

Do factors related to participation in physical activity change following restrictive bariatric surgery? A qualitative study

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Conflict of Interest: The authors declare no conflict of interest.

Funding: Juliana Zabatiero was supported by a Curtin Strategic International Research Scholarship (CSIRS). Daniel F. Gucciardi is supported by a Curtin Research Fellowship.

Abstract

Aims: To explore participants' ability to participate in physical activity (PA), and barriers and facilitators to PA, at 12 months following restrictive bariatric surgery, and how these differed from participants' pre-surgery perceptions. Motivators for PA post-surgery were also explored.

Methods: Qualitative one-on-one in-depth interviews were conducted pre- and 12 months post-surgery. Data were analysed using inductive thematic analysis.

Results: Fourteen adults (12 females), with a mean (range) age of 41.4 years (25.0 to 56.0), body mass index (BMI) of 31.7 kg/m² (22.3 to 48.2), and excess weight loss of 66% (2 to 127) completed both interviews. Lack of participation in PA during the first 3-6 months post-surgery was a common theme. Although participants reported increased ability to participate in PA, attributing this to a reduction in obesity-related physical barriers to PA, many participants reported that some pre-surgery obesity-related barriers to PA remained at 12 months post-surgery. For most participants, pre-surgery non-obesity related barriers to PA also remained at 12 months post-surgery. Facilitators to PA were consistent pre- and post-surgery. Weight loss and improvement in physical appearance were the most common motivators for PA post-surgery.

Conclusions: At 12 months following surgery, many participants reported residual obesity and non-obesity related barriers to PA. These barriers may explain the small, if any, pre- to post-surgery change in PA levels reported by earlier research. Facilitators to PA did not change and post-surgery motivators for PA were mostly esteem-related. These data are relevant to shape interventions aimed at optimising PA in this population.

Keywords: barriers, facilitators, motivators, physical activity, bariatric surgery, qualitative

Introduction

Bariatric surgery has been used increasingly to manage obesity worldwide[1]. This is because, when compared to non-surgical treatment, bariatric surgery results in greater and sustained weight loss and reduction of obesity-related comorbid conditions[2]. However, despite successful weight-related outcomes following surgery, data are less convincing for the effect of bariatric surgery on health-related behaviors, such as physical activity (PA) levels.

The health benefits of participating in PA, particularly of moderate-to-vigorous intensity, are well established[3]. Earlier research suggests that increased participation in PA following bariatric surgery is associated with greater weight loss[4-6], favorable changes in body composition[7], greater reduction in cardiometabolic risk factors[8] and better quality of life[4]. Nevertheless, recent activity monitor data suggest that bariatric surgery candidates participate in little PA pre-surgery and that only modest or no change in PA levels is observed post-surgery[9-12]. Of note, around two thirds of people between 1 and 3 years post-surgery do not meet the minimum recommended levels of PA linked to health benefits and chronic disease prevention, and also participate in less PA than the general population[9, 10]. Studies which have sought to promote participation in PA among people undergoing bariatric surgery are scarce, and those that have, used generic approaches and indicate that they are often ineffective. For example, Coleman et al.[13] recently performed a randomised controlled trial of people within 6 to 24 months following surgery and found that, when compared to a usual care control group, those randomly allocated to a 6-month supervised exercise intervention presented no significant change in time spent in moderate to vigorous PA. Nevertheless, there is increasing evidence on the relevance and effectiveness of tailored interventions targeting specific factors relevant to an individual's participation in PA, rather than using generic approaches to promote PA[13-16]. For this reason, a better understanding of factors such as perceived ability to participate in PA, barriers and facilitators to, and motivators of PA among bariatric surgery candidates, and how they change post-surgery, is needed to inform behavioral interventions. Interventions that target such factors with techniques specifically focused at changing them are likely to be more effective than those who use generic approaches[17]. This study aimed to explore

participants' perceived ability to participate in PA, as well as barriers and facilitators to PA, at 12 months following restrictive bariatric surgery, and how these differed from participants' pre-surgery perceptions. Perceived motivators of PA post-surgery were also explored.

Methods

Participants

Obese adults scheduled to undergo laparoscopic restrictive bariatric surgery were recruited from a private bariatric surgery clinic in Perth, Western Australia. Inclusion criteria were: age between 18 and 70 years, and body mass index (BMI) > 30 kg/m². Exclusion criteria were: pregnancy or planning pregnancy within 12 months, presence of a permanent health condition (e.g. neurological, or orthopedic disease) that could compromise daily PA, and cognitive or language barriers which could interfere with interview participation. The study was approved by the Human Research Ethics Committee of [institution name removed for blind review] and written informed consent was obtained from all participants.

Data collection and analysis

Pre-surgery and 12 months post-surgery, semi-structured, one-on-one interviews were conducted by the lead author face-to-face or via telephone, according to participants' preference. The pre-surgery exploration of beliefs about PA and perceived barriers and facilitators to PA in a sample of 19 participants has been published elsewhere[18]. The post-surgery interviews took place between February and August of 2014 in 14 of 19 participants who participated in the pre-surgery interviews and were available at 12 months post-surgery.

The post-surgery interview was informed by the pre-surgery interviews' findings, and was comprised of open-ended questions exploring potential changes in participation in PA, ability to participate in PA, and barriers and facilitators to PA, when compared to participants' pre-surgery perceptions. Consistent with the pre-surgery interview, perceived barriers to PA were defined as factors that participants believed prevented or made it difficult to engage in PA. Similarly, perceived facilitators

to PA were defined as factors that participants believed to help or make it easier to engage in PA. Given lack of motivation was a frequently reported pre-surgery barrier to PA, at the post-surgery interview, participants were asked to report on perceived motivators of PA, defined as factors that participants perceived to make them want to engage in PA. All interviews were audio-recorded and transcribed verbatim.

The interview transcripts were entered into NVivo10 (QSR International Pty Ltd, version 10, 2012) to facilitate data organization, coding, and management. Data collection and analyses were performed concurrently to monitor the emergence of new themes. Inductive thematic analysis was used to identify codes and themes that reflected participants' perceptions and experiences[19]. To enhance trustworthiness of the analysis, individual data and interpretations were independently reviewed by a second investigator experienced with thematic analysis.

Results

Five participants were lost to follow-up, four due to non-response to repeated contact attempts and one did not undergo surgery. Themes identified in the pre-surgery interviews of these five participants did not differ from those who were interviewed post-surgery. The characteristics of participants who completed both pre- and post-surgery interviews are presented in Table 1.

