

ACUTE CHANGES IN PHYSICAL ACTIVITY  
POSTBARIATRIC SURGERY

by

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## ABSTRACT

Bariatric surgery has become a prevalent and effective method to reduce body weight and improve the health profiles of morbidly obese individuals. However, variability in the success of the procedure exists, yet few research studies have examined lifestyle changes that may enhance surgical outcomes. Therefore, the primary purpose of this study was to objectively monitor the physical activity patterns of bariatric patients, presurgery and postsurgery. The secondary purpose of this study was to build support for the validation of the Cross-Cultural Activity Participation (CAPS) weekly physical activity questionnaire, a questionnaire that may take the place of objective measurements.

Twenty-four bariatric patients were recruited for this study (height:  $165.6 \pm 9.9$  cm, weight:  $121.8 \pm 24.8$  kg and BMI:  $44.0 \pm 6.5$ ) and were asked to complete 2 office visits (1 presurgery and 1 postsurgery) for testing and wear an accelerometer physical activity monitor for 7 days presurgery and 7 days postsurgery. The office visits included body composition testing via Bod Pod, reporting of dietary intake, reporting of weekly exercise and completion of the CAPS questionnaire. Accelerometers were worn for 7 days presurgery and 7 days, 3 to 5 weeks postsurgery.

Findings show that participants did not significantly change their physical activity patterns postsurgery ( $p \geq 0.05$ ). Physical activity appears to positively impact health and assist in the retention of weight loss. Therefore, the lack of change in physical activity postsurgery signifies a postsurgical lifestyle change that may be improved upon.

An archived data set was used to determine the validity of the CAPS questionnaire. CAPS-derived reports of moderate to vigorous physical activity was not significantly correlated with steps per day. Further, regression analysis revealed that the CAPS questionnaire could explain only 5.2% of the variation in steps per day. Therefore, it does not appear that the CAPS questionnaire is a valid surrogate measure of physical activity.

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## CHAPTER 1

### INTRODUCTION

Projected medical costs associated with obesity are staggering, making obesity a condition that has far-reaching negative consequences for our national health and economy. Health conditions directly linked with obesity (BMI > 30), including type 2 diabetes, coronary artery disease, and hypertension, incur costs that make up 5.7% of our yearly national healthcare spending (Wolf & Colditz, 2012). On average obese individuals will spend anywhere from \$1,429 ± 156 (41.5%; Finkelstein, Trogdon, Cohen, & Dietz, 2009) to \$2,741 ± 745 (150%; Cawley & Meyerhoefer, 2012) more money on medical services and treatment each year than individuals who fall within a Body Mass Index (BMI) range consistent with normal body weight for height.

Bariatric surgery has emerged as a robust treatment option for obesity that is promoted as a procedure that reduces obesity and associated comorbid conditions (Adams et al., 2012; Adams et al., 2010; Buchwald et al., 2009; Rubino, Schauer, Kaplan, & Cummings, 2010; Sjöström et al., 2004), and may result in reduced medical spending for patients, particularly for those who present with comorbid conditions such as type 2 diabetes (Sampalis, Liberman, Auger, & Christou, 2004). There is disagreement in the literature, however, regarding whether the costs of bariatric surgery are recouped by lower medical spending postsurgery, or if bariatric surgery is cost-effective. Some

researchers have examined data and concluded that the surgery becomes cost-effective within as little as a year (Gallagher et al., 2003). Other researchers, using a different metric, suggest that bariatric surgery for obese patients may even provide a return on investment (ROI) for employers of patients (Craig & Tseng, 2002; Sampalis et al., 2004). However, more recent and lengthier longitudinal reviews suggest that bariatric surgery may not provide an ROI to employers or patients (Bleich et al., 2012; Maciejewski & Arterburn, 2013).

In addition to its initial development for weight loss purposes, bariatric surgery has somewhat serendipitously become a viable treatment for type 2 diabetes. Complete remission of type 2 diabetes with long-term maintenance of blood sugar control occurs in approximately 78% of bariatric patients and significant improvements in fasting glucose (decline to within 100–125 mg/dL) and reductions in diabetes medication occurs in about 87% of bariatric patients (Buchwald et al., 2004; Buchwald et al., 2009). While all surgical options appear to improve fasting glucose and insulin sensitivity in type 2 diabetics, the procedures that are both energy restrictive and malabsorptive in nature, such as Roux-en-Y gastric bypass surgery, generally have higher success rates (Buchwald et al., 2004; Buchwald et al., 2009; Lima et al., 2010).

A review by Buchwald et al. (2009) showed type 2 diabetes remission was most likely for biliopancreatic diversion with duodenal switch patients (average rate = 98.9%, 95% CI [96.8, 100%]) and in descending order thereafter; gastric bypass (average = 83.7%, 95% CI [77.3, 90.1%]), gastropasty (average = 71.6% 95% CI [55.1, 88.2%]), gastric banding (average = 47.9%, 95% CI [29.1, 66.7%]; Buchwald et al., 2004). The mechanisms underlying surgically induced remission of type 2 diabetes are complex and

still being studied; however, researchers suggest bariatric surgery may remit diabetes by imposing: reduced caloric intake, reduced nutrient absorption (depending on the procedure), alterations in hormonal response to nutrient intake (depending on the procedure), and potentially tissue specific changes in insulin sensitivity (Rubino et al., 2010).

Perhaps disparities in comorbid condition remission rates and weight loss between various bariatric surgical options accounts for the differences in the cost-effectiveness calculations in the literature (Sjöström et al., 2004). Procedures such as vertical banded gastroplasty and Roux-en-Y gastric bypass (RYGB), for example, produce greater weight losses and have more of an impact on type 2 diabetes than gastric banding, making the former procedures appear to be more cost-effective (Sjöström et al., 2004). However, variable responses within surgical procedures have also been noted (Goergen et al., 2007; Sugerman, Starkey, & Birkenhauer, 1987). For example, at 2 years postsurgery, weight loss by RYGB may vary by as much as 34 pounds ( $-96 \pm 34$  pounds) and weight loss by vertical banded gastroplasty may vary by 27 pounds ( $-67 \pm 27$  pounds; Sugerman, et al., 1987).

Not only is there variability in short-term weight loss following bariatric surgery, there is variability in the longer-term responses, including weight regain. Sjöström (2008), in a follow-up of the Swedish Obese Subjects Study (SOS), reported that at 10 years postsurgery, weight relapse ranged from 32% to 15% for gastric bypass, 25% to 16% for vertical-banded gastroplasty, and 20% to 14% for banding. The relapse percentages were quite variable with 11% (gastric bypass), 11% (vertical-banded gastroplasty) and 14% (banding) standard deviations for the 10-year follow-up body

weights. Similarly, Christou et al. (2006) examined gastric bypass patients at a mean of 11.4 years of follow-up and reported that there was a significant increase in body weight after the patients reached a peak low body weight at approximately 2 years postsurgery. Postsurgery BMI (>10 years following surgery) was used to categorize surgery success (BMI < 30 = excellent, BMI 30–35 = Good, BMI > 35 = failure). Using this categorization process, Christou et al. (2006) reported a failure rate of 20.4% for morbidly obese patients and 34.9% for super obese patients. Together these data suggest that although bariatric surgery patients lose weight, there is considerable variability in the relative amount of weight lost and the amount of weight regain.

Relatively little research has sought to identify causes for the variability in postbariatric surgery weight regain (Odom et al., 2010). The majority of literature relative to improving bariatric surgery outcomes involves studies for the enhancement of the procedure itself (Kral, 1998; McCarty, Arnold, Lamont, Fisher, & Kuhn, 2005), rather than causes for weight regain.

Conversely, a number of researchers have studied nonsurgical approaches to treating obesity and their results suggest that there are many possible explanations for weight regain after weight loss including: history of weight cycling, binge eating, increased hunger, emotional eating, and stress eating (Elfhag & Rossner, 2005). Factors that are observed with individuals who are able to prevent weight regain include: more initial weight loss, attainment of a self-determined goal weight, healthier eating habits, regular meal timing, control of overeating, and having a physically active lifestyle (Elfhag & Rossner, 2005). The National Weight Control Registry has provided a forum for thousands of individuals (surgical and nonsurgical weight losers) to report on the

lifestyle changes necessary for maintenance of weight loss: 98% of registrants have altered their nutrition in some way, 94% have increased their daily physical activity primarily through walking, 90% of registrants exercise for approximately 1 hr per day, 75% weigh themselves weekly, and 62% report watching less than 1 hr of television per day (Wing & Hill, 2014). Befort and colleagues (2007) reported that physical activity is one of the strongest predictors of successful weight loss maintenance (Befort et al., 2007).

Despite the data from some researchers and the self-report data from the National Weight Control Registry highlighting the importance of physical activity behaviors in preventing weight regain, little attention has been given to systematically examining the postsurgery physical activity behaviors of bariatric patients. The lack of attention to physical activity may reflect an assumption that as soon as the excess body weight is lost, the patient will be better able to move and so will naturally increase their daily physical activity (Bond et al., 2009; Evans et al., 2007; Papalazarou et al., 2009). However, there is no objective and conclusive evidence that bariatric surgery-induced weight loss increases patients' daily physical activity (Bond et al., 2010; Chapman et al., 2013).

The inclusion of a postsurgical standard of care that encourages physical activity may reduce sedentary behavior (Bond et al., 2011) and improve the volume and intensity of physical activity (increased MVPA time per day) in the postsurgery period (Bond et al., 2009). Such changes in physical activity behaviors may reduce the likelihood of weight regain and also improve the health of the individual, contributing to reductions in medical spending associated with bariatric surgery (Bond, Phelan, Leahey, Hill, & Wing, 2008; Papalazarou et al., 2009).

Presently, the available research on physical activity in bariatric surgical patients is inconsistent. Research that has relied on self-reported changes in physical activity postsurgery suggests that physical activity increases after surgery (Boan, Kolotkin, Westman, McMahon, & Grant, 2004; Bond, Jakicic, Unick, et al., 2010). However, research that has used physical activity monitors such as pedometers or accelerometers has produced variable results. The work of Bond and colleagues shows that physical activity did not increase at 6 months postsurgery despite the fact that patients reported being more physically active (Bond, Jakicic, Unick, et al., 2010). Conversely, King et al. report that postsurgery, bariatric patients are taking approximately 1,225 more steps per day and accumulating more minutes of moderate to vigorous physical activity per week (King et al., 2012). Therefore, more research is needed to determine if bariatric surgical patients change their physical activity levels postsurgery.

The rationale for the current research study is twofold. First, acute changes in physical activity postbariatric surgery have not yet been evaluated and may offer a possible explanation for the marked and immediate remission of type 2 diabetes, as physical activity independently alters blood sugar control. Secondly, prior to arguing for programs to facilitate physical activity changes postsurgery to improve short-term weight loss and reduce the long-term likelihood of weight regain, there is a need to better understand the naturally occurring physical activity patterns adopted by patients postbariatric surgery. If bariatric surgery patients do not naturally adopt physical activity behaviors consistent with optimal health, it might be that a paradigm shift is in order, a shift where bariatric surgery is a “quick start” and not a “quick fix.” In other words, the surgery might provide a “quick start” to weight loss and remission of various comorbid

conditions, but bariatric surgery does not guarantee the appropriate lifestyle alterations necessary for optimal health.

Several questions remain regarding physical activity changes including: do patients naturally change their physical activity volume after surgery, do patients naturally change their sedentary time after surgery, do patients change the intensity (speed) of movement after surgery, and finally, do patients' self-reported and self-perceived changes in physical activity patterns agree with objective data collected over the same period?

### **Study Aims**

The first aim of this study is to determine if there are significant changes in physical activity patterns after bariatric surgery, particularly the Roux-en-Y gastric bypass and sleeve gastrectomy (SG) surgical procedures. Physical activity will be assessed by measuring participants free-living step accumulation patterns using walking cadence (Tudor-Locke, Brashear, Johnson, & Katzmarzyk, 2010) and comparing values before surgery and 3–6 weeks postsurgery (Tudor-Locke et al., 2011).

Aim One Hypothesis: Bariatric patients will alter their physical activity patterns postsurgery. They will significantly increase the amount of time spent (minutes per day and percentage of the day) in walking cadence bands that are of higher intensity and will significantly reduce the amount of time spent in walking cadence bands of lower intensity.

The second aim of this study is to compare the observed peak 1-min and peak 30-min walking cadence presurgery and postsurgery, to better determine if there are changes

in selected walking cadence (Tudor-Locke, Brashear, Katzmarzyk, & Johnson, 2012).

Aim Two Hypothesis: Significant pre- to postsurgical increases in the peak 1-min and peak 30-min walking cadences will occur.

The third aim of this study is to examine the Cross-Cultural Activity Participation Study (CAPS) weekly physical activity questionnaire, using pedometer and accelerometer data to determine if the CAPS questionnaire is a viable alternative to objective measurement of physical activity (PA). Validity evidence will be acquired by comparing the MVPA calculated from the CAPS questionnaire and average steps per day data from three datasets (presurgery participants from the current study, postsurgery participants from the current study, and 168 bariatric surgical candidates from a different laboratory at the University of Utah).

Aim Three Hypothesis: There will be significant evidence in support of the CAPS questionnaire as an assessment tool for measuring PA.

### **Assumptions**

1. The tools for measuring physical activity (including walking cadence and sedentary time) are valid and reliable for use with bariatric populations.
2. Participants will wear the activity monitor as prescribed and will otherwise report errors in monitor placement or wear time.
3. The use of accelerometry will not alter participants' regular daily physical activity habits.

### **Limitations**

1. The majority of bariatric patients in this study were women; therefore, results may not be applicable to men who are receiving bariatric surgery.

2. Physical activity will only be assessed one time before surgery and one time postsurgery.

3. Presurgery bariatric patients are prescribed a liquid diet for the 1.5–3 weeks before surgery and after surgery caloric intake is very restricted; therefore, the dietary records collected for this study are limited to use as a source of descriptive information.

4. Consumption of a very low-calorie diet before and after surgery may result in participants feeling less energetic and thus curbing their physical activity.

5. The present study was originally under the umbrella of an ongoing investigation that did not permit the recruitment of participants who had heart disease. Therefore, the influence of heart disease on physical activity patterns before and after bariatric surgery is not possible.

### **Delimitations**

1. A 7-day period was used as the required wear time for the participants. Although this period may increase participant burden, the week period was selected to obtain a representation of average weekly physical activity patterns.

2. It is possible that physical activity may change as a result of weight loss due to smaller body size and reduced stress on joint structures and improved ease of movement. However, the proximity of the postsurgical reassessment (4–6 weeks) of physical activity was selected to allow for recovery from surgery, but not so long as to allow maximal

weight loss. Our goal was to obtain a picture of possible changes in physical activity patterns associated initial surgery-related weight loss.

3. The dietary data collection was limited to the period immediately before surgery and the period 3–6 weeks after surgery. While it is possible that the very low caloric intake following bariatric surgery may be associated with a low physical activity level, the limitation of low caloric intake on physical activity following surgery was mitigated by the fact that we also measured physical activity during a caloric restriction before surgery (due to the liquid diet implemented).

## CHAPTER 2

### REVIEW OF LITERATURE

Examination of the impact of bariatric surgery on obesity and its comorbidities has taken place for several decades, but one outcome variable has received relatively little attention and this variable is the patient's postsurgery physical activity patterns. Physical activity can influence body weight, health, and wellbeing. Bariatric surgery is employed as a strategy to reduce body weight and improve many health variables; therefore, it is reasonable that any potential interaction between surgical body weight-related outcomes and patient physical activity should be better understood. This review of literature is presented to provide a backdrop for understanding bariatric surgery outcomes relative to weight loss and physical activity patterns. This chapter consists of four primary sections: (a) a review of weight loss curves, health changes, and potential health care savings due to bariatric surgery; (b) an examination of the impact that physical activity and sedentary behavior have on body weight, weight loss, and health; (c) a review of physical activity patterns in various populations, including patients before and after bariatric surgery; (d) and a summary connecting the ideas that physical activity may not automatically increase postbariatric surgery and increases in postsurgery physical activity may augment the benefits achieved by surgery alone.

## **Bariatric Surgery**

### Trends in Bariatric Surgery

Since the 1960s, when bariatric surgery was first introduced as a treatment option for weight loss, the surgery has become progressively safer, more effective, and prevalent. In recent history, the number of bariatric surgeries performed in the United States has increased. In 1998, 13,365 surgeries were performed. This number increased to 72,177 in 2002 and 102,794 in 2003 (Santry, Gillen, & Lauderdale, 2005). From 2003 to 2009, there was a plateau or slight decrease in the number of surgeries being performed in the United States, perhaps because there was a decrease in patient demand, or more likely, the United States reached a maximum in terms of qualified surgeons (Kohn, Galanko, Overby, & Farrell, 2009).

A variety of surgical options exist for patients and the prevalence of specific surgeries has changed over time. From 1998 to 2015, gastric bypass surgery has remained the most prevalent surgical procedure (Kohn et al., 2009; Santry et al., 2005). From 1998 to 2002 gastric bypass accounted for approximately 80% of surgeries, this number declined to 75% by 2008 (Nguyen, Nguyen, Gebhart, & Hohmann, 2013; Santry et al., 2005). From 2008 to 2012, there was a large increase in the number of sleeve gastrectomy surgeries (0.9% in 2008 and 36.6% in 2012) and a concurrent decline in the number of gastric bypass surgeries (75.4% in 2008 and 59.6% in 2012) and laparoscopic adjustable banding procedures (23.8% in 2008 to 4.1% in 2012), perhaps reflecting reports supporting the superior safety and effectiveness of the sleeve gastrectomy in comparison to other procedures (Li, Lai, Ni, & Sun, 2013; Nguyen et al., 2013).

### Bariatric Surgery and Resultant Weight Loss

Significant evidence exists in support of bariatric surgery as a potent treatment for obesity. A 14-year follow-up study of 591 gastric bypass surgery patients showed dramatic reductions in weight after 1 year (preoperative weight [138.1 kg] versus 1-year weight [87.4 kg]). Publications by Sjöström and colleagues analyzed data from the Swedish Obese Subjects Study (Sjöström, Peltonen, Wedel, & Sjöström, 2000; Sjöström, L. et al., 2004), a project that has tracked changes in body weight. These researchers reported that gastric bypass surgery resulted in significantly more weight loss than either gastric banding ( $p = 0.034$ ) or vertical banded gastroplasty ( $p = 0.057$ ; Sjöström et al., 2000). Across all procedures, weight was reduced rapidly and was minimized at 1-year postsurgery, with gastric bypass showing the largest percent decline in body weight,  $-38 \pm 7\%$ , followed by vertical banded gastroplasty,  $-26 \pm 9\%$  (Sjöström et al., 2004). At 10 years postsurgery, gastric bypass patients were able to maintain  $-25 \pm 11\%$  weight change, vertical banded gastroplasty  $-16.5 \pm 11\%$  and gastric banding  $-13 \pm 13\%$  (Sjöström et al., 2004). Ten-year weight loss curves appeared similar between all procedures; there was a sharp decline in weight at 1-year postsurgery, a slow incline to year 8 and stabilization thereafter (Sjöström et al., 2004).

Other researchers have used BMI as the metric for assessing the impact of bariatric surgery. In their 14-year follow-up study of 591 gastric bypass surgery, patients showed dramatic reductions in BMI after 1 year; preoperative BMI ( $49.7 \text{ kg/m}^2$ ), compared to 1-year BMI ( $31.5 \text{ kg/m}^2$ ; Pories et al., 1995). By year 5, BMI had increased slightly to  $33.7 \text{ kg/m}^2$ , where it remained stable until 14 years postsurgery (Pories et al., 1995). In a meta-analysis on randomized control trials that compared changes in BMI

between bariatric surgical patients and standard of care (alteration of diet and exercise habits) patients, Padwal and colleagues (2011) found that all types of bariatric surgery are significantly more effective at reducing BMI than the current standard of care. While their analyses concentrated only on 1 year postsurgery, the results were slightly different than previous research in terms of which procedures were most effective, perhaps due to some formerly unstudied surgery types being included in the study. Padwal ordered procedures from most to least efficacious for reducing BMI as follows: jejunoileal bypass ( $-11.4 \text{ kg/m}^2$ ), mini gastric bypass ( $-11.3 \text{ kg/m}^2$ ), biliopancreatic diversion ( $-11.2 \text{ kg/m}^2$ ), sleeve gastrectomy ( $-10.1 \text{ kg/m}^2$ ), Roux-en-Y gastric bypass ( $-9.0 \text{ kg/m}^2$ ), vertical banded gastroplasty ( $-6.4 \text{ kg/m}^2$ ), horizontal gastroplasty ( $-5.0 \text{ kg/m}^2$ ) and adjustable gastric banding ( $-2.4 \text{ kg/m}^2$ ). Roux-en-Y gastric bypass, sleeve gastrectomy and adjustable gastric banding are the most commonly performed procedures in the United States, the former inducing more reduction in BMI and gastric banding inducing significantly less reduction in BMI, but presenting with fewer postsurgical complications, hernias and shorter hospital stays (Padwal et al., 2011).

Several researchers have evaluated the efficacy of bariatric surgery by examining loss of excess body weight. Buchwald and colleagues showed that bariatric surgery results in rapid loss of excess weight within 1 year postsurgery, yet differences exist between the surgical types (95% CI); gastric banding (40.7%–54.2%) gastric bypass (56.7%–66.5%), gastroplasty (61.5%–74.8%) and biliopancreatic diversion or duodenal switch (66.3%–73.9%; Buchwald, et al., 2004). More recently, Li and colleagues completed a meta-analysis that compared the efficacy of Roux-en-Y gastric bypass surgery and laparoscopic sleeve gastrectomy on the treatment of morbid obesity (Li et al.,

2013). They included only randomized controlled trials and concluded that the excess weight loss associated with the two surgeries was significantly different. Roux-en-Y gastric bypass surgery resulted in a weighted mean difference of 6.67% more excess weight lost (95% CI [4.61, 8.91%],  $p < 0.001$ ) than sleeve gastrectomy (Li et al., 2013). The authors concluded that while Roux-en-Y gastric bypass surgery appears more successful, additional research is needed to adequately evaluate sleeve gastrectomy, as there are few randomized controlled trials available with the appropriate power levels to develop a conclusion regarding the efficacy of the sleeve gastrectomy surgical procedure.

In summary, it appears that overall, bariatric surgery is quite effective at inducing weight loss and a reduction in the level of obesity. There is, however, conflicting data regarding the relative efficacy of various procedures and there is considerable variability in the weight loss response of individual patients (Adams et al., 2012). Further research is needed to examine possible factors that may account for the variability in weight loss responses to bariatric surgical procedures. Up until now, most projects have been observational in nature and have failed to compare surgery types while controlling for other external factors that may influence weight loss experienced by bariatric patients. Potential external factors include postsurgical nutritional interventions, volitional physical activity, and postsurgical physical activity or exercise interventions.

### Bariatric Surgery and Resultant Health

Bariatric surgery was initially developed for weight loss purposes, with the added intention of impacting the comorbidities associated with obesity, with cardiovascular disease being one significant example. Kwok et al. (2014) and Pontiroli and Morabito

(2011) have reported that bariatric surgery may reduce risk of mortality, myocardial infarction, stroke, and other cardiovascular events when surgery patients are compared to matched controls who did not have surgery or interventions. Mortality risk was calculated in a meta-analysis of 11 studies and results indicated that individuals who opted for bariatric surgery had reduced odds of mortality (odds ratio = 0.60, 95% CI [0.49, 0.74]; Kwok et al., 2014). In the same meta-analysis, five studies were assessed to determine the odds of myocardial infarct (odds ratio = 0.67, 95% CI [0.54, 0.83]), four studies were assessed to determine odds of stroke (odds ratio = 0.58, 95% CI [0.45, 0.74]) and four studies were assessed to determine odds of other cardiovascular events (odds ratio = 0.63, 95% CI [0.49, 0.80]; Kwok et al., 2014). In each of the analyses that investigated cardiovascular disease, it seems that bariatric surgery may have a role in protecting individuals from cardiovascular degradation and failure. However, the results of the work of Kwok and colleagues was somewhat expected as the comparisons were made against obese individuals who were not receiving any interventions to diminish their obesity or treat cardiovascular disease.

Type 2 diabetes is another major comorbidity of obesity which seems to be significantly impacted by bariatric surgery. Complete remission of type 2 diabetes with long-term maintenance of blood sugar control occurs in approximately 78% of bariatric patients and clinically significant improvements in fasting glucose (decline to within 100–125 mg/dL) and reductions in diabetes medication occurs in about 87% of bariatric patients (Buchwald et al., 2004; Buchwald et al., 2009). While all surgical options have the potential to improve fasting glucose and insulin sensitivity in type 2 diabetics, the procedures that are both energy restrictive and malabsorptive in nature generally have

higher success rates (Buchwald et al., 2004; Buchwald et al., 2009; Lima et al., 2010). A review by Buchwald et al. showed type 2 diabetes remission was most likely for biliopancreatic diversion with duodenal switch patients (average rate = 98.9%, 95% CI [96.8, 100%]) and in descending order thereafter; gastric bypass (average = 83.7%, 95% CI [77.3, 90.1%]), gastropasty (average = 71.6%, 95% CI [55.1, 88.2%]), gastric banding (average = 47.9%, 95% CI [29.1, 66.7%]; Buchwald et al., 2004). Remission rates with sleeve gastrectomy have been reported as anywhere from 50% (Li et al., 2013) to 66.2% (Gill, Birch, Shi, Sharma, & Karmali, 2010) at 1 year postsurgery, making the sleeve gastrectomy nearly as successful as gastric bypass surgery. Similarly, Kashyap and colleagues compared the effects of sleeve gastrectomy and adjustable gastric banding to Roux-en-Y gastric bypass surgery. They discovered that despite the fact that the gastric bypass patients were more insulin resistant ( $p \leq 0.05$ ) than the other patients prior to surgery (determined by HOMA-IR index), gastric bypass resulted in greater improvements in insulin sensitivity at 4 weeks postsurgery (measured by hyperglycemic clamp) than either sleeve gastrectomy or gastric banding (Kashyap et al., 2009). Roux-en-Y gastric bypass surgery also resulted in normalization of fasting plasma glucose by week 4 (baseline glucose =  $139 \pm 13 \text{ mg} \cdot \text{dl}^{-1}$ , 4 weeks post =  $95 \pm 3 \text{ mg} \cdot \text{dl}^{-1}$ ), where the alternate surgeries did not allow for normalization of fasting plasma glucose (baseline =  $143 \pm 21 \text{ mg} \cdot \text{dl}^{-1}$ , 4 weeks post =  $121 \pm 11 \text{ mg} \cdot \text{dl}^{-1}$ ; Kashyap et al., 2009).

Data show that remission of diabetes as a result of bariatric surgery may occur quickly (within days) and without substantial weight loss when restrictive and malabsorptive surgical procedures such as Roux-en-Y gastric bypass are performed (Pories et al., 1995). Wickremesekera and colleagues (2005) reported that type 2 diabetes

may be remitted in as little as 6 days postsurgery and that the remittance is not related to surgically induced weight loss, as weight loss happens along a longer time course. Their study included 31 type 2 diabetics, 11 individuals with impaired fasting glucose and 29 individuals with normal glucose tolerance who underwent Roux-en-Y gastric bypass surgery. At 6 days postsurgery, all tested participants (approximately half of the cohort) showed loss of insulin resistance (HOMA measurements), including those who originally presented as having normal fasting glucose. Wickremesekera suggests that based on the opposing time courses of type 2 diabetes remission and weight loss, obesity may in fact be a result of insulin resistance and not the other way around (Wickremesekera, Miller, Naotunne, Knowles, & Stubbs, 2005).

Glycemic control also appears to be sustainable for years after gastric bypass surgery. Adams and colleagues followed a cohort of 1,156 severely obese ( $\text{BMI} \geq 35$ ), type 2 diabetics (surgical patients = 418, controls = 738) for 6 years and found that at year 6, gastric bypass patients had a remission rate of 62% (Adams et al., 2012). Before surgery, 49% of participants had fasting glucose  $\geq 100 \text{ mg}\cdot\text{dl}^{-1}$ ; however, this number fell to 7% by year 1 and was at 11% by year 6. Surgical patients showed an average decrease in their fasting glucose levels of  $19.5\text{--}23.7 \text{ mg}\cdot\text{dl}^{-1}$  compared to their presurgical values (Adams et al., 2012).

A considerable body of research literature supports the use of bariatric surgery to decrease excess body weight and influence several of the comorbidities associated with obesity. The largest reductions in body weight seem to be associated with procedures that are both restrictive as well as malabsorptive, such as Roux-en-Y gastric bypass and these same procedures seem to also be associated with significant reduction in cardiovascular-

related morbidity as well as the remission of type 2 diabetes. Not all patients, however, experience the same magnitude of weight loss or health outcomes from bariatric surgery, prompting interest in determining explanations for outcome variability (Adams et al., 2012; Warburton, Nicol, & Bredin, 2006).

### Bariatric Surgery and Medical Spending

Bariatric surgery does significantly decrease excess body weight and impact some of the comorbidities of obesity, but the procedures are costly, thus prompting interest in examination of the cost-effectiveness of bariatric surgery. The literature regarding the cost-effectiveness of bariatric surgery is complex and presented in many ways including: direct comparison of presurgical and postsurgical monies spent, longitudinal investigations of money spent over years, and estimates of incremental cost-effectiveness ratios (ICER) based on cross-sectional data.

