (32)	Post	Participants in the control group were given usual care recommendations focused on trying to maintain an active lifestyle after surgery (for weight loss and maintenance), but no specific advice was given.	The frequency of the intervention increased throughout the 6-month intervention period, beginning with 2 sessions/week for the first two months, then three sessions/week in the following two months, to four sessions/week for the final two. Sessions in the first two months were 60 minutes, increasing to 90 minutes in the following 4 months. The intervention involved cardiorespiratory and strengthening exercises, and sessions such as 'body expression, dance, directed activities (aerobic, spinning etc.), beach and pool activities, core training, trekking and traditional Spanish games'. Participants were provided with home exercises which did not require 'large resources or joining a gym'.	6 months	The attendance rate for the intervention group was 80% (68.1-88.9%). Retention for the intervention and control group at 13 months post-surgery (final assessment) was 89.4 (n=17) and 75% (n=15) respectively.
Papalazarou et al 2010 (26)	Post	Post-operative dietetic assessment every week for the first three months, reducing to every other week for three months, and then monthly for six months. Participants were reviewed every three months in the second year, and every six in the third (total of 30 sessions). During these	A patient-centred collaborative approach was used with behaviour modification techniques such as self-monitoring, self-evaluation, goal setting, reinforcement, stimulus control, and relapse prevention. Every session included nutritional education, dietary intake and physical activity with information provided on	36 months	All 30 participants (100%) attended all sessions and follow up.

		sessions general information was provided on adopting PA.	increasing PA. The intervention was delivered when participants attended for their usual care appointments.		
Sellberg et al 2018 & 2019 (24, 35)	Post	Consultation with a dietitian, nurse or surgeon to discuss medical complications, weight loss and post-surgery diet, this took place 'a few weeks, 6 months, 1 and 2 years after surgery'.	Weekly group sessions over a period of four weeks, comprising 4 different topics, the first of which concerned physical activity. Participants were encouraged to discuss how they wanted to behave in future specific situations, and the aim was to provide participants with strategies to manage future difficulties with PA behavior.	4 weeks	156 participants were allocated to the intervention group. Of these n=53 did not attend any sessions, n=15 attended 1, n=18 attended 2, n=37 attended 3 and n=33 attended 4. Of 259 participants, 203 completed follow up.
Shah et al 2011 (34)	Post	Participants from both groups had individual behavioural therapy focusing on stimulus control, eating behaviour and stress management.	Participants were asked to exercise on at least 5 days/week and attend supervised exercise sessions 1-2x/week. In addition, participants had behavioural therapy relating to exercise every 2 weeks, which included goal setting, self-monitoring, cognitive–behavioural strategies, and problem solving and relapse prevention.	12 weeks	33 participants were randomised; 12 to the control group and 21 to the intervention group. Four of control group provided baseline data only; three withdrew because they wanted to be in the intervention group. The fourth did not have time to participate. Five participants in the intervention group did not complete the study; four provided baseline and follow up data at 6 weeks but not at 12 weeks, and one provided data only at baseline. Time was given as the reason for dropping out of the study.
Stolberg et al 2018 (25)	Post	Participants were given the clinics standard information about the importance of being physically active after RYGB.	Forty minutes of exercise, twice weekly for 26 consecutive weeks. The sessions comprised moderate intensity endurance and resistance exercises and were supervised by a physiotherapist. Participants also had free access to fitness centres during the intervention.	26 weeks	Nineteen of 32 participants (59.4%) allocated to the intervention group attended ≥ 50% of the planned training sessions (deemed to be acceptable attendance). Out of the 60 participants randomised, 42 completed follow up.

165 *Table 2 Intervention and control conditions; attendance, engagement and retention.*

BCTs to increase PA could be identified in all intervention, but not all control groups. The number of BCTs in intervention conditions varied from four (25) to nineteen (29, 37). The five most common were: Instruction on how to perform the behaviour (BCT 4.1) (n=10), demonstration of the behaviour (BCT 6.1) n=10, goals setting behaviour (BCT 1.1) (n=9), behavioural practice/ rehearsal (BCT 8.1) (n=9) and action planning (BCT 1.4) (n=7). One BCT, prompts and cues (BCT 7.1) was identified as being used to reduce SB in the intervention group, although SB was not measured as an outcome in the study (29).