At the post-surgery interview, participants mean (range) weight was 90.3 kg (60.0 to 152.0), and BMI was 31.7 kg/m² (22.3 to 48.2). The average (range) weight loss was 24% (1 to 40) of pre-surgery weight or 66% (2 to 127) of their excess weight. Participants were interviewed, on average, within 12.7 months (standard deviation [SD], 1.1) post-surgery. Interviews lasted for an average of 32.2 minutes (SD, 11.2). Five (36%) interviews were conducted face-to-face and nine (64%) were conducted via telephone.

Participants' perceptions and experiences of factors related to PA were captured within six broad categories. The emergent themes from the six categories explored are depicted in Figure 1, and further description of themes and supporting quotes are presented in Tables 2, 3 and 4.

Changes in reported participation in physical activity

Reports of participation in PA over the 12 months post-surgery varied and encompassed descriptions of increased, no change or decreased PA. Regardless of whether any changes in participation in PA were reported, most participants described not engaging in PA during the first 3 to 6 months post-surgery (Table 2).

Changes in perceived ability to participate in physical activity

When compared to their pre-surgery perceptions, participants reported an increase in their ability to participate in PA, mostly described as a result of the reduction in obesity-related physical barriers to PA (Table 2).

Changes in perceived barriers to physical activity

At 12 months post-surgery, most participants reported reductions in obesity-related barriers to PA, such as bodily pain and self-presentational concerns (Table 3).

Residual perceived barriers to physical activity

Despite reports of reductions in obesity-related physical barriers to PA, several participants reported that some of the obesity-related barriers to PA reported in the pre-surgery interview remained at 12 months post-surgery. In addition, for some participants there was a shift in focus regarding self-presentational concerns, from excess weight to excess skin. For most participants, many of the non-obesity related barriers to PA identified in the pre-surgery interview were still present at 12 months post-surgery (Table 3).

Residual perceived facilitators to physical activity

Facilitators to PA were the same in both pre- and post-surgery interviews (Table 4).

Perceived motivators of physical activity

Motivators of PA, over the 12 months post-surgery, were mostly related to body weight and appearance (Table 4).

Discussion

This study is the first to provide an in-depth exploration of people's perceived ability to participate in PA, barriers and facilitators to, as well as motivators of PA 12 months post-surgery, including consideration of how these factors changed from pre-surgery. Most participants reported not engaging in PA during the first 3 to 6 months post-surgery. Participants often explained they did not find the need or will to participate in PA during this period as substantial weight loss was achieved, which is consistent with previous research identifying the first months post-surgery as a period of recovery from the surgical procedure and adaptation to drastic changes in eating habits and body weight[20, 21]. Following the first 3 to 6 months post-surgery, reported participation in PA was variable, with some participants reporting an increase and many reporting no change or even decreased participation in PA. Participants who reported an increase in participation in PA indicated that it was primarily related to daily life PA, rather than planned and structured PA (i.e. exercise). One explanation for this finding is that participants reported feeling more able to engage in everyday tasks that had previously been difficult (e.g. walk to the shops or play with their children). Similarly, in an earlier qualitative exploration, women reported being more active over the first year following gastric bypass due to increased daily life PA, but with no increased participation in planned and structured PA[21]. As most participants also reported not engaging in planned and structured PA pre-surgery, this study reveals that surgery did not change the way in which people participate in PA (i.e. daily life PA versus exercise).

Participants reported a greater ease to engage in PA following surgery. Similarly, findings from previous cross-sectional qualitative studies have indicated that 6 to 12 months post-surgery, people believe that they are more able to engage in PA, largely as a result of a reduction in physical barriers to PA[20, 21]. Self-efficacy, defined as the belief that one has the ability to successfully engage in a

specific behavior, has been recognized as a main determinant of change in PA[22, 23]. According to Bandura's self-efficacy theory, different factors may influence people's self-efficacy to engage in PA, including their interpretation of physical and emotional reactions when engaging in PA (e.g. anxiety due to increased heart rate when engaging in PA), personal mastery of PA tasks (e.g. accomplishments related to PA), verbal persuasion (e.g. encouragement and/or feedback delivered by important others), and modelling experiences (e.g. observing someone similar to oneself succeeding in PA-related tasks)[24]. At 12 months post-surgery, data collected during the interviews revealed that participants reported positive physical and emotional reactions to PA as a result of a greater ease to engage in PA, as well as the experience of mastering activities they previously believed they were not able to perform, which likely enhanced their self-efficacy to engage in PA. Interventions aimed at promoting PA following bariatric surgery could build on these reported positive changes in order to further improve people's self-efficacy. For instance, clinicians could provide meaningful positive feedback related to competence or mastery of PA to help people understand their own abilities and skills. Given most participants reported increased ability to engage in PA, strategies aimed at promoting further improvements in people's self-efficacy to engage in PA might have a positive influence on their motivation to participate in PA.

The current findings indicate that although participants reported reductions in obesity-related barriers to PA, when compared to their pre-surgery perception, many reported that some of these barriers were still present post-surgery. These findings are consistent with previous research on PA-related experiences after bariatric surgery[20, 25, 26]. A survey of people who underwent bariatric surgery showed that bodily pain and chronic obesity-related comorbid conditions were frequently reported as post-surgery physical barriers to PA[26]. Our data highlight it is not only actual pain that acts as a barrier to PA, fear of pain and/or injury might also act as a barrier to PA for those people who experience chronic obesity-related comorbid conditions or who are still overweight post-surgery. In a study that investigated changes in self-reported PA and exercise cognitions following restrictive bariatric surgery, fear of injury was also found to be a barrier to PA at one year, and a predictor of reduced participation in PA at two years post-surgery[25]. It would seem important for clinicians to

routinely provide information regarding the expected pre- to post-surgery changes (or lack thereof) in barriers to PA. Also, patients could benefit from a multidisciplinary approach that provides strategies to minimize the residual barriers to PA post-surgery. For instance, those who perceive chronic pain and/or fear of pain as barriers to PA would benefit from optimal pain management and development of coping strategies to deal with PA-related pain and/or fear of pain.

Regarding self-presentational concerns, excess skin resulting from substantial weight loss was described as a new barrier to PA. Similarly, a cross-sectional qualitative study exploring people's experiences around 28 months following gastric bypass, found that excess skin was commonly reported as an undesired weight loss consequence, with some participants reporting being more self-conscious about the excess skin than they had been about being obese[27]. Physical activity behavior change interventions which applied barrier identification and problem solving, when compared to those who did not, have been shown to be more effective among people who are obese[23].

Professional advice on strategies to prevent or minimize new barriers to PA that appear post-surgery, such as skin rashes or infections related to excess skin could also be beneficial.