A large body of research supports the notion that bariatric surgery will save insurance companies and patients money by reducing prescription drug needs, physician visit costs, and hospital costs due to reduced severity of conditions such as type 2 diabetes, coronary artery disease, hypertension, and sleep apnea (Crémieux et al., 2008). Several studies have independently demonstrated that bariatric surgery can pay for itself within 2–5 years (Crémieux et al., 2008; Finkelstein & Brown, 2005, 2008; Sampalis et al., 2004). Finkelstein used a multivariate regression analysis approach to determine the number of years to a breakeven point, or number of years it takes for bariatric surgery to become a money saving procedure (Finkelstein & Brown, 2005). Finkelstein concluded that when national data regarding healthcare costs and work days missed for obese

individuals were considered, it would take approximately 5 years for bariatric surgery to save money. Sampalis and colleagues compared two age-, sex-, and BMI-matched cohorts of obese Canadian citizens, half of whom underwent bariatric surgery and half that served as controls (Sampalis et al., 2004). They found that at 1-year postsurgery the surgical group had spent far more money on healthcare than the control group (surgical = \$12,461,938 Canadian; control = \$3,609,680 Canadian). By year 5, however, cumulative spending was reduced for the surgical group, suggesting that the group had already “broken even” and was now saving money (surgical = \$19,516,667 Canadian; control = \$25,264,608 Canadian). Finally, Crémieux and colleagues tracked bariatric surgical patients and their matched controls ( $n = 3,651$  patients) for 5 years postsurgery in order to assess the return on investment gained from bariatric surgery (Crémieux et al., 2008). In as little as 13 months following surgery, patients who underwent bariatric surgery procedures were saving an average of \$900 per month in medical spending when compared to nonsurgical counterparts. Further, Crémieux reports that costs associated with surgical procedures are recouped in 25 months (95% CI [16, 34] months).

Researchers have also examined the cost-effectiveness of bariatric surgical procedures by determining if the calculated incremental cost-effectiveness ratio (ICER) is within a reasonable range. The ICER is not a calculation to predict if a procedure is going to save money; instead, it is useful in comparing a treatment to an alternative one, or the expense of no treatment at all. Interpretation of ICER is commonly done in one of two ways. The first method involves calculating a monetary value per quality adjusted life year (QALY) and subjectively deciding if the money spent per QALY is agreeable. Quality adjusted life years account for increased life span and increased life quality

attributed to a treatment's potential to reduce disease burden. The second method of ICER interpretation involves constructing a cost-effectiveness acceptability curve, where the x-axis displays a range of "willingness-to-pay" values and y-axis displays a value that describes the probability that the treatment will be effective at the given ICER (Weintraub & Cohen, 2009). When attempting to cure type 2 diabetes is the focus, the greater the amount of money being spent, the greater the chances that the associated treatment(s) will be effective (see Figure 1; Ikramuddin, Klingman, Swan, & Minshall, 2009).

While either method of ICER interpretation is somewhat subjective, research supports that the ICER for bariatric surgical procedures is within a reasonable limit of \$25,000–\$60,000 per QALY (Campbell et al., 2010; Craig & Tseng, 2002; Ikramuddin et al., 2009; Salem, Devlin, Sullivan, & Flum, 2008). Salem and colleagues found that the ICER for gastric banding (men = \$11,604 per QALY and women = \$8,878 per QALY) was somewhat less than that for Roux-en-Y gastric bypass surgery (men = \$18,543 per QALY and women = \$14,680 per QALY), owing to the lower mortality rate and lesser operative cost of gastric banding (Salem et al., 2008). In a similar investigation, Campbell and colleagues evaluated the ICER for individuals with varying degrees of obesity ( $\text{BMI} = 35\text{--}39.9 \text{ kg/m}^2$ ,  $\text{BMI} = 40\text{--}49.9 \text{ kg/m}^2$ , and  $\text{BMI} \geq 50 \text{ kg/m}^2$ ) and also found that ICER was within a reasonable limit ( $< 25,000$  per QALY) for both gastric banding and Roux-en-Y gastric bypass when the treatments were compared to no treatment (Campbell et al., 2010).

The ICER appears to increase, but remains within a reasonable limit, when the goal of bariatric surgery is to treat both obesity and type 2 diabetes. Ikramuddin studied

the cost-effectiveness of Roux-en-Y gastric bypass as a treatment for type 2 diabetes and found that the direct lifetime medical costs associated with the surgery were higher than the standard treatment of medication and lifestyle (gastric bypass = \$83,482 per patient, standard treatment = \$63,722 per patient; Ikramuddin et al., 2009). Despite the apparent differences in direct medical costs associated with Roux-en-Y gastric bypass versus standard treatment, the ICER for gastric bypass was \$21,973 per QALY, which is still within an acceptable limit.

Contrary to researchers contending that bariatric surgery will save money, others have concluded that postsurgical health care costs are greater than presurgical costs for longer than previously reported. Bleich found that medical spending was higher at 1 and 6 years after surgery compared to presurgical spending for type 2 diabetics who underwent bariatric surgery (presurgery: \$9,326 per year; 1 year: \$13,400 per year; 6 years: \$13,664 per year; Bleich et al., 2012). Bleich attributes the prolonged increase in medical spending to postsurgical complications. However, she also notes that only 8% of the initial 7,806 participants provided follow up information at 6 years postsurgery, perhaps biasing the outcome and points out that future reduction (past the 6-year mark) in medical spending are possible. Finkelstein and Brown (2005) suggest that the expected “breakeven point,” or time point at which bariatric surgery has paid for itself and has begun to elicit savings, may happen between 8 and 17 years postsurgery, much later than previous reports. Furthermore, Finkelstein and Brown (2008) suggest that postsurgical costs may include expenses directly related to the procedure itself (adverse reactions and complications in response to the surgery) or indirectly related expenses such as: removal of excess skin due to the massive weight loss, hip and knee surgeries because of obesity

related damage, or damage resultant from increased postsurgical activity. Regardless of when cost-effectiveness occurs, both authors agree that the less monetarily impactful benefits of bariatric surgery such as improved quality of life, improved mobility and elimination of weight-related comorbidities are still of great importance and difficult to include in the more objective calculations.

Controversies in the bariatric surgery economic assessment literature may reflect the fact that there is large variability in surgical success for individual patients (Benoit, Hunter, Francis, & Cruz-Munoz, 2014). In a study to examine the variability in bariatric surgical outcomes, Benoit and colleagues (2014) developed regression equations using upwards of 12 predictors obtained from patient medical records. Regression models were able to explain 37 to 55% of variability in percentage of BMI lost and 52 to 65% of variability in absolute weight loss (Benoit et al., 2014). Researchers concluded that the explained variability was primarily a function of the type of surgery (44.8%), with Roux-en-Y gastric bypass and sleeve gastrectomy surgeries producing greater weight loss than adjustable gastric banding. The only other contributing factor that approached significance was body weight prior to surgery. The unexplained variability was determined to be approximately 34.2%, a substantial amount that warrants further investigation.

While there is support for bariatric surgery as a strategy for helping to treat obesity and the costs associated with its comorbidities, the variability in surgical outcomes, both short-term and long-term, will continue to stimulate more research. Although Benoit and colleagues were one of the first groups to attempt to explain postsurgical variability in a large cohort, they did not attempt to identify what might be

accounting for the 34.2% of unidentified variability in bariatric surgical outcomes.

## **Physical Activity**

### Physical Activity, Body Weight, and Weight Loss Maintenance

There is considerable literature supporting positive relationships between physical activity and normal body weight. Observational studies and analyses of the National Health and Nutrition Examination Survey (NHANES) data and other large datasets have allowed researchers the opportunity to observe the physical activity habits of Americans and look for correlations in the data to understand connections between physical activity (volume and intensity), and body weight. Tudor-Locke and colleagues analyzed the 2005–2006 NHANES data for both volume and intensity of physical activity in normal weight, overweight, and obese adult Americans (Tudor-Locke, Brashear, Johnson, & Katzmarzyk, 2010). Volume of physical activity was measured as steps per day and activity counts per day, while intensity was measured as activity counts per minute. Two-thousand twenty (2,020) activity counts per minute is considered the threshold for moderate intensity physical activity and anything over 5,999 activity counts per minute is considered vigorous physical activity. Tudor-Locke found that normal weight individuals (BMI 18.5–25 kg/m<sup>2</sup>) took  $7,190 \pm 157$  steps/day (data presented as mean  $\pm$  SE) and spent  $25.7 \pm 0.9$  min/day in moderate physical activity and  $7.3 \pm 0.4$  min/day in vigorous activity. Comparatively, obese individuals (BMI  $\geq 30$  kg/m<sup>2</sup>) took  $5,784 \pm 124$  steps/day and spent  $17.3 \pm 0.7$  min/day in moderate physical activity and  $3.2 \pm 0.4$  min/day in vigorous physical activity (Tudor-Locke et al., 2010).

In 2001, Tudor-Locke recruited 109 individuals (age =  $44.9 \pm 15.8$  years, BMI =

$26.9 \pm 51 \text{ kg/m}^2$ , body fat percentage =  $29.1 \pm 8.3\%$ ) to examine the relationship between volume of physical activity (steps/day as measured with pedometers), BMI and body fat percentage. She reported that there was a significant inverse relationship between steps per day and BMI ( $r = -0.30$ ,  $p \leq 0.05$ ) and steps per day and body fat percentage ( $r = -0.27$ ,  $p \leq 0.05$ ; Tudor-Locke et al., 2001). On average, 57% of individuals who walked more than 9,000 steps per day had normal BMI and 30% of individuals who walked less than 5,000 steps per day had a normal BMI. When steps per day were divided into tertiles (high, medium, and low activity) data showed that 41% of individuals in the lowest physical activity tertile were obese, 22% of people in the medium activity tertile were obese, and only 11% of individuals in the highest active tertile were obese (Tudor-Locke et al., 2001).

There is some research literature in support of physical activity as a strategy for losing small amounts of weight, when done in combination with other lifestyle modifications (Jakicic, Wing, & Winters-Hart, 2002; Slentz et al., 2004; Swift et al., 2012). Jakicic and colleagues (2002) completed an 18-month weight loss intervention with 104 women (age:  $37.4 \pm 5.3$  years, weight:  $88.9 \pm 10.7 \text{ kg}$  and BMI:  $32.4 \pm 3.8 \text{ kg/m}^2$ ), during which calories were reduced to 1200–1500 per day and exercise was gradually increased from 100 to 200 min per week. Upon examination of the Paffenbarger physical activity questionnaire (Paffenbarger, Hyde, Wing, & Hsieh, 1986), there was a positive correlation ( $r = 0.33$ ) between amount of weight lost and increases in reported physical activity. Resultant weight loss was modest and highly variable, however ( $-7.8 \pm 7.5 \text{ kg}$ ; Jakicic, et al., 2002). Swift and colleagues (2012) performed a similar intervention with 325 women, but employed three levels of exercise (4, 8 or 12

kcal/kg of exercise per week) and monitored physical activity with pedometers over the 6-month study period. Findings showed that body weight was reduced in all groups, but high levels of physical activity outside of exercise training was only effective at improving weight loss in the 4 kcal/week exercise training group (Swift et al., 2012). Swift and colleagues (2012) did not report the absolute amount of weight lost for any group. However, they described the weight loss in all groups as modest and concluded that even individuals who were in the highest tertile of habitual physical activity (achieving  $7,358 \pm 1,000$  steps per day) outside of aerobic training experienced little additional weight loss benefit compared to the lowest tertile ( $3,609 \pm 630$  steps per day).

Overall, it appears that in the absence of structured exercise, as many as 19,000 steps per day, in conjunction with a restricted diet of 1,000–1,600 kcal/day may be necessary to induce even moderate losses of body weight (Yamanouchi et al., 1995). Yamanouchi et al. (1995) monitored two groups of type 2 diabetic women for 6–8 weeks in a hospital setting, with the goal of remitting type 2 diabetes via caloric restriction, increases in physical activity and weight loss. The groups were either diet restricted or diet restricted plus physical activity of at least 10,000 steps per day. The diet only group averaged  $4,500 \pm 900$  steps per day and the diet plus physical activity group averaged  $19,200 \pm 2,100$  steps per day. At the end of the study, average weight loss was significantly different between the groups (diet only lost 4.2 kg, diet plus physical activity lost 7.8 kg), however, the level of physical activity achieved in this study may not fit into the daily lives of average Americans (Wadden, Webb, Moran, & Bailer, 2012; Wing, 1999). According to Marshall et al. (2009), it takes approximately 30 min to achieve 3,000 steps at a brisk walking pace; therefore, it would take approximately 6.3 hr

to achieve 19,000 steps (Marshall et al., 2009).

When it comes to the maintenance of weight loss, the role of physical activity becomes more evident and the amount of physical activity, more feasible (Hill & Wyatt, 2005; Wing, 1999; Wing & Hill, 2001). Wing and colleagues examined data from the National Weight Control Registry and found that only 9% of individuals who were able to maintain their weight loss did so without any changes to their physical activity (Wing & Hill, 2001). Reported weekly caloric expenditure due to exercise and/or physical activity was 2,545 kcal/week for women and 3,293 kcal/week for men, equating to roughly 1 hr of moderate intensity activity each day. Registry members report the type of activity they do: 49% report using a combination of walking and structured exercise, 24% of men and 20% of women lift weights, 28% report only walking, and 14% report only partaking in structured exercise (Wing & Hill, 2001). It appears that walking, exercising or doing a combination of both are all viable ways to maintain weight loss.

### Physical Activity and Health

Individuals who are more physically active, irrespective of body weight or BMI, tend to be healthier than people who have low levels of physical activity (Warburton et al., 2006). Regular physical activity, structured exercise, and reductions in sedentary time can improve whole body and liver insulin sensitivity (Tamura et al., 2005), reduce HbA<sub>1c</sub> (Zanuso, Jimenez, Pugliese, Corigliano, & Balducci, 2010), attenuate chronic low-grade inflammation (Kadoglou et al., 2007; Pedersen, 2006), reduce the likelihood of developing metabolic syndrome (Ford, Kohl, Mokdad, & Ajani, 2005), and overall positively influence fuel uptake, utilization, and turnover (Sigal, Kenny, Wasserman, &

Castaneda-Sceppa, 2004). Longitudinal investigations suggest that small amounts (as little as 20 min per day) of daily moderate to vigorous physical activity (MVPA) may improve insulin sensitivity without extreme changes in body weight (Alderete et al., 2012).

An extensive review by Warburton and colleagues discussed the impact of physical activity on health and reported a linear relationship between increasing volumes of physical activity and positive health status (Warburton et al., 2006). Warburton described the role of physical activity in primary and secondary prevention of many disease states including: cardiovascular disease, diabetes, cancer, and osteoporosis (Warburton et al., 2006). Being active or fit has been associated with greater than a 50% reduction in risk of cardiovascular disease-related death (Myers et al., 2004). Being physically inactive and engaging in less than 1 hr of exercise per week is responsible for a doubling of cardiovascular-related risk of death (Hu et al., 2004). Further, expending at least 2,200 kcal per week by way of physical activity has been shown to reduce arterial plaque in individuals with heart disease (Franklin, Swain, & Shephard, 2003). Men and women who complete daily physical activity of a moderate intensity also have reduced relative risk of certain types of cancer; 30–40% reduction of relative risk for colon cancer in men and women and a 20–30% reduction of relative risk of breast cancer in women (Lee, 2003).

Alderete and colleagues conducted a study during which 66 overweight (BMI Percentile =  $97.1 \pm 3$ ) adolescents (age =  $15.6 \pm 1.1$  years) were monitored before and after a physical activity and nutrition intervention, to determine if increases in MVPA over a 16-week period would coincide with health and body composition outcomes

(Alderete et al., 2012). Researchers found that 62% of their participants increased their weekly min of MVPA, while the remaining 38% decreased MVPA (participants who increased their weekly MVPA by  $> 0$  min were considered increasers, and those who decreased activity by  $> 0$  min were considered decreasers). On average, increasers added  $19.7 \pm 16.5$  min of MVPA to their daily activity, while decreasers reduced their MVPA by  $10.7 \pm 10.1$  min per day. Despite the large variability within both groups, statistically, and clinically relevant reductions in hepatic fat fraction (%) and plasma leptin were found, with increasers showing greater reductions in both. Upon comparison of participants who increased their daily MVPA by at least 20 min per day ( $n \approx 14$ ) and the pool of decreasers, differences in metabolic parameter improvements became more evident. Those who increased their MVPA by 20+ min per day had significant improvements in insulin sensitivity (measured by HOMA-IR), fasting insulin, body fat percentage and greater hepatic fat reductions, thus emphasizing the impact that as little as 20 min of MVPA per day can have upon metabolic health.

Chan and colleagues also completed an intervention study, but did so with 106 sedentary adult office workers. The study involved an intervention designed to change the volume of physical activity (steps per day) of the study participants over a 12-week period. Several health variables were assessed (Chan, Ryan, & Tudor-Locke, 2004). Prior to the intervention, the workers were taking an average of  $7,029 \pm 3,100$  steps per day, and by the fourth week of the intervention they were up to an average of  $10,480 \pm 3,224$  steps per day, where they remained for the final 8 weeks of the study. Upon completion of the study, there were significant reductions in BMI, resting heart rate and waist girth; however, there was not a reduction in blood pressure. This study agrees with many other

research findings, highlighting how modest increases in physical activity may elicit clinically relevant changes in risk factors.

### Lifestyle Weight Loss Versus Surgical Weight Loss

When individuals who have lost weight through nonsurgical means are compared to bariatric surgical patients, interesting relationships can be seen between methods of weight maintenance and resulting health changes. The National Weight Control Registry (NWCR) offers the unique opportunity to compare individuals who have lost weight because of surgery to those who have lost similar amounts of weight by nonsurgical means. Bond and colleagues compared two matched NWCR cohorts (surgical weight loss participants and nonsurgical weight loss participants) who reportedly lost an average of 56 kg and have kept off  $\geq 13.6$  kg for 5.5–7.1 years (Bond et al., 2008). Their findings suggest that when weight loss outcomes are equal, individuals who lose weight without surgery report significantly greater levels of daily physical activity ( $p = 0.001$ ), fewer fast food meals per week ( $p = 0.002$ ), greater dietary restraint ( $p = 0.001$ ) and lower levels of depression ( $p = 0.015$ ) and stress ( $p = 0.015$ ). A significantly larger percentage of nonsurgical participants reported expending  $\geq 2000$  kcal/week via physical activity (nonsurgical = 62%, surgical = 33%).

Since admission to the NWCR requires that at least 20 kg of weight loss be maintained for 2 years, there are also data supporting that weight lost through nonsurgical interventions can be maintained as well as surgery-induced weight loss (Wing & Hill, 2014). It also appears that individuals who lose substantial weight without surgery tend to be more physically active, have a higher quality diet and enjoy increased psychological

wellbeing and improved mental health (Bize, Johnson, & Plotnikoff, 2007; Bond et al., 2008; Brown et al., 2003).

In summary, both increasing volume and/or intensity of daily physical activity appears to offer health benefits, even if there are not extreme changes in body weight or BMI. Physical activity, particularly moderate to vigorous physical activity in even low doses (20 min per day), can improve health markers such as insulin sensitivity and hepatic fat storage while reducing the risk of cancer and the risk of cardiovascular-related mortality. In more sizeable doses (60 min per day), physical activity is an important component to the maintenance of weight loss and the prevention of weight regain. When individuals who have lost the same amount of weight employing surgical versus nonsurgical interventions, the people who have lost weight using nonsurgical interventions enjoyed greater mental health and psychological wellbeing benefits beyond those who lost weight by having bariatric surgery. For bariatric surgical patients, increasing physical activity after surgery may help with long-term postsurgical outcomes, including wellbeing and the maintenance of weight loss.

### **Physical Activity Patterns**

#### Physical Activity Patterns of U.S. Adults

Physical activity is often reported in terms of total volume per day (steps per day). When the metric is steps per day, <5,000 steps per day is considered “sedentary”, 5,000–7,500 is “low active,” 7,500–9,999 is “somewhat active” and likely includes some vigorous activity,  $\geq 10,000$  steps per day is “active” and  $> 12,500$  steps per day is “highly active.” Tudor-Locke reported that 6,000–7,000 steps per day is the “usual activity” of

American adults, and that briskly walking for 30 min will result in 3,000–4,000 steps depending on the age and sex of the individual (Tudor-Locke & Bassett, 2004). In a report of the 2005–2006 NHANES data, 36.1% of Americans were sedentary, 47.6% were low to somewhat active and 16.3% were active to highly active (Sisson, Camhi, Tudor-Locke, Johnson, & Katzmarzyk, 2012). Further, having a higher BMI, being female, currently smoking, or having a household income of < \$25,000 per year were all associated with an increased odds of being physically inactive (Sisson et al., 2012).

Physical activity intensity, rather than volume, is objectively measured by utilizing accelerometer-derived activity counts in a prescribed period, with counts greater than 2,020 activity counts per minute being the threshold for moderate intensity physical activity and anything over 5,999 activity counts per minute being considered vigorous physical activity. Under these definitions, the average American adult spends 56.8% of the day in sedentary behavior, 23.7% in low activity, 16.7% in light activity, 2.6% in moderate activity and 0.2% in vigorous activity and as few as 3.2% of U.S. adults are getting the recommended amount of physical activity (Tudor-Locke et al., 2010). There appear to be significant negative trends in physical activity when individuals in different BMI categories are compared, with decreases in steps per day and time spent in moderate and vigorous activity being associated with increased BMI. Normal weight individuals attain 7,190 steps per day, spend 25.7 min per day in moderate activity and 7.3 min per day in vigorous activity. Comparatively, overweight individuals take an average of 6,879 steps per day and spend 25.3 min in moderate activity and 5.3 min of vigorous activity and obese individuals take an average of 5,784 steps per day and spend 17.3 min in moderate activity and 3.2 min in vigorous activity (Tudor-Locke et al., 2010).

Recently, scientists have begun measuring walking cadence (steps per minute) to define the physical activity levels of Americans. Walking cadence (compared to activity counts per minute) is a practical way to monitor and report physical activity because the metric is easily understood by the public. One hundred steps per minute is a walking cadence that has been universally accepted as the cut point for moderate intensity physical activity for men, women, and individuals of various ages (Harrington et al., 2012; Tudor-Locke et al., 2005). While variability in the walking cadence associated with moderate intensity does exist among individuals, primarily due to differences in lower limb lengths and age (Beets, Agiovlasitis, Fahs, Ranadive, & Fernhall, 2010; Rowe et al., 2011), the bulk of literature that measures cadence relies on 100 steps per minute to define MVPA.

Walking cadence has also been used to categorize movement into the following cadence bands (Tudor-Locke et al., 2011): 0 = no movement; 1–19 = incidental movement; 20–39 = sporadic movement; 40–59 = purposeful steps; 60–79 = slow walking; 80–99 = medium walking; 100–119 = brisk walking; and 120+ = faster locomotion (Tudor-Locke et al., 2011).

Walking cadence research has revealed some interesting patterns for Americans. On average, U.S. adults spend only 6.5 min per day in MVPA. Other specific cadence band statistics include: 0 steps/min = 289 min/day or 34% of waking hours; 1–19 steps per minute = 383 min/day or 46%; 20–39 = 102 min/day or 12%; 40–59 = 39 min/day or 5%; 60–79 = 16 min/day or 2%; 80–99: 7.5 min/day or 1%; 100–119 = 5 min/day or 0.5%; and 120+ = 1.5 min/day or 0.2% (Tudor-Locke et al., 2011). It appears that with advancing age, time spent in each of the cadence bands decreases, however, time spent in

0 movement increases with age (Tudor-Locke et al., 2011).

Walking cadence data have also been used to describe the typical walking speeds of Americans, with the average fastest 1-min of the day and the average fastest 30-min of the day being two common metrics (Tudor-Locke et al., 2012). Tudor-Locke and colleagues examined the 2005–2006 NHANES accelerometry data from 3,522 American adults over the age of 20 (Tudor-Locke et al., 2012) and found that on average, the fastest 30 min of walking per day was significantly faster for men (95% CI [71.9, 75.5] steps/min) than women (95% CI [67.7, 71.4] steps/min). However, no significant differences exist for the fastest 1 min of the day between men and women (average = 100.7 steps/min). Significant trends exist for age, BMI and steps per day defined physical activity levels ( $p < 0.05$ ). The average 30-min and 1-min walking cadences of individuals 20–29 years of age are (30 min = 76.8 steps/min, 1 min = 106.6 steps/min) compared to 70+ years of age (30 min = 52.6 steps/min, 1 min = 81.5 steps/min). The average 30-min walking cadences by BMI: normal = 76 steps/min, overweight = 73.4 steps/min, obesity class I = 69.4 steps/min, obesity class II = 64.8 steps/min, obesity class III = 57.3 steps/min, highlighting the negative relationship between BMI and walking cadence. Finally, the average 30-min walking cadences by step per day defined physical activity levels are: basal activity ( $<2,500$ ) = 38.5 steps/min, limited activity (2,500–4,999) = 60.8 steps/min, low active (5,000–7,499) = 74.9 steps/min, somewhat active (7,500–9,999) = 84.5 steps/min, active (10,000–12,499) = 90.2 steps/min, highly active (12,500+) = 93.1 steps/min. While Tudor-Locke and colleagues were not able to report on factors that may limit physical activity (orthopedic injury for example), their large sample size ( $n = 3,522$ ) was a strength of the research and it can be said with reasonable certainty that individuals

who are obese tend to have lower 30- and 1-min walking cadences.

The literature describing the physical activity patterns of U.S. adults provides a foundation for understanding the differences in adults of various ages, physical activity levels, fitness levels, and BMI classifications. Due to the abundance of literature on U.S. adults, it is possible to make comparisons between typical physical activity patterns in the United States with smaller, more specific populations within the United States that are not accounted for in the general population. One group of adults whose physical activity patterns have not been well studied is the group of individuals who are seeking or who have had bariatric surgery.

#### Physical Activity Patterns of Bariatric Surgical Patients

Initial research, using self-reported physical activity measures, indicated that in general, bariatric surgery patients significantly increase physical activity after surgery (Boan et al., 2004; Bond et al., 2009). Boan and colleagues reported that at 6 months postsurgery, bariatric patients had reduced their BMI significantly from 52.9 to 38.9 kg/m<sup>2</sup> and significantly increased physical activity and reduced sedentary behavior as measured by the Baseline Questionnaire of Activity (BQA). Specifically, Boan used eight questions from the BQA and asked respondents for information such as: how active they are compared to their peers, the number of city blocks walked per day, the number of flights of stairs walked per day, and how often they partake in exercise or brisk walking. At 6 months postsurgery, bariatric patients reported to have increased their physical activity in relation to peers (friends, acquaintances, and relatives that they spend time with), increased exercise, increased their overall physical activity, and reduced TV time.

Bond and colleagues used the Paffenbarger Physical Activity Questionnaire to calculate daily MVPA (Bond et al., 2009). Participants reported significant increases in physical activity, equating to an average 168 more minutes of MVPA each week.

These studies reporting an increase in postsurgery physical activity used questionnaires or self-reported data to quantify physical activity. An extensive review by Prince and colleagues contends that there is no clear trend in the relationship between self-reported and measured physical activity (Prince et al., 2008). While it is possible that objective physical activity measuring devices may miss certain physical activities, such as arm movement and swimming; subjective self-reports have the potential for perceptual errors to influence the accurate assessment of physical activity. In other words, the perceived difficulty of exercise or physical activity may skew an individual's perception regarding the true intensity of the activity and cause them to overreport involvement in physical activity (they perceive exercise to be more challenging than it is physically).

Researchers who have sought to explore the relationship between self-reported physical activity values and accelerometer physical activity data report that the tendency is for overreporting of physical activity to occur on self-reports. The range for under and overreporting is very large (-78% to 500%), a range that is somewhat skewed towards a tendency to overreport when comparison to accelerometer data is used as the objective standard for physical activity.

In regards to pedometer data, seven of eight reviewed studies reported that participant's self-reported physical activity reflected overreporting. Prince and colleagues (2008) analyzed a subgroup of their studied population and found that obese individuals tend to overreport their physical activity in relation to objective measurements. They

explained that overreporting by individuals with BMI > 25 may be due to “social desirability,” presumably because having a physically active lifestyle is socially desirable. Based upon both pedometer and accelerometry data, it is likely that bariatric patients will overreport physical activity, although there is still a lack of data to substantiate this assumption.

Self-reported physical activity data are an important source of information, but the subjectivity of self-reported data is a limiting factor, prompting several researchers to use objective techniques to examine bariatric patient physical activity patterns. Bond and colleagues (2011) used arm-mounted accelerometers to monitor the amount of time that bariatric surgical candidates spend in sedentary behavior and found that on average, 81% of the day, or  $11.1 \pm 2.4$  hr per day were spent in sedentary behavior (Bond et al., 2011). In comparison, according to 2003–2004 NHANES accelerometry data, the average American, spends 54.9% (7.7 hr per day) of wear time in sedentary behavior (Matthews et al., 2008). While Matthew and colleagues (2008) did not report on the BMI of the 2003–2004 NHANES data set, there were 6,329 individuals surveyed and given the randomization processes employed this cohort probably was not made up entirely of obese individuals. Therefore, it appears that surgical candidates are more sedentary than the average American (80% vs. 55% sedentary time, respectively).

As a population, bariatric surgical candidates vary in their physical activity levels, but a majority are in the sedentary or low activity categories. When 757 bariatric surgical candidates were evaluated as part of the Longitudinal Assessment of Bariatric Surgery study, researchers concluded that 20% were sedentary (<5,000 steps per day), 34% were low activity (5,000–7,999 steps per day), and only 20% of the study participants were

accumulating  $\geq 10,000$  steps per day (Belle et al., 2008). Surgical candidates also appear to have significantly fewer activity counts per hour and spend fewer minutes in MVPA per day than normal weight individuals (minutes MVPA surgical candidates =  $26.4 \pm 23$ , normal weight =  $52.4 \pm 24.7$ ; Bond, Jakicic, Vithiananthan, et al., 2010). Finally, when surgical candidates' physical activity was evaluated compared to matched controls who would otherwise qualify for surgery, but were not actively seeking surgery, there were not differences in physical activity or sedentary behavior profiles (Bond et al., 2012). Thus, obese American adults, whether seeking bariatric surgery or not, appear to be fairly sedentary and accumulate much less MVPA than normal-weight Americans.