Information regarding control group conditions (n=11) was generally lacking, (see table 2) making it difficult to extract details. From the eleven control groups, five had identifiable BCTs: goal setting (BCT 1.1) (n=3), information about health consequences (BCT 5.1) (n=2), problem solving (BCT 1.2) (n=1) and self-monitoring behaviour (BCT 2.3) (n=1), with two being the maximum number of identifiable BCTs identified in any one group (27, 32). (See table 3 for BCTs identified in each of the studies)

Reference	Control/ Intervention	BCT identified and confidence (+, ++) All coded for PA unless indicated. No BCTs for SB were identified.
Baillot et al 2018 (30)	Control	None
	Intervention	2.4 Self-monitoring of outcomes of behaviour + 2.6 Bio feedback ++ 3.1 Social support unspecified + 4.1 Instruction ++ 8.1 Behavioural practice rehearsal ++ 8.7 Graded tasks ++ 11.2 Reducing negative emotions ++
Bond et al 2017 (29)	Control	1.1 Goal setting ++
	Intervention	1.1 Goal setting behaviour ++ 1.2 Problem solving + 1.4 Action planning ++ 1.5 Review goals behaviour + 1.8 Behavioural contract+ 2.2 Feedback on behaviour ++ 2.3 Self-monitoring behaviour + 3.1 Social support unspecified ++ 4.1 Information on how to do the behaviour+ 5.3 Information about health consequences ++ 6.1 Demonstration of behaviour + 7.1 Prompts and cues+ (PA & SB) 8.2 Behaviour substitution + 8.7 Graded tasks ++ 9.2 Pros and cons + 11.2 Reducing negative emotions + 12.5 Adding objects to the environment ++ 14.7 Reward incompatible behaviour +
Carnero et al 2017 (31)	Control	2.3 Self-monitoring behaviour +
	Intervention	1.4 Action planning ++ 2.1 Monitoring of behaviour by others without feedback ++ 2.2 Feedback on behaviour ++ 2.3 Self-monitoring of behaviour ++ 2.6 Biofeedback ++ 4.1 Instruction on how to perform the behaviour ++ 6.1 Demonstration of the behaviour ++ 8.1 Behavioural practice/rehearsal ++ 8.7 Graded tasks ++
	Control	None

Coleman et al 2017 (33)	Intervention	1.1 Goal setting ++ 1.4 Action planning ++ 2.2 Feedback on behaviour + 2.3 Self-monitoring behaviour + 3.1 Social support unspecified + 4.1 Instruction ++ 6.1 Demonstration of the behaviour (or modelling) ++ 8.1 Behavioural practice ++ 12.5 Adding objects to the environment ++
Hanvold et al 2019 (28)	Control	None
	Intervention	1.1 Goal setting ++ 1.4 Action planning ++ 2.3 Self-monitoring ++ 4.1 Instruction on how to perform the BH + 5.1 Information about health consequences + 5.3 Information about social and environmental consequences ++ 8.1 Behavioural goals (PA & SB) ++ 8.3 Habit formation + 12.5 Adding objects to the environment ++
Herring et al 2017 (27)	Control	1.1 Goal setting behaviour + 1.2 Problem solving +
	Intervention	1.1 Goal setting behaviour ++ 1.2 Problem solving ++ 4.1 How to do behaviour + 8.1 Behavioural practice/ rehearsal ++ 8.7 Graded tasks ++
Jassil et al 2015 (23)		1.1 Goal setting behaviour ++ 1.4 Action planning ++ 1.5 Review of behavioural goals ++ 2.1 Monitoring of behaviour without feedback + 2.3 Self-monitoring behaviour ++ 4.1 Instruction on how to perform the behaviour ++ 8.1 Behavioural practice ++ 8.7 Graded tasks ++ 12.5 Adding objects to the environment ++
Jimenez-Loaisa et al 2020 (32)	Control	1.1 Goal setting BH ++ 5.1 Information about health consequences ++
	Intervention	1.1 Goal setting BH ++ 2.2 Feedback on BH ++ 4.1 Instruction on how to perform the BH ++ 5.1 Information about health consequences ++ 8.1 Behavioural practice/ rehearsal ++ 10.4 Social reward +
	Control	None