The present findings also highlighted that several non-obesity related barriers to PA identified pre-surgery, including lack of motivation, lack of time, and social support issues remained at 12 months post-surgery. Findings from the pre-surgery exploration of participants' barriers to PA showed that participants experienced feelings of helplessness and hopelessness towards weight loss and maintenance[18]. As a result of unsuccessful attempts at weight loss using diet and increased PA, post-surgery, participants still appeared to believe that their participation in PA was permanently outside of their control. Although participants believed that regular participation in PA results in health benefits, their previous experiences of participation in PA were primarily concerned with weight loss. Given participants generally experienced post-surgery weight loss without increasing their participation in PA, they perceived PA to be unnecessary. A lack of intentionality (i.e. people may have no reasons or rationale to engage in PA) and devaluation of the activity (i.e. people may not value PA outcomes enough to engage in regular PA), as well as a lack of willingness to invest the necessary effort to overcome the residual barriers to PA (e.g. learn and apply time management

strategies to overcome lack of time as a barrier to PA) seem to contribute to the lack of motivation to engage in PA reported post-surgery. These factors are consistent with the concept of amotivation (i.e. lack of intention to act) and are associated with avoidance and desistance of participation in PA[28-30].

Lack of time has also been frequently reported as a barrier to PA in previous studies involving bariatric surgery candidates and people who are obese [26, 31]. Participants' reports of being too busy with family and work commitments to engage in PA suggested they did not believe PA to be important enough to be a priority. Most people have multiple concomitant goals in everyday life that may conflict when they compete for the same resources[32]. Goal commitment (i.e. determination to reach a goal) is usually based on the belief that a goal is both desirable, which is determined by the expected value or attractiveness of the activity, and feasible, which is determined by one's belief they can achieve the expected outcome by their own effort[33]. Participants appeared to experience conflicting goals regarding participation in PA and other activities, which was likely influenced by the devaluation of PA, resulting in lack of prioritization of PA. Similarly, the results of a cross-sectional survey highlighted that lack of motivation was a commonly reported post-surgery barrier to exercise, and was related to difficulties with regular participation in PA and making PA a priority[26]. Planning has been reported as a useful strategy to manage goal conflict and improve maintenance of PA[34]. Interventions that aim to optimize action planning (i.e. planning when, where, and how goals will be pursued) and coping planning (i.e. anticipating obstacles and devising coping strategies) may be beneficial to optimise PA in this population[32].

The present findings indicate social support issues, such as lack of family support, were still reported as barriers to PA at 12 months post-surgery, when compared to pre-surgery perceptions. Issues such as lack of support with family responsibilities and lack of company to engage in PA, have been previously reported as post-surgery barriers to PA[20, 26]. Social support issues are also likely to influence people's belief regarding the feasibility of regular participation in PA, and therefore negatively influence their commitment to participate in PA. A qualitative study found that the need of support from family, friends and health professionals to be physically active was a salient theme 12

months following gastric bypass[20]. Although previous investigations were cross-sectional in nature, converging evidence from different studies suggests that the substantial weight loss achieved following bariatric surgery does not remove all barriers to PA, particularly those non-obesity related.

This study is the first to explore facilitators to PA following restrictive bariatric surgery and how they differed from participants' pre-surgery perceptions. Weight loss was reported as the most important and only obesity-related facilitator to PA at the post-surgery interview, which was consistent with pre-surgery perceptions. Weight appears to be related to both barriers and facilitators to PA, as participants believed weight loss was a facilitator to PA and excess weight was no longer a barrier to PA following surgery. Pre-surgery non-obesity related facilitators were confirmed post-surgery, including social factors and better time management. A systematic review and meta-analysis found that time management and social support/social change were the most effective behavior change techniques in changing self-efficacy to engage in PA, and that social support was also effective in changing PA behavior of people who are obese[23]. Since social support and better time management were reported as facilitators to PA both pre- and post-surgery, it is reasonable to expect that strategies aimed at enhancing these factors would facilitate participation in PA.

This study is also the first to explore factors perceived as motivators of PA over the first 12 months following restrictive bariatric surgery. Different types of motivations emerged from participants' reports, which can be understood within the context of self-determination theory[28]. Most participants, regardless of their participation in PA, reported that additional weight loss or weight maintenance, as well as improvement in physical appearance were the main motivators of PA at 12 months post-surgery. Specifically, participants explained that additional weight loss or weight maintenance acted as motivators of PA around 6 months post-surgery, when their weight loss slowed down or plateaued, and the presence of excess skin started to be a concern. These motivators appear to be based on esteem-related factors, which are considered an extrinsic type of motivation (i.e. dependent on external reward, avoiding a punishment, or attaining approval), and tend not to be related to PA maintenance[28, 29].

Few participants reported that enjoyment of activity was a motivator of PA, which is considered an intrinsic type of motivation (i.e. dependent on the inherent pleasures and satisfactions), and positively associated with PA maintenance[28, 29]. Further, participants' reports suggest they were more receptive and motivated to change their PA around 6 months post-surgery, once the post-surgery adaptation period was over and they felt more able or confident to engage in PA. Increasing motivation to engage in PA among people who undergo bariatric surgery is needed, given that lack of motivation has been frequently reported as a barrier to PA, both pre- and post-surgery. Specifically, interventions aimed at optimising PA in this population could benefit from focusing on reducing amotivation and promoting more intrinsic rather than extrinsic types of motivation[28, 30].

Amotivation is a common symptom of depressive disorder[35] and people who are obese have been shown to be more likely to present with depressive disorder and depressive symptoms[36]. People who present with these symptoms would benefit from cognitive behaviour therapy to reduce depressive symptoms and amotivation following bariatric surgery[37]. After bariatric surgery, people are likely to encounter stress, which can cause hormonal changes and subsequent increase in the risk of binge eating of high-fat diet[38]. Cognitive behavioural therapy can target binge eating and replace maladaptive eating behaviour by engagement in PA. For those people that report lack of time and social support as barrier to PA, the use of smartphone applications in bariatric after-care can be beneficial. Previous research that investigated the use of a smartphone application found that people who received bariatric surgery reported it to be useful for self-management of health conditions post-surgery, which can be related to its ability to save time and overcome social isolation[39].

Strengths, Limitations, and Suggestions for Future Research

The main strength of this study is the longitudinal in-depth exploration that provided insight into temporal characteristics of important factors related to participation in PA. A limitation of this study is that the participants attended a private bariatric clinic, which may limit the transferability of the results to people in the public health system or of lower socio-economic status. A second limitation is the lack of objective PA assessment, as previous studies have shown that people who are obese,

including those who underwent bariatric surgery, often overestimate participation in PA when assessed by self-report. Therefore, it is not clear if the increased participation in PA reported by some participants was real or if the increase in participants' perceived ability to participate in PA was mistakenly understood as an increase in actual participation in PA[40]. Future studies should consider the combination of objective methods to investigate changes in PA with qualitative exploration of factors related to PA post-surgery.