The question remains: "Does the objective assessment of the physical activity of bariatric surgery patients increase following surgery?" Bond et al. (2010) objectively measured physical activity and noted that changes in physical activity from presurgery to postbariatric surgery may not be as great as previously reported by studies using self-report. A study of 20 individuals who underwent the laparoscopic adjustable banding procedure found that bariatric surgery patients reported substantial improvements in the amount and intensity of physical activity when assessed via questionnaire (Bond, Jakicic, Vithiananthan, et al., 2010). However, nonsignificant reductions (presurgery average MVPA = 186 min/week, postsurgery average MVPA = 151 min/week) in physical activity were observed when arm-mounted accelerometer data were collected and compared from presurgery to 6 months postsurgery (Bond, Jakicic, Unick, et al., 2010). Researchers hypothesized that participants most likely overreported their physical activity after surgery (Bond, Jakicic, & Unick, et al., 2010).

Two recent studies support the concept that bariatric surgical patients may not

become sufficiently active after surgery. Chapman and colleagues (2013) monitored 40 patients 6–18 months after either sleeve gastrectomy or gastric banding and found that they spent about  $72 \pm 12\%$  of their waking hours in sedentary behavior (Chapman et al., 2013), similar to the results reported by Bond's study (80% of waking hours spent sedentary) of presurgical candidates (Bond et al., 2011). They also found that postsurgery, patients spent no time in vigorous activity and only  $5 \pm 3\%$  of their day in moderate activity, a level much lower than necessary to maintain weight loss. King and colleagues (2012) observed 310 bariatric surgery patients and found that from presurgery to 1 year postsurgery physical activity improved statistically, but not to a practically significant level (King et al., 2012). Twenty-five to twenty-nine percent of the patients studied by King reduced their physical activity after surgery and a large range of changes in steps per day was evident ( $-7,648$  to  $+17,205$  steps per day difference presurgery to postsurgery). King concluded that positive predictors of increased physical activity postsurgery included: greater presurgery levels of physical activity, less physical pain after surgery, not having asthma, and reporting the intention to increase physical activity as a means of weight loss after surgery (King et al., 2012). Perhaps a weakness of King's work was the inclusion of a vast array of bariatric surgical patients, including those who may not be physically able to change their activity levels. Further, King and colleagues evaluated their data using a cut point (80 steps per minute equating to MVPA) that is much different than the accepted 100 steps per minute cut point and has not been validated in the literature.

In general, it appears that bariatric surgical patients have different physical activity patterns compared to normal-weight Americans, both before and after surgery.

Surgical patients tend to spend about 80% of their time in sedentary behavior, and while they report increases in physical activity after surgery, there is not much objective evidence to support that physical activity does in fact increase after surgery. The objective data that exist show large variability in physical activity change, ranging from -7,648 to +17,205 steps per day and the most accepted metrics for categorizing physical activity patterns have not been used by researchers examining the impact of bariatric surgery on physical activity patterns. Therefore, more research is needed to quantify physical activity patterns in the 4–6 weeks following bariatric patients postsurgery.

### **Summary**

While there is substantial literature in support of positive relationships between physical activity, health, and the maintenance of weight loss; there is a paucity of information about the postsurgery physical activity behaviors of bariatric patients. Some early researchers used self-report data to suggest that following surgery, bariatric patients increased their physical activity. The use of objective techniques to assess physical activity postsurgery has lead researchers to suggest that self-report data results in inflated claims of physical activity. Also the few studies that have used objective techniques to quantify presurgery to postsurgery physical activity have monitored physical activity at varying time periods following surgery and have not used physical activity categorization techniques that have been validated. Therefore, our understanding of presurgery to postsurgery physical activity patterns is far from comprehensive and warrants further investigation.

A better understanding of the physical activity patterns adopted by bariatric

surgery patients might provide insights that would be helpful in optimizing bariatric surgery outcomes and explain the variability in postsurgery weight loss and weight maintenance. Historically, approaches to improving surgical outcomes has centered on considering only the type of surgeries that achieve maximal weight losses or reductions in obesity comorbidities. Consequently, there is still 34% of unidentified variability in bariatric surgery outcomes. If we know more about the physical activity patterns adopted after surgery it may become more evident that using postsurgery interventions focused on optimizing physical activity could be used to augment bariatric surgery-induced weight loss as well as the maintenance of surgery-induced weight loss, thus reducing variability in bariatric surgery outcomes. However, before recommendations for postsurgery physical activity interventions are made, more research using objective tools and validated cut points is necessary to quantify the physical activity patterns of bariatric patients both presurgery and postsurgery and further compare potential differences in self-reported physical activity and objectively measured physical activity.

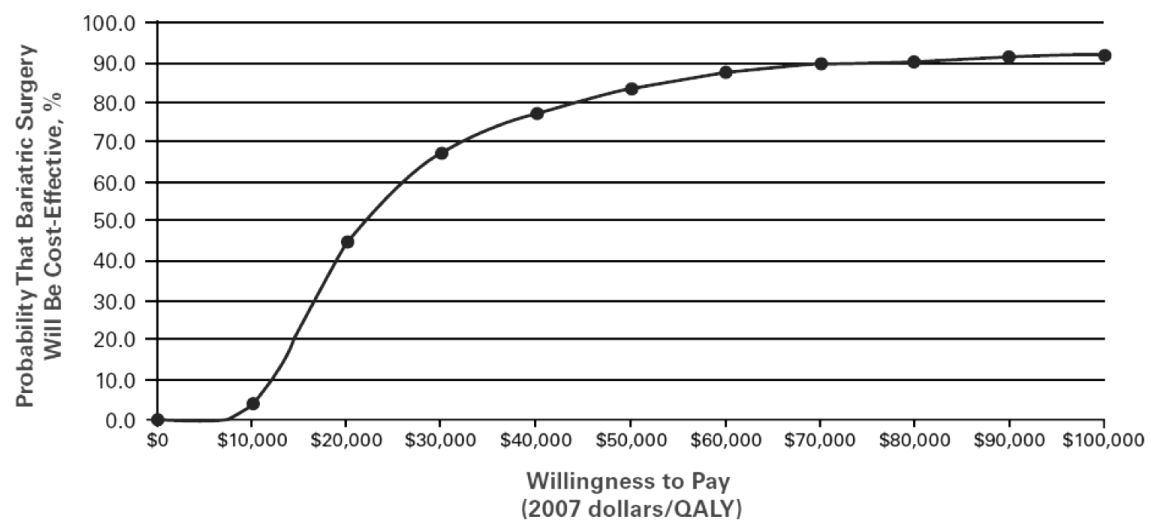


Figure 1. Cost-effectiveness acceptability curve: shows how probable it is that a treatment is going to be cost-effective dependent on the willingness to pay value.

## CHAPTER 3

### METHODS

A description of the recruitment process, study procedures, and instruments is presented in this chapter. This descriptive study was designed to objectively quantify the physical activity behaviors of patients before and after bariatric surgery. The study was also developed to examine support for the validity of the CAPS weekly physical activity questionnaire by comparing self-reported physical activity with pedometer and accelerometer data. Prior to initiating the study, approval from the Institutional Review Board (IRB) at The University of Utah was obtained. All study procedures were administered according to the ethical and legal procedures established by the IRB.

#### **Participants**

Initially, approximately 150 potential participants were approached by the principal investigator during regularly scheduled, presurgical meetings at their respective hospitals. As a result, 35 participants from the Bariatric Medicine Institute and four participants from Rocky Mountain Associated Physicians in Salt Lake City, Utah consented to participate in the study. Both female and male participants were recruited for this study since there is no reason to believe that either gender is more likely to change their physical activity patterns as a result of surgery. Typically more women than

men seek bariatric surgery, with the ratio being approximately 4:1 (Buchwald et al., 2004), therefore, the higher percentage of women (87%) recruited for this study was expected. Other inclusion criteria consisted of BMI  $\geq 35$  and  $< 60$  kg/m<sup>2</sup>, age 21–65 years, and every ethnicity/race. Exclusion criteria included: history of myocardial infarction, stroke, coronary bypass surgery or angioplasty, active cancer, current or unresolved and diagnosed orthopedic injury, or any other known contraindication to regular daily physical activity.

The presurgical meeting was held for all patients scheduled for bariatric surgery in the upcoming weeks. Generally, the principal investigator would address a group of one to eight potential participants at the start of the meeting and begin by asking who would be having either RYGB or sleeve gastrectomy, as these were the two procedures included in the study. Next, an explanation of the research study and expectations for individuals who would like to be involved was given, along with information regarding the location of Peak Health and Fitness (where office visits would take place). Exclusion criteria were discussed with primary emphasis on the ability to perform regular physical activity, as inability to perform regular physical activity was an immediate exclusion criterion. Finally, patient questions were answered, with the most common questions being; “where are you located,” “how does the physical activity monitor work,” “why are you interested in doing this research,” and “will we get our results at the end of the study?”

Approximately 115 potential participants who were approached to become involved in the research study were either ineligible, or elected not to participate in the study. The primary reasons that potential participants were ineligible for the study were

(a) they were having a surgical procedure that was not on the accepted surgery list for the present study; (b) they were unable to participate in regular physical activity due to undiagnosed pain, physical deformity, or known orthopedic injury, or (c) the surgical date was less than 1 week from recruitment, making it impossible to obtain 7 days of physical activity data prior to surgery. Obtaining information regarding why individuals did not want to participate was not done formally. However, during the recruitment process, noted objections were (a) “I do not have time to be in the study,” (b) “I would like to be involved, but live too far away to do an office visit with you,” and (c) “I have enough to worry about with having surgery and cannot accommodate an additional commitment at this time.” Finally, approximately 20% of potential participants gave no reason for abstaining from becoming involved in the present study.

Ultimately, 24 of the original 35 participants who signed informed consent forms completed testing for this study. Eleven were unable to complete testing for a variety of reasons including: inability to wear the accelerometer in their place of work, equipment malfunction, decision to not have surgery, pregnancy before the surgical date, unforeseen family obligations, presurgical time constraints, and postsurgical complications leading to withdrawal from the study. Of the 11 who dropped out of the study, nine removed themselves prior to pretesting, one dropped out after pretesting and one dropped out after surgery. While testing time was minimal, some participants seemed too stressed out to incorporate the testing alongside having surgery, while others were very interested at first, but lost interest once they had returned home after the initial meeting. Height and weight before surgery was recorded for eight lost participants and postsurgical weight was obtained for four lost participants. A Mann-U Whitney analysis was used to assess

body weights from presurgery to postsurgery of lost participants because of the unequal participant pool. Mann-U Whitney analysis revealed that the height, presurgery and 6 weeks postsurgery weights for the lost participants were not significantly different from those who completed the study ( $p > 0.05$ ).

## **Procedures and Instrumentation**

### **Recruitment**

Participants were informed that they would be required to come to Peak Health and Fitness at the University of Utah on two occasions and would be responsible for wearing an activity monitor for 7 consecutive days before and after their surgery. Once participants understood the commitment and were deemed eligible for the study, they were given ample time to read the consent documents and have any questions answered. After participants signed the consent documents, they were given an accelerometer, detailed directions for using the accelerometer (Appendix A), an exercise log (Appendix B), and were given verbal instructions for completing a 3-day dietary record (Appendix C). Dietary records were simple because participants were consuming a physician-ordered presurgical liquid diet before surgery and were consuming a very low calorie diet postsurgery, making tracking very simple. Contact information was exchanged between the participant and the principal investigator, and arrangements were made for the participant to have their pretest meeting at Peak Health and Fitness.

### Pretest

Pretesting occurred  $12 \pm 6$  days before surgery and took approximately 60 min. Participants were greeted at Peak Health and Fitness and their accelerometer, completed 3-day dietary record, and exercise log were collected. The onsite pretesting consisted of a health history questionnaire, the CAPS weekly physical activity questionnaire, as well as measurement of height, weight, waist circumference, hip circumference, and body composition. Testing procedures and sequencing of the procedures can be seen in Figure 2.

### Health, Dietary, and Physical Activity Questionnaires

A health history questionnaire was administered electronically on a password encrypted Apple iPad (Cupertino, CA) and was used to assess general health and obesity-related chronic disease status. Health history data were collected and managed using REDCap electronic data capture tools hosted at Peak Health and Fitness on the University of Utah Campus. The REDCap (Research Electronic Data Capture) is a secure, web-based application designed to support data capture for research studies, providing (a) an intuitive interface for validated data entry; (b) audit trails for tracking data manipulation and export procedures; (c) automated export procedures for seamless data downloads to common statistical packages; and (d) procedures for importing data from external sources (Harris et al., 2009).

A 3-day dietary intake record was used to measure caloric intake and macronutrient composition of the diet during the days the accelerometer was worn. A 3-day dietary record was chosen because it is the minimum number of days necessary to

estimate food energy intake within 10% of true intake (Basiotis, Welsh, Cronin, Kelsay, & Mertz, 1987). In addition, a 3-day dietary record yields approximately 75% agreement between reported and actual dietary intake (Krantzler et al., 1982), without a great deal of participant burden. Participants were instructed to keep a written record of all solid foods and calorie containing liquids that they consumed. Verbal instructions were given to record food and liquids during or immediately after consumption to avoid forgetting. Participants were asked to report the date, time food was eaten, along with the type (using specific brand names whenever possible), quantity, and method of preparation. Food quantity could be reported in any units that the participant was comfortable and familiar with, as the analysis software can accommodate any units of measurement.

Dietary intake records were analyzed by a registered dietician using the ESHA Food Processor database (ESHA Research, Salem, OR; named for its founders Elizabeth Stewart Hands and Associates) version 10.10.2. The ESHA Food Processor database contains the nutritional information on over 50,000 foods, with data obtained from more than 1,700 sources. Dietary records were only analyzed if 3 full days were reported, otherwise, the dietary records were eliminated from analyses. Reporting less than 3 days would not give a valid representation of dietary habits. Twelve participants' presurgery 3-day dietary records and 18 participants' postsurgery 3-day dietary records were analyzed.

During presurgery testing, all participants were on a presurgical liquid diet that was used to reduce the fat deposits in the liver and spur weight loss (Appendix D). Encouragement of presurgical weight loss has become common practice as it may reduce postsurgical healing time and the size and fat content of the liver, making the surgery easier to complete (Lewis et al., 2006; Livhits et al., 2009).

The Cross-Cultural Activity Participation Study (CAPS) typical weekly physical activity survey (Ainsworth, Irwin, Addy, Whitt, & Stolarczyk, 1999) was used to assess the types and amounts of physical activity that each participant did per week (Appendix E). This questionnaire has been validated against doubly-labeled water in postmenopausal women, and was the only questionnaire that did not overestimate measured expenditure in obese participants (Mahabir et al., 2006). The CAPS questionnaire has never been validated against pedometer, accelerometer data, or any other type of objective measurement of physical activity.

### Anthropometrics

Height was measured using a Harpenden anthropometer (Holtain, Ltd, Crymch, United Kingdom) and recorded to the nearest centimeter. Body composition and weight were assessed using air displacement plethysmography (Bod Pod GS Model; COSMED, Rome, Italy) and the associated calibrated electronic scale. In accordance with the Bod Pod recommended body composition measurement instructions, participants were asked to abstain from food or exercise for 3 hr prior to testing. Participants were also instructed to bring form fitting clothing such as a swimsuit (without excess material) or spandex undergarments to wear for the body composition test. Participants were given a swim cap to wear on their head to compress their hair because hair can influence body volume measurement and invalidate results.

The use of air displacement plethysmography for body density assessment in severely obese individuals has been validated against underwater weighing and the resultant values were highly correlated ( $r = 0.94$ ; Ginde et al., 2005). When the two

compartment Siri equation was applied to predict body fat percentage, the resultant values were also highly correlated ( $r = 0.94$ ) and comparison by Bland-Altman plot did not show any bias (Ginde et al., 2005). Air displacement plethysmography also appears to be highly reliable ( $r = 0.99$  and a coefficient of variation = 0.15%) when two measurements were taken 15–30 min apart with a large, heterogeneous sample (Noreen & Lemon, 2006).

Waist and hip measurements are indicators of changes in body size and were used to enhance our understanding of the body size changes participants experience postsurgery. Measurements were taken with a flexible, nonelastic tape measure, while the participant was wearing form fitting clothing. Waist measurements were taken at the level of the iliac crest and hip measurements at the level of the greatest protrusion of the buttocks, according to standardized methods (Harrison et al., 1988). Waist measurement at the natural waistline is difficult in bariatric patients due to abdominal body fat deposition obscuring the waistline. As weight is lost, bariatric patients also experience changes in their body shape, therefore, to account for possible changes in body shape with surgery, both presurgery and postsurgery waist measurements were taken at the level of the iliac crest. Waist and hip measurements were recorded to the nearest centimeter.

### Accelerometry

Actigraph GT3X (Pensacola, FL) triaxial accelerometers were used in the present study. Data collection included 7 contiguous days in order to capture average daily physical activity (Troost, McIver, & Pate, 2005). Participants wore the accelerometer all

waking hours, except while swimming or bathing. Accelerometers were worn on the right hip, where they were secured at the waist by a plastic clip or a waist belt. Monitors were set to collect raw data at 30 Hz in accordance with the recommendations for adults (Trost, et al., 2005). High interinstrument reliability has been shown for Actigraph monitors for total activity counts, steps and time spent in sedentary, light, vigorous, and moderate to vigorous physical activity (MVPA) intensities (McClain, Sisson, & Tudor-Locke, 2007). If participants completed any planned exercise or other strenuous activity (e.g., mowing the lawn, washing their vehicle, or moving heavy boxes at work), they were instructed to log the activities by reporting the date, time of day, and a brief description of the activity to enhance data analysis (Appendix B).

Actigraph data were extracted using ActiLife 6 Data Analysis Software (Pensacola, FL). Raw data files, along with 1-min epoch length data files were extracted and saved on an encrypted computer and encrypted external hard drive. One-minute epochs were chosen because most cut points in the literature are based on 1-min epoch lengths; also, adults do not typically engage in very short bursts of vigorous physical activity as is characteristic of children. An additional rationale for selecting 1-min epochs was to facilitate the comparison of the current data with the work of other researchers who have extensively reported on the physical activity patterns of obese and normal weight Americans (Tudor-Locke, Camhi, & Troiano, 2012).

Data cleaning and screening were done using Microsoft Excel 2010 (Redmond, WA). Determination of beginning and end of daily wear time was done by individually viewing each day of time-stamped data and cutting data before the first recorded movements of the day and after the last recorded movements of the day. Time between

the first and last daily movements was considered wear time and a minimum of 10 hr was used to determine a valid day (Trost et al., 2005). Participants were asked to wear the accelerometer for 7 days; however, a minimum of 3 days was accepted for later analysis. Trost (2005) and Ward et al. (2005) agree that 3–5 days of valid wear time is needed to gain a reliable estimate of daily physical activity in adults.

#### Cross-Cultural Activity Participation Study (CAPS) Weekly Physical Activity Questionnaire

Participants filled out the CAPS questionnaire at their Peak Health and Fitness visit both presurgery and postsurgery. When completing the CAPS questionnaire presurgery and postsurgery, participants were given verbal instructions on how to fill out the questionnaire and could ask questions at any time while they were completing the questionnaire (Appendix C).

The CAPS questionnaire has been used extensively by Adams and colleagues to track the long-term changes in physical activity of bariatric surgical patients (Adams, Angulo, & Lindor, 2005; Adams et al., 2012; Adams et al., 2010). However, Adams and colleagues have not previously published any findings from the CAPS. The validity and reliability of this questionnaire has been reported in a population sample of subjects with an average age of 53 years and BMI of 31 kg/m<sup>2</sup> (LaMonte MJ, 2003).

The CAPS questionnaire includes several low- and moderate-intensity activities of daily living that may be typical in obese individuals, making the questionnaire a potentially attractive tool for using with obese populations. Scoring of this questionnaire provides output that includes a description of physical activity behavior in terms of time

(minutes/day) in specific activity items (i.e., walking, self-care, occupation) or intensity categories (i.e., moderate, vigorous). Using previously published standardized energy costs (Ainsworth et al., 2000), the time and intensity of reported activities can be weighted to yield energy expenditure estimates using CAPS-derived data.

The research of Tudor-Locke et al. (2011) supports the notion that volume and intensity of physical activity are related by showing strong correlations between accelerometer derived steps per day and daily activity counts in light ( $R^2 = 0.69$ ) and moderate physical activity ( $R^2 = 0.63$ ; Tudor-Locke, Johnson, & Katzmarzyk, 2011). Thus, the work of Tudor-Locke et al. (2011) provides support for using the CAPS questionnaire as a self-report tool for the current study.

The CAPS questionnaire was designed and initially used as a tool to quantify the regular weekly or daily amount of MVPA (in MET minutes) for women from many cultures (Ainsworth, et al., 1999) and the unit of analysis for the current study was MET minutes per day of MVPA (MMVPA). Therefore, the use of the CAPS questionnaire seemed appropriate, as the majority of participants in the current study are women (88% of participants).

### Self-Evaluation of Changes in Physical Activity

In addition to the CAPS Questionnaire, which was used to identify specific physical activity behaviors, participants were asked to respond to a subjective question regarding their expected change in physical activity presurgery and their perceived actual physical activity change postsurgery. Presurgery, the question posed was: “Do you feel that your physical activity will change after surgery?” and participants were asked to

circle a number ranging from -3 to +3. The -3 was labeled as “become much less active.” The 0 was labeled as “remain the same” and +3 was labeled as “become much more active”). The numbers -1, -2, +1 and +2 were also visible and were viable choices that represented gradations of positive or negative change, though they were not explicitly labeled. Postsurgery the subjective question posed was: “Do you feel that your physical activity has changed?” The same -3 to +3 scale was used. The subjective question was included as an additional measure of physical activity change to compare to the CAPS Questionnaire. If participants feel that they have changed their physical activity it should be consistent across the subjective questions and the CAPS Questionnaire.

### Posttest

Postsurgical testing was done at  $31 \pm 10$  days postsurgery in order to gain an understanding of patient acute physical activity changes. There is a need for research on physical activity change in this period because type 2 diabetes may be remitted within a few days or weeks postsurgery, a phenomenon that has no conclusive cause. However, physical activity alone can improve glycemic control and insulin sensitivity. In addition, the research regarding postsurgical changes in physical activity remains inconclusive, therefore, more tightly controlled observations of the naturally occurring acute and long-term changes in physical activity postsurgery are needed.

Each participant was contacted 18–21 days postsurgery, to assess their readiness to complete posttesting. They were asked several questions such as: how they were feeling in general, if they were back to work, if their incisions were fully healed, if they were adjusting to their new way of eating, how their energy levels were, and if they felt

well enough to initiate their postsurgical accelerometry testing. Differences in the start time of postsurgical accelerometry reflect the differences in participant healing time. Phone calls and emails were exchanged between the principal investigator and each participant to ensure that posttesting occurred as soon as the participant had returned to their presurgery schedule (work, school, etc.) and reported that they were physically feeling well enough to continue.

In most cases, participants were mailed a preset accelerometer to wear for 7 contiguous days before their postsurgery office visit. Participants were also mailed the accelerometer directions and exercise log. The postsurgery office visit was exactly the same as the presurgery visit. Postsurgical extraction of accelerometer data was also the same.

Once the postsurgical visit had been completed, a results package containing relevant clinical information and advice geared towards increasing physical activity safely was emailed to each participant within a month of study completion (Appendix F).

### Validation of the CAPS

Steps per day and CAPS-derived MMVPA per day were analyzed using accelerometer-derived steps-per-day data from the present study and pedometer-derived steps-per-day data from an archived data set from Dr. Adams's research group on the University of Utah campus. Adams and colleagues have been researching the effects of Roux-en-Y gastric bypass surgery (Adams et al., 2005; Adams et al., 2012; Adams et al., 2010). The archived data set contains pedometer (Yamax Digiwalker SW200, Warminster, PA) data from 167 of the original 1156 participants in a longitudinal trial of

Roux-en-Y bariatric surgical candidates and severely obese controls supported by the National Institutes of Health (NIH). All 1,156 participants in Dr. Adams's longitudinal trial continue to complete the CAPS questionnaire on each follow-up visit, and approximately 10% of them wore a pedometer at the baseline assessment for three consecutive weekdays and one weekend day (Adams, et al., 2005).

Adams and colleagues' pedometer data may very well be the first to objectively examine the physical activity habits of bariatric surgical candidates, and as such, has some inherent problems in regards to methodology. Participants were shown and instructed to wear the pedometer on the either the right or left hip, creating an inconsistency. Research however shows that the Yamax SW-200 and other models of Yamax pedometers that are similarly equipped are able to count daily steps within 1% of the actual value regardless of placement on the left or right side of the body (Schneider, Crouter, & Bassett, 2004). The Yamax SW-200 also has been shown to provide an accurate assessment of physical activity in obese individuals (Schneider et al., 2004).

## **Statistical Analyses**

### Aim One Hypothesis

Bariatric patients will alter in their physical activity patterns. They will significantly increase the amount of time spent (minutes per day and percentage of the day) in walking cadence bands that are of higher intensity and will significantly reduce the amount of time spent in walking cadence bands of lower intensity.

To test the above hypothesis, the intraindividual differences for time spent in eight predefined walking cadence bands were examined. A MANOVA was calculated to

determine if they differed significantly presurgery to postsurgery. The dependent variables were the eight walking cadence bands and the independent variable was time (pre- vs. posttesting). Pearson correlation matrixes for presurgery and postsurgery cadence bands were used to determine the appropriateness of using the MANOVA statistics. Tabachnick and Fidell (Tabachnick & Fidell, 2007, p. 268) suggest that highly negative correlations and moderate correlations in either direction ( $r = 0.60$ ) are most appropriate for the use of MANOVA. Our correlations ranged from highly negative, to highly positive, however, the MANOVA was retained because 18 of 28 correlations were within the range suggested by Tabachnic and Fidell (2007).

#### Aim Two Hypothesis

Significant presurgical to postsurgical increases in the peak 1-min and peak 30-min walking cadences will occur.

To test the above hypothesis, the intraindividual differences for peak walking cadences were determined by conducting separate repeated measures analysis of variances. Bonferroni correction for multiple comparisons were applied to the results (Field, 2009).

#### Aim Three Hypothesis

There will be evidence in support of the CAPS questionnaire as a valid assessment tool for measuring PA.

To examine evidence for the validity of the CAPS questionnaire as a measure of physical activity, two different sets of data were used. Accelerometer data from the

present study and pedometer data from an archived data set from Adams group at the University of Utah were used to assess validity of the CAPS. Pearson Product Moment correlations between pedometer determined steps per day and CAPS-derived MMVPA per day were completed for the archival data. The same analysis was completed between the accelerometer derived steps per day data and the CAPS-derived MMVPA for the presurgery data and postsurgery data separately.

Regression analysis was performed on the Adams archival data set to determine how much variation in steps per day could be explained by CAPS-derived MMVPA. Pedometer and CAPS-derived MMVPA were log transformed prior to regression analysis, as the dataset was not normally distributed.

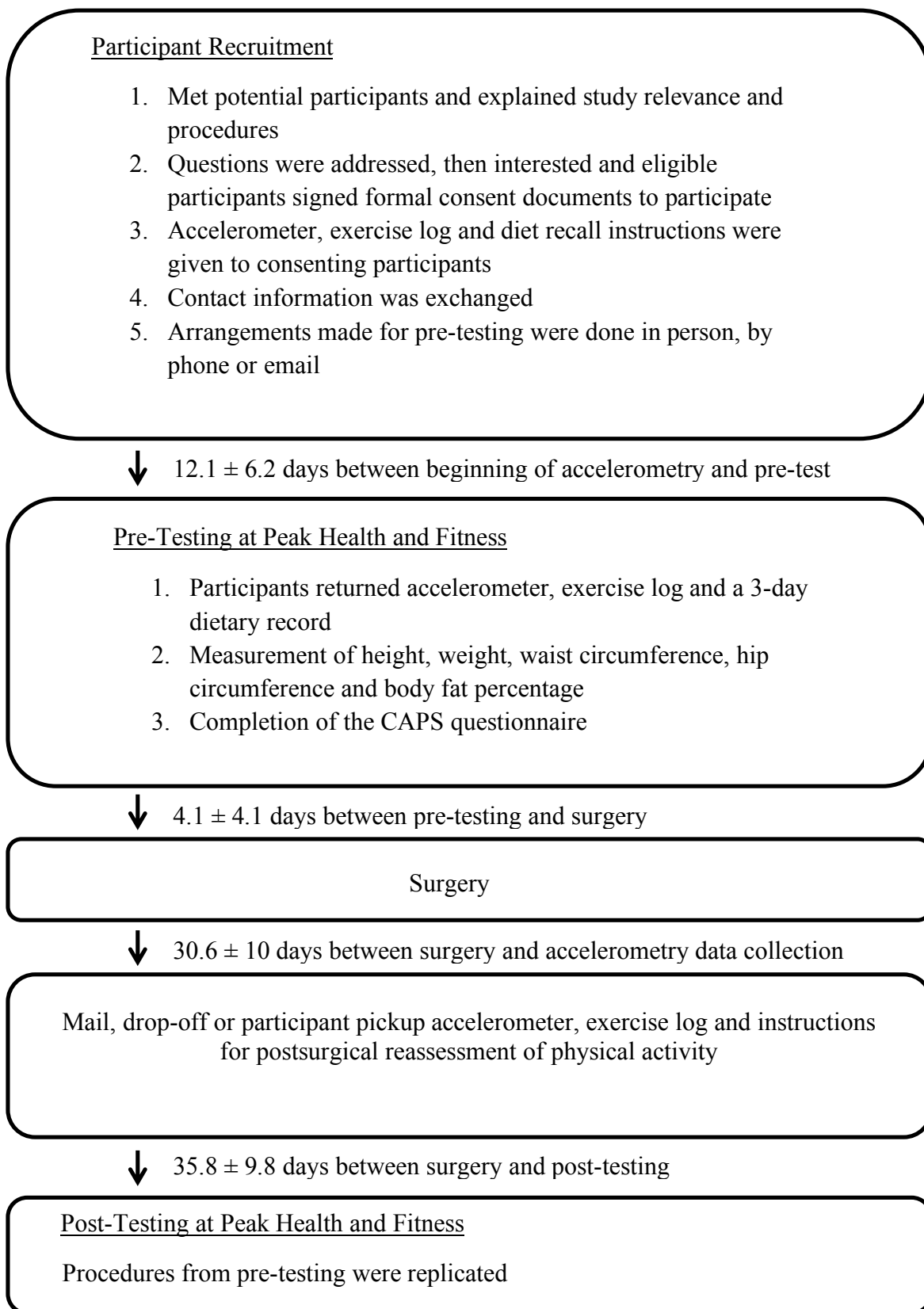


Figure 2. Testing order and times of testing (mean ± SD).