Papalazarou et al 2010 (26)	Intervention	1.1 Goal setting behaviour ++ 1.2 Problem solving ++ 1.7 Review outcome goals ++ 2.4 Self-monitoring outcome ++ 10.9 Self-reward++
Sellberg et al 2018 & 2019 (24, 35)	Control	None
	Intervention	1.1 Goal setting BH ++ 1.2 Problem solving ++ 1.4 Action planning ++ 8.3 Habit formation + 11.2 Reduce negative emotions + 13.3 Incompatible beliefs +
Shah et al 2011 (34)	Control	None
	Intervention	1.1 Goal setting behaviour ++ 1.2 Problem solving ++ 1.3 Goal setting outcome ++ 1.4 Action planning ++ 2.1 Monitoring of behaviour by others without feedback ++ 2.3 Self-monitoring of behaviour ++ 2.7 Feedback on outcome of behaviour ++ 4.1 Instruction on how to perform the behaviour ++ 6.1 Demonstration of the behaviour ++ 8.1 Behavioural practice/ rehearsal ++ 8.7 Graded tasks ++
Stolberg et al 2018 (25)	Control	5.1 Information about health consequences+
	Intervention	2.1 Monitoring of behaviour by others without feedback 4.1 Instruction on how to perform the behaviour ++ 8.1 Behavioural practice ++ 12.5 Adding objects to the environment +

179 *Table 3 BCTs identified in each study*

None of the authors powered their studies to detect a change in PA or SB, specifically in the time period following bariatric surgery although post-operative PA, SB or both, were measured by all in this review. Six studies presented aims or hypothesis related to PA, five of which sought to assess if the intervention would increase this (24, 25, 30, 32, 33) with one identifying bout related MVPA and steps specifically as outcomes of interest (29). The remaining six measured PA as one of their study outcomes (23, 26-28, 31, 34).

Self-report and objective measures were used to assess PA; four studies used self-report only (23, 26, 28, 30), four used self-report and objective tools (25, 27, 33, 34) and four used objective measures only (24, 29, 31, 32). (See table 4 for outcome details).

Of the eight studies that used self-report, validated questionnaires were used in five (26-28, 30, 34), whilst the others either adapted or used questions from existing questionnaires (23, 25, 33).

Accelerometers were used in six studies and were worn either on the arm, at the mid-axillary line at the superior aspect of the iliac crest, or the hip (24, 25, 27, 29, 31, 32); pedometers were used in two (33, 34).

SB and sitting time was measured in eight studies, three used self-report (26, 28, 33), and five measured this objectively via accelerometery (25, 27, 31, 32, 35).

Reference	PA measurement tool and units	Post intervention or follow up period	Results
Baillot et al 2018 (30)	Self-report, IPAQ-SF: METs	Follow up 1 year following surgery (intervention pre-surgery)	Changes in the self-reported levels of PA were not significantly different between groups. According to accelerometery, the intervention group had a greater number of steps, light and moderate PA compared to the control group one-year post-surgery; however, there was no objective baseline measure of this and the authors acknowledge poor concordance between self-report and objective measures.
Bond et al 2017 (29)	Objective, accelerometer: MVPA mins and steps/day	Follow up 6 months after surgery (intervention pre-surgery).	The intervention group had a greater mean increase in bout related MVPA of 22.0 (mins/day) increasing from 4.3 to 26.3 (mins/day) (p=0.016), compared to the control group whose mean MVPA increased by 1.0 (mins/day) from a baseline of 10.4 (mins/day). At follow up, mean MVPA in the intervention group was 28.7 mins/day, and 18.5 in the control groups; statistical significance was no longer maintained (p=0.15). The intervention group increased their mean steps/day by 2793 from a baseline of 5163 to 7950 (corrected p =0.031), which slightly reduced at follow up to 7870 (p=0.024) but was still statistically significant compared to the control group who increased their steps from a baseline of 5069 to 5601 at post-intervention but reduced to 5087 at follow up.
Carnero et al 2017 (31)	Objective, accelerometer: METs, steps	Post intervention: For the last week of the intervention which was 6 months in duration.	Both groups significantly increased their steps per day and time spent in light, moderate and vigorous PA and reduced their sedentary time, but there was no difference between the groups.
Coleman et al 2017 (33)	Self-report via questionnaire with measures of sedentary activity and questions from Behavioural Risk Factor Surveillance survey: MVPA and sedentary activity mins/day. Pedometer: steps/day	Post intervention (after 6 months of intervention), repeated 6 months after the maintenance phase.	No differences between the groups in self-reported PA or steps/day.
Hanvold et al 2019 (28)	Self-report, 7-day physical activity recall questionnaire: time spent on low, moderate and high PA.	Post intervention.	No differences between the groups in changes in PA level or time spent on different activities.