The lack of significant changes in PA commonly reported in previous research might be partially explained by the residual barriers to PA reported in the post-surgery interview, new post-surgery barriers to PA replacing pre-surgery ones (e.g. excess skin), as well as by devaluation of PA and low motivation to participate in PA. The present study highlighted the complexity of barriers and facilitators to, as well as motivators of PA among people who underwent bariatric surgery, which included physical and psychosocial factors that were both specific to this population and common to the general population. These data are relevant to inform the development of tailored successful interventions aimed at optimizing participation in PA in this population.

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Table 1. Characteristics of participants

Code	Sex	Age	Type of surgery	Pre-surgery Weight (kg)	Pre-surgery BMI (kg/m²)	Post-surgery Weight (kg)	Post-surgery BMI (kg/m²)	Weight loss (% of pre-surgery weight)	Weight loss (% of excess weight loss)
P2	Male	38	LSG	130.0	39.2	85.0	25.7	35	95
P3	Female	47	LAGB	114.0	36.8	94.0	30.3	18	55
P5	Female	39	LAGB	92.8	30.3	82.0	26.8	12	67
P6	Female	37	LSG	100.8	38.4	68.5	26.1	32	92
P7	Female	43	LSG	93.7	34.8	60.0	22.3	36	127
P9	Female	41	LSG	144.0	54.2	108.0	40.6	25	46
P11	Female	32	LAGB	116.6	42.3	96.0	34.8	18	43
P13	Female	24	LSG	124.4	44.6	74.5	26.7	40	91
P14	Female	39	LSG	106.3	40.5	69.0	26.3	35	92
P15	Female	50	LSG	102.9	37.8	70.5	25.9	31	93
P16	Female	35	LAGB	104.4	37.0	100.0	35.4	4	13
P17	Female	29	LSG	127.6	46.9	80.0	29.4	37	80
P18	Female	50	LAGB	125.9	48.6	125.0	48.2	1	1
P19	Male	55	LAGB	182.2	53.8	152.0	44.9	17	31

Abbreviations: BMI: body mass index; LAGB: laparoscopic adjustable gastric banding; LSG: laparoscopic sleeve gastrectomy.

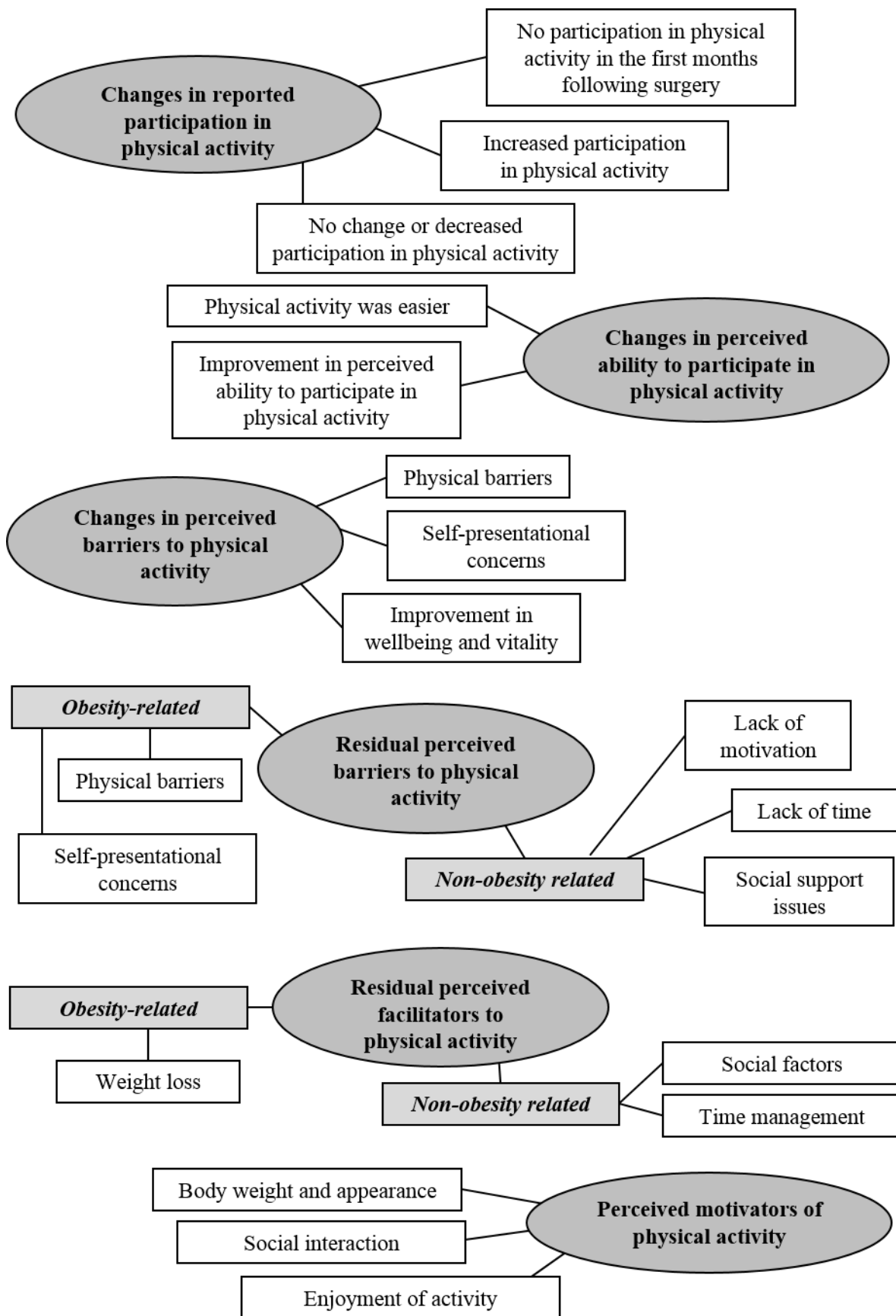


Figure 1. Categories and emergent themes from the 12 months post-surgery interview.