## CHAPTER 4

### RESULTS

The purpose of this chapter is to present all findings from the present study. The order of results are as follows: (a) presentation of descriptive data, (b) examination of changes in participant physical activity patterns using eight walking cadence bands, (c) examination of changes that occurred in participant peak 1- and 30-min walking cadences, and (d) evidence in support of the CAPS physical activity questionnaire as a valid physical activity measurement tool.

#### **Participant Characteristics**

Participant characteristics from presurgery and postsurgery can be seen in Table 1. Twenty-four participants completed testing. On average, participants were  $42.2 \pm 12.6$  years of age, 21 were women, three were men, seven had Roux-en-Y gastric bypass, and 17 had sleeve gastrectomy. Twenty-one participants were Caucasian, one was native Hawaiian/Pacific Islander, one was multiracial, and two were Hispanic. Education varied among the group: three held master's degrees, four bachelor's degrees, three associates degrees, 13 completed some college, and one finished high school.

Repeated measures ANOVA with Bonferroni correction for multiple comparisons (Field, 2009) showed that participants significantly reduced their weight, BMI, and

anthropometric measurements from presurgery to  $31 \pm 10$  days postsurgery (see Table 1). Change values can be seen in Table 2.

All participants wore the accelerometer for at least 3 days, with at least 10 hr per day. Wear time was not significantly different for days or hours from presurgery to postsurgery when compared via paired t-test ( $p < 0.05$ ) and results suggest that wear time was adequate for further analyses (Troost et al., 2005; Ward et al., 2005). Presurgery wear time was  $6.0 \pm 1.6$  days and  $13.4 \pm 1.4$  hr per day. Postsurgery wear time was  $5.8 \pm 1.2$  days and  $13.3 \pm 1.8$  hr per day. Exact numbers of participants and associated number of days and hours per day of accelerometer wear time presurgery and postsurgery can be seen in Table 3.

Weekday versus weekend wear time was evaluated and results may be seen in Table 4. Presurgery, weekday, and weekend average daily wear time was not significantly different when compared via paired t-test ( $p > 0.05$ ). Presurgery, participants averaged 4.54 weekdays and 1.54 weekend days of wear time and two participants had zero days of weekend wear time. Postsurgery, weekend average daily wear time was significantly less than weekday average daily wear time ( $p < 0.05$ ). Postsurgery, participants averaged 4.21 weekdays and 1.58 weekend days of wear time and one participant had zero days of weekend wear time.

Analysis of presurgery to postsurgery dietary intake was done using a Wilcoxon Signed-Rank test. The Wilcoxon Signed-Rank test was chosen because it is the appropriate statistic for data sets that have paired data (in the present study, presurgery, and postsurgery) and an unequal n. An unequal n existed in the current study because not all participants adequately reported their dietary intake both presurgery and postsurgery.

Thirteen participants completed 3-day presurgery dietary records and 19 completed 3-day postsurgery dietary records. Caloric intake was not different from presurgery to postsurgery (presurgery  $584.0 \pm 139.1$  kcal, postsurgery  $626.9 \pm 307.4$  kcal,  $p > 0.05$ ), nor was carbohydrate intake (presurgery  $36.3 \pm 25.8$  g, postsurgery  $44.5 \pm 29.8$  g,  $p > 0.05$ ). There was a significant decrease in protein intake postsurgery (presurgery  $106.6 \pm 34.5$  g, postsurgery  $53.7 \pm 27.4$  g,  $p < 0.05$ ) and a significant increase in fat intake postsurgery (presurgery  $7.9 \pm 6.7$  g, postsurgery  $26.4 \pm 16.7$  g,  $p < 0.05$ ). Therefore, it appears that caloric intake did not change, however, dietary protein was significantly reduced and dietary fat significantly increased from presurgery to postsurgery.

### **Physical Activity Patterns**

Description of participant physical activity patterns presurgery and postsurgery was accomplished by comparing eight predefined walking cadence bands. For each of the bands, both absolute time (minutes per day in each cadence band) and relative time (percentage of wear time per day in each cadence band) were calculated. Absolute values are of interest because that is the metric that is typically presented in the literature. Relative values are also of interest because participant presurgery and postsurgery wear times were not exactly the same (range: +2.0 to -1.9 hr difference from presurgery to post).

The MANOVA for absolute time spent in each cadence band was not significant  $V = 0.22$ ,  $F(8, 39) = 1.40$ ,  $p > 0.05$ . MANOVA was also not significant for the presurgery to postsurgery changes in percentage of wear time in each of the eight cadence bands,  $V = 0.27$ ,  $F(8, 39) = 1.83$ ,  $p > 0.05$ . In addition, since the accelerometer wear-

times for presurgery and postsurgery were nearly identical and there was not a significant MANOVA for either the presurgery to postsurgery absolute or relative wear times, only the absolute time spent in each of the walking cadences are plotted in Figure 3 as a visual depiction of the presurgery and postsurgery patterns of physical activity. By plotting absolute time spent in each of the walking cadence bands for both presurgery and postsurgery, the similarity in the physical activity patterns presurgery and postsurgery as well as the large amount of time that the participants spend doing little or no physical activity are clearly seen. Participants spent most time in 0 steps per minute (no movement) or 1-19 steps per min (incidental movement) bands, which equals to on average 738 min per day (12.3 hr per day), or 92% of wear time at both presurgery and postsurgery.

Sex differences were examined and there were small differences in daily accelerometer wear time and relative time (% of wear time) spent in some of the cadence bands (Table 5). On average, men wore the accelerometer 92 min per day longer presurgery and 71 min per day longer postsurgery than women. Sex differences appear to be present only in the lowest two cadence bands of 0 steps per minute and 1-19 steps per minute, but not in higher activity cadence bands. Men spent more time in 0 steps per minute and women spent more time in 1-19 steps per minute. Despite small sex differences, the pattern of physical activity did not change over the course of the study for either the men or women.

Differences by surgical type were also examined (Table 6). There were no differences in average daily accelerometer wear time by surgical type: sleeve gastrectomy (presurgery = 808 min/day, postsurgery = 796 min/day), gastric bypass (presurgery = 789

min/day, postsurgery = 807 min/day). The sleeve gastrectomy group spent slightly more time in the 0 steps per minute cadence band, but both groups appeared similar in all other cadence bands. There were not apparent differences for either group over time.

When presurgical weekday and weekend data were compared, there appear to be slight differences and greater deviation in time and percentage of daily wear time spent in the lower walking cadence bands (0, 1-19 and 20-39 steps per minute; Table 7 a and b). Specifically, there appears to be slightly more time spent in 0 steps per minute during the weekdays and standard deviations appear to be slightly elevated in the three lowest intensity cadence bands on weekend days. These differences do not appear to be a clinically relevant and may be a function of the fact that weekend days are often more variable than weekdays. There were no discernable differences between presurgical weekday and weekend day physical activity in the more intense walking cadence bands.

When postsurgical weekday and weekend data were compared, differences were visible in only the 0 steps per minute cadence band (Table 7). It appears that participants were spending more time (minutes per day) and a larger percentage of daily wear time in the 0 steps per minute cadence band during weekdays compared to weekend days. Time spent in 0 steps per minute (weekdays: 475 + 160, weekend days: 410 + 141). Percentage of daily wear time spent in 0 steps per minute (weekdays: 57 + 15%, weekend days: 54 + 13%). Weekday sedentary time may be explained by the fact that typically people are driving to work and working in sedentary jobs during the weekdays compared to weekend days. There were no discernable differences between postsurgical weekday and weekend day physical activity in the more intense walking cadence bands.

### **Peak 1- and 30-Minute Walking Cadences**

Repeated measures ANOVA, with Bonferroni correction for multiple comparisons (Field, 2009) showed no significant difference for peak 1- or 30-min walking cadence from presurgery to postsurgery. Presurgery to postsurgery values for 1-min peak walking cadence (presurgery  $87.2 \pm 14.4$  steps/min, postsurgery  $84.5 \pm 18.4$  steps/min) and  $V = 0.03$ ,  $F(1, 23) = 0.65$ ,  $p > 0.025$ . Presurgery to postsurgery values for 30-min peak walking cadence (presurgery  $49.3 \pm 13.4$  steps/min, postsurgery  $48.6 \pm 20.8$  steps/min) and  $V = 0.00$ ,  $F(1, 23) = 0.62$ ,  $p > 0.025$ .

There were no apparent differences in peak 1- and 30-min walking cadences between the sexes or surgical type (Table 8 a) or weekend versus weekday (Table 8 b).

### **Exercise Log**

Participants were asked to keep a daily log of structured exercise and activities of daily living that they deemed unusual (for example, helping a friend move) to their typical daily physical activity. The exercise log (Appendix B) has blank spaces for participants to write down the date, time, and type of exercise.

Presurgery, four participants reported doing exercise. Table 9 shows exercise type, number of days of reported exercise, reported minutes per day of exercise, and the percentage of the peak 30 min that was accounted for by exercise. To determine the percentage of the peak 30 min of each day that was accounted for by exercise, the peak 30 min of activity for each day was analyzed and minutes that coincided with reported exercise time were counted up and divided into the total. For example, if a participant wore their accelerometer for 7 days, data for their best 30 min of each day is equal to 210

min. If this participant exercised on 2 days and the exercise coincided with their peak 30 min on those days, this equals 60 min of exercise (60 min divided by 210 min equates to 29% of their peak 30-minute time accounted for by exercise). On average, participants exercised for 1 to 3 days per week and did a variety of different types of exercise.

Therefore, it does not appear that they preferred any one type of exercise. One participant reported doing water aerobics 3 days per week. This participant's data are included in Table 9. Since the type of accelerometer used in the present study was not able to capture water activities, this participant's physical activity data did not include any values from the water aerobics classes.

Postsurgery, three participants reported doing exercise, none of whom also exercised presurgery (Table 10). Therefore, it does not appear that there is clear trend towards increasing or decreasing exercise at 30 days postsurgery. The amount of exercise and percentage of peak 30-min time accounted for by exercise is low and similar when presurgery is compared to postsurgery. To put this into context, if a participant were to exercise at a level consistent with MVPA for 30 min, 7 times per week, this would equate to 100% of peak 30 min accounted for by exercise (assuming 7 days of accelerometry). The highest percentage of peak 30-min time accounted for by exercise was 33.8% presurgery (exercising for 3 of 7 days) and 16.7% postsurgery (exercising 1 of 7 days). Therefore, very few participants were exercising and the ones who were did not exercise very frequently or intensely.

### **CAPS Physical Activity Questionnaire**

The three data sets (presurgery, postsurgery, and archived data from Adams and colleagues) were assessed for normality to determine the appropriate statistics for correlation analyses. Participant characteristics for the 137 women and 30 men (white = 155, Hispanic = 6, Native American = 5, African American = 1) from archival data (Adams et al., 2012) may be seen in Table 11. CAPS-derived MMVPA per day and steps per day statistics for participants from the present study (presurgery and postsurgery) and the archival data set are presented in Table 12. Presurgery accelerometry was normally distributed, but CAPS-derived MMVPA per day was not normally distributed. Postsurgery accelerometry and reported CAPS-derived MMVPA per day were both normally distributed. Finally, archival pedometer data and CAPS-derived MMVPA per day data were not normally distributed. Spearman's Rho correlation was chosen to assess presurgery data, due to the nonnormal distribution of CAPS-derived MMVPA per day ( $r = 0.14$ ,  $p = 0.55$ ). Pearson's product moment correlation was chosen to assess postsurgery data because both steps per day and CAPS-derived MMVPA per day were normally distributed ( $r = 0.18$ ,  $p = 0.44$ ). Spearman's Rho correlation was chosen to assess bariatric surgical archived pedometer data and CAPS-derived MMVPA per day because both variables had nonnormal distributions ( $r = 0.22$ ,  $p = 0.01$ ). Correlations from the three data sets did not agree with one another, presurgery and postsurgery correlations were not significant, but data from the archived data showed a significant correlation between steps per day and CAPS-derived MMVPA per day.

Regression analysis was used to determine if CAPS-derived MMVPA per day could predict physical activity objectively measured via pedometer (steps per day).

Results showed that CAPS-derived MMPA per day significantly predicted steps per day ( $\beta = 0.23, p < 0.05$ ) and explained 5.2% of variance in steps per day ( $R^2 = 0.05, F [1, 165] = 9.0, p < 0.05$ ).

### **Self-Evaluation of Change in Physical Activity**

On average, presurgery participants reported that they expected they would become much more physically active  $2.81 \pm 0.40$ , while postsurgery, participants reported to have increased their physical activity to a moderate degree  $1.86 \pm 0.96$ . T-test revealed that there was a significant difference between participants' expected change in physical activity and postsurgical perceived change in physical activity ( $p < 0.05$ ).

Presurgery, five participants expected a moderate increase in physical activity (score = 2) and 16 participants expected a larger increase in physical activity (score = 3). Postsurgery all but one participant reported that they increased their physical activity; one reported a reduction in physical activity (score = -1), four reported a small increase (score = 1), 10 reported a moderate increase in their physical activity (score = 2), five participants reported a larger increase in physical activity (score = 3).

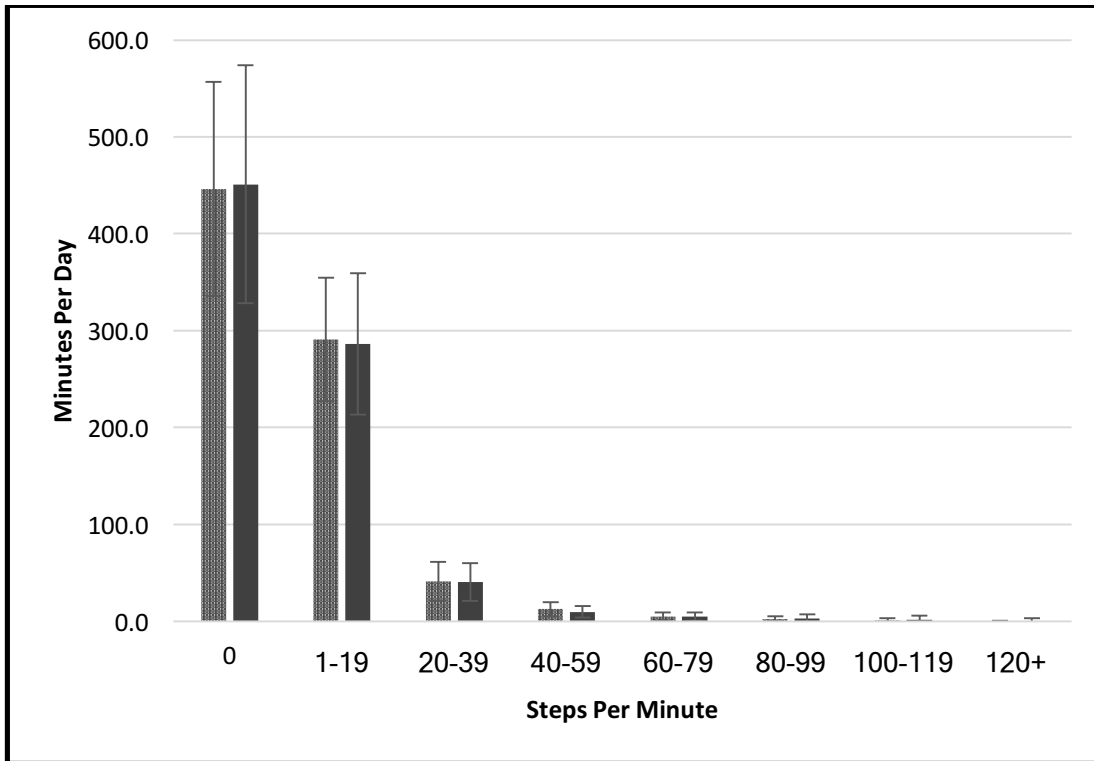


Figure 3. Mean and Standard Deviation Error Bars for Time Spent (Minutes/Day) in Each Cadence Band Presurgery and Postsurgery, Respectively. (Gray Bars Denote Presurgery and Black Bars Denote Postsurgery.)

Table 1. Repeated Measures ANOVA Table of Within Subjects Differences  
in Descriptive Statistics

	Presurgery ( <i>Mean</i> $\pm$ <i>SD</i> )	Postsurgery ( <i>Mean</i> $\pm$ <i>SD</i> )	<i>df</i>	<i>Mean Square</i>	<i>F</i>	<i>p</i>
<b>Height (cm)</b>	165.6 $\pm$ 9.9					
<b>Body Mass (kg)</b>	121.80 $\pm$ 24.78	110.10 $\pm$ 23.30	1	1640.766	182.22	*<0.01
<b>BMI</b>	44.01 $\pm$ 6.48	39.76 $\pm$ 6.11	1	236.431	184.43	*<0.01
<b>Waist Circumference (in)</b>	53.18 $\pm$ 6.38	49.66 $\pm$ 6.33	1	148.579	52.19	*<0.01
<b>Hip Circumference (in)</b>	53.52 $\pm$ 5.27	50.83 $\pm$ 5.41	1	87.21	86.55	*<0.01
<b>Body Fat Percentage (%)</b>	52.75 $\pm$ 5.39	50.4 $\pm$ 6.28	1	66.04	32.98	*<0.01

*p*-value adjusted by Bonferroni correction to  $p < 0.01$ , (\*) denotes significant difference

Table 2. Presurgery to Postsurgery Changes  
in Anthropometric Measurements

	<b>Average</b>	<b><i>SD</i></b>
<b>Body Mass (kg)</b>		
<b>Absolute Change</b>	-11.69	±4.24
<b>Percent Change</b>	-9.69	±3.29
<b>BMI (kg/m<sup>2</sup>)</b>		
<b>Absolute Change</b>	-4.44	±1.61
<b>Percent Change</b>	-10.12	±3.69
<b>Waist Circumference (in)</b>		
<b>Absolute Change</b>	-3.52	±2.39
<b>Percent Change</b>	-6.57	±4.41
<b>Hip Circumference (in)</b>		
<b>Absolute Change</b>	-2.70	±1.42
<b>Percent Change</b>	-5.07	±2.61
<b>Body Fat Percentage</b>		
<b>Absolute Change</b>	-2.35	±2.00
<b>Percent Change</b>	-4.60	±3.99

Table 3. Number of Participants, Mean Number of Days, and Mean Hours of Wear Time

<b>Number of Wear Days</b>	<b>Number of Participants Presurgery</b>	<b>Hours Per Day Presurgery</b>	<b>Number of Participants Postsurgery</b>	<b>Hours Per Day Postsurgery</b>
<b>7</b>	9	13.63	7	13.56
<b>6</b>	9	13.87	9	13.35
<b>5</b>	1	15.78	4	14.11
<b>4</b>	2	11.39	3	13.33
<b>3</b>	3	11.63	1	10.04

Table 4. Weekday and Weekend Mean Wear Time Statistics

<b>Presurgery Weekday</b>	<b>Wear Time (hours)</b>	<b>Presurgery Weekend</b>	<b>Wear Time (hours)</b>
<b>Mean</b>	13.59	<b>Mean</b>	13.22
<b>Standard Deviation</b>	2.29	<b>Standard Deviation</b>	2.22
<b>Postsurgery Weekday</b>	<b>Wear Time (hours)</b>	<b>Postsurgery Weekend</b>	<b>Wear Time (hours)</b>
<b>Mean</b>	13.73	<b>Mean</b>	12.57
<b>Standard Deviation</b>	2.29	<b>Standard Deviation</b>	2.56

Table 5. Differences in Percent of Wear Time in Walking Cadence Bands by Sex

Steps Per Minute								
	0	1-19	20-39	40-59	60-79	80-99	100-119	120+
Presurgery								
Women (%)	55 + 11	37 + 8	5 + 3	2 + 1	1 + 1	0	0	0
Men (%)	60 + 17	32 + 13	5 + 3	2 + 1	1 + 1	0	0	0
Postsurgery								
Women (%)	54 + 12	38 + 9	5 + 3	1 + 1	1 + 1	0	0 + 1	0
Men (%)	65 + 7	27 + 4	5 + 2	1 + 1	1 + 1	1 + 1	0 + 1	0

Table 6. Differences in Percent of Wear Time in Walking Cadence Bands by Surgical Type

	Steps Per Minute							
	0	1-19	20-39	40-59	60-79	80-99	100-119	120+
<b>Presurgery</b>								
<b>SG (%)</b>	56 + 12	36 + 9	5 + 2	1 + 1	1 + 0	0	0	0
<b>RYGB (%)</b>	53 + 10	37 + 6	6 + 3	2 + 1	1 + 1	0 + 1	0	0
<b>Postsurgery</b>								
<b>SG (%)</b>	57 + 12	36 + 10	5 + 3	1 + 1	1 + 0	0 + 1	0 + 1	0
<b>RYGB (%)</b>	53 + 9	37 + 8	6 + 2	2 + 1	1 + 1	0 + 1	0	0 + 1

Table 7. Presurgical Comparison of Weekday and Weekend Day Walking Cadence

Bands

(a) Average Time Spent (Minutes per Day) in Each Cadence Band

<b>Cadence Band</b>								
<b>(Steps/Minute)</b>								
	<b>0</b>	<b>1-19</b>	<b>20-39</b>	<b>40-59</b>	<b>60-79</b>	<b>80-99</b>	<b>100-119</b>	<b>120+</b>
<b>Weekday</b>								
<b>Mean</b>	458	292	40	12	5	3	1	0
<b>Standard</b>	129	103	22	9	6	4	3	0
<b>Deviation</b>								
<b>Weekend</b>								
<b>Mean</b>	425	295	47	15	6	3	1	0
<b>Standard</b>	158	116	34	14	6	4	2	1
<b>Deviation</b>								

Table 7 Continued

(b) Average Percentage of Wear Time Spent in Each Cadence Band

<b>Cadence Band</b>								
<b>(Steps/Minute)</b>								
	<b>0</b>	<b>1-19</b>	<b>20-39</b>	<b>40-59</b>	<b>60-79</b>	<b>80-99</b>	<b>100-119</b>	<b>120+</b>
<b>Weekday</b>								
<b>Mean</b>	56%	36%	5%	1%	1%	0%	0%	0%
<b>Standard Deviation</b>	14%	12%	3%	1%	1%	0%	0%	0%
<b>Weekend</b>								
<b>Mean</b>	53%	37%	6%	2%	1%	0%	0%	0%
<b>Standard Deviation</b>	17%	12%	4%	2%	1%	1%	0%	0%

Table 8. Differences in Peak 1 and 30 Min Walking  
by Sex (a) and Surgical Type (b)

	<b>Peak 1 Min</b>	<b>Peak 30 Min</b>
	<b>(Steps/Min)</b>	<b>(Steps/Min)</b>
<b>Presurgery Women</b>	88 ± 15	49 ± 13
<b>Presurgery Men</b>	81 ± 13	50 ± 18
<b>Postsurgery Women</b>	85 ± 18	48 ± 20
<b>Postsurgery Men</b>	83 ± 22	55 ± 29
<b>Presurgery SG</b>	86 ± 14	46 ± 11
<b>Presurgery RYGB</b>	91 ± 17	56 ± 17
<b>Postsurgery SG</b>	81 ± 18	44 ± 19
<b>Postsurgery RYGB</b>	93 ± 18	59 ± 23

(b.)

	<b>Peak 1 Min</b>	<b>Peak 30 Min</b>
	<b>(Steps/Min)</b>	<b>(Steps/Min)</b>
<b>Presurgery Weekday</b>	87 ± 23	49 ± 17
<b>Presurgery Weekend</b>	84 ± 25	49 ± 20
<b>Postsurgery Weekday</b>	84 ± 28	48 ± 24
<b>Postsurgery Weekend</b>	81 ± 30	45 ± 25

Table 9. Presurgical Exercise Log Data

<b>Participant ID</b>	<b>Type of Exercise</b>	<b>Number of Days</b>	<b>Percentage of Peak 30 Min</b>
<b>1</b>	Resistance Training	2	10%
<b>2</b>	Water Aerobics	3	0%
<b>3</b>	Low Intensity Yoga	1	0.5%
<b>4</b>	Treadmill or Exercise Class	3	33.8%
<b>Average <math>\pm</math> Standard Deviation*</b>		<b><math>2 \pm 1</math></b>	<b><math>14.8 \pm 17.2\%</math></b>

(\*) Average and standard deviation calculations do not include the data from participant 2, who was involved in water aerobics. Accelerometers cannot be worn in the water for long periods of time, so it is not possible to quantify physical activity completed in water.

Table 10. Postsurgical Exercise Log Data

<b>Participant ID</b>	<b>Type of Exercise</b>	<b>Number of Days</b>	<b>Percentage of Peak 30 Min</b>
<b>5</b>	Stationary Bike and Rowing Ergometer	1	8.3%
<b>6</b>	Resistance Training	2	16%
<b>7</b>	Helping Family with Home Care, Many Flights of Stairs	1	16.7%
<b>Average <math>\pm</math> SD</b>		<b>1 <math>\pm</math> 0.6</b>	<b>13.7 <math>\pm</math> 4.7%</b>

Table 11. Descriptive Statistics for Adams et. al. (2012) Archival Data Set

	<b>Age (years)</b>	<b>Height (cm)</b>	<b>Body Mass (kg)</b>	<b>BMI</b>	<b>Body Fat Percentage*</b>
<b><i>Mean</i></b>	45	167.90	129.20	45.75	52.10
<b><i>SD</i></b>	10	8.66	26.91	7.52	7.89

\*Body fat percentage was assessed using bioelectrical impedance.

Table 12. CAPS-Derived MVPA in MET Minutes Per Day (MMVPA) and Objectively Measured Steps Per Day

		<b>MVPA (MET min/day)</b>	<b>Accelerometer and Pedometer (Steps/Day)</b>
<b>Presurgery</b>	<i>Mean</i>	441	4013
	<i>SD</i>	±510	±1503
<b>Postsurgery</b>	<i>Mean</i>	497	4007
	<i>SD</i>	±342	±1797
<b>Adams Data</b>	<i>Mean</i>	661	4901
	<i>SD</i>	±1423	±2927

## CHAPTER 5

### DISCUSSION

This chapter will consist of four sections, including: (a) discussion of the findings for the present study, (b) concluding thoughts, (c) strengths and limitations of the study, and (d) suggestions for future research.

#### **Physical Activity Patterns Presurgery to Postsurgery**

##### Changes in Physical Activity Patterns

The primary finding of this study is that patients who have had Roux-en-Y gastric bypass surgery, or sleeve gastrectomy do not change their postsurgery physical activity patterns or peak 1- or 30-min walking cadences. While individual differences were present, in general, there does not seem to be a significant positive shift in physical activity within the first  $31 \pm 10$  days after surgery. Thirteen participants increased their daily time (minutes per day) spent in the 0-cadence band (no movement), with values ranging from 29 to 193 min per day; one participant remained the same; and 10 decreased their time spent in the 0-cadence band, with values ranging from 13 to 198 min per day. On the other end of the spectrum, only three participants increased their daily minutes spent in MVPA by at least 5 min, but two increased their daily MVPA to 20 min per day, which is just 10 min less than the 30 min per day recommendation (Haskell et al., 2007).

The remaining six participants stayed at approximately 1–3 min of MVPA per day, a level far below recommendation (Garber et al., 2011). The few individuals who made positive adjustments to their walking cadence patterns were counterbalanced by others who made no change, or who became less active postsurgery. Table 13 outlines moderate to vigorous physical activity in bariatric patients presurgery and postsurgery, with data taken from five studies, including our present analysis.

The peak 1- and 30-min walking cadence findings from the present study also support the conclusion that patients who have had Roux-en-Y gastric bypass surgery, or sleeve gastrectomy, do not change their postsurgery physical activity patterns. Our bariatric patients did not significantly change their peak 1- and 30-min walking cadences from presurgery to postsurgery. In fact, their peak walking cadences stayed almost exactly the same at around 86 steps per minute (peak 1-min cadence) and 49 steps per minute (peak 30-min cadence). Tudor-Locke and colleagues (2012) quantified the peak walking cadences of Americans in different BMI classifications and reported that there was a significant negative trend with peak 1- and 30-min walking cadences decreasing as BMI increases (Tudor-Locke et al., 2012). Table 14 shows data from Tudor-Locke (2012) and bariatric patient data from the present study. It appears that participants in the present study were similar to other obese individuals with regard to their peak 1-min walking cadence; however, participants from the current study had a slower peak 30-min walking cadence. When the 95% confidence intervals for peak 30-min walking cadence of obese and bariatric patients are compared (see Table 14), it appears that bariatric patients may walk significantly slower than obese individuals with similar BMI who are not seeking surgery. Tudor-Locke and colleagues (2012) report that individuals with BMI

$\geq 40$  have peak 30-min walking cadences of (95% CI [54.6, 60.1] steps per minute), while participants from the present study had peak 30-min walking cadences of (95% CI [41.4, 55.8] steps per minute). Pre- and postbariatric surgery, patients from the current study move at speeds lower than overweight and obese individuals studied previously. Furthermore, based upon the lack of change in physical activity presurgery to postsurgery observed in the currently study, bariatric patients are unlikely to naturally increase walking speed immediately following surgery.