Herring et al 2017 (27)	Self-report, IPAQ-SF: METs. Objective, accelerometer: sedentary, light PA, MVPA and step count	Post intervention immediately following the intervention and follow up 12 weeks thereafter.	Post intervention, MVPA increased by 10.5 (SD 9.2) (mins/day) in the intervention from a baseline of 28.3 (SD 24.0) (min/day) (p=0.043). MVPA in the control group reduced by -1.5 (SD 14.5) from a baseline of 29.7 (SD 18.7) mins/day). At follow up, mean MVPA in the intervention group was 7.5 (SD 19.8) mins/day above baseline. This reduced by -3.4 (SD 16.2) in the control group from the baseline, and the difference between the groups was no longer statistically significant.
Jassil et al 2015 (23)	Self-report, questionnaire adapted from National Audit of Cardiac Rehabilitation: MVPA mins	Post intervention; one month after the intervention.	Authors report mean time spent on strenuous activity was 44 (49) minutes, from a baseline of zero (p<0.05), no significant differences to moderate intensity PA.
Jiménez-Loasia et al 2020 (32)	Objective, accelerometer: time spent in sedentary, light, moderate to vigorous PA.	Post intervention; six months after the intervention and again six months thereafter.	No increases in PA in the intervention group, at any time point when compared with the control group.
Papalazarou et al 2010 (26)	Self-report, Harokopio Physical Activity Questionnaire: METs and time spent watching television (hours/day)	Post intervention	PA increased from 1.26 (SEM=0.01) to 1.62 (SEM=0.04) in the intervention group and from 1.30 (SEM=0.20) to 1.34 (SEM=0.03) in the control group; statistically significant difference between the groups (p=0.001). SB reduced in the intervention group from a baseline of 2.8 (SEM =0.28) (hours/day) to 0.80 (SEM= 0.14) and from 2.46 (SEM = 0.35) to 2.30 (SEM= 0.33), statistically significant difference between the groups (p=0.039)
Sellberg et al 2019 (24)	Objective, accelerometer: sedentary, light and moderate-vigorous PA.	1-year post intervention	No effects of the intervention were found.
Shah et al 2011 (34)	Self-report, Seven-day physical activity recall Objective, pedometer steps	Mid-intervention (6 weeks) and post-intervention.	Self-reported PA increased by more than three times in the intervention group but was unchanged in the control group. Significant group by week interaction in the intervention group (p=0.02) and within group change (p<0.001). Steps/day increased from about 5500 at baseline to nearly 10,000 in the intervention group, and only slightly in the control group. Group by week interaction (p=0.03) and within group change in the intervention group were statistically significant (p<0.0001).
Stolberg et al 2018 (25)	Self-report, Recent Physical Activity Questionnaire + authors added 5 questions to home activities section. Objective, accelerometer: METs	Post-intervention and follow up 12 months after the intervention	No significant difference between the groups at post intervention or follow up.