Table 2. Changes in reported participation and perceived ability to participate in physical activity

Changes in reported participation in physical activity	
Theme description	Representative quotes
<p><u>No participation in physical activity in the first months following surgery.</u> Most participants reported they did not need or want to participate in PA within the first 3 to 6 months following surgery (P2, P17), regardless of their pre-surgery participation in PA. Participants explained that as the weight loss was occurring rapidly even in the absence of PA, due to the drastic dietary changes, they believed PA was unnecessary.</p>	<p>‘So it's only really the last six months that I've made more efforts towards activities. The first six months really was pretty much just not doing much at all.’ (P2)</p> <p>‘I guess because some days, particularly early on when you're not in the habit of exercising, and you don't necessarily want to because the weight is coming off so easily, you don't really have to exercise. It sounds terrible. Because it always used to feel like a punishment and then all of a sudden you're losing the weight and you don't have to do the physical activity so you know, “Oh well, just you know, I'm doing fine without it.” You feel lazy thinking that way, but that's the way it is in the beginning.’ (P17)</p>
<p><u>Increased participation in physical activity.</u> Compared to their pre-surgery perceptions of participation in PA, many participants reported being more active post-surgery. The reported increase in PA was primarily related to daily life or leisure-time PA (P3, P7). When compared to their pre-surgery perceptions, some participants reported that the increase in participation in PA comprised an increase in both quantity and intensity of planned and structured PA (P6, P17).</p>	<p>‘I take the dog for a walk now. I make sure if I come home sometimes from work, and I've had a day where I've been in the office all day, sitting around all day at meetings, I'll come home and go for a walk around the block. Yeah, I just generally am more active.’ (P3)</p> <p>‘I think that I'm doing more housework. Yeah, doing more housework and not sitting on my ass because I was so heavy. Yeah, we just get out more. We do more, go to places. So I'm actually, in this last month or six weeks I've been like walking to the park instead of driving to the park, and walking to the park, walking back, taking my little son. You see, my number one son, we just used to sit around the house, the poor little bugger. And now it's just so different with this little fellow, with number two. We walk into town or we walk, we get on the bikes a bit more. We do a bit more family stuff. You know what I mean?’ (P7)</p>

‘I’m still doing my personal training twice a week with the group training. I also jog now. So I jog or walk probably three or four times a week. It just depends how busy I am with work. Between 30 minutes and one hour.’ (P6)

‘I go to yoga regularly now to help with my muscle flexibility and strength. I really enjoy that and I find that it relaxes me as well. It was quite amazing for me doing some of the poses I knew that I would have never been able to achieve in a million years that I can do now because my body has changed, so that’s good. Yeah, and I go walking and that, but in the last month or so, I’ve tried to introduce exercise that gets my heart rate up a bit more. So I’m doing a running training program where you do interval training. You walk for a few minutes, run for a few minutes and build up your fitness until you can just run.’ (P17)

No change or decreased participation in physical activity. Compared to their pre-surgery perceptions of participation in PA, several participants reported no change in their participation in PA (P5, P16), or a decrease in the amount of PA they engage with (P14). Some participants indicated that although the quantity of pre-surgery PA was maintained, they believed there was an improvement in the intensity of the PA performed post-surgery (P9, P18), such as engagement in more challenging exercises and an increase in the intensity of walking.

‘Yeah, I’ve been going walking three times a week. I still just do my walking with friends, and then if they can’t come I’ll just go on the treadmill. But I haven’t joined the gym or anything like that. Yeah, I think it is exactly the same. Well, I haven’t pushed myself any further, do you know what I mean? I haven’t pushed myself to a higher level.’ (P5)

‘Nothing, really, to be honest. I am not more physically active now. I’ve played netball for six months (as before the surgery), and I love netball. I love team sports, and that’s what I did six months, and I love that. When netball tends to finish, I kind of just fall into a bit of a heap.’ (P16)

‘None. Not really. I’ve got less activity. I did more before. Carrying her (daughter). That's about it. None, none. No. I walk to the park, but it's like walking from here to the car park. It’s not getting my heart rate up, you know? Before, I’d be getting my heart rate up.’ (P14)

‘Because we’ve got a dog, I take her walking probably three times a week, twice a day, for about half an hour. It was a light walk. But now, it’s like a brisk walk now, when I walk.’ (P9)

‘Yeah, twice a week it's been (Pilates class, same as before surgery) but the type of exercises are more ... the harder exercises. I've just improved in that way.’ (P18)

Changes in perceived ability to participate in physical activity

Physical activity was easier. Several participants reported that engaging in PA was easier (P6, P15), and attributed this change to factors related to weight loss, such as reduction in obesity-related physical issues that acted as barriers to PA pre-surgery.

‘Well, I’ve always done personal training. So I still do that. But it’s a lot easier now, and yeah, I can do a lot more and can be pushed a lot further. Definitely it’s a lot easier. I look back and I think, “Gosh, I could only do that! Now I’m probably doubling or tripling what I used to do”. Like before I’d go, “Are you kidding me? I don’t want to do that kind of thing”, but now I just do whatever has to be done.’ (P6)

‘Physical activity is a lot easier than it was. I'm still not doing enough of it but it's a lot easier than it was.’ (P15)

Improvement in perceived ability to engage in physical activity. Participants perceived a greater ability or confidence to engage in PA (P13, P17), which was confirmed by experiences of performing activities they

‘I feel good. Because I’m able to do it as I wasn’t able to do it before. Now I can do it, yeah. Physically, I feel like I could do anything and get away with it. Before, I couldn’t.’ (P13).

did not believe were possible pre-surgery (P9, P14).

One participant indicated that the greater ease to engage in PA resulted in a renewed perception of what constitutes exercise (P3).

‘Yeah. Well, before, it was sort of the first thing that would pop into my head, was, “Oh no, I can’t do that.” Now I think, “Oh yeah, I think I could do that. I’d like to try and see. That’s something that is within my power to change now (PA levels), whereas before I didn’t feel like it was within reach.’ (P17)

‘We went up North, up Northwest. We walked, and walked, and walked. And I thought, “I couldn’t have done this before!” Then, a couple of months later, we went down South. We went whale-watching, and we did a five-kilometre walk. I thought, “I couldn’t have done that before, because I wouldn’t have had the energy.” I would have to my husband, “Nah, I can’t, turn around. Let’s stop and go back.” But I continued. I just walked, and walked, and walked.’ (P9)

‘We’ve got this big hill where I work. It’s massive. It’s on a really big gradient. And I used to get sore knees and be puffing when I used to get to the top of the hill to work. And probably embarrassing if anyone was behind me. Now, not even puffing at all. I could run down again, back up again. So that was nice.’ (P14)

‘Where I used to think I was exercising and it was a chore, now that’s just normal, active life. I think what I see as exercise now, I didn’t before. Before, I used to see everything as exercise - moving almost as exercise, if you know what I mean. The most basic thing was exercise. To me, exercise was hard work and it made you sweat and feel gross, and my face would go red. But now those things don’t make me feel like that, so I just do those things normally.’ (P3)

Table 3. Changes in perceived barriers and residual perceived barriers to physical activity