The lack of change in physical activity immediately following bariatric surgery is of interest since the few researchers who have examined the presurgery to postbariatric surgery changes in physical activity have examined changes at 6 months to 3 years postsurgery. Therefore, a strength of the present study is that it fills a gap in the physical activity literature by providing some insight as to physical activity behaviors in the time immediately following bariatric surgery (3 to 5 weeks) when patients are first permitted to exercise.

Moderate to vigorous physical activity time is the most common physical activity variable reported in the literature for individuals who are postbariatric surgery (see Table 13), but direct comparisons between studies is challenging since different MVPA cut points have been used and the various monitoring devices used yield different units of data. In the present study, the cut point for MVPA was 100 steps per minute and MVPA did not significantly differ from presurgery to postsurgery, with participants achieving 1 to 3 min of MVPA per day. When the cut point from the present study is reduced to 80 steps per minute, our data can be compared to the work of King (2012). Using 80 steps per minute or greater as the cut point, participants in the present study spent less time in

MVPA (presurgery = 5 min/day, postsurgery = 6 min/day) than the participants in the King study (presurgery = 10.6 min/day, postsurgery = 16 min/day; King, et al., 2012). The physical activity from King (2012) was taken 3 years postsurgery; therefore, patients may have increased physical activity as they were more fully recovered from surgery, lost more weight, or had more time to discover various methods to maintain physical activity. However, it should be noted that the King (2012) participants were quite sedentary, even 3 years postsurgery.

On average, the present study shows that participants spent much less time in MVPA presurgery and postsurgery than previous reports of bariatric patients. Our postsurgery participants spent 3 min per day in MVPA, whereas at 6 months to 3 years postsurgery patients are achieving 16 to 26.6 min per day of MVPA (Bond, Jakicic, Unick, et al., 2010; Chapman, et al., 2013; King et al., 2012; Ramirez-Marrero, Miles, Joyner, & Curry, 2014). It is possible that the increased MVPA 6 months to 3 years following surgery reflects complete recovery from the surgery. Regardless, it does not appear that bariatric patients are increasing their MVPA postsurgery, nor are they attaining the recommended 30 min of MVPA per day.

#### Low Levels of Physical Activity of Bariatric Patients

The relatively low levels of physical activity observed for bariatric patients in the current study is even more apparent if the study participant values are compared to the values reported for other obese and normal weight Americans. Tudor-Locke and colleagues (2011) compiled walking cadence data for 1,781 men and 1,963 women over the age of 20 from the 2005–2006 NHANES dataset to characterize the average

American's physical activity pattern. Tudor-Locke et al. (2011) found that it was uncommon for adults to spend large amounts of time at speeds equal to or greater than 100 steps per minute (average of 6.5 min per day; Tudor-Locke et al., 2011). In comparison, our bariatric patients spend even less time at speeds greater than or equal to 100 steps per minute (average 2 min per day). While this does not appear to be a large difference, at the level of walking observed in the current study, the average American would get 31.5 min more MVPA per week than bariatric patients. The average American also appears to spend more minutes per day in all light cadence bands including: purposeful movement, slow walking, and medium speed walking.

When average Americans were compared to our bariatric surgical patients, time spent in no movement (0 steps/min) also appears to be different (289.1 and 448.8 min/day respectively; see Table 15). While Tudor-Locke (2011) did not report the weight or BMI of the average American, it is assumed that her sample was constructed to represent the American population, and while a portion of the sample was probably obese, many would not have been categorized as being obese. Clearly differences exist in physical activity patterns when bariatric patients in the current study are compared to the American population identified by Tudor-Locke (2011).

Some researchers have specifically sought to compare walking speeds for obese and normal weight individuals; however, the results are inconsistent. Some have reported that obese individuals tend to choose slower walking speeds than normal weight individuals, while others have reported comparable walking speeds for obese and their normal weight counterparts. Using cross-sectional population data, Tudor-Locke and colleagues have observed faster peak 30-min walking cadences in lean adults compared

to overweight and obese adults (Tudor-Locke et al., 2012). Malatesta and colleagues (2008) evaluated the preferred walking speed of obese and normal weight individuals along a 10-m walking path equipped with gait analysis cameras. They found that overall, obese participants had significantly slower preferred walking speeds than normal weight individuals (1.18 versus 1.33 m per second, respectively; Malatesta et al., 2009). This trend exists at greater walking distances as well. When obese and normal weight participants were asked to walk 2 km at a speed that felt like “walking for pleasure,” obese participants chose significantly slower walking speeds than normal weight participants (1.5 vs. 1.6 approximate m per second, respectively; Hills, Byrne, Wearing, & Armstrong, 2006). Browning (2005), on the other hand, reports that there were no significant differences in preferred walking speed when obese men and women were compared to normal weight men and women, although slightly lower speeds were noted in obese participants. Our data support the popular notion that obese individuals self-select slower walking speeds than the walking speed reported for normal-weight adults.

Many of the aforementioned studies concluded that obese individuals incurred higher metabolic costs for walking at the same speed as normal weight individuals and attributed their slower self-selected walking speed to the associated metabolic cost and perceived difficulty (Browning, Baker, Herron, & Kram, 2006; Hills, et al., 2006; Malatesta et al., 2009). This explanation of the differences between bariatric surgical patients’ walking speeds in comparison to normal weight individuals has some support in the literature. When asked to walk at a speed consistent with “walking for pleasure,” obese individuals walk significantly slower than normal weight individuals, while exhibiting significantly higher heart rates (Hills et al., 2006). Browning and colleagues

(2006) measured peakVO<sub>2</sub> (ml/kg lean mass/minute) in obese and normal weight adults and reported that the obese participants had lower peakVO<sub>2</sub> values than the normal weight participants. These researchers also compared VO<sub>2</sub> per minute for obese and normal weight adults over various walking speeds. When VO<sub>2</sub> while walking was expressed as a percent of peakVO<sub>2</sub>, Browning et al. observed that obese participants and the obese women in particular had significantly higher percentages of peakVO<sub>2</sub> compared to normal weight participants across a wide spectrum of speeds. The relative VO<sub>2</sub> (ml/kg/min) values while walking at a given speed were on average 33% higher for the obese women and 28% higher for the obese men when compared to their normal weight counterparts. Browning et al. interpreted the lower peak VO<sub>2</sub> values in combination with the elevated VO<sub>2</sub> values for walking at a given speed as evidence that obese individuals have an elevated metabolic cost for walking at a given speed when compared to normal weight individuals.

Based upon the results of Hill et al. (2006) and Browning et al. (2006), it is possible to conclude that the lower self-selected walking speeds exhibited by our bariatric patients can be partially explained by the high metabolic cost of walking at faster speeds. It is also possible that individuals who seek out bariatric surgery have some unique psychological or physiological characteristics that contribute to lower self-selected walking speeds.

The work of Levine and colleagues supports the hypothesis that self-selected walking speed is unique to the individual and independent of body weight. More specifically, these researchers report that as individuals purposefully gain weight, they will naturally reduce their daily walking distance and not their walking speed, regardless

of whether they were lean or were obese before the weight gain (Levine et al., 2008). In Levine's study, participants gained  $3.6 \pm 1.6$  kg and concurrently reduced their walking distance by 5,632.7 m per day and had a nonsignificant decrease in average daily walking speed. In the current study, participants lost an average of  $11.7 \pm 4.3$  kg, but did not experience an increase in their walking speeds or physical activity patterns, suggesting that bariatric patients may not naturally change their walking speeds or physical activity patterns as they lose weight. Therefore, while it is possible that as participants from the present study continue to lose weight, they will adopt faster walking speeds; however, it is not likely that this will occur naturally without conscious effort or an external intervention.

### **CAPS Physical Activity Questionnaire**

While the first two aims of this study were to assess physical activity patterns before and after bariatric surgery, the third aim of the study was to examine the evidence in support of the CAPS questionnaire as a valid measurement of physical activity. The CAPS physical activity questionnaire was chosen because it has been used in a large ongoing longitudinal study within our institution (Adams et al., 2012), and it also lends itself to the calculation of over 1,000 physical activity variables, making it a flexible resource. However, the CAPS questionnaire is quite long (six pages, 27 questions with two to six responses per question) and relies heavily on a participant's memory of a full week's volume of physical activity. Despite challenges with the questionnaire, it could be a valuable tool because such a vast array of variables may be calculated using the CAPS questionnaire.

Reported CAPS-derived MMVPA per day both presurgery and postsurgery were exceedingly high (presurgery:  $441 \pm 510$  MMVP per day, postsurgery:  $497 \pm 342$  MMVP per day) compared to accelerometer derived minutes of MVPA and the ACSM standards of 150 min of moderate intensity physical activity per week, or 30–60 min per day. Briefly, moderate intensity physical activity is defined as activity performed at 3.0 to 5.9 METs. Therefore, as an example, 450 MMVPA per day done at 5.9 METs would equal 76 min of MVPA, a value far exceeding what was captured via accelerometry. Before statistical analysis, the extremely high CAPS-derived MMVPA gives the impression that either participants were unable to fill out the CAPS correctly, leading to drastically inflated values, or the questionnaire is not a valid measurement tool.

Correlations between CAPS-derived MMVPA per day and archival pedometer-derived steps per day data revealed a significant correlation of  $\pm = 0.22$ . Various other correlations were attempted, but none theoretically made as much sense, or produced higher correlation coefficients than the examination of the relationship between MMVPA and pedometer-derived steps per day. The literature shows wide variations in criterion validity coefficients for physical activity questionnaires ranging from 0.14 to 0.53, with a median of 0.30 (Sallis & Saelens, 2000). An investigation similar to the present study compared accelerometry to the long and short form International Physical Activity Questionnaire (I-PAQ; Booth et al., 2003). Booth and colleagues found correlations of ( $r = 0.05$  to  $0.32$ ) between total physical activity and long form reported physical activity. In the work of Booth and colleagues, when the questionnaire was given to one group, their reports correlated better with measured physical activity than a second group. Therefore, while the IPAQ appeared to be reliable within groups, it was not necessarily

valid for all groups. According to the criterion validity coefficients reported in the literature, the CAPS questionnaire is below the average of  $r = 0.30$ . Regression analysis completed for the current study showed that the CAPS questionnaire was able to predict 5.2% of variation in steps per day ( $p < 0.05$ ). The ability of CAPS to predict only 5.2% of variation in pedometer-measured physical activity does not represent strong evidence for the validity of the CAPS questionnaire.

Analysis of the relationships between CAPS-derived MMVPA and accelerometer data from the current study also did not support the validity of the CAPS as a tool for assessing physical activity in bariatric surgery patients. Correlations between presurgical CAPS-derived MMVPA and accelerometer derived MMVPA were  $r = 0.14$  and  $r = 0.18$  for presurgery and postsurgery, respectively. Alterations to the method by which CAPS is administered could allow for more reasonable reporting. Increasing the clarity of the CAPS instructions, shortening the questionnaire, and/or having personnel available to support the interpretation of the questionnaire might increase the accuracy of the CAPS questionnaire as a tool for assessing MVPA.

In an effort to further examine evidence for the validity and reliability for the CAPS questionnaire, accelerometry, and CAPS responses were analyzed for 21 of 24 participants from the present study (not archival data). Three of 24 participant questionnaires were deemed unusable because their responses were not plausible (for example, greater than 24 hr of physical activity in a given day, or incomplete/inaccurate responses such as 8 days per week). Data (MET minutes of MVPA) from the 21 participants completing the CAPS questionnaire both presurgery and postsurgery were correlated with accelerometer (presurgery and postsurgery) derived steps per day. Scatter

plots were visually inspected for both the presurgery and postsurgery in each respective dataset.

There was modest evidence for the validity of the CAPS questionnaire. Accelerometry presurgery and postsurgery showed low to moderate, but significant ( $p < 0.05$ ) correlations with CAPS-derived MMVPA per day ( $r = 0.35$  and  $r = 0.18$ , respectively). However, to establish validity we would expect these correlations to be stronger. Similarly, to establish reliability, we would expect correlation values to be more consistent over time. Participants' steps per day data from presurgery to postsurgery showed no difference when measured with a paired t-test (presurgery  $4,013 \pm 1,503$ , postsurgery  $4,007 \pm 1,797$ ,  $p > 0.05$ ); therefore, we would expect to see this consistency in questionnaire data as well. Figure 4 is a Bland-Altman plot showing poor agreement between CAPS-derived MMVPA per day presurgery and postsurgery. Bias of 55.9 min exists and the 95% limits of agreement are fairly wide ( $\pm 365.3$  min) and there are many outliers. It is unlikely that the CAPS questionnaire provides a reliable or valid measurement of changes in physical activity. Evidence to validate the CAPS questionnaire does not exist.

#### Self-Evaluation of Physical Activity Change

In addition to the CAPS questionnaire, participants were asked a single question regarding their change in physical activity from presurgery to postsurgery. Participants were asked to use a -3 to +3 scale to rate their expected (presurgery) and actual changes (postsurgery) in physical activity. Overall, participants expected to increase their physical activity and reported doing so. All participants expected their physical activity to increase

after surgery (average  $\pm$  SD expected change:  $+2.8 \pm 0.4$ ) and all participants reported that their physical activity had improved after surgery (average  $\pm$  SD perceived change:  $+1.86 \pm 0.96$ ). When participants' presurgery expected change value was compared to their postsurgery perceived change value via a t-test, the difference was statistically significant ( $p < 0.05$ ). This means that participants expected to change dramatically ( $+2.8 \pm 0.4$ ), but postsurgery perceived that they had changed less than they thought ( $1.86 \pm 0.96$ ), although they still reported an increase in physical activity. From presurgery to postsurgery, participant physical activity patterns and peak 1- and 30-min cadences were not statistically different, nor were their steps per day; thus, perceived change differed from actual change in physical activity.

Findings from the current study are consistent with the work of Bond and colleagues (2010). In the present study, bariatric patients perceived an increase in their physical activity postsurgery, but this was not supported by the objective assessment of postsurgical physical activity. Similarly, Bond and colleagues showed that patients increased reported physical activity from  $44.6 \pm 80.8$  min per week presurgery to  $151.2 \pm 118.3$  min per week postsurgery, although slight decreases in physical activity were measured objectively (Bond, Jakicic, Unick, et al., 2010).

Although participants perceived a positive change in their physical activity postsurgery ( $+1.86 \pm 0.96$  points), results from the CAPS questionnaire showed that there was no difference in reported MMVPA per day. Paired sample t-test on presurgical and postsurgical CAPS-derived MMVPA per day was not significant (mean  $\pm$  SD MMVPA per day: presurgery =  $441.22 \pm 509.69$ , postsurgery =  $497.12 \pm 341.68$ ),  $t(21) = -0.70$ ,  $p = 0.49$ ). Therefore, perception of change in physical activity on a simple scale of -3 to +3

appears to differ from reported physical activity on the CAPS questionnaire. It ought to be noted that the reporting of potential and perceived physical activity change (-3 to +3) was done immediately after completing the CAPS questionnaire. Therefore, considering having just reported regular weekly physical activity on the CAPS, participants still perceived that they had made positive changes. This comparison gives further support to the notion that it is difficult to find consistent trends in reported physical activity as the two methods of self-report in the present study produced inconsistent results (Prince et al., 2008). It is possible that participants perceived they were more active because they were losing weight, although the weight loss was probably due to the surgery.

#### Dietary Change

Presurgery, participants were involved in a meeting designed to prepare them for surgery. During this meeting, they were given explicit instructions for the consumption of a presurgical liquid diet and were also given information containing recommendations for postsurgical dietary intake. Liquid diet instructions (Appendix D) and presurgical and postsurgical information packets (Appendix G) may be seen in their respective appendices.

Results show that presurgery participants adhered to the liquid diet, which recommended intake of low or no calorie liquids, broth, and protein shakes. The most commonly consumed protein shakes were whey concentrate and whey isolate protein shakes with minimal or no carbohydrate or fat. Therefore, the low caloric content ( $584 \pm 139$  kcal/day), low fat content (11% of intake), low carbohydrate content (22% of intake), and relatively high protein content (66% of intake) of the presurgery diet were expected

based on the recommended foods. Qualitatively, most participants gave unsolicited opinions of the presurgical liquid diet. Approximately one fifth of the participants were unhappy with the diet. However, despite their attitude towards the liquid diet, only one participant noted that she felt fatigued. Coincidentally, this is the same participant who also felt generally fatigued at the time of her postsurgical testing as well. Therefore, it is not likely that the caloric content or composition of the presurgical liquid diet was responsible for the low daily physical activity of participants.

Postsurgery caloric intake and dietary carbohydrate intake were not significantly different, but dietary protein and fat content significantly differed, making up 34% and 37% of the diet respectively compared to 66% and 11% presurgery. The decrease in dietary protein and increase in dietary fat were expected because participants were no longer on a liquid diet that was heavily based on supplemental protein shakes. The presurgical liquid diet also eliminated dietary fat to a large degree because the food choices were limited to clear low or noncaloric beverages, popsicles, and broth.

Since caloric intake did not change, it is unlikely that diet was responsible for the observed low level of physical activity postsurgery. It is also unlikely that the significant changes in dietary composition were responsible for the low physical activity of participants. It is possible however that the chronically low caloric and low protein nature of the postsurgical diet could result in poorer recovery from training in surgical patients who begin exercising intensely postsurgery. In the present study, no participants were involved in high intensity exercise; however, future studies may investigate the long-term body composition adaptations that occur in postsurgical patients who begin or continue exercising after surgery.

### Concluding Thoughts

Bariatric surgery has been shown to reduce body weight (Buchwald, et al., 2004; Buchwald et al., 2009; Padwal et al., 2011) and improve overall health (Adams et al., 2012; Adams et al., 2010; Boan et al., 2004; Buchwald et al., 2009; Gill et al., 2010; Lima et al., 2010); however, it is likely that increases in physical activity postsurgery will enhance outcomes beyond that achievable by surgery alone (Befort et al., 2007; Bize et al., 2007; Bond et al., 2008; Elfhag & Rossner, 2005; Warburton et al., 2006). Physical activity is instrumental in the maintenance of weight loss, with successful weight losers expending approximately 2,500–3,300 calories per week via physical activity (Wing & Hill, 2001). Physical activity may also offer reductions in stress and depression, beyond that which is attainable by surgical weight loss (Bond et al., 2009). Therefore, the purpose of this study was to investigate the physical activity patterns of bariatric patients before and after surgery to describe the natural physical activity changes that occur and to overall determine if physical activity interventions may be necessary or beneficial.

Our research agrees with previous studies, in that it does not appear that bariatric patients as a whole are naturally increasing their MVPA postsurgery or walking speeds, nor are they attaining the recommended 30 min of MVPA per day (Haskell et al., 2007). We have concluded that physical activity patterns (minutes per day and percentage of the day spent in various cadence bands) and naturally occurring movement velocities do not change because of bariatric surgery and the associated weight loss in general. Previous research shows that as individuals gain weight, they concurrently reduce their daily volumes and intensities of physical activity (Levine et al., 2008); however, when obese individuals lose weight, they do not move more (Levine et al., 2005). The present and

previous studies show that postsurgical changes in physical activity are highly variable and on average physical activity remains the same.

Increasing daily physical activity involves a significant change in lifestyle. While a bariatric surgical procedure physically limits caloric intake, and can decrease the absorption of consumed calories, the surgery itself does nothing to support a patient with the challenging task of changing their lifestyle. Therefore, it is not surprising that the surgical procedure alone does not seem to result in patients significantly increasing their daily physical activity without a purposeful commitment to change. Without attaining even a low volume of physical activity, it is not possible for a patient to experience the long-term health benefits associated with regular, daily physical activity or exercise (Donnelly et al., 2009).

To that end, it may be beneficial for hospitals and institutes who care for bariatric patients to establish patient-centered interventions that facilitate and support patients in committing to and sustaining physical activity and exercise goals. If it is not possible for hospitals or surgical centers to create the type of programming described above, developing relationships and referral networks with local health coaches and trainers who have proven success with facilitating lifestyle changes would be a great alternative. Levine shows that even modest alterations in daily physical activity such as walking very slowly (1.1 mph) instead of being passively seated nearly triples caloric expenditure (Levine & Miller, 2007). Furthermore, individuals who are more physically active, irrespective of body weight or BMI, also tend to be healthier than people who have low levels of physical activity (Warburton et al., 2006). Taken together, the research supports the notion that adopting changes in physical activity is not a natural process that is

influenced by weight loss alone. Just as weight loss clients often require the assistance of a trainer in their efforts to lose body weight, bariatric patients most likely require support from professionals who are willing to help them use their personal strengths and values to support behavior change.

## **Strengths and Limitations**

### Strengths

A strength of the current study is that physical activity was measured acutely postsurgery, where most studies report physical activity at 6–12 months or greater postsurgery (Boan et al., 2004; Bond, Jakicic, Unick, et al., 2010; Bond et al., 2009; Chapman et al., 2013; Dwyer et al., 2011; Hawke et al., 2008; King, et al., 2012), the objective of the current study was to monitor acute changes that occur prior to peak weight loss. Previous objective data from large data sets such as King (2012), show that there is sizable variability in bariatric patients postsurgery physical activity change at 1 year (-7,648 to +17,205 steps per day; King et al., 2012). While the current dataset was smaller than King (2012), care was taken to monitor only individuals who were free of any limitations to physical activity. As a result, variability was smaller (-1,883 to +1,856 steps per day) and likely more representative of changes that occur in a physically functional segment of bariatric patients.

The current study is also unique in that very few studies report on the acute postsurgery changes in body weight, BMI, and body fat percentage. Guidone and colleagues reported changes from presurgery to 4 weeks postsurgery in 10 type 2 diabetic patients who underwent biliopancreatic diversion (Guidone et al., 2006). Results from the

present study are consistent with those reported by Guidone and colleagues (results shown as Guidone, followed by the present study, respectively); body mass percent change = 9.3 and 9.7%, BMI percent change = 10.4 and 10.1%, body percentage percent change = 7.4 and 4.6%.

### Limitations

A major limitation of the present study was the low number of participants. While physical activity data were normally distributed, investigations with more participants would help identify the typical variability in postsurgical physical activity and potentially determine why some participants decrease physical activity and others increase.

Although the present study was the first to report on dietary composition and caloric content along with concurrent objective measurement of physical activity, a limitation was that dietary intake was not controlled in the present study. Dietary recommendations were provided, but not enforced. It is possible that the extreme dietary restraint provided by bariatric surgery may acutely reduce participant physical activity as they adjust to their new diet. However, physical activity was monitored during a period of presurgical liquid dieting and postsurgical low calorie diet. When asked, in conversation about their overall wellbeing, some participants noted that they felt tired, while others felt normal. The caloric content of the diet was not significantly different (presurgery = 584.0 kcal/day, postsurgery = 626.9 kcal/day), showing that the reduced calorie diet presurgery and postsurgery was not likely the reason that postsurgery bariatric patients are inactive.

An unforeseen weakness of the present study was that the CAPS questionnaire was surprisingly difficult for participants to navigate. Ample time was given to complete

the questionnaire and participants were encouraged to ask questions at any time. However, based on the overestimate of physical activity, more direction was necessary.

### **Future Research**

Research involving a larger sample size and potentially other surgery types is necessary. Larger investigations will address the variability found in the bariatric population. While there were not significant differences between RYGB and SG in the present study, future research investigating more surgical types may show differences that could not be assessed now.

Future studies may also include a comprehensive questionnaire that accounts for fatigue levels due to dietary changes, making it possible to determine if physical activity did not change due to low energy from the low-calorie diet imposed by presurgical weight loss and liquid diets and postsurgical low-calorie diets because of surgery.

Future studies may focus on improving the directions for and application of the CAPS questionnaire. Taking more time to administer the CAPS and checking over the responses immediately after the participant has filled out the questionnaire may aid in obtaining more accurate results. However, participant error cannot be ascertained from the present study.

Future projects involving physical activity or exercise interventions may be necessary to determine if physical activity patterns are more likely to improve with a patient-centered behavior change intervention.

Finally, future research may involve the application of all that we know to create a long-term approach to increasing physical activity and improving the physical and

mental health of bariatric surgical patients. It appears that before patients lose substantial weight, they are not likely to adopt faster walking speeds, probably due to the fact that they have low VO<sub>2</sub> max values as a population (DeJong et al., 2008) and working at various percentages of their VO<sub>2</sub> max feels harder (and is harder metabolically) than normal weight individuals. Understanding that bariatric patients and morbidly obese individuals are essentially working at a higher percentage of their VO<sub>2</sub> max compared to normal weight individuals is an important concept when applying recommendations. Therefore, future research may include charting change in VO<sub>2</sub> max, physical activity levels, walking cadences over time, and associated perceived exertion. Research exists that explains that even when obese individuals self-select a walking pace, their associated perceived exertion is higher than normal weight individuals for a variety of reasons (Ekkekakis & Lind, 2006). Therefore, longitudinal data on the health and fitness improvements of patients who are becoming more active would allow physicians and trainers to understand the interplay between body weight, fitness, and natural movement speeds over time, leading to optimal training progressions.

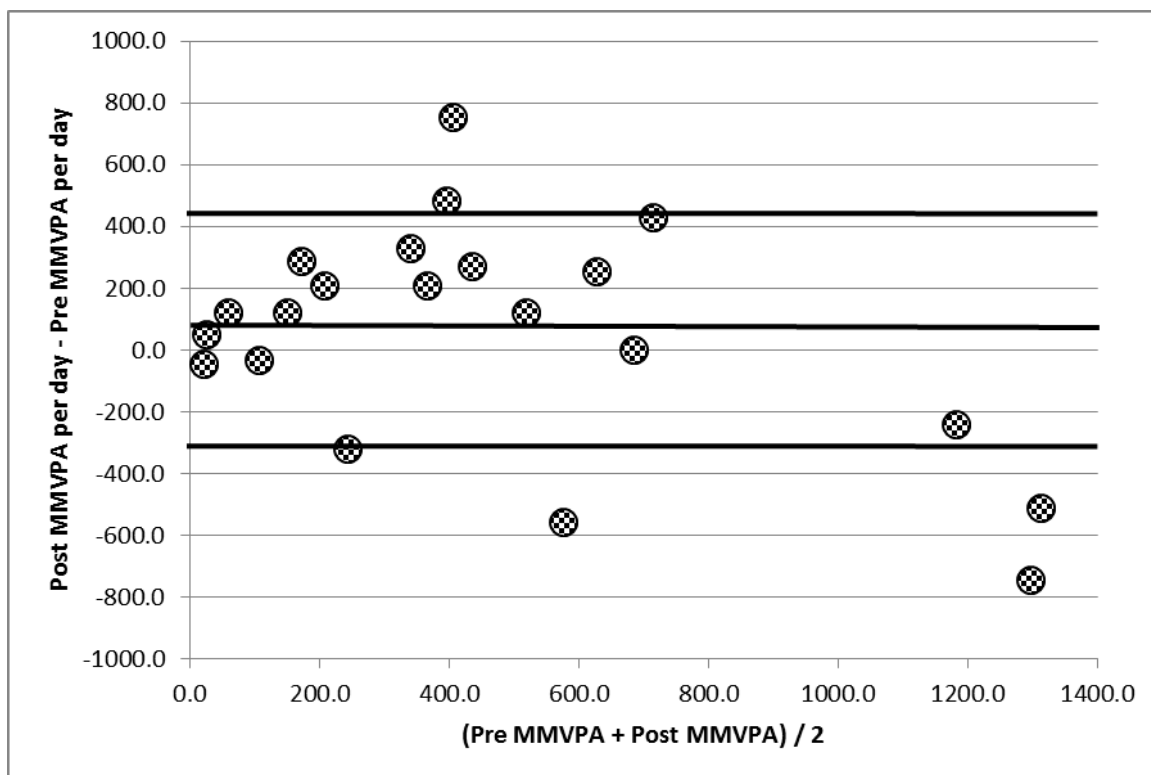


Figure 4. Bland-Altman Plot of Agreement Between CAPS-Derived MMVPA Per Day Presurgery and Postsurgery

Table 13. Presurgery and Postsurgery Moderate to Vigorous Physical Activity in

## Bariatric Patients

Author	Year	Surgical Procedure	Time Post-Operative	n	MVPA Cutpoint	Presurgery	Postsurgery
Present Study	2014	gastric bypass and sleeve	3 to 5 weeks	24	100 steps/min	1 min/day	3 min/day
Bond	2010	gastric bypass and gastric band	6 Months	20	100 steps/min 80 steps/min 984 activity counts/min	0.20% of wear time 6 min/day 26.6 min/day	0.36% of wear time 5 min/day 21.6 min/day
Ramirez-Marrero	2014	gastric bypass	12+ Months	13	1953 activity counts/min	–	26.6 min/day
Chapman	2013	gastric band	12 to 18 Months	40	3 METS	–	5% of wear time
King	2012	gastric band	3 Years	310	80 steps/min	10.3 min/day	16 min/day

Table 14. Comparison of Peak 1 and 30 Min Walking Cadences of Adult Americans and Bariatric Surgical Patients

	N	1 Min Peak Cadence		30 Min Peak Cadence	
		mean	95% CI	mean	95% CI
<b>BMI (kg/m<sup>2</sup>) Classification</b>					
<b>Underweight: &lt;18.5</b>	69	95.5	[87.4, 103.5]	66.0	[58.4, 73.5]
<b>Normal: 18.5-24.9</b>	1016	105.4	[103.5, 107.3]	76.0	[73.6, 78.4]
<b>Overweight: 25-29.9</b>	1195	102.2	[100.8, 103.7]	73.4	[71.6, 75.3]
<b>Obesity Class I: 30-34.9</b>	719	98.3	[96.1, 100.5]	69.4	[67.2, 71.7]
<b>Obesity Class II: 35-39.9</b>	314	94.2	[91.4, 97.0]	64.8	[61.9, 67.7]
<b>Obesity Class III: ≥40</b>	209	87.6	[84.1, 91.0]	57.3	[54.6, 60.1]
<b>Bariatric Presurgery: 44.0 ± 6.5</b>	24	87.2	[80.4, 94.0]	49.3	[42.1, 56.5]
<b>Bariatric Postsurgery: 39.8 ± 6.1</b>	24	84.5	[77.7, 91.2]	48.6	[41.4, 55.8]

Table 15. Comparison of The Stepping Cadence Patterns\* of Average Americans and Bariatric Surgical Patients

	Cadence categories (steps/min)							
	0 Non movement	1-19 Incidental movement	20-39 Sporadic move- ment	40-59 Purposeful movement	60-79 Slow walking	80-99 Medium walking	100-119 Brisk walking	120+ Faster loco- motion
Time (min/day)								
Average American	289.1	383.4	102.0	38.8	15.5	7.52	5.02	1.54
Bariatric Surgical Patient	448.8	288.8	41.0	11.3	5.2	3.0	1.7	0.4
Time (% of day)								
Average American	34.3	45.5	12.1	4.6	1.8	0.9	0.6	0.2
Bariatric Surgical Patient	55.6	36.4	5.2	1.4	0.7	0.4	0.2	0.1

## APPENDIX A

### ACCELEROMETER DIRECTIONS

## Accelerometer Directions



### Placement:

- Your accelerometer should rest slightly to the front side on your right hip. It can be over or under your clothing as long as you are comfortable and it remains in the same spot throughout the day. \*\*If you make a mistake and put it on the left hip, please switch it to the right side as soon as possible and notify me or Dr. Davidson when you return it.