197 *Table 4 Outcomes, follow up and results*

198 Five of the interventions resulted in statistically significant improvements in PA compared to the
199 control group or baseline (where there was no control). Bond et al (29) found that intervention
200 participants had greater increases than the control group in bout related MPVA minutes/day at post-
201 intervention (p=0.016) but not at follow up (six months post-surgery) (p=0.15). Steps/day also
202 differed between the groups at post-intervention (p=0.031) and follow up (p=0.024).
203 Herring et al (27) found a mean increase in MVPA in the intervention group between baseline and
204 follow up, this decreased in the control group, resulting in a significant difference between the two
205 (p=0.043), however the difference was no longer significant 12 weeks thereafter, following a period of
206 no intervention.
207 Jassil et al (23) reported a significant increase in strenuous PA minutes/week from a baseline of zero
208 to 44 (SD 49) ($p<0.05$) and a non-statistically significant reduction (p=0.310) in MVPA following eight
209 weeks of intervention compared to baseline (no control).
210 Shah et al (34) reported a significant increase in steps in the intervention group from ~5500 to almost
211 10000 steps/day. There was a statistically significant group by week interaction (p=0.03) and within
212 group change in the intervention group ($p<0.0001$). Self-reported time spent in moderate PA
213 increased by more than three times for the intervention group but remained the same in the control
214 group when compared to baseline. Again, there was a significant group by week interaction (p=0.02)
215 and within group change in the intervention ($p<0.0001$) but not in the control group. There were no
216 changes in self-reported light PA in either of the groups, and time spent in vigorous PA remained at
217 zero for both groups at all time points.
218 Post-intervention, Papalazarou et al (26) reported a significant increase in PA (p=0.001) and a
219 reduction in SB measured via time spent watching (hours/day) (p=0.039), compared to the control
220 group. The remaining seven studies reported that there were no significant differences between the
221 intervention and control group following the intervention on either PA or SB.
222

None of the authors commented on fidelity of delivery i.e. whether the intervention was delivered as planned; although one did report that instructors undertook training prior to delivering the intervention, which included peer review and feedback (32).

Attendance, engagement and retention varied across the studies, as did the level of detail provided by authors. Baillot et al (30) delivered their intervention pre-surgery reporting a mean duration of 32.6 weeks, with variation between participants due to anticipated surgical dates. Median participant attendance was 70 (45-90%) of the total sessions. Of an initial 30 participants (15 in each group), 25 completed the study with 14 and 12 in the intervention and control group respectively.

Bond et al (37) randomised 80 participants, with 42 and 38 in the intervention and control group respectively. Thirty-three out of 40 (83%) allocated to the intervention completed all six sessions. Of the 80 who were randomised, 36 went on to have surgery (n=22 in intervention, n=14 in control), with final follow up data available for 31.

Carnero et al (31) randomised 66 patients to the intervention group, six of whom did not complete the intervention; five reported time constraints with the sixth lost to follow up. Of the 60 participants in this group, 14 were excluded from analysis due to insufficient PA data.

Coleman et al (33), randomised 51 participants to the control or intervention. In the first six months, intervention participants attended 56% of all classes offered (average of one class per week) and reported exercising 3.1 (± 1.7) days per week outside of this. Engagement was limited for some, who were unable to undertake the intervention as planned. Ten (40%) were limited by a pre-existing condition (not detailed) and of the remaining participants, 15 (44%) developed a condition, which limited their participation. During the 'maintenance phase' in the following six months, attendance reduced to 32% of classes/week and participants reduced their exercise outside of the classes to 2.9 (±1.8) days a week. In this later period, contact with the counsellor increased from 69% in the first six months to 93%. Post-intervention measures were completed by 23 and 21 participants from the control and intervention group respectively with final follow up data for 23 and 20 participants

249 respectively.

250 Hanvold et al (28) randomised 165 participants; 85 to the intervention and 80 to the control group.

251 Average intervention session attendance varied from 35-84%, (8 ± 4 sessions from a possible 16 over

252 2-years). Follow up measures were available for 77 and 65 participants in the intervention and

253 control groups respectively.

254 Herring et al (27) randomised 24 participants equally. Over the 12-week intervention period, mean

255 attendance was 34.2 sessions out 36 (95%). Final follow up data was available for 21 participants

256 (n=11 and n=10 in intervention and control respectively).