Changes in perceived barriers to physical activity	
Theme description	Representative quotes
<p><u>Physical barriers.</u> Most participants who identified bodily pain as a pre-surgery barrier to PA reported reductions in pain, particularly of the lower limb and back (P7, P15). All participants who experienced pain pre-surgery reported a reduction in pain, often attributed to the decreased load on the joints related to weight loss (P6, P13). When compared to their pre-surgery perceptions, participants also reported a significant reduction in the extra physical work they experienced when participating in PA, often referred to as ‘strain’, ‘stress’ or feeling unfit (P5, P11, P17). Some participants reported a change in the fear of the physical consequences of obesity they experienced pre-surgery (P3, P13)</p>	<p>‘Just being able to walk down the beach and in the sand dunes and be able to carry my boy. Far out, it was just ... yeah, I can't tell you how bloody unreal it was. My knees, my legs weren't sore, and I was back and forth.’ (P7)</p> <p>‘I think the main thing is the easing of the physical pain in the feet and knees particularly. I had to have orthotics. Yes, to go for a walk I would have to change into joggers with orthotics. Now, I can walk a couple of kilometres in just whatever shoes I happen to be wearing. When we went to Sydney I didn't have to wear special shoes. Actually, I really noticed it when we went to America, because we did a lot of walking. By the end of the day I'd have had foot pain and knee pain. And it was great. I loved that I could ... where you could just walk all day and I was fine.’ (P15)</p> <p>‘I have had nothing. It's just amazing that my feet ... I haven't had any injuries or anything. So now all good – I don't have any pain on the heel. Obviously the weight's come off and the feet don't take as much ... don't have to hold as much weight I suppose.’ (P6)</p> <p>‘I don't have pain. I don't suffer from my knee problem anymore, no back problems, as before that would stop me because of the excess weight, and now I just feel good.’ (P13)</p>

‘I huffed and puffed, because it was harder for me to get uphill because I was bringing more ... you’re obviously carrying more weight. Whereas now I sort of cruise up the hill, so I get up quite quickly. Yeah, I’ve got more energy, I’ve got more oomph to go.’ (P5)

‘Physically it doesn’t feel like there’s so much of a toll either on the legs. I mean, I don’t feel like I’m dragging myself around now, yeah.’ (P11)

‘Well, before I used to get short of breath really easily. I climbed to the top, and I actually got to the top before a few of my friends who I thought were slimmer and fitter than me. For me, it was a really special achievement, because I know that I would have never been able to do that, or I would have never even considered it because I would have gone, “No, I can’t do that. I’ll be in pain.” Or you know, “I’m not fit enough.”’ (P17)

‘I don’t feel like I’m going to have a heart attack, and I can get in and out of cars without straining.’ (P3)

‘I don’t think I’ve ever like done so much effort in 45 minutes (in a personal training session) to be honest. Like luckily, I’m a smaller person now because I don’t think my heart would have taken it if I was bigger. I would probably die of a heart attack if I was to do it.’ (P13)

Self-presentational concerns. Pre-surgery, participants reported feeling self-conscious and worried about people’s judgement when engaging in PA in public.

‘That’s very different (feeling self-conscious when engaging in PA). I don’t feel so out of it now. I feel more normal. And yeah, I do feel like, in my own mind feeling better. Even

Following surgery, most participants reported not being as concerned about people's thoughts, nor feeling 'judged' because of their size as they did pre-surgery (P3, P17, P19).

though nobody has actually changed towards me, it's the way I feel, it has made a difference in my perception of what people think of me.' (P3)

'Well, before when I went out walking or whatever, even though it wasn't necessarily a rational thought, I always felt like everyone was staring at me. Particularly if I was in a place like a gym, I felt like a fish out of water, because I was this morbidly obese person in the gym with people who looked fit and healthy and slim. Now, I don't feel like I stick out like a sore thumb. I can go out and do my running or I can go to yoga. I can go to those places though and just feel normal. I just feel like I blend in, which is great.' (P17)

'I don't walk into a room feeling that people are looking at me, thinking, "Oh, Jesus Christ, he's huge," and things like that. I'm a bit more comfortable with myself so I'm able to socialise more and be very comfortable, more active.' (P19)

Improvement in wellbeing and vitality. Compared to their pre-surgery perceptions, several participants reported improvements in their perceived wellbeing and vitality (P5, P9). Participants explained that the pre-surgery perceptions of low energy and health impairment influenced their participation in PA.

'So yeah, I feel healthier. I've got more energy. I have lots more energy, some days I wouldn't want to get out of bed, you feel really lethargic because of that extra weight holding you down. Whereas now, I'm up early, and out and about doing things, and I feel good, I feel really good. I don't know, just a lot more energy.' (P5)

'I just had no energy at all. I just felt lifeless. Just my outlook on life, I just see my life differently now ... a lot happier. I'm a lot happier. My diabetes. That's under control now. My cholesterol, my blood pressure – that's all under control...' (P9)

Residual perceived barriers to physical activity

Residual obesity-related perceived barriers to physical activity

<p><u>Physical barriers.</u> Despite the theme of positive changes in pain as a result of the surgery, some participants reported that pain was not completely resolved, and that it consequently remained a barrier to PA. The persistence of pain as a physical barrier to PA was mostly reported for those participants who experienced chronic issues such as chronic low back pain (P5) and osteoarthritis (P19). The fear of pain also appeared to act as a barrier to PA for P19, who despite a substantial loss of 31% of his excess weight was still obese at 12 months post-surgery.</p>	<p>‘And I’ve always suffered ... the reason why I had the operation was because I suffered from a lot of back pain, and I still do but not as much.’ (P5)</p> <p>‘Pain, still the fear of ... both my ankles, I’ve had ligament surgery and bits and pieces and the bone fragments so very, very unstable. So walking for me is a concentrated effort rather than ... I can’t walk on uneven surfaces with any confidence. My left knee is just starting to flare up again at the moment.’ (P19)</p> <p>‘Look, the main things are obviously getting out in the cold air has certainly been a major barrier and the other is, yeah, just I suppose the pain, the fear of or the lack of confidence, I suppose, in my limbs, my lower limbs.’ (P19)</p>
<p><u>Self-presentational concerns.</u> When compared to their pre-surgery perceptions, some participants reported residual self-consciousness regarding their physical appearance or size when engaging in PA, particularly for exercise in a group setting (P11, P19). For other participants, there was a shift in focus regarding their self-presentational concerns, which was related to excess skin resulting from weight loss, rather than the pre-surgery concern about the excess weight (P15, P17).</p>	<p>‘Yeah, I think if I was exercising in a group environment like doing boot camp or things like that, I’d still be self-conscious about it, yeah.’ (P11)</p> <p>‘If I was feeling accepted, I would ... if I went into a gym, I would feel like the odd one out, I suppose, so I avoid those circumstances. So getting out and doing exercise in a public beach with my kayak still isolates me from the rest of the world but going to a gym means you’re in a confined space with people who are generally, they’re pretty hot. They’re pretty muscley. You are really, really the odd one out. No matter what you’re there for, you are.’ (P19)</p> <p>‘Oh, certainly with swimming ... I mean, I’ve got a bit of loose skin. You’re sort of aware of that. But then I’m 51. But a bit more loose skin than you would have’ (P15)</p>