### Wear Time:

- First thing in the morning: Put your accelerometer on as soon as you wake up.
- When you shower: You may wear your accelerometer into the shower as it is water resistant for up to 30 minutes. Simply wipe off excess water once you are done. If you choose to take it off, leave it where you will see it (perhaps on your drying towel) so you do not forget to put it back on.
- During exercise: If you have times where you exercise (something other than daily living tasks such as an exercise class, bike riding or lifting weights), keep your accelerometer on and make a note on the provided sheet detailing what you did and for how long.
- While you sleep: Take your accelerometer off and put it by your bedside or somewhere it is safe and you will remember to put it back on in the morning.

Questions: Please call, text or email any time. Kristen (860)966-1520, K.Ouellette@utah.edu

## APPENDIX B

### EXERCISE LOG



## APPENDIX C

### DIETARY RECORD VERBAL INSTRUCTIONS AND VERBAL CAPS INSTRUCTIONS

### Dietary Record Verbal Instructions

- Please maintain a record of all of the food and liquids you ingest for 3 days while you are wearing your accelerometer.
- Please be as detailed as possible regarding your food consumption.
  - You may use any units of measurement (cups, ounces, tablespoons etc.).
  - Include details about your food such as (how was it prepared, if it had sauces added, brand names when possible etc.).
  - If you go out to eat, please include the name of the restaurant and the name of the item(s) you had (our software is capable of looking up restaurant foods).
  - If you take any food supplements (protein shake, meal replacement shake etc.) please include the name brand and if you mix it with anything (almond milk, skim milk etc.).
- If you are currently using a web-site or phone application to track your food intake, you may continue to use this method, simply print off your dietary record and bring it to your next meeting.
- In order to be as accurate as possible, write down your food during or immediately after you have it so you don't forget.

### CAPS Verbal Instructions

- Please take as long as you need to complete this questionnaire.
- The CAPS has been designed to get an idea of your typical weekly physical activity levels.
- It's unlikely that you do ALL of the activities on the CAPS. So if there are activities that you don't do, simply check (no) and move to the next question.
- When you see activities that you do, check (yes) and then note how many days you do this per week (Monday through Sunday) and for approximately how long each time (hours and minutes per day).
  - *Show a question and give an example*
- Do you have any questions?
- If you have any questions while filling out the questionnaire, please don't hesitate to ask.

## APPENDIX D

### PRESURGICAL LIQUID DIET INSTRUCTIONS

## Pre-op Diet

It is recommended by your surgeon and dietitian to follow a low sugar, liquid diet 10 days before surgery. The purpose of this liquid diet is to deplete your glycogen stores, which in turn will make laparoscopic surgery placement easier. Here are examples of liquids you can have during this time period. The nutritional guidelines are as followed:

### Consume these liquids in moderation, they contain larger amounts of sugar.



1. **Juice, Gatorade®, or Powerade®** – limit to 2 cups or less each day. (*Try to choose juices lower in sugar such as apple, orange, or grapefruit*) OR FRUIT
2. **Regular jello, popsicles, or no sugar added fudgsicles-** 3 or less servings each day
3. **1 cup of milk** (*skim, 1%, Lactaid®, or 2%*) or **8 oz. Light Yogurt** (*Dannon Light, Yoplait Light or Colombo Light*) or **½ cup cottage cheese** - 3 or less each day.
4. **Atkins Shakes or Carb Solutions Shakes.** 1-2 a day (These can be found at Osco, Walgreens, and CVS). **DO NOT BUY:** Slim Fast, Ensure, Boost, etc.)

### These liquids can be taken in any amount since they do not contain sugar.

1. Sugar-free beverages such as Crystal Light, Wyler's Light, Sugar-free Kool Aid or Sugar-free Tang, diet Snapple, diet sodas, Fruit2O®, Propel®, coffee or tea with sugar substitute, or water.
2. Broth soups(all varieties)
3. Sugar-free popsicles and sugar-free jello



**Attention Diabetics!** For those with diabetes we recommend consuming 15 grams of carbohydrates every 1-2 hours. Be sure to monitor your blood sugars and contact your doctor if necessary. If your blood sugar is >150mg, spread out these sugar sweetened liquids over a 3 hour period.

### Liquids with 15 grams of carbohydrates:

- ¾ cup carbonated beverage with soda
- ½ cup orange, apple, or grapefruit juice
- 1 popsicle
- 1 cup milk
- 6 ounces light yogurt (Dannon Light, Yoplait Light or Colombo Light)
- ½ cup cottage cheese
- 1/3 cup regular jello
- ½ cup Kool Aid
- 1 tbsp. honey or sugar (can be used to sweeten a beverage)

If you have questions please contact **[insert contact name]**

Email: **[insert email address of contact]** or pager: **[insert pager number of contact]**

## APPENDIX E

### CROSS-CULTURAL ACTIVITY PARTICIPATION QUESTIONNAIRE (CAPS)



Unique ID   
 MRN   
 Visit Date

## CAPS: TYPICAL WEEK PHYSICAL ACTIVITY SURVEY



Think about the types of activities you did during a typical week in the past month (28 days). For each question, check a box for **YES** or **NO** to indicate whether or not you did this type of activity. Then, for each item you marked as **YES**, write the **NUMBER OF DAYS** you did the activity Monday thru Friday and Saturday thru Sunday. Also, indicate the **AVERAGE TIME** in hours and minutes that you did the activities. Use the **activity examples** listed by each item to guide your recollection of time spent.

### 1. DO YOU PARTICIPATE IN THE FOLLOWING HOUSEHOLD ACTIVITIES?

*Cooking, washing dishes, straightening up, making the bed, dusting, shopping.*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 2. DO YOU PARTICIPATE IN THE FOLLOWING HOUSEHOLD ACTIVITIES?

*Scrubbing, mopping, vacuuming, doing repairs, washing car.*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 3. DO YOU PARTICIPATE IN THE FOLLOWING LAWN/GARDEN/YARD/FARM ACTIVITIES?

*Weeding, sweeping, mowing, raking, snow blowing.*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 4. DO YOU PARTICIPATE IN THE FOLLOWING LAWN/GARDEN/YARD/FARM ACTIVITIES?

*Shoveling dirt or snow, pruning, chopping wood.*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY



## CAPS: TYPICAL WEEK PHYSICAL ACTIVITY SURVEY (cont.)

### 5. DO YOU PARTICIPATE IN THE FOLLOWING CARETAKER ACTIVITIES W/CHILDREN/ADULTS/ANIMALS?

*Bathing, feeding, low intensity playing with child or animal*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 6. DO YOU PARTICIPATE IN THE FOLLOWING CARETAKER ACTIVITIES W/CHILDREN/ADULTS/ANIMALS?

*Lifting and carrying, pushing wheelchair or stroller, heavy play*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 7. DO YOU PARTICIPATE IN THE FOLLOWING TRANSPORTATION ACTIVITIES?

*Driving or riding in the car, riding the subway or bus (include all travel to work)*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 8. DO YOU PARTICIPATE IN THE FOLLOWING TYPES OF WALKING?

*Walking to get places, to the bus, car or work*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 9. DO YOU PARTICIPATE IN THE FOLLOWING TYPES OF WALKING?

*Walking for exercise or social walking, walking your pet*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY



## CAPS: TYPICAL WEEK PHYSICAL ACTIVITY SURVEY (cont.)

### 10. DO YOU PARTICIPATE IN THE FOLLOWING DANCE AND SPORTS ACTIVITIES?

*Dancing in church, ceremonies, or for pleasure*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 11. DO YOU PARTICIPATE IN THE FOLLOWING DANCE AND SPORTS ACTIVITIES?

*Sports: Golf, fishing, hunting, softball, hockey, basketball, racquetball, squash*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 12. DO YOU PARTICIPATE IN THE FOLLOWING CONDITIONING ACTIVITIES?

*Low impact aerobics, rollerblading, ice skating, bicycling, hiking (level), Tai Chi*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 13. DO YOU PARTICIPATE IN THE FOLLOWING CONDITIONING ACTIVITIES?

*Step aerobics, running/jogging, karate, swimming, snowshoeing, hiking (uphill), skiing (snow/water)*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

### 14. DO YOU PARTICIPATE IN THE FOLLOWING CONDITIONING ACTIVITIES?

*Stretching and flexibility exercises, yoga*

☐ YES (see below) ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY \_\_\_\_\_ MINUTES/DAY

## CAPS: TYPICAL WEEK PHYSICAL ACTIVITY SURVEY (cont.)

**15. DO YOU PARTICIPATE IN THE FOLLOWING CONDITIONING ACTIVITIES?***Strength training (weights or machines), Calisthenics (pushups, situps, pullups), pilates*☐ YES (see below) ☐ NO (proceed to next question)**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**16. DO YOU PARTICIPATE IN THE FOLLOWING LEISURE ACTIVITIES?***Watching TV and doing nothing else*☐ YES (see below) ☐ NO (proceed to next question)**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**17. DO YOU PARTICIPATE IN THE FOLLOWING LEISURE ACTIVITIES?***Reading, sewing, or using a computer (not at work)*☐ YES (see below) ☐ NO (proceed to next question)**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**18. DO YOU EARN MONEY AT WORK?**☐ YES (see below) ☐ NO (*proceed to question #23*)**HOW MANY HOURS PER WEEK DO YOU WORK TO EARN MONEY IN ALL JOBS?** \_\_\_\_\_ HRS/WEEK**HOW MANY DAYS PER WEEK DO YOU WORK TO EARN MONEY IN ALL JOBS?** \_\_\_\_\_ DAYS/WEEK**19. DO YOU PARTICIPATE IN THE FOLLOWING ACTIVITIES AT WORK?***Sitting activity: office/lab work*☐ YES (see below) ☐ NO (proceed to next question)**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

## CAPS: TYPICAL WEEK PHYSICAL ACTIVITY SURVEY (cont.)

**20. DO YOU PARTICIPATE IN THE FOLLOWING ACTIVITIES AT WORK?***Standing activity: copy making, assembly, clerking*☐ YES (see below) ☐ NO (proceed to next question)**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**21. DO YOU PARTICIPATE IN THE FOLLOWING ACTIVITIES AT WORK?***Standing or walking activity: nursing, custodial, making deliveries, landscaping, carpentry*☐ YES (see below) ☐ NO (proceed to next question)**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**22. DO YOU PARTICIPATE IN THE FOLLOWING ACTIVITIES AT WORK?***Heavy manual labor, ranching or farming, loading/unloading trucks, forestry, construction*☐ YES (see below) ☐ NO (proceed to next question)**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**23. DO YOU WORK AS A VOLUNTEER IN ACTIVITIES YOU HAVE NOT YET MENTIONED ON THIS SURVEY?**☐ YES (see below) ☐ NO (proceed to question #27)**24. DO YOU PARTICIPATE IN THE FOLLOWING ACTIVITIES IN YOUR VOLUNTEER WORK?***Easy sitting or standing activity*☐ YES (see below) ☐ NO (proceed to next question)**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS

\_\_\_\_\_ HOURS/DAY

\_\_\_\_\_ MINUTES/DAY

## CAPS: TYPICAL WEEK PHYSICAL ACTIVITY SURVEY (cont.)

**25. DO YOU PARTICIPATE IN THE FOLLOWING ACTIVITIES IN YOUR VOLUNTEER WORK?***Moderate intensity standing or walking activity*
☐ YES (see below)    ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS    **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY    \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY    \_\_\_\_\_ MINUTES/DAY

**26. DO YOU PARTICIPATE IN THE FOLLOWING ACTIVITIES IN YOUR VOLUNTEER WORK?***Heavy pushing, lifting, or walking activity*
☐ YES (see below)    ☐ NO (proceed to next question)

**MONDAY THRU FRIDAY:** \_\_\_\_\_ NUMBER OF DAYS    **SATURDAY THRU SUNDAY:** \_\_\_\_\_ NUMBER OF DAYS  
 \_\_\_\_\_ HOURS/DAY    \_\_\_\_\_ HOURS/DAY  
 \_\_\_\_\_ MINUTES/DAY    \_\_\_\_\_ MINUTES/DAY

**27. HOW MANY HOURS DO YOU SLEEP PER NIGHT DURING THE WEEK?**
**MONDAY THRU FRIDAY:** \_\_\_\_\_ HRS/NIGHT

**SATURDAY THRU SUNDAY:** \_\_\_\_\_ HRS/NIGHT

*Thank you for completing this survey.*

## APPENDIX F

### PARTICIPANT RESULTS PACKAGE

Hello!

First, thank you all so much for participating in this research project. The following is a guide to understanding your physical activity results. The attached excel sheet has both your “pre-surgery” and “post-surgery” physical activity. During the study, each of you was assigned a unique ID number. No one in the study knows your number except you and the primary investigator (Kristen). Your results and unique IDs have not been shared with anyone but you.

On to the results.

The first and most common way you can determine your regular daily physical activity level is by counting how many steps you take each day. Research shows that people who are more physically active (take more steps per day) typically enjoy greater health, as long as they are consuming a healthy diet with an appropriate number of calories.

On the results sheet you will see a column that shows your average steps per day before and after surgery. The chart below shows physical activity classifications based on steps per day.

<b>Steps Per Day</b>	<b>Activity Level Classification</b>
<b>Under 5,000</b>	Sedentary
<b>5,000-7,499</b>	Low Active
<b>7,500-9,999</b>	Somewhat Active
<b>10,000-12,490</b>	Active
<b>Over 12,5000</b>	Highly Active

### Benefits of Walking

- Helps to reduce blood pressure by increasing the health of your cardiovascular system (heart and blood vessels).
- Walking enough over time may reduce the risk of heart disease and stroke if you are also eating healthfully, abstaining from smoking, reducing your stress and getting enough sleep at night.
- Walking will help to maintain or possibly increase your muscle and bone strength. Once you are getting at least 10,000 steps per day, adding resistance training 2-4 times per week will increase strength even more.
- Adequate physical activity may improve your body composition (reduce body fat and help maintain muscle).
- Walking may also help to improve your mood and energy!

### Recommendations

10,000 steps per day is a general recommendation for overall health. This is about the equivalent of approximately 5 miles of walking per day. While it is inevitable that you will have sedentary days, attempt to make these days an exception and not a regular occurrence.

Using a pedometer (step counter) is an excellent way to keep track of your walking without having to set aside extra time to specifically walk or exercise. Spend a few days wearing your pedometer to see approximately how much you are walking and then build up slowly from there.

Add about 10% more steps per day each week or 2. It may take as long as 6-12 months to reach 10,000 steps per day. It is better to increase your physical activity slowly than to attempt 10,000 steps immediately. If you do too much too soon it is likely that you will develop sore muscles and possibly overuse injuries (tendon, ligament etc. injuries).

### Helpful Practices

- Keep a step log and a nutrition journal (or use a phone application) so you can see where improvements have been made and where you still have room for improvement.
- Wear cushioned shoes that are less 1-1.5 years old.

- Aim for permanent changes. It takes about six months to truly change a behavior. If you get bored of walking, find a physical activity that is more entertaining for you such as riding a bike or swimming.
- Plan daily walks. After a while, increase the speed of your walks.
- Have a friend or family member help you meet your walking goals.
- Remember, any amount of walking is better than none!

Another way to examine your physical activity levels is by looking at the amount of time you spend in sedentary activity and the amount of time you spend in moderate to vigorous physical activity (MVPA).

### MVPA and Health

A study was conducted on 1,626 men and women. Scientists found that people who did no MVPA were 2x as likely to develop metabolic syndrome than people who did at least 150 minutes of MVPA per week (20 minutes of MVPA per day).

### Sedentary Time and Health

In the same study people who watched < 1 hour/day of television (sitting and watching TV or using the computer is considered sedentary time) outside of work were compared to people who watched > 1 hour/day.

People who were sedentary 1 hour/day had 1.3x the odds of developing metabolic syndrome.

People who were sedentary 2 hours/day had 1.4x the odds of developing metabolic syndrome.

People who were sedentary 3 hours/day had 1.7x the odds of developing metabolic syndrome.

People who were sedentary >4 hours/day had 2.1x the odds of developing metabolic syndrome.

### Recommendations

The US Government recommends at least **30 minutes/day** of MVPA to maintain health.

The recommendation for weight loss and health improvement is **60 minutes/day** (5-7 days per week).

### *Your Results*

To see how much sedentary time you are getting per day, find your unique ID number and see how many minutes you are sedentary per day (divide this value by 60 to determine hours per day). Keep in mind, this number includes your work and TV time combined (but not your sleeping hours, sleep does not count as sedentary time). This number is also an average from all of the days you wore the activity monitoring device.

To see how much MVPA time you are getting per day, find your unique ID number and see on average how many minutes of MVPA you are getting per day on average.

### *Goals*

If you are not currently getting any MVPA, a good way to start is by increasing your walking speed and then time. Your average walking speed (best 1 minute of the day) and (best 30 minutes of the day) is on the results spreadsheet. See how quickly you naturally walked before and after your surgery. 90+ steps per minute is considered a fast enough walking speed to be considered MVPA.

1. If your best 1 minute of the day is below 90 steps per minute, improving your walking speed is your first goal. Go outside, to the park or on a treadmill and begin by walking for 1 minute and counting how many steps you take. Your natural walking speed may be below 90 steps per minute. That is ok and normal. However, to get a better health benefit, walking a bit quicker will help to slowly improve your cardiovascular health. Try to walk for 1 minute at a 90-110 step rate and see how it feels.
2. In order to build up your walking, you may do 1 minute at 90+ steps/minute and 1 minute slower. Alternating between the two.
3. Don't get discouraged if you are starting out slowly. In the next year, you will be losing weight rapidly and walking may feel easier over time. Building up your walking speed and time slowly is better than pushing yourself too hard at the beginning. You may choose to simply increase your usual walking speed during the day instead of setting aside a specific time to walk.
4. A long-term goal is to get 30-60 minutes of MVPA walking per day or 30-60 minutes of structured exercise.

- It is easier to count 30 minutes of exercise or walking in a row, however, there are many commercially available devices to count the number of steps you get per day and/or the time you spend in sedentary, light and moderate to vigorous physical activity.
  - See the last page for a list and links to a few devices (tools for success). We do not support any one monitoring system, the choice is entirely up to you. We added a few as examples.

This data table shows some information regarding various populations and their walking speeds. You can use this information to see on average how fast people walk. You can see average speeds for men, women, various ages and various body mass indexes (BMI). You can calculate your own BMI at this website. [BMI Calculator Website](#)

	<b>Peak 1 Minute Speed (Steps/Minute)</b>	<b>Peak 30 Minute Speed (Steps/Minute)</b>
	Average	Average
<b><u>Sex</u></b>		
<b>Male</b>	101	74
<b>Female</b>	101	70
<b><u>Age</u></b>		
<b>20-29</b>	107	77
<b>30-59</b>	104	75
<b>60-69</b>	94	65
<b>70+</b>	82	53
<b><u>BMI</u></b>		
<b>Underweight: &lt;18.5</b>	96	66
<b>Average Weight: 18.5-24.9</b>	105	76

<b>Overweight: 25-29.9</b>	102	73
<b>Obese Class I: 30-34.9</b>	98	69
<b>Obese Class II: 35-39.9</b>	94	65
<b>Obese Class III: <math>\geq 40</math></b>	88	57
<b><u>Activity Level</u></b> <b><u>(Steps/Day)</u></b>		
<b>Basal Activity: &lt;2500</b>	69	39
<b>Sedentary: 2500-4999</b>	95	61
<b>Low Activity: 5000-7499</b>	105	75
<b>Somewhat Active: 7500-9999</b>	111	85
<b>Active: 10,000-12,500</b>	113	90
<b>Highly Active: 12,500+</b>	114	93

Tools For Success:

Pedometers / Accelerometers

- TrackFast Step Pedometer
  - o \$1.74
  - o Counts how many steps you take each day.
- PE317c Multi-Function Pedometer
  - o \$19.00
  - o Counts how many steps you take each day.
  - o Measures the distance you walk each day.
  - o Counts the calories you burn from walking each day.
  - o Has a clock.
- BodyBugg
  - o \$92.99
  - o Counts how many steps you take each day.
  - o Measures your skin temperature.
  - o Lets you see how many calories you have burned throughout the day.
  - o Includes software where you can log the food you eat to track calorie intake.
  - o Customized for your age, weight, height, and personal goals.

- Fitbit
  - o \$99.95
  - o Counts how many steps you take each day.
  - o Measures the distance you walk/job/run each day.
  - o Measures the calories you burn each day.
  - o Counts how many stairs you climb each day.
  - o Measures your time sleeping and sleep quality.
  - o Acts as an alarm clock for the morning.

Phone Apps:

- Argus
- M7 Pedometer
- Pedometer++
- Running Keeper
- Accupedo Pedometer
- Runtastic Pedometer
- Noom Walk Pedometer

## APPENDIX G

### PRESURGERY AND POSTSURGERY INFORMATION PACKET



MY BEFORE PICTURE

PICTURE

Name\_\_\_\_\_ Doctor \_\_\_\_\_

Surgery Date\_\_\_\_\_ Picture Date\_\_\_\_\_

### My Record of Progress

### 3 Months

Weight \_\_\_\_\_ BMI \_\_\_\_\_

PICTURE

## 6 Months

Weight \_\_\_\_\_ BMI\_\_\_\_\_

PICTURE

## 9 Months

Weight\_\_\_\_\_ BMI\_\_\_\_\_

PICTURE

1 Year

Weight\_\_\_\_\_ BMI\_\_\_\_\_

PICTURE

<u>My Record of Progress</u>	
<div>2 Years</div> <div>Weight _____ BMI _____</div> <div>PICTURE</div>	<div>3 Years</div> <div>Weight _____ BMI _____</div> <div>PICTURE</div>
<div>4 Years</div> <div>Weight _____ BMI _____</div> <div>PICTURE</div>	<div>5 Years</div> <div>Weight _____ BMI _____</div> <div>PICTURE</div>



## MY AFTER PICTURE

PICTURE

<b>Tracking My Success</b>											
	Date	Weight	Weight Loss	BMI	Body Fat %	Chest	Waist	Hips	Thighs	Arms	Pant Size
<b>Pre Surgery</b>											
<b>2 Weeks</b>											
<b>1 Month</b>											
<b>2 Months</b>											
<b>3 Months</b>											
<b>4 Months</b>											
<b>5 Months</b>											
<b>6 Months</b>											
<b>7 Months</b>											
<b>8 Months</b>											
<b>9 Months</b>											
<b>10 Months</b>											
<b>11 Months</b>											
<b>1 Year</b>											
<b>13 Months</b>											
<b>14 Months</b>											
<b>15 Months</b>											

	Date	Weight	Weight Loss	BMI	Body Fat %	Chest	Waist	Hips	Thighs	Arms	Pant Size
<b>16 Months</b>											
<b>17 Months</b>											
<b>18 Months</b>											
<b>19 Months</b>											
<b>20 Months</b>											
<b>21 Months</b>											
<b>22 Months</b>											
<b>23 Months</b>											
<b>2 Years</b>											
<b>2 ½ Years</b>											
<b>3 Years</b>											
<b>3 ½ Years</b>											
<b>4 Years</b>											
<b>4 ½ Years</b>											
<b>5 Years</b>											

## Pre-Surgical Counseling

### Preparing for Surgery:

- You must have nothing to eat or drink after midnight prior to surgery.
- Same day surgery will contact you the day before your surgery to tell you what medications to take and what time to take them.
- If you are a male patient and have a beard, you will be asked to shave your beard.
- Showers should be taken the night before and morning of your surgery.
  - Scrub carefully under arms, under breasts, under abdomen, belly button, and groin area with antibacterial soap.
  - Normal shampoo can be used on your head.
- Every attempt is made to do surgery laparoscopically. Laparoscopic surgery patients have five or six separate one inch-long incisions where they insert the cameras and instruments. If the surgery is unable to be performed laparoscopically, then open surgery patients will have a long vertical incision on the abdomen. Single incision surgical candidates have one small horseshoe shaped incision in the belly button and another very small incision. **The number of incisions can vary depending on each individual patient's situation.**
- You will be on a ventilator during surgery. Unless you have difficulty breathing, this is removed before you ever wake up. Your throat may feel sore and a little swollen from the tube.
- If you use CPAP or BiPAP for sleep apnea, bring the machine with you to the hospital.

### Common Issues after Surgery:

- Gas pain following surgery is the most common complaint.
  - The best thing you can do is to WALK!
  - Mylicon tablets may help alleviate some of the gas.
  - Heating pads and icy-hot also work well at relieving pain in the shoulders and upper back. (Don't fall asleep with heating pad on)
- Constipation is also a common complaint
  - To relieve this, take stool softeners or Miralax.

### Pain Control:

- Gastric Bypass & Sleeve Gastrectomy patients will be hooked up to a special pump through your IV called a PCA (patient controlled analgesia) pump. You will be able to push a button and give yourself pain medication. This will be discontinued the morning after your surgery. You will then begin oral pain medications to prepare to go home.
- Gastric Banding, Imbrication, and Bandication patients will be given an oral narcotic prescription prior to discharge. This packet contains post-operative pain control instructions for those patients who wish to use Tylenol and Motrin for pain control.

### Prevention Measures for Complications:

There are three major possible complications that arise from any surgery, all of which are preventable!

#### 1. Infection:

- Wash your hands well, before ever touching your incisions.
- Always pat your incision dry after a shower and leave it open to air as much as possible.

#### **Warning Signs:**

*Please call your doctor immediately if you have any of the following:*

- Heart rate over 100 beats per minute
- Breathing at a rate over 25 breaths per minute

- Fever of 101 degrees F or flu-like symptoms
- Bleeding from the incision or an increase in its size
- Increased redness, swelling or drainage from the surgical sites
  - **NOTE: Transparent drainage is NORMAL**
- Pain in or around the incision
- Change in the color of the incision
- A feeling something is not right

**If you need to contact the physician after hours, please call the office (801-746-2885) and you will be given the option to contact the provider on call.**

2. Pneumonia/ Atelectasis:

- When you breathe, your diaphragm pulls downward to suck air into your lungs, which causes pressure on your incision(s). Often times this causes discomfort after surgery, so the tendency is to breathe shallowly. When you don't breathe deeply, fluid can collect in the spaces in your lungs. This is called atelectasis or collapsed lung sacs. This can cause pneumonia.
- Pneumonia happens most often in post-surgical patients when they are immobile and/or unable to clear their lung secretions normally.
- An incentive spirometer is a tube with a meter on it that helps you to reach your lung capacity. You will need to blow and breathe into it every hour when you are awake.
- You will be taught to deep breathe and cough while splinting your incision. Coughing with a splint will not "break" your stitches, and is very important to a speedy recovery.

3. Deep Vein Thrombosis/Blood Clots

- When you are normally up and walking, your calf and thigh muscles help to pump blood in the legs back to your heart. When you are lying in bed after surgery these muscles are not working as much, therefore blood may have a tendency to pool in your legs. This blood has the potential to form clot, which can be life threatening.
- The best way you can prevent clots is to walk every hour that you are awake.
- Another prevention for blood clots is using the pressure boots while you are sleeping or in bed. They are not a substitute for walking, but are useful in helping to keep your blood circulating properly while you are in bed. These boots will be put on at the time of surgery and be there for you to use after surgery.
- When you are lying in bed, do foot pumps or "gas pedals" (toes up, toes down) and flex and relax you thigh muscles to increase the blood flow and circulation in your legs.
- The risk of blood clots can extend several weeks after surgery, so keep moving!

**Going Home from the Hospital:**

- Gastric Bypass & Sleeve patients stay overnight in the hospital. Most patients take 1-3 weeks off from work.
- Gastric Banding & Imbrication patients usually go home the same day. Some insurance companies require an overnight stay. Most patients take 1 week off from work.