257 Jassil et al (23) recruited a single cohort of 10 patients; eight completed the intervention over an

258 eight-week period, median attendance was six out of eight sessions (75%).

259 Jiménez-Loaisa et al 2020 (32) randomised forty participants equally, and reported an average

260 intervention attendance rate of 80% (range 68-89%). Follow up data was available for 17 and 15

261 participants in the intervention and control groups respectively.

262 Sellberg et al (24) provided a comprehensive breakdown for participant attendance. One hundred

263 and fifty-six out of 259 were randomised to the intervention group; n=33 attended zero sessions,

264 n=13 attended one, n=13 attended two, n=31 attended 3 and n=30 attended four. One hundred and

265 twenty intervention participants, and 83 out of 103 from the control group completed the study

266 follow up.

267 Shah et al (34) recruited 33 participants, with 21 randomised to the intervention and 12 to the

268 control group. Four withdrew from the control group after baseline measures, three because they

269 wanted to be in the other group, and one due to time constraints. From the 21 participants in the

270 intervention group, five withdrew with four providing follow up data.

271 Stolberg et al (25) randomised 60 participants resulting in 32 in the intervention and 28 in the control

272 group. In the 26-week intervention period, 19 out of 32 participants (59.4%) attended ≥50% of

273 planned exercise sessions (considered to be compliant). Data for 27 and 25 participants in the

intervention and control group respectively was available for analysis at 12 months, reducing to 22 and 20 for intervention and control group respectively at 24-month measures.

Papalazarou et al (26) reported 100% attendance at each of the sessions, which was delivered when participants attended for their usual care and was attributed to the intervention being intense and delivered on a 1:1 basis (correspondence with author).

ROB was assessed using the Cochrane ROB2 tool (22) (see table 5), because there are no other suitable tools for behavioural interventions evaluated in randomised studies. All studies were judged to have 'some concerns'. The reasons for this included the absence of a published protocol ahead of the study, lack of masking of participants and the use of self-reported tools to measure PA or SB.

Reference	Domain 1: ROB from randomisation process	Domain 2: ROB due to deviations from intended intervention	Domain 3: ROB due to missing outcome data	Domain 4: ROB in measurement of the outcome	Domain 5: ROB in selection of the reported result	Overall ROB judgement according to guidance
Baillot et al 2018 (30)	Low	Low	Low	High	Some concerns	High
Bond et al 2017 (29)	Low	Some concerns	Low	Low	Some concerns	Some concerns
Carnero et al 2017 (31)	Low	Some concerns	Low	Low	Low	Some concerns
Coleman et al 2017 (33)	Low	High	Some concerns	Low/ High *	Some concerns	High
Hanvold et al 2019 (28)	Low	Some concerns	Low	High	Some concerns	High
Herring et al 2017 (27)	Low	Some concerns	Low	Low / High*	Some concerns	Some/ high*
Jassil et al 2015* (23)	N/A	Some concerns	Low	High	Some concerns	High
Jimenez-Loaisa et al 2020 (32)	Low	Some concerns	Low	Low	Some concerns	Some concerns
Papalazarou et al 2010 (26)	Low	Low	Low	High	Some concerns	High
Stolberg et al 2018 (25)	Low	Some concerns	Low	Low/ High*	Some concerns	Some/ high*
Shah et al 2011 (34)	Low	Some concerns	Low	Low/ High	Some concerns	Some/high*
Sellberg et al 2019 (24)	Low	Some concerns	Low	Low	Some concerns	Some concerns

284 *Table 5 ROB for each of the studies. * refers to judgement for objective and self-report measures respectively.*

Discussion

This review identified twelve studies and found mixed evidence about intervention effects on increasing PA and/ or reducing SB following bariatric surgery. Detail regarding intervention and control conditions in particular varied, and was often lacking in regards to chosen BCTs and the rationale for their use. This is a significant limitation; by definition BCTs were expected in all studies included in this review as they are the 'active ingredients' (21) in behaviour change interventions, and all the studies included in this review sought to change at least one of the two target behaviours. The lack of detail regarding control conditions made it difficult to extract BCTs and as a result limited our ability to draw comparisons between conditions. Five out of the twelve studies reported evidence for a positive effect, but this needs to be interpreted with caution as studies were not statistically powered to detect changes in PA or SB after bariatric surgery. It is this specific time period that is of interest in this review in line with a research recommendation by NICE, which seeks to identify if post-operative intervention programmes improve outcomes including weight and weight loss maintenance following surgery (5). Only one study found a significant reduction in SB, measured as time watching television (26).