‘I think while I do feel a lot better about how I look and how I feel about myself, I think it's going take time for me to feel really happy with my body, because now I've got loose skin. In some ways, I feel like I still have self-image issues, but they're just slightly different. Rather than it being about my thighs, it's about how my body has changed, and I have loose skin and stuff.’ (P17)

Residual non-obesity-related perceived barriers to physical activity

Lack of motivation. Several participants reported that lack of motivation remained a barrier to PA (P5), which for some was linked to a perceived lack of discipline or laziness (P14, P15). Specifically, many participants reported lack of motivation to engage in PA in the first few months post-surgery. Participants explained that they were not motivated to engage in PA during this period since considerable weight loss was happening as a result of the drastic dietary changes (P2, P14, P17). The lack of motivation to engage in PA in the first few months post-surgery was mostly reported by those participants who lost over 80% of their excess weight in the first 12 months post-surgery.

‘I just need to push myself. I mean, that’s the thing – I’ve got get my head set around like, if I do want to join a gym and go, and do that sort of thing again like I used to years ago.’ (P5)

‘Just put lazy. I guess now I’m at maintenance, nearly at maintenance, so I need to be looking at toning up. I know when I need to tone up, so I’ve got some free weights at home. But I could’ve been doing that already and have nice arms, but I haven’t, because I’m lazy. I’m like, “Oh, I’ll do that next week, next month”.’ (P14)

‘Lack of motivation it would appear. And lack of organization. But I will have to think about what motivates me, because clearly I'm not a highly motivated person. Apparently self-discipline has to come in, or organisation has to come in. I think it's not a nice realization to come to, but I think I'm a naturally ... in some ways I'm a naturally lazy person’ (P15)

‘One of the interesting things that I found about having gone through the operation is in that first probably two- to three-month period, because you're on very restricted calorie and

volume amounts, I was losing quite a lot of weight without really doing anything. So there is a certain level of apathy that sets in, where you just think, “Well, it doesn't matter what I do. So long as I just stick to that amount of volume of food and that type of food, I'm going to keep losing weight anyway.” So, I guess the drive to back that up with doing something physical, activity-wise, wasn't really there. Because I was getting good loss of weight without doing anything.’ (P2)

‘Don't need to exercise because I'm losing weight. Now I'm losing weight, so the motivation to do that is gone. I have all of them (benefits of PA) without doing the exercise [laughs]. Do you know what I mean? And I've always been lazy, but I did that before (PA), because I knew I had to at least make an effort and try and lose weight. But now I don't need to make an effort because it's just happening by itself.’ (P14)

‘Definitely in the beginning when your weight loss is coming off so rapidly, you think, “Oh, well, I don't really need to. [laughs]. I'd go for a walk every now and then, but it was just ... in some ways, it's scary how fast it comes off (the weight), and you sort of like you go, “Oh gosh, I don't want it to come off too fast”.’ (P17)

Lack of time. Several participants reported that a lack of time to engage in PA due to work and family responsibilities remained a barrier to PA (P2, P5). Although participants did not report it as a perceived barrier, data from some participants suggest that they did not believe PA was of sufficient importance to be prioritised against other aspects of daily life (P3, P7, P11).

‘It's all that I can do at the moment, with the kids and with work. I don't have time for anything. I like doing it. It's not something I get to do a lot of, because I've got a pretty sedentary sort of job and so forth, and the kids keep the rest of the time active. But when I do get to go for a ride or catch up with friends and go do other stuff, it's good. I enjoy it. And I feel pretty good doing it.’ (P2)

‘But then I look at my ... the main days that I do my exercise are the days that I have off, but when I work, we leave home at seven o'clock in the morning, we come home at 6.30 at

night, so it's really difficult. You come home and you're tired, it's been a long day, and then you got to cook. So that's why those sort of days you don't really do any exercise. So it's mainly the weekends and the couple of days that I have off during the week. If I was home all day, you'd have plenty of time to do exercise. [laughs]' (P5)

'I've just started doing Pilates videos, so I'm going to try and do that three times a week. Yeah, that's sort of just now, start training a bit more, training my body up a little bit more. Other than that it's mostly just walking, playing with my daughter and sometimes bike riding.' (P3)

'No, just been touching on a bit of Pilates to strengthen up my pelvic floor area and my lower back. And that's probably what I'll continue to do and I'll do more sessions of that. I've been doing one a fortnight which is way better than anything yet and then I'll slowly move into that. We've got a busy couple of months coming up and then I'll lock in.' (P7)

'I did enrol for boot camp, and then they cancelled it, but I did see another sign for boot camp across the road from my work, so I did say that I was going to do that when I get back to Melbourne next week, go and enquire. Fingers crossed. [laughs]' (P11)

Social support issues. Some participants reported that the lack of company to engage in PA and lack of support with family responsibilities such as child care remained a barrier to PA (P5, P14, P16).

'I mean I'd always like to do more. If I had ... see, that's the thing – not that I need motivation, but I like to go walking with somebody. I don't like to go by myself. So when I've got a walking partner, I'd go every day. But unfortunately, I haven't gotten a walking partner three days, so that's why I'm limited to that 3-4 times a week.' (P5)

‘She (daughter) won’t go in the pram anymore, and she won’t walk very far. So that’s my walk out. If I want to go for a walk, I have to go by myself, and that’s very difficult to do, because she’s always with me. So that’s a barrier.’ (P14)

‘I try to get out and go for a walk or a run or something, and just because it’s me, on my own, doing it myself, I’m not accountable to anyone, I just don’t do it, because I’ve got assignments to do and everything like that. It’s all busy, so I think, “I’ll just do this, and I’ll exercise later,” and it never happens.’ (P16)

Table 4. Residual perceived facilitators to physical activity and perceived motivators of physical activity