**Support and Follow-up:**

- You will follow up in our office at one week from the day of discharge; call 801-746-2885 if you need to change your appointment.
- You should follow-up with our office on a monthly basis for the first year, or more often if you are a lap band patient and are in need of an adjustment. A follow-up timeline is included in your patient guidebook.

- After the first year, regular follow up is still important. You should schedule an appointment with us at 18, 24, 36, 48 & 60 months after your surgery.
- The education fee you pay at the time of surgery includes visits with the dietitian and exercise trainers for as long you would like their coaching, even if you are 10 years after your operation.
- Labs are generally run post op every three months for the first year for gastric bypass patients and every year after that. This is important to help detect nutritional deficiencies early. Band and sleeve patients should have labs drawn yearly.
- Plan to attend the monthly post-operative support group. We have support group in Salt Lake, Davis, and Utah County throughout the month. We send out reminders via email. If your email address changes, please make sure to update this with our office. A support group schedule is in your patient guidebook. You can also find support group dates on our website [www.bmiut.com](http://www.bmiut.com) or [www.facebook.com/bmiut](https://www.facebook.com/bmiut) to receive updates.

#### **Medications:**

- After gastric bypass surgery, avoid using Motrin (Ibuprofen) and Aspirin (Salicylic Acid) and any other medications that may contain them. These medications can cause ulcers and stomach problems. If you need to be on Ibuprofen or Aspirin long-term, please discuss this with us at your appointment. Tylenol is acceptable for minor aches and pains.
- Your medications need to be adjusted as you lose weight. This adjustment of medications should happen for every 20 lbs. of weight lost and should be coordinated by your Primary Care Physician.

#### **Birth Control:**

- Even a 10% decrease in body weight can result in an increase in fertility for female patients.
- If you are a female of childbearing age, please use at least one method of birth control for 18 months post-op.

#### **Gastric Banding Patients and Adjustments:**

- Adjustments are the key to making gastric banding work for you. The band is a tool, if it is not adjusted, it will not work. Don't wait too long to come in and get an adjustment
- How can you tell it's time for an adjustment? You can eat more, you feel hungry between meals, and your weight has plateaued.
- Please bring your food diary to your appointment to review with the provider and/or the dietitian.
- If your insurance is paying for your adjustments, it will take about a week to obtain an authorization.

### **Suggested Items for Your Hospital Stay**

- **Educational binder you received at your pre-op visit**
- Pillows, one regular and one small firm one for splinting your incision when you cough
- Robe
- Lip Balm or Moisturizer
- Slippers
- Personal toiletries (soap, shampoo, toothbrush and toothpaste)
- Pads for women who are menstruating. It is not uncommon for women who are menstruating to start their period at the time of surgery. No tampons please.
- Comfortable, loose clothing for the ride home
- Reading material or cards if desired
- Familiar items to make your room more comfortable if you would like
- Insurance card, co-pay, and photo ID
- Copy of Living Will and/or Medical Power of Attorney if you have one
- Case for contacts, glasses, and hearing aids if needed
- Written list of
  - ✓ Medications and dosages
  - ✓ Vitamins and minerals
  - ✓ Past surgeries and dates
  - ✓ Allergies
- Inhalers for asthma patients
- CPAP or BiPAP machine for sleep apnea patients



Do not bring any of the following:

- Computers
- Cell Phones, beepers
- Radios
- Jewelry
- Send your purse or wallet home with your support person after checking into the hospital.
- Any expensive or valuable items

## Postsurgical Coughing

Deep coughing helps keep your lungs clear. If you've had surgery, it will help you get better faster. It may also prevent a lung infection. If you have lung problems, it will help you breathe better. Follow the steps below.



- 1**
  - Sit on the edge of a bed or a chair. Or lie on your back with your knees slightly bent.
  - Lean forward slightly. Hold a pillow firmly against your incision with both hands.
  - Breathe out normally.



- 2**
  - Breathe in slowly and deeply through your nose.
  - Then breathe out fully through your mouth. Repeat.
  - Take a third deep breath. Fill your lungs as much as you can.



- 3**
  - Cough 2 or 3 times in a row.
  - Try to push all of the air out of your lungs as you cough.
  - Then relax and breathe normally.
  - Repeat as directed.

## Postsurgical Deep Breathing

Deep breathing helps keep your lungs clear. If you've had surgery, it will help you get better faster. It may also prevent a lung infection. If you have lung problems, it will help you breathe easier. Follow the steps below.



- 1**
  - Sit on the edge of a bed or a chair. Or lie on your back with your knees slightly bent.
  - Hold a pillow or rolled-up towel firmly against your incision with both hands.
  - Breathe out normally.



- 2**
  - Breathe in deeply through your nose.
  - You should feel your stomach push out as you breathe in.



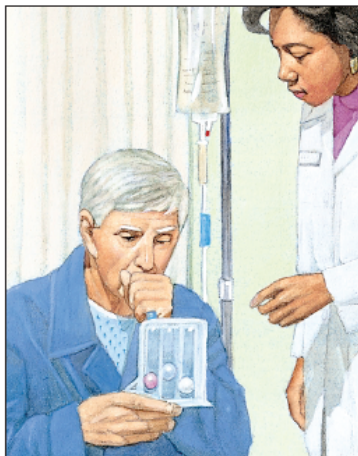
- 3**
  - Pucker your lips as if you were going to blow out a candle.
  - Breathe out slowly through your mouth. You should feel your chest go down as you breathe out.
  - Rest for a few seconds. Then repeat as many times as directed by your health care provider.

### Using an Incentive Spirometer

Soon after your surgery, a nurse or therapist will teach you exercises. These keep your lungs clear, strengthen your breathing muscles, and help prevent complications. The exercises include **incentive spirometry**, a deep-breathing exercise.

#### Four Steps to Clear Lungs

- 1 Exhale normally.**
  - Relax and breathe out.
- 2 Place your lips tightly around the mouthpiece.**
  - Make sure the device is upright and not tilted.
  - If your device has a light signal on it, position it so that you can easily see it.
- 3 Inhale as much air as you can.**
  - Inhale slowly and deeply.
  - Hold the breath long enough to keep the balls or disk raised for a least 2 seconds *or*: the device alerts you that you may exhale
- 4 Repeat the exercise regularly.**
  - Perform this exercise at least 4 times per day, or as your doctor directs.
  - You will also be taught coughing exercises and be asked to perform them regularly on your own.



Deep breathing expands the lungs, aids circulation, and helps prevent pneumonia.

**Please be sure to perform this exercise at least 10 times every hour.**

### **Post Operative Gastric Band Pain Control Instructions**

Almost all post operative pain after Gastric Band surgery can be controlled by over the counter medications. Usually, simple Tylenol and Motrin are enough after LAGB surgery. These medications offer the same level of pain relief as narcotics without the side effect of nausea.

You can purchase Motrin 200mg tablets at any drug store. These are cheap and they are very small so they won't get stuck in your band. You can purchase liquid Tylenol at any drug store. Often only the children's section will have it but it is almost always there. (if you have had a gastric bypass, you should avoid liquid suspensions as they contain a lot of sugar. Rapid dissolve tablets or chewables are a better option)

You may take 250 to 500 mg of liquid Tylenol at home every 8 hours as needed. Alternate with or take at the same time with 400 mg of Motrin tablets (two tablets) at home every six hours as needed.

The maximum daily dose of Tylenol is 4000 milligrams. This amount can only be taken for 3 days. After that you can only take 2500mg of Tylenol a day. This amount can be done indefinitely. Taking too much Tylenol can result in liver failure

The maximum amount of Motrin is 2400 milligrams a day. Motrin should not be taken if you have a history of kidney failure.

If there is still pain despite the maximum amount of Tylenol and Motrin being taken an ice pack over the LAGB port site will help.

When getting up and down place pressure over the LAGB Port site. This helps alleviate pain.

If this pain regimen is inadequate please call our office and we will call you right back.

### **Frequently Asked Questions for Adjustable Gastric Band Patients**

*Q. I have been vomiting every time I eat for the past 3-4 days, even fluids, what should I do?*

A. Call the office, so the medical assistant can assess the situation, your band may be too tight, and some fluid may need to be removed. If you wait too long to call, persistent vomiting can cause a slip.

*Q. It has been at least five days since I've had a bowel movement, is this normal? I do not feel like I need to go to the bathroom.*

A. This can be normal, since you have been on a liquid diet before and after surgery. If you feel the urge to go, but can't or it hurts, this would be constipation.

*Q. I have the urge to have a bowel movement but can't, it hurts when I have one, what can I do?*

A. This means you are constipated. Make sure you are drinking plenty of fluids and getting fiber in your diet. If this does not help, you can try 1 oz prune juice and 1 oz milk of magnesia to help with this. If the above items do not help, please call the office for further instructions.

*Q. I feel nauseated all the time, but I am not vomiting, what can I do?*

A. Make sure you are getting in 64 oz of fluid, as dehydration can lead to nausea. Drink peppermint or chamomile herbal tea. This can help to settle your stomach. If this does not help, please call the office for further instructions.

*Q. Whenever I eat, my stomach feels unsettled and/or my band feels tight, what can I do?*

A. Drink warm fluids 30 minutes before you eat, this will relax your muscles and food won't feel like it is hard on your stomach.

*Q. There is pain in my shoulder, what should I do?*

A. Try a heating pad or walking around. This could be gas pain from your surgery. If it does not improve in 2-3 days, please call our office.

*Q. I am having pain where my largest incision is, what should I do?*

A. Apply a heating pad to the area. The port is stitched to the muscle in this location, and can cause some pain after surgery. If this persists, please call the office.

*Q. I am hungry all the time and am not losing weight, but I just had an adjustment, the surgery must not have worked?*

A. You should come back in for another adjustment. The frequency and amount of fluid needed in your band can vary from person to person. Sometimes several adjustments are needed before a difference is noticed.

If you have any of the following symptoms, please call our office immediately (801-746-2885), even if it is after hours, it will connect you to your surgeon's cell phone.

• Heart Rate over 100 beats per minute	• Breathing at a rate over 25 breaths per minute
• Fever of 101 degrees F or flu-like symptoms.	• Bleeding from incision or an increase in size.
• Increased redness, swelling or drainage from the surgical sites.	• Pain in or around the incision or change in the color of the incision.

## **Post-Operative Gastric Banding**

### ***Discharge Instructions***

#### **Post-Operative Care**

- You will follow up in our office at one week from the day of discharge; call 801-746-2885 if you need to change your appointment.
- Only take medications your physician has instructed you to take.
- Take your own measurements and record them at least once per month.
- Avoid pregnancy for 18 months. Even a 10% decrease in body weight can increase fertility in women of childbearing years.
- Remember no lifting anything greater than 8 lbs. for the first week, and nothing greater than 20 lbs. for 3 weeks after surgery.
- If you have questions about your recovery or have symptoms you are concerned about, please call your doctor. Call your doctor immediately if you have:
  - Fever of more than 101 degrees F
  - Heart Rate of over 100 beats per minute
  - Breathing rate of over 25 breaths per minute
  - Redness or drainage or increased pain from your incision
  - Chest pain
  - Shortness of breath
  - Abdominal pain or vomiting
  - Swelling, pain, or redness in your leg
  - Severe depression or thoughts of harming yourself
  - A feeling that something is not right.

#### **Nutrition Guidelines**

- Do not drink any liquids 30 minutes before, during, or after meals.
- Sip fluids slowly. Do not drink carbonated beverages at all!
- Follow-up with the dietitian at 1 month post-op. Call with any questions prior to that.
- Follow the diet stages carefully. You will go home on a full liquid diet. You will be in this food stage for two weeks following surgery. Please refer to your nutrition guide for foods that are allowed during this food stage.
- You may be ready for an adjustment when your weight plateaus, you feel hungrier between meals, and you can eat more at one meal.
- Average weight loss for gastric banding 1-2 lbs. per week.
- Avoid nausea and vomiting. Excessive vomiting can lead to band slippage.
- Check the color of your urine. Dark urine can mean you are not drinking enough fluid.
- Stop eating when you begin to feel full. Even one extra sip / bite can make you extremely uncomfortable.
- Eat slowly. Put your spoon down between bites. Chew each bite of food at least 20 times. Failure to do so could result in nausea, pain, and vomiting. It could also cause bleeding, blockage, leaking, and other serious medical problems.
- If you are constipated, use ½ prune juice and ½ milk of magnesia to help with this.
- If you have nausea, try herbal teas: chamomile or peppermint tea or other warm fluids.

### **Frequently Asked Questions for Sleeve Gastrectomy Patients**

*Q. I have been vomiting every time I eat for the past few days, even fluids, what should I do?*

A. Call the office, so the medical assistant can assess the situation, you may have a stricture and need to be treated for this.

*Q. It has been at least five days since I've had a bowel movement, is this normal? I do not feel like I need to go to the bathroom.*

A. This can be normal, since you have been on a liquid diet before and after surgery. If you feel the urge to go, but can't or it hurts, this would be constipation.

*Q. I have the urge to have a bowel movement but can't, it hurts when I do have one, what can I do?*

A. This means you are constipated. Make sure you are drinking plenty of fluids and getting fiber in your diet. If this does not help, you can try 1 oz prune juice and 1 oz milk of magnesia to help with this. If the above items do not help, please call the office for further instructions.

*Q. I feel nauseated all the time, but I am not vomiting, what can I do?*

A. Make sure you are getting in 64 oz of fluid, as dehydration can lead to nausea. Drink peppermint or chamomile herbal tea. This can help to settle your stomach. If this does not help, please call the office for further instructions.

*Q. Whenever I eat, my stomach feels unsettled, what can I do?*

A. Drink warm fluids 30 minutes before you eat, this will relax your muscles and food won't feel like it is hard on your stomach.

*Q. There is pain in my shoulder, what should I do?*

A. Try a heating pad or walking around. This could be gas pain from your surgery. If it does not improve in 2-3 days, please call our office.

If you have any of the following symptoms, please call our office immediately (801-746-2885), even if this is after hours, it will connect you to your surgeon's cell phone.

- Heart Rate over 100 beats per minute
- Breathing at a rate over 25 breaths per minute
- Fever of 101 degrees F or flu-like symptoms.
- Bleeding from the incision or an increase in its size.
- Increased redness, swelling or drainage from the surgical sites.
- Pain in or around the incision.
- Change in the color of the incision.
- A feeling something is not right

## Post-Operative Sleeve Gastrectomy *Discharge Instructions*

### **Post-Operative Care**

- You will follow up in our office at one week from the day of discharge; call 801-746-2885 if you need to change your appointment.
- Only take medications your physician has instructed you to take.
- Leave your incision(s) open to air. Take a daily shower. Dry your incisions well.
- Take your own measurements and record them at least once per month.
- Avoid pregnancy for 18 months. Even a 10% decrease in body weight can increase fertility in women of childbearing years.
- Tylenol is fine for minor aches and pains. Do not take Ibuprofen (Motrin) and Aspirin (Salicylic Acid) unless instructed by your physician. These may cause bleeding in the stomach or stomach irritation.
- Remember no lifting anything greater than 8 lbs. for the first week, and nothing greater than 20 lbs. for 4 weeks following surgery.
- If you have questions about your recovery or have symptoms you are concerned about, please call your doctor. Call your doctor immediately if you have:
  - Fever of more than 101 degrees
  - You feel like your heart is racing (over 100 beats per minute)
  - Breathing rapidly (over 25 breaths per minute)
  - Redness, drainage, or increased pain from your incision
  - Chest pain
  - Shortness of breath
  - Abdominal pain or vomiting (*nausea is normal, vomiting is not*)
  - Swelling, pain, or redness in your leg
  - Severe depression or thoughts of harming yourself
  - You feel like something is just not right.

### **Nutrition Guidelines**

- Do not drink any fluids 30 minutes before or after meals. No fluids with meals.
- Sip fluids slowly. Do not drink carbonated beverages at all!
- Follow the diet stages carefully. You will go home on a full liquid diet. You will be in this food stage for two weeks following surgery. Please refer to your nutrition guide for foods that are allowed during this food stage.
- Be sure to take your vitamins. For more information about vitamins and minerals, consult your dietary guidelines or call the dietitian at 746-2885.
- Check the color of your urine. Dark urine can mean you are not drinking enough fluid.
- Stop eating when you begin to feel full. Even one extra sip/bite can make you extremely uncomfortable.
- Eat slowly. Put your spoon down between bites. Chew each bite of food at least 20 times.
- The recommended meal size is 4-6 oz by weight of solid foods. If you are not able to eat this much, that is normal. Do not overeat.
- Follow-up with the dietitian at 1 month post-op. Call with any questions prior to that.
- If you are constipated, try ½ prune juice and ½ milk of magnesia to help with this.
- If you have nausea, try herbal teas: chamomile or peppermint tea or other warm fluids to help settle your stomach.

### **Frequently Asked Questions for Gastric Bypass Patients**

*Q. I have been vomiting every time I eat for the past few days, even fluids, what should I do?*

A. Call the office, so the medical assistant can assess the situation, you may have a stricture and need to be treated for this.

*Q. It has been at least five days since I've had a bowel movement, is this normal? I do not feel like I need to go to the bathroom.*

A. This can be normal, since you have been on a liquid diet before and after surgery. If you feel the urge to go, but can't or it hurts, this would be constipation.

*Q. I have the urge to have a bowel movement but can't, it hurts when I do have one, what can I do?*

A. This means you are constipated. Make sure you are drinking plenty of fluids and getting fiber in your diet. If this does not help, you can try 1 oz prune juice and 1 oz milk of magnesia to help with this. If the above items do not help, please call the office for further instructions.

*Q. I feel nauseated all the time, but I am not vomiting, what can I do?*

A. Make sure you are getting in 64 oz of fluid, as dehydration can lead to nausea. Drink peppermint or chamomile herbal tea. This can help to settle your stomach. If this does not help, please call the office for further instructions.

*Q. Whenever I eat, my stomach feels unsettled, what can I do?*

A. Drink warm fluids 30 minutes before you eat, this will relax your muscles and food won't feel like it is hard on your stomach.

*Q. There is pain in my shoulder, what should I do?*

A. Try a heating pad or walking around. This could be gas pain from your surgery. If it does not improve in 2-3 days, please call our office.

If you have any of the following symptoms, please call our office immediately (801-746-2885), even if this is after hours, it will connect you to your surgeon's cell phone.

- Heart Rate over 100 beats per minute
- Breathing at a rate over 25 breaths per minute
- Fever of 101 degrees F or flu-like symptoms.
- Bleeding from the incision or an increase in its size.
- Increased redness, swelling or drainage from the surgical sites.
- Pain in or around the incision.
- Change in the color of the incision.
- A feeling something is not right

## Post-Operative Gastric Bypass

### *Discharge Instructions*

#### **Post-Operative Care**

- You will follow up in our office at one week from the day of discharge; call 801-746-2885 if you need to change your appointment
- Only take medications your physician has instructed you to take.
- Leave your incision(s) open to air. Take a daily shower. Dry your incisions well.
- Take your own measurements and record them at least once per month.
- Avoid pregnancy for 18 months. Even a 10% decrease in body weight can increase fertility in women of childbearing years.
- Tylenol is fine for minor aches and pains. Do not take Ibuprofen (Motrin) and Aspirin (Salicylic Acid). These may cause bleeding in the stomach or stomach irritation.
- Remember no lifting anything greater than 8 lbs. for the first week, and nothing greater than 20 lbs. for 4 weeks following surgery.
- If you have questions about your recovery or have symptoms you are concerned about, please call your doctor. Call your doctor immediately if you have:
  - Fever of more than 101 degrees
  - You feel like your heart is racing (over 100 beats per minute)
  - Breathing rapidly (over 25 breaths per minute)
  - Redness, drainage, or increased pain from your incision
  - Chest pain
  - Shortness of breath
  - Abdominal pain or vomiting (*nausea is normal, vomiting is not*)
  - Swelling, pain, or redness in your leg
  - Severe depression or thoughts of harming yourself
  - You feel like something is just not right.

#### **Nutrition Guidelines**

- Do not drink any fluids 30 minutes before or after meals. No fluids with meals.
- Sip fluids slowly. Do not drink carbonated beverages at all!
- Follow the diet stages carefully. You will go home on a full liquid diet. You will be in this food stage for two weeks following surgery. Please refer to your nutrition guide for foods that are allowed during this food stage.
- Be sure to take your vitamins. Do not take the calcium and iron at the same time. Take one at night and one in the morning. For more information about vitamins and minerals, consult your dietary guidelines or call the dietitian at 746-2885.
- Check the color of your urine. Dark urine can mean you are not drinking enough fluid.
- Stop eating when you begin to feel full. Even one extra sip/bite can make you extremely uncomfortable.
- Eat slowly. Put your spoon down between bites. Chew each bite of food at least 20 times. Failure to do so could result in nausea, pain, and vomiting. It could also cause bleeding, blockage, leaking, and other serious medical problems.
- The recommended meal size is 4-6 oz by weight of solid foods, and 6-8 oz of liquid. If you are not able to eat this much, that is normal. Do not overeat.
- Follow-up with the dietitian at 1 month post-op. Call with any questions prior to that.
- If you are constipated, use ½ prune juice and ½ milk of magnesia to help with this.
- If you have nausea, try herbal teas: chamomile or peppermint tea or other warm fluids.

### **Frequently Asked Questions for Duodenal Switch Patients**

*Q. I have been vomiting every time I eat for the past few days, even fluids, what should I do?*

A. Call the office, so the medical assistant can assess the situation, you may have a stricture and need to be treated for this.

*Q. It has been at least five days since I've had a bowel movement, is this normal? I do not feel like I need to go to the bathroom.*

A. This can be normal, since you have been on a liquid diet before and after surgery. If you feel the urge to go, but can't or it hurts, this would be constipation.

*Q. I have the urge to have a bowel movement but can't, it hurts when I do have one, what can I do?*

A. This means you are constipated. Make sure you are drinking plenty of fluids and getting fiber in your diet. If this does not help, you can try 1 oz prune juice and 1 oz milk of magnesia to help with this. If the above items do not help, please call the office for further instructions.

*Q. I have been having a liquid or soft stool several times a day what should I do?*

A. It is normal and expected for DS patients to have a liquid or soft stool. Very few DS patients have hard stools or become constipated. DS patients malabsorb fat, binders and some emulsifiers in the foods they eat thus they have softer stools. Soft or liquid stools are typically worse when patients eat fatty foods or processed foods. If you have had an increase in liquid stooling you may want to look at what you ate earlier in the day, it may have been too processed or too high in fat for your new system.

*Q. I feel nauseated all the time, but I am not vomiting, what can I do?*

A. Make sure you are getting in 64 oz of fluid, as dehydration can lead to nausea. Drink peppermint or chamomile herbal tea. This can help to settle your stomach. If this does not help, please call the office for further instructions.

*Q. Whenever I eat, my stomach feels unsettled, what can I do?*

A. Drink warm fluids 30 minutes before you eat, this will relax your muscles and food won't feel like it is hard on your stomach.

*Q. There is pain in my shoulder, what should I do?*

A. Try a heating pad or walking around. This could be gas pain from your surgery. If it does not improve in 2-3 days, please call our office.

*Q. How much weight should I expect to lose and what happens if I lose too much weight too fast?*

A. Expected weight loss is 10-15 lbs a month after the first month. One should never lose more than 10% of their body weight in one month (ex: You weigh 300 and lose 30 or more pounds in a month). If you are losing 10% of your body weight come in and be seen by a provider and the dietitian you may need enzymes to help you absorb more fat and protein which will slow your weight loss.

If you have any of the following symptoms, please call our office immediately (801-746-2885), even if this is after hours, it will connect you to your surgeon's cell phone.

- Heart Rate over 100 beats per minute
- Breathing at a rate over 25 breaths per minute
- Fever of 101 degrees F or flu-like symptoms.
- Bleeding from the incision or an increase in its size.
- Increased redness, swelling or drainage from the surgical sites.
- Pain in or around the incision.
- Change in the color of the incision.
- A feeling something is not right

## Post-Operative Duodenal Switch

### *Discharge Instructions*

#### **Post-Operative Care**

- Call to make an appointment for a wound check within one week of your discharge at 746-2885
- Only take medications your physician has instructed you to take.
- You can take a shower the day after your surgery. Do not bathe until your incisions are completely healed over and your scabs have come off of your incisions.
- Take your own measurements and record them at least once per month.
- Avoid pregnancy for 18 months. Even a 10% decrease in body weight can increase fertility in women of childbearing years.
- Tylenol is fine for minor aches and pains. Do not take Ibuprofen (Motrin) and Aspirin (Salicylic Acid). These may cause bleeding in the stomach or stomach irritation.
- Remember no lifting anything greater than 8 lbs. for the first week, and no heavy lifting or straining for the following three weeks.
- If you have questions about your recovery or have symptoms you are concerned about, please call your doctor. Call your doctor immediately if you have:
  - Fever of more than 101 degrees
  - You feel like your heart is racing (over 100 beats per minute)
  - Breathing rapidly (over 25 breaths per minute)
  - Redness, drainage, or increased pain from your incision
  - Chest pain
  - Shortness of breath
  - Abdominal pain or vomiting (*nausea is normal, vomiting is not*)
  - Swelling, pain, or redness in your leg
  - Severe depression or thoughts of harming yourself
  - You feel like something is just not right

#### **Nutrition Guidelines**

- Do not drink any fluids 30 minutes before or after meals. Do not drink with meals.
- Sip fluids slowly. Do not drink carbonated beverages at all!
- Follow the diet stages carefully. You will go home on a full liquid diet, which will last for two weeks following surgery. Please refer to your nutrition guide for foods that are allowed during this stage.
- Be sure to take your vitamins – not doing so can result in serious malnutrition, this can occur quickly with the type of procedure you have had. A multivitamin, ADEK multivitamin, calcium, and iron are recommended. Do not take the calcium and iron at the same time.
- Check the color of your urine. Dark urine can mean you are not drinking enough fluid.
- Stop eating when you begin to feel full. Even one extra sip/bite can make you extremely uncomfortable.
- Eat slowly. Put your spoon down between bites. Chew each bite of food at least 20 times. Failure to do so could result in nausea, pain, and vomiting. It could also cause bleeding, blockage, leaking, and other serious medical problems.
- The recommended meal size is 4-6 oz by weight of solid food. If you are not able to eat this much, that is normal. Do not overeat.
- Follow-up with the dietitian at 1 month post-op. Call with any questions as needed prior to that.
- If you are constipated, use ½ prune juice and ½ milk of magnesia to help with this.
- If you have nausea, try herbal teas: chamomile or peppermint tea or other warm fluids.

**If you need to contact the physician after hours, please call the office and you will be given the option to contact the provider on call.**

# **Exercise Guide for Weight Loss Surgery**

## Moving Through the Stages of Exercise

As you know this surgical procedure is to help you lose weight by changing your eating habits and by exercising. Meal planning, along with a regular physical activity program, is the cornerstone to your success.

Phase I: Surgery – Week 1: No exercise at this point, light walking/moving every hour that you're awake. Distance is based on what is tolerable. No lifting beyond 8 lbs.

Phase II: Week 1 – Week 2: No exercise at this point, light walking/moving every hour that you're awake. Start increasing the distance as tolerated. No heavy or strenuous lifting.

Phase III: Week 2 – Week 3: Begin cardiovascular exercise. Start with 1-2 days per week for about 5-10 minutes each day.

Phase IV: Week 3 – Week 4: Continue cardiovascular exercise. Progress forward to 2-3 days per week for about 10-15 minutes each day.

Phase V: Week 4 – Month 2: Continue cardiovascular exercise. Progress forward to 3-4 days per week for about 15-20 minutes each day. You may now begin strength training exercises. Begin with one day per week of strength training exercises.

Phase VI: Month 3 – Month 6: Continue cardiovascular exercise. Progress forward to 4-6 days per week for about 20-30 minutes each day. Continue with strength training exercises. Progress forward with 2 days per week of strengthening exercises. Allow at least 24-48 hours between strengthening routines to allow the muscles to repair and to grow.

Phase VII: Month 6 and beyond: The exercise done in this time period will be very individualized, please see the Exercise Physiologist for further instruction.

\*PLEASE NOTE: Before you begin walking, check with your primary healthcare provider if you are: new to exercise, over 40, overweight, a smoker, have heart disease, high blood pressure, diabetes, arthritis, asthma, or any other medical condition that concerns you.

\*\*Not every patient will be able to move through the weekly schedule with ease. If you are finding it difficult to move into the next phase, please continue with your current phase until your body is able to move into the next phase.

### Rules to Follow: Guidelines for Success

The type of exercise you choose may vary, but it must keep your heart rate up.

Here are some suggestions to make exercising easier:

- Choose a time of day that is good for you and stick to it. Try to choose a time when you are unlikely to be interrupted. Remember, in the summer you will not want to be exercising at 2 p.m. during the heat of the day.
- Wear loose fitting and comfortable clothing. Don't try to sweat off the weight by using non-breathing sweat suits.
- Try doing the exercise to music. It will help make the time pass more quickly.
- Exercising is easier and more enjoyable if done with a friend.
- Do not set goals too high, as this will guarantee that you fail. Do the exercises in small segments and increase to more strenuous workouts.
- Do not perform any of the exercises if they cause you pain. Work into your exercise program gradually.
- Do not compare yourself to others, we all function differently.
- Change what exercise you do every 4 to 6 weeks. Do not allow your body to become adapted to the type of exercise you do.
- Discontinue exercising and contact your physician should you experience severe pain, shortness of breath, dizziness, or any other unusual symptoms during exercise.