Data was extracted for both the intervention and control groups, although they were not always fully described, which necessitated contact with the study authors. Use of the TIDier checklist would have been helpful and should be considered by researchers, as it would more confidently enable researchers and clinicians to appraise the evidence, decide upon its relevance, and replicate effective interventions (38).

Components of the interventions varied; some involved repeated supervised exercise sessions over a prolonged period, whilst others were counselling based. Regardless, all of the interventions directed participants to increase their PA outside of the sessions, thereby requiring participants to change their behaviour.

Authors stated that they used 'behavioural modification techniques' (26), 'the most enduring strategies for behaviour change' (33) and employed 'self-regulatory behaviour change techniques' (23), but the target behaviour to which these strategies or techniques related to was not always clear. BCTs associated with initiation of PA were present in four of the five interventions that showed positive effect: demonstration of the behaviour (23, 27, 29), behavioural practice/rehearsal (23, 27) and graded tasks (23, 27, 29, 34). BCTs associated with maintenance of PA (39), were present in five of the interventions with significant positive effects: action planning (BCT 1.4) (23, 29, 34), how to perform the behaviour (BCT 4.1) (23, 27, 29, 34) prompts and cues (BCT 7.1) (29), behavioural practice and rehearsal (BCT 8.1) (23, 27, 34), graded tasks (BCT 8.7) (23, 27, 29, 34) and self-reward (BCT 10.9) (26). Thus, this review provides preliminary support the use of these BCTs from primary research in this patient group.

Of the seven studies that measured SB (24-28, 32, 33) only one found a reduction following the intervention (26). However, as BCTs could not be coded for this target behaviour, this review is unable to add to the evidence base for interventions to reduce SB after bariatric surgery. Drawing from the wider literature, meta-analytical evidence suggests that promising BCTs may include: self-monitoring (40), social comparison, problem solving, demonstration of the behaviour, goal setting (behaviour), behaviour substitution, and habit reversal (41).

Future research that seeks to change PA or SB should ensure that the rational for and descriptions of BCTs are clear. The latter could be achieved by using the BCTT[v1](21). Researchers should also state whether the intervention aims to support initiation or maintenance of PA or SB as there is evidence that effective BCTs may differ (39)

Both objective and self-reported tools were used to measure PA and SB. In eight of the 12 studies questionnaires were used. Compared with objective measuring tools, questionnaires are cheap, more easily available, reliable, but their validity has been questioned as they are susceptible to bias (20). Where self-reported and objectively measured PA has been compared, validity has been described as

336 'moderate at best' (42, 43) and is supported by a study in this review (27); there was a significant
337 difference between the groups according to accelerometer data but not the IPAQ-SF. It is important
338 to note that self-reported outcomes allow only a proxy measure of time spent being physically active,
339 whereas objective tools quantify PA (44), but this must be balanced against available clinical
340 resources.
341
342 We found that interventions that required the greatest time commitments in terms of participant
343 attendance and contact hours showed lower session attendance (30) and engagement (33).
344 Conversely interventions with positive effect were either relatively short in duration six (29), eight
345 (23) or 12 weeks (27, 34) or combined with participants' usual care appointments (26) over a longer
346 period of time. Sellberg et al (24) reflected on participant attendance and suggested that time
347 commitments required for the intervention (4 sessions of 1.5 hours duration) might not be suited to
348 this patient group and alternative delivery methods should be considered. Time was cited by other
349 authors as a factor in participant withdrawal (31, 34) as was the unacceptability of randomisation to
350 control conditions (27, 34) and these issues should be considered in future research. It might be
351 more appropriate to randomise sites rather than individuals to reduce the risk of participant
352 withdrawal for this reason. Participant burden must be reduced as much as possible with alternative
353 modes of delivery considered. For example, publicly available online platforms e.g. Skype or Zoom
354 could be used. Although these are non-traditional methods of delivering interventions, their use has
355 increased during the Covid-19 pandemic as they ensure 'social distance', and it would also help to
356 protect this patient group who are at greater risk of serious disease from Covid-19 (45). Both of these
357 issues are illustrated by primary qualitive research with participants from cardiac rehabilitation, which
358 found that reasons for participants' disengagement can be due to their perception of the programme
359 and intervention characteristics, including their [in]convenience (46).
360