Residual perceived facilitators to physical activity	
<i>Residual obesity-related perceived facilitators to physical activity</i>	
Theme description	Representative quotes
<p><u>Weight loss.</u> Weight loss remained the main perceived facilitator to PA. Participants who reported an increase in PA post-surgery explained that the effect of weight loss on their physical barriers and perceived ability to engage in PA was the main facilitator for the change in PA (P2, P9, P13).</p>	<p>‘Because I was lighter. There was less stress on my knees and ankles and so forth. So walking and even simple things like going upstairs and so forth, you were no longer out of breath doing so.’ (P2)</p> <p>‘Just knowing that I’ve lost all this weight, and just knowing that I can do it. I can do the walking, and I know I can do the exercises now.’ (P9)</p> <p>‘Being lighter. I was able to get out there and do it, yeah.’ (P13)</p>
<i>Residual non-obesity-related perceived facilitators to physical activity</i>	
<p><u>Social factors.</u> Some participants reported that having company to engage in PA remained a facilitator to PA. The increase in perceived ability to participate in PA reported by participants appeared to enable them to engage in PA with friends or family members (P17). One participant (P19), who reported an increase in participation in specific types of PA that he found enjoyable following surgery (e.g. kayaking), indicated that having company would facilitate engagement in activities he would not normally do. Another</p>	<p>‘I have lots of friends and family members who like things like say, cycling or running, and before I never felt like I could join them in those activities. So now I feel like I can, so I definitely think it's a maintainable thing.’ (P17)</p> <p>‘My son is fairly active now and we’ll catch up with him. He’s moved back closer to Perth so I sort of see him once a month and we’ll go walking and things like that.’ (P19)</p> <p>‘Somebody looking after (child’s name), and then another friend saying, “Come on, let’s go out for a walk together”.’ (P14)</p>

participant (P14), who reported a decrease in participation in PA post-surgery mostly due to lack of motivation and family commitments, reported that participation in PA would be easier if she would have someone to help with child care and to engage in PA with her.

Time management. For some participants, better time management in order to prioritise time for PA was found to facilitate their participation in PA (P11, P17).

‘Then you come to the exercise that I’m actually in a bit of a routine now because I’ve got the work hours under control.’ (P11)

‘Sometimes, I might have a week where I just don’t have the time to do as much (PA) as I normally do, but then the next week when I’ve got more time I get back into it. Do you know what I mean?’ (P17)

Perceived motivators of physical activity

Body weight and appearance. The main perceived motivators to participate in PA for most participants were additional weight loss and/or maintenance of the weight loss achieved post-surgery, as well as to improve their physical appearance. These motivators were described by both those participants who reported no change or decreased participation in PA (P5, P14, P16) and those who reported increased participation in PA (P13, P17). Additionally, some participants reported that wanting to improve their fitness levels

‘To lose more weight. Or to look good, and to fit into clothes, [laughs] some old clothes that ... nice clothes that I haven’t fit into for many years. Oh – to maintain, because basically, I’ve known all my life, if I don’t do exercise, I gain weight. So regardless of what I eat, it’s ... obviously, I’ve got a sluggish metabolism that I need to do exercise, some form of exercise. I guess sometimes when you still look in the mirror you see ... I mean you know you’ve done well and you’ve lost weight, but I try and still push myself to lose some more, because I really think that I should be able to move those extra five kilos if I work harder.’ (P5)

also motivated them to increase their participation in PA (P9, P17).

‘I know I need to tone up my arms, so I need to start doing my weights. I haven’t started that yet. I’m in the pre-contemplation phase. Yeah, yeah. So summer’s coming, so I know that a lot of the dresses that I’ve got are sleeveless, so yeah. That will be a motivation to ... yeah, tone up my arms. You don’t tone up your arms by walking.’ (P14)

‘I want to say to lose weight. Sometimes when I get a really, really strong willpower, I know there’s nothing that will deviate me from doing exercise every day, and I feel guilty if I miss a day. Yeah, so I guess the number one motivator for me is to lose weight, and that comes back to associating it with loss of weight.’ (P16)

‘Well, I knew there would have to be a time that I would have excessive skin, so I just thought I’d get onto that before me having that problem of having another surgery just to get rid of the excess skin but yeah, me getting onto that has made it a bit better.’ (P13)

‘Like I said before the last ... it will feel so ... like I was told I would only get down to 90 kilos, and it felt amazing when I went further than that. I just think it will feel amazing if I get to say 68 kilos, which is what I’m meant to be and to be a normal BMI. I think that will be an amazing feeling and a feeling of achievement and accomplishment, and I never ever imagined that I would ever be able to get to 68 kilos. Whereas now I can imagine it and I can see that it’s possible, so that has a huge part in motivating me to exercise. Over the last few months, I have made an effort to be more active. Not that I didn’t do any exercise before, but now, because I would like to lose those last 15 kilos, I’m thinking more about what I can do physically, in terms of physical exercise to help that.’ (P17)

‘Just wanting to get fit, just wanting to lose a bit more weight and just be a bit more healthy.’ (P9)

‘I think definitely when my weight loss slowed down, right down -- I lose about a kilo a month now -- that's when I started thinking more about aerobic exercise that it would increase my fitness.’ (P17)

Social interaction. Some participants reported that they were motivated by the social aspect of engaging in PA with someone else or with a pet (P9, P11, P13).

‘My husband sometimes comes with me when I go walking. That’s good, because you can talk. He motivates me to keep going, and I motivate him to keep going, so we both motivate each other.’ (P9)

‘A little bit of guilt that the dogs have been home all day. They live in a small yard now, so they need that stimulation to go out. That’s a motivator to be a responsible pet owner, [laughs] to get them the exercise. I know it makes them happy, so it makes me happy. That’s my main motivator, my little babies.’ (P11)

‘Just for that motivation to keep going, that nothing in life can stop me now. And just to maybe like even go out there and meet new people with my PT or whatever. I think because we live like right near Asheville Reserve, so there is like always something happening there, and especially the motivation to have a look at hot Italian guys playing soccer. That’s a great motivator. Good motivator.’ (P13)

Enjoyment of activity. A small number of participants reported that choosing to engage in types of PA they

‘It's something I did when I was a kid, and the enjoyment of it has not diminished, which is great. You enjoy it for what it is rather than feeling ... so like I can do things and enjoy the

find enjoyable was a motivator to participating in PA (P2, P6).

activity, rather than thinking about how I'm feeling in the activity. So you're enjoying the scenery or the company or the conversation. Whereas in the past, it was more about how do you feel in that situation.' (P2)

'Hmm, what motivates me? I do love it. I just love doing it. So it's not something I think, "Oh gosh, I've got personal training tonight." You know what I mean? I just love going, and it is a social aspect as well, but I do like ...I think now, I just realized that the diet ... you have to have a good diet and you have to push yourself to maintain what you've lost, basically. And I think that's in the back of my head as well. You've got to keep doing this. You know? But I think I just love it more than anything. I think always my head's loved the sport and loved that kind of thing, but the weight definitely put me off unfortunately. No, I love it. I love it. I still always liked it, but I absolutely love going and I definitely push myself now to my limits, especially on those personal training sessions.' (P6)