A limitation of the studies in this review are that none reported on fidelity - the extent to which interventions were delivered as intended. As a result, it can be challenging to confidently attribute positive effect or lack of thereof to the intervention as this could be due to [sub-optimal] delivery rather than the intervention itself (47-49). Strategies to promote treatment fidelity such as assessment of adherence to intervention protocols in behavioural interventions and assessment of fidelity mean that validity and reliability could be more confidently assured (50). This is particularly important in interventions where there is potential for variation, for example in multi-centre studies where there are different facilitators delivering the intervention. Future complex intervention studies which seek to change behaviour should include fidely assessments to assess if the intervention has been delivered as planned and if participants have the necessary skills to be able to implement the intervention even if it is delivered faithfully (50, 51).

Although every study was deemed to have at least some concerns for bias, this does need to be seen in the context of interventions where either it is not possible to mask participants to their allocation, or because the participants themselves are the assessor of the outcome due to the use of self-reported outcome measures (52). The ROB judgements in this review are consistent with those in other behaviour change studies, and a reflection of the tool used which is more suited to bio-medical trials, where variables can be controlled to provide internal validity to infer causality and are not necessarily reflective of real-life situations (52, 53). The lack of a valid and reliable risk of bias tool for behaviour change interventions evaluated in randomised studies meant that the team chose the Cochrane Risk of Bias ROB2 tool (22). Although this tool is not ideally suited to behaviour change research, it was able to highlight that future studies could reduce their risk of bias by using objective rather than self-reported measures which would help to strengthen evidence of efficacy and effectiveness.

Strengths and limitations

A strength of this review is that the methods were robust; authors were contacted as required to obtain missing or additional information and two members of the research team executed each stage; screening, data extraction and ROB assessment. Rather than focusing solely on the efficacy of the interventions on PA and SB, this review also considered how healthcare professionals might facilitate changes in the two target behaviours using BCTs. This is particularly valuable to clinicians whose role, either as specialists or as part of a wider public health strategy is to support patients to increase PA and/or reduce SB.

A limitation is that grey literature was not searched and articles that were not published in English were excluded. Meta-analysis could not be conducted due to the heterogeneity of the outcomes and their measurements used in this review.

Conclusion and implications of key findings

In conclusion, this review identified evidence from five interventions that were able to provoke increases in PA but only one demonstrated a reduction in SB. Importantly none of these studies were powered with PA or SB as the primary outcome measure, measured post-surgery. It is this specific time-period, which is the focus of the review as there is evidence that changes in the two target behaviours of PA and SB after surgery might have a positive impact on patients' post-surgical and longer-term outcomes.

Details regarding intervention and control conditions in particular varied and the choice of and rationale for BCTs was not always clear. This is an important finding from the review; there is robust evidence for the physiological effects of increasing PA and reducing SB, which clinicians can use as evidence to support the aim of their treatment plans, but a lack of evidence for how to facilitate changes in these two target behaviours using BCTs. Any study that seeks to change a target behaviour should be explicit with regards to the rationale, chosen BCTs and whether the aim is to initiate or maintain behaviour change. Therefore, there is a need for high-quality studies evaluating theory and

412 evidence-based interventions to promote PA and reduce SB, that clinicians can use to help patients to
413 change these target behaviours and optimise their post-surgical outcomes.
414
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