### Exercise Instructions/Limitations

1. Be sure to continue exercising until your surgical date. It is important to maintain the benefit you've received from your cardiovascular exercise. Keeping up with your exercise will help you recover faster from your surgery and help you get back to your daily routine faster.
2. After surgery, it is important that you are up and walking once an hour, every hour that you are awake. This will help your healing process and help to prevent blood clotting. It is important that your support person, as well as your self, challenges you to move regularly.
3. Once you are home the same rule will apply at home as it applied in the hospital, it is important that you continue to get up and move. Every hour that you are awake you should get up and walk around the house. Getting out and walking outside is great (if weather permits). If not, go to a store or a mall where you can get some distance in. Keep in mind: not exercise – ***movement!***
4. Stairs should not be a problem after your surgery. Take them one at a time – slowly. If you are using a handrail for stability, do not aid by pulling! Please, at this time, do not use stairs as a form of exercise.
5. Avoid any abdominal exercises or straining (i.e. crunches), that would strain the abdominal wall, for one month after your surgery date.
6. Avoid lifting anything greater than 8 pounds for the first week. Please also try to avoid any heavy lifting or straining for four weeks following surgery.
7. Try to sit in a straight-backed chair with armrests to assist in getting up from the seated position. The two weeks following surgery are the most crucial.
8. Avoid sleeping in waterbeds or anywhere that makes getting up difficult. It is important that you focus on using your arms and legs to get up, and avoid using your abdomen. Remember, when getting out of bed, you should do so by rolling on your side, raising your body, then standing using your arms and legs for assistance (see illustration on next page).

## Getting Into and Out of Bed

### **1. Roll Onto Your Side**

- Keep your knees together.
- Flatten your stomach muscles to keep your back from arching.
- Put your hands on the bed in front of you.



### **2. Raise Your Body**

- Push your upper body off the bed as you swing your legs to floor.
- Keeping your back straight, move your whole body as one unit.
- Don't bend or twist at the waist.
- Let the weight of your legs help you move.



### **3. Stand Up**

- Lean forward from your hip and roll onto the balls of your feet.
- Flatten your stomach muscles to keep your back from arching.
- Using your arm and leg muscles, push yourself to a standing position.



### Getting Back to Exercise

1. Two weeks out from surgery you may now return to cardiovascular exercise. It is very important that you gradually increase your exercise. Please refer to the exercise stages to safely increase activity levels. More exercise = more weight loss. Never forget that!
2. Remember to avoid heavy lifting or straining and any abdominal exercises that may strain the abdominal wall for the first month after surgery.
3. If you begin exercising and feel that your range of motion in your mid-section is limited, you may try trunk stretching. While sitting down, rotate the upper half of your body in one direction (either right or left) until you feel gentle tension, not pain. Hold the stretch for 20-30 seconds. Shift to the other side and perform the same stretch, holding for 20-30 seconds. Lastly, stretch your arms straight above your head as far as they will go, to the point of tension. **Remember** no stretches should be done to the point of pain!
4. Please avoid pool exercises until your incisions are fully healed. Pools have a lot of bacteria in them and you want to avoid that bacterium from entering your incision. Average time frame is 3-4 weeks after surgery, if you are healing slower, please only do pool exercise after the incisions are fully healed.
5. One of the main reasons to meet with the Exercise Physiologist at your 1-month follow-up appointment is to evaluate your metabolism.

## Metabolism Matters

Your metabolism – combined with your daily physical activity – determines how many calories your body burns each day.

Until recently, there was no convenient or affordable way to measure your metabolism. Now, with the MedGem device, you can easily and quickly learn your metabolic rate with a simple breath tests that is administered.

### Why would I want my metabolism measured?

A metabolic measurement will determine how many calories your body needs to meet your goals. Such goals may include:

- Trying to lose weight
- Trying to maintain weight
- Interested in improving overall health and fitness

### Why should you retest every 6 months?

Your metabolism changes as you lose weight. Re-measurement during weight loss allows you to avoid weight loss plateaus by altering your exercise plan to reflect changes in your body.

### What should you know the day of your measurement appointment?

- Do not eat or drink anything other than water for at least 4 hours prior to the measurement.
- Do not exercise (aerobic or strength training) for at least 4 hours prior to the measurement.
- Do not consume caffeine, nutritional supplements, or medications containing ephedra, Ma Huang, or pseudoephedrine for at least 4 hours prior to the measurement.
- Do not smoke or use nicotine for at least 1 hour prior to the measurement.
- Sit quietly for 5-10 minutes prior to measurement.

An accurate measurement of your metabolism will enable you to personalize your health and wellness program, and tailor your plan to your body's unique needs.

You will have the option to have your metabolism tested at your 1 month appointment. Although the metabolism testing is not part of your program fee, you can see how important it is to know your metabolic rate. Call your insurance to see if this is a covered test. If you are a cash-pay patient, this test is an additional fee.

## Setting Exercise Goals

SMART goals help to evaluate if what you are trying to achieve is reachable. Use these goals to help in making your exercise program:

Make SMART Goals:

S = Specific

M = Measurable

A = Attainable

R = Realistic

T = Timely

Specific: Specifics will help you to focus on your efforts and clearly define what your plan is. What are you going to do? Why is it important to you? How are you going to do it?

Measurable: Establish tangible criteria for measuring progress toward the accomplishment of each goal you set. When you measure your progress you stay on track, reach your target dates and experience the excitement of achievement that motivates you.

Attainable: Setting goals too far out of reach will lead to not achieving them (i.e. saying you are going to go to the gym for an hour everyday when you have not exercised in a long time might be too much to start with). Although you may start with the best of intentions, the knowledge that it is too much for you means your subconscious will keep reminding you of this fact and will stop you from giving it your best effort.

Realistic: Realistic means, “do-able.” A goal needs to be realistic for you and where you are at the moment. Do not make your goals so out of reach you set yourself up for failure. Set yourself up for success. If it sounds too easy then there is no reason why you cannot or will not do it.

Timely: Putting an end point on your goal gives you a clear target to work toward. If you do not set a time, the commitment is too vague. It tends not to happen because you feel you can start at any time. Without a time limit, there is no urgency to start taking action now.

# **Nutrition Guide for Weight Loss Surgery**

### The 4 Phases of Meal Planning

As you know, this surgical procedure is to help you lose weight and change your eating habits at the same time. Meal planning, along with a regular physical activity program, is the cornerstone to your success. The space in your stomach is so small that the amount of food you eat is well controlled. It is important to eat the correct foods to maximize your weight loss.

There are four stages of meal planning. As you begin, you are training your stomach pouch to tolerate different foods, gradually moving from liquids to solids. You need to stick to each phase as listed below to ensure proper healing and prevent complications from occurring.

Surgery	Food Phase	When Phase Occurs
Band, Sleeve, Bypass, Duodenal Switch	Clear liquids & Protein drinks	Pre Surgery Only (1-2 weeks)
	Full liquids	Weeks 1 & 2 post op
	Soft foods	Weeks 3 & 4 post op (4-6 oz)
	Solid foods	Week 5 and beyond (4-6 oz)
Imbrication, Bandication	Clear liquids & Protein Drinks	Pre Surgery (1-2 weeks) Weeks 1 & 2 post op
	Full liquids	Weeks 3 & 4 post op
	Soft foods	Weeks 5 & 6 post op (2 oz meals)
	Solid foods	Weeks 7 & 8 post op (3 oz meals) Weeks 9 and beyond (4 oz meals)

It is very important to follow the stages above. Also, you need to get in the habit of weighing your food at each meal. **Purchase a food scale prior to surgery, so you can start weighing your food right after surgery.**



### Rules to Follow: Guidelines for Success

The process of eating changes once you have had weight loss surgery. In a way, you are relearning the process of eating again. Below are rules to follow after surgery, to assist you in this process.

**Take your time when you are eating.** More of the digestive process needs to occur in your mouth after surgery. Chew your food to the consistency of applesauce, and this will eliminate the problem of food getting stuck.

**Follow phases of the meal plan.** It can get boring to eat a lot of the same foods over and over again, but the food phases are designed to allow for adequate healing time. Rest assured that you will be able to add variety to your diet as time goes by.

**Do not drink with meals.** Avoid drinking fluids 30 minutes before, during, or 30 minutes after meals. This will allow food to sit in your stomach longer after eating. Drinking with meals or right after can cause food to empty out of your stomach too quickly, causing you to eat more or eat more often.

**Eat only 3 meals per day, avoid snacking.** Snacking can lead to overeating and weight gain, as you can consume just as many calories as you did prior to surgery. It is not the food that is being snacked on, but the habit of snacking that you should avoid.

**Avoid high calorie or carbonated beverages.** High calorie fluids do not contribute to fullness, and should be avoided. Carbonated beverages have been shown to attribute to weight gain, whether they are diet or not. Do not drink any alcoholic beverages. The affects of alcohol are intensified after gastric bypass surgery. Also, alcohol is very high in calories. Water and other low-calorie beverages (i.e. crystal lite) are the best choice for fluids.

**Avoid foods with simple sugars or simple carbohydrates.** These foods are meant to be used up quickly in your body for fuel, digesting at a more rapid rate than protein and complex carbohydrate foods (i.e. fruit and vegetables). It is best to avoid these foods for long term to facilitate weight loss and maintenance.

**Stay calm.** Your stomach needs a calm atmosphere so it is important to stay relaxed and avoid distractions. If you have had a stressful or emotional day, you may find that it is difficult to tolerate food. If so, try drinking warm fluids 30 minutes prior to eating to relax your stomach.

**Vitamin/mineral supplements are a must!** Due to the restricted intake, and with some surgeries, malabsorption of nutrients, it is important to take supplements to guarantee adequate nutrient intake. This is a habit to get into for lifetime. Nutritional deficiencies do not typically occur within the first year post-operatively, it is usually five or more years after that these problems can occur.

**Get an adequate fiber intake.** Constipation is very common after weight loss surgery. Smaller portions and a higher intake of protein can be contributing factors. Be sure to get fruit and/or vegetables at each meal. Drinking plenty of fluids and exercising can help combat this as well.

## Liquid Diet Instructions

**1-2 weeks prior** to surgery you will be on a liquid diet. The purpose of this diet is to help shrink your liver by removing fat from it. This decreases your risk of having to have an open procedure and makes the surgery easier to perform. The liquid diet includes:



- **Protein Drinks**
  - 3-4 protein drinks per day, in place of meals, are essential to provide you with adequate energy
  - Choose a protein supplement with at least 20 grams of protein per serving and less than 10 grams of carbohydrates
  - Whey Protein Isolate is best absorbed, choose a protein drink that has this as the protein source (look at the ingredient list to check for this)
  - You can mix your protein drink with water, skim milk, or 1% milk
  - Blending your protein drinks in the blender will help eliminate the “gritty” taste that can occur with protein drinks
- **Clear Liquids**
  - Aside from protein drinks, you can have as many clear liquids as you would like.
  - Clear liquids would be any liquid you can see through when held up to the light
  - No carbonated, caffeinated, or alcoholic beverages
  - Choose liquids that are low calorie, low sugar, and low fat
  - Examples include:
    - Sugar-free Jell-O
    - Sugar-free popsicles
    - Clear broth and bouillon
    - Herbal tea

## Protein Supplement Suggestions

*(This is just a suggested list, if you choose something not on this list; please make sure it meets the guidelines above)*

Product	Serving	Protein	Carbs	Examples of Flavors
Isopure Zero Carb (liquid) <a href="http://www.advantagesupplements.com">www.advantagesupplements.com</a>	1 packet	40 g	0 g	Passion Fruit, Pineapple Orange Banana, Mango Peach, Icy Orange, Grape Frost, Apple Melon, Blue Raspberry, Alpine Punch
Bariatric Advantage (powder) <a href="http://www.bariatricadvantage.com">www.bariatricadvantage.com</a>	2 scoops	27 g	8 g	Chocolate, Vanilla, Strawberry, Orange Cream, Banana, Iced Latte
Nectar/Matrix <a href="http://www.si03.com">www.si03.com</a>	1 scoop	23 g	0g	Caribbean Cooler, Crystal Sky, Fuzzy Navel, Roadside Lemonade, Strawberry Kiwi, Twisted Cherry, Pink Grapefruit, Apple Ecstasy
Dymatize Elite Whey Protein <a href="http://www.dymatize.com">www.dymatize.com</a>	1 packet or scoop	24 g	2 g	Smooth Banana, Butter Cream Toffee Mix, Rich Chocolate, Gourmet Vanilla, Café Mocha, Berry Blast, Chocolate Mint, Pina Colada, Chocolate Fudge
Unjury <a href="http://www.unjury.com">www.unjury.com</a>	1 scoop	20 g	3 g	Chocolate, Vanilla, Strawberry, Chicken Broth, Unflavored

## Non Whey Isolate Protein Drinks

*(These are options, only if you cannot find a Whey Protein Isolate that will be appropriate to meet your needs)*

High Protein Slimfast <a href="http://www.slimfast.com">www.slimfast.com</a>	1 can	20 g	4 g	Creamy Chocolate, Vanilla Cream
Fortified skim milk & Carnation instant breakfast (No sugar added) <a href="http://www.carnationinstantbreakfast.com">www.carnationinstantbreakfast.com</a>	1 packet	20 g <sup>o</sup>	24 g <sup>o</sup>	Chocolate, Vanilla, Strawberry <sup>o</sup> (1/3 cup nonfat dry milk added to 1 cup skim or 1 % milk with instant breakfast powder)

## Recipes That Work For You: *Clear Liquids*

### Orange Spiced Tea

1 pkg Orange tea  
1 scoop Unflavored protein powder

1 pkg Cinnamon spice tea

#### Directions:

1. Prepare tea as directed, using both tea bags in 8 oz of water.
2. Add protein powder and mix until dissolved.

*Total Protein: 15+ grams*

### High Protein Jell-O

1 pkg (4 oz) Sugar-free Jell-O (any flavor)

2 scoops Unflavored protein powder

*Serving Size: 1 cup*

#### Directions:

1. Follow package directions for dissolving Jell-O in boiling water.
2. Measure 1 cup of cold water. Add two scoops of unflavored protein powder to cold water, one scoop at a time, stirring slowly to dissolve. Add ice to water to equal one cup.
3. Stir protein powder with ice into dissolved Jell-O until ice has melted. Place in freezer for at least 30 minutes to chill quickly.

Note: The protein will settle somewhat toward the bottom, but the taste is unchanged.

**Source:** [www.unjury.com](http://www.unjury.com)

*Protein (per serving): 15+ grams*

### High Protein Herbal Tea

1 pkg any flavor herbal tea

1 scoop Unflavored protein powder

#### Directions:

1. Prepare tea as directed
2. Add protein powder and mix until dissolved.



*Total Protein: 15+ grams*

### Strawberry Lemonade

1 pkg Lemon herbal tea

1 scoop Strawberry protein powder

#### Directions:

1. Prepare tea as directed
2. Add protein powder and mix until dissolved. For a cool treat, wait until it cools down and serve over ice.

*Total Protein: 15+ grams*

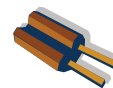
### Make Your Own Popsicles

1 pkg Crystal Lite (any flavor)

1 scoop Unflavored protein powder

#### Directions:

1. Prepare crystal lite as directed on package. Add unflavored protein powder.
2. Pour into ice cube trays. Add toothpicks to each "Popsicle" once frozen enough for the toothpicks to stand up straight.



*Total Protein: 15+ grams*

### High Protein Broth

1 can Clear broth (chicken, beef, or vegetable)

1 scoop Unflavored protein powder

#### Directions:

1. Prepare broth as directed on can.
2. Add protein powder and stir until dissolved.

*Total Protein: 15+ grams*

## FULL LIQUIDS

Foods that are liquid or semi-solid at room temperature are allowed during this phase of meal planning. Do not eat solid foods at this stage! It could result in a blockage in the stomach, pain, vomiting, etc. You need to allow your stomach time to heal.

WISE CHOICES	AVOID
Hot cereals: Cream of Wheat Cream of Rice Malt-o-Meal Grits	Oatmeal (too thick)
Soups: (puree in blender or strain pieces) Broth (beef, chicken, vegetable) Bouillon Cream soup (chicken, potato, mushroom) Split pea	Cream of Tomato (too acidic) Cream of Celery (too stringy) No noodles, pasta, or rice
Beverages: Sugar-free, caffeine-free liquids Carbonation-free liquids Water Decaffeinated coffee and tea Propel sports drink Crystal Lite	Carbonation Citrus or Acidic Fluids Juice
Sweeteners: Splenda, Stevia Equal, Sweet & Low	SUGAR
Protein sources: 1% or skim milk Dried powdered skim milk Double-strength milk <b>(Combine 1 quart milk and 1 1/3 cups non-fat powdered milk)</b> Unsweetened soy milk Protein supplements No sugar added yogurt (puree fruit pieces in blender)	Ensure Boost Slimfast (regular)
Other suggestions: Sugar-free Popsicles Sugar-free Jell-O Sugar-free pudding Sugar-free baked custard	



- It is a good idea to consume 1-2 protein drinks per day, while on full liquids, to aid in the healing process.
- Please note that gastric bypass patients may find it difficult to eat 4 oz of food at this stage. Take your time and eat what you are able, do not force food down. In time, your portions will increase to 4 oz.

## Recipes That Work For You: *Full Liquids*

### Mint Chocolate Shake

½ cup Light vanilla yogurt                      ½ cup Milk  
1 pkg No sugar added instant breakfast (chocolate)                      ½ tsp Mint extract

*Directions:*

1. Combine all ingredients in blender and blend until smooth.

*Total Protein: 12 grams*

### Rootbeer Float

1 cup Light vanilla yogurt                      ½ tsp Rootbeer extract  
½ cup Milk                      1 tsp Splenda  
1/3 cup Powdered milk

*Directions:*

1. Combine all ingredients in blender and blend until smooth.



*Total Protein: 20 grams*

### Strawberry Vanilla Smoothie

½ cup Diluted orange juice                      1 cup Light strawberry yogurt  
½ cup Ice cubes                      1 tsp Vanilla extract  
1 pkg No sugar added instant breakfast (vanilla)                      1/3 cup Powdered milk

*Directions:*

1. Place all ingredients in blender and blend until smooth.

*Total Protein: 20 grams*

### High Protein Cream Soup

1 can Cream of Chicken Soup (or other)                      1 cup Milk  
1/3 cup Powdered milk

*Directions:*

1. Prepare soup as listed on can, except adding milk and powdered milk.
2. Make sure that all pieces in the soup are pureed before eating.

*Total Protein: 23 grams*

### Banana Nut Cream of Wheat

1 pkg Cream of Wheat (original)                      1/3 cup Powdered milk  
1 tsp Banana flavoring                      1 tsp Splenda  
½ tsp Almond extract

*Directions:*

1. Prepare Cream of Wheat as listed on package
2. Add other ingredients and stir well.



*Total Protein: 11+grams*

### Maple Nut Cream of Wheat

1 pkg Cream of Wheat (original)                      1/3 cup Powdered milk  
1 tsp Maple flavoring                      1 tsp Splenda  
½ tsp Almond extract

*Directions:*

1. Prepare Cream of Wheat as listed on package.
2. Add other ingredients and stir well.

*Total Protein: 11+grams*


## FULL LIQUIDS SHOPPING GUIDE

- Food scale
- All items allowed on clear liquid phase
- Creamed soups
- Hot cereals (not oatmeal)
- Protein supplements
- Non-fat powdered skim milk
- Crystal Lite or sugar-free Kool Aid/Tang
- Herbal teas: ginger tea, peppermint tea, chamomile tea, smooth move tea
- Light yogurt
- Sugar-free instant pudding
- Extract flavorings: vanilla, strawberry, cherry, lemon
- Sugar substitutes
- Chewable vitamins



## SOFT MEALS

Semi-soft foods are easy to digest. Remember that after surgery the stomach and intestines have to heal well before regular foods can pass through. Following the guidelines is important to avoid blockage, vomiting, and other problems. It is important that you try only one new food at a time and try it several times to be sure it is agreeing well with your stomach and intestines.

FOOD GROUP	RECOMMENDED FOODS	FOODS TO AVOID
Eggs	Scrambled, soft cooked, hard cooked, egg salad.	Fried Eggs.
Seafood	Canned tuna in water, canned salmon in water, baked or poached white fish, shrimp, and imitation crab.	Seafood that has been fried.
Vegetarian	Soy based patties, tofu, textured vegetable protein.	
Ground meats	Ground turkey.	Beef (all types).
Chicken	Canned chicken, shaved deli style chicken.	Dry white chicken meat.
Turkey	Shaved deli style turkey meat.	Dry white turkey meat.
Ham	Canned ham and deli style shaved ham.	
Pork	Pork loin and tenderloin.	Dry and non-tender cuts.
Protein supplements	Fortified skim milk, whey, egg and soy based supplements or protein bars.	Do not drink protein drinks in between meals. These can be substituted for a meal, if desired.
Dairy proteins	Double strength milk, Lactaid milk (if needed), low-fat cottage cheese, low-fat ricotta cheese, low-fat cheeses, string cheese, lite yogurt, sugar-free puddings and custard.	
Soups	Lentil, pea, homemade soups, broths.	
Fruits 	No sugar added applesauce, canned peaches, pears, apricots (in natural juice or lite syrup). Soft fresh fruit (ripe banana, ripe peeled peach and seedless melon).	Careful with skins and seeds.
Vegetables	Cooked vegetables (green beans, beets, carrots, peas, eggplant, mushrooms, cooked greens, spinach). Tomato and V-8 juice. Mashed beans using bean-o or soaking in water and changing the water to reduce gas.	Avoid winter and summer squash with strings. Avoid gas-producing vegetables (broccoli, beans, cabbage, or raw and whole vegetables). Use bean-o to control the gas.
Starches	Hot cereals: cream of wheat, cream of rice, malt-o-meal, and grits.	Whole grain cereals and breads. Soft, gummy breads. Rice and pasta.
Sweeteners	Equal, Sweet-n-Low, Stevia, Splenda.	Sugar, honey, corn syrup.
Fats	May have low-fat salad dressings, cream cheese, mayonnaise, olive oil, canola oil, peanut oil, butter/margarine, cooking spray.	<b>LIMIT to 1 teaspoon per meal maximum</b>

## Recipes That Work For You: *Soft Foods*

### Lime Fluff

*Yield: 6 servings*

1 pkg (3 oz) Lime Jell-O, sugar-free  
2 cups Cottage cheese, low-fat

1 pkg (8 oz) Light cream cheese  
½ cup Unsweetened applesauce

*Directions:*

1. Blend cottage cheese, cream cheese, and applesauce in the blender.
2. Stir in sugar-free lime Jell-o

*Protein (per serving): 12 grams*

### Barbecue-Glazed Meatloaf “Muffins”

*Yield: 4 servings*

2 cups Corn flakes  
¼ cup Barbecue sauce, divided  
1/3 cup Cholesterol-free egg product  
¾ lb Extra lean ground turkey

1 medium Yellow onion, chopped  
1 medium Green pepper, chopped  
½ cup Shredded carrots

*Directions:*

1. Mix cereal, 1/8 cup of the barbecue sauce and egg product in large bowl until well blended. Add remaining ingredients; mix lightly.
2. Mound the meat mixture in 8 muffin cups sprayed with no stick cooking spray. Brush tops with remaining barbecue sauce.
3. Bake at 375 for 30 minutes or until cooked through.

*Source: Kraft Foods.com*

*Protein (per serving): 21 grams*

### Fruit Smoothie

*Yield: 1 serving*

¼ cup Strawberries, sliced  
½ Banana  
½ cup Plain yogurt

1 tbsp & 1 tsp Frozen blueberries  
¼ cup Diluted orange juice  
1/3 cup Powdered milk



*Directions:*

1. Combine ingredients in blender. Blend until smooth.

*Source: Allrecipes.com*

*Total Protein: 12 grams*

### Peanut Butter Banana Smoothie

*Yield: 1 serving*

½ cup Light vanilla yogurt  
½ cup Nonfat dry milk  
¼ cup Creamy peanut butter (light)

½ Banana, sliced  
3 to 5 Ice cubes

*Directions:*

1. Place all ingredients in a blender and blend until smooth.

*Total Protein: 21 grams*

### No Noodle Lasagna

*Yield: 6 servings*

1 cup Cottage cheese  
½ cup Shredded cheddar cheese

1 cup Ground turkey, cooked  
1 cup Marinara sauce



*Directions:*

1. Preheat oven to 350 degrees. Layer ingredients in greased casserole dish. Cottage cheese, ground turkey, marinara sauce, cheddar cheese and begin layers again.
2. Cover with foil and bake in oven 15-20 minutes or until warm throughout.

*Protein (per serving): 18.5 grams*

**Meat Wrap**

1 oz Deli-style turkey  
 ¼ cup Chopped tomato, peeled  
 4 Black olives, chopped  
 ½ tsp Olive oil

¼ cup Shredded cheese  
 ¼ cup Chopped onion  
 1 tbsp Italian-style salad dressing

*Directions:*

1. Sauté chopped tomato, onion, and olives in olive oil until soft.
2. Drain vegetable mixture. Place in middle of deli meat along with cheese.
3. Roll up deli meat and enjoy!

*Protein: 13 grams***Cereal Yogurt Bars**

2 cups Corn flakes  
 ¼ cup Flour  
 ½ cup Unflavored protein powder  
 ¼ cup Splenda  
 ½ tsp Ground cinnamon



½ cup Margarine  
 8 oz Light strawberry yogurt  
 1 Egg, slightly beaten  
 2 tbsp Flour

*Yield: 16 bars**Directions:*

1. Mix cereal, ¼ cup flour, protein, sugar, and cinnamon in medium bowl. Cut in margarine until mixture resembles coarse crumbs. Press ½ of the mixture firmly onto bottom of greased 8-inch square baking pan.
2. Mix yogurt, egg, and 2 tbsp flour until well blended; spread over crust. Sprinkle with remaining cereal mixture.
3. Bake at 350 for 30 minutes or until golden brown. Cool in pan on wire rack.

*Source: Kraft Foods.com**Protein (per serving): 6+ grams***Egg Salad**

8 Hard-cooked eggs, diced  
 ¼ cup Dried onion flakes  
 1 tsp Mustard powder  
 ¼ tsp Black pepper

1 cup Light mayonnaise  
 ½ tsp Salt  
 ¼ tsp Garlic powder  
 1 tsp Dill weed

*Yield: 4 servings**Directions:*

1. In a bowl, gently mix the ingredients. Cover, and refrigerate 8 hours, or overnight. Spoon onto sliced cucumbers or tomatoes (peeled) to eat.

*Source: www.allrecipes.com**Protein (per serving): 15 grams***Crustless Mini-Greek Quiche Pie**

¼ cup Ground Turkey  
 1 ½ cups Egg substitute  
 10 oz Spinach  
 ½ cup mushrooms

1 chopped onion  
 ¼ cup fat free shredded cheese  
 6 oz Fat Free Greek Yogurt  
 Salt and Pepper (optional)

*Yield: 12 servings**Directions:*

1. Preheat oven to 350 degrees. Generously coat muffin tin with non-stick cooking spray.
2. Cook ground turkey meat until fully brown.
3. Whisk egg substitute and Greek yogurt (salt and pepper) till smooth
4. Dice all veggies and cook on stove top with a few tablespoons of water, then place diced veggies in muffin tins. Sprinkle with fat-free shredded cheese.
5. Top off muffin tins to top with egg mixture
6. Place in oven for 35-45 minutes or till golden brown.

*Source: she-fit.com**Protein (per serving): 6 grams*

## SOFT MEALS SHOPPING GUIDE

- All items on full liquid list
- Eggs
- Low-fat cheeses (string, sliced, cottage, and ricotta cheese)
- Low-fat or fat-free salad dressing, mayonnaise, cream cheese, sour cream
- Unsweetened applesauce
- Fruits (following guidelines)
- Vegetables (following guidelines)
- Tomato and V-8 juice
- Hot cereals
- Natural, low-sugar, creamy peanut butter (such as Adam's or Smuckers)
- Tuna, salmon, chicken, ham (canned in water)
- Dark chicken meat
- Shaved chicken, turkey, ham (deli style)
- Dried beans cooked well, presoaked and drained
- Canned beans (fat free refried, black, kidney, etc.)
- Bean-o
- Chewable vitamins

## Meal Ideas for Soft Foods



BREAKFAST	LUNCH	DINNER
Banana Cream of Wheat (add 1 Tbsp unflavored protein powder)	Crab salad (NO CELERY) Cream soup	Deli chicken slices Cooked vegetables & cheese
Scrambled egg Grated cheese Mild salsa	Low-fat cottage cheese Cooked vegetable Soft fruit	Baked white fish Cooked vegetable Cheese
Lite yogurt Dry cereal, (moistened with milk)	Tuna fish Low-fat cottage cheese	Deli turkey slices Cooked green beans
Cooked cereal (add 1 Tbsp unflavored protein powder)	Soup Banana	Egg salad Cooked vegetable Peaches
Low-fat cottage cheese Canned fruit	Chili Soft fruit	Cooked eggplant Tomato sauce Mozzarella cheese
Sugar-free pudding Soft fruit	Ricotta cheese Tomato sauce or salsa Soft vegetable	Spaghetti meat sauce Parmesan cheese
Scrambled egg Chopped ham (deli thin) Cheddar cheese	Shrimp cocktail	Canned chicken Lite yogurt
String cheese Soft fruit	Fat-free refried beans Shredded cheese Salsa	Crab salad
Scrambled egg (1-2 tbsp milk) Imitation bacon bits	Vegetarian chili	Veggie meatballs Spaghetti sauce Mozzarella cheese
Canned peaches Malt-o-meal (with 1 Tbsp unflavored protein powder)	Veggie burger (no bun) Provolone cheese	Tuna Cooked carrots

**BE CAREFUL, REMEMBER TO CHEW, CHEW, CHEW!!!**  
**START WITH SMALLER PORTION SIZES**  
**AND STOP EATING WHEN YOU FEEL FULL!!!**

## SOLID FOODS

Solid food does not mean any food. There are still foods that you will want to avoid and limit your intake of. Make sure you eat slowly and chew your food well.

FOOD GROUP	RECOMMENDED FOODS	FOODS TO AVOID
Meat	Moist chicken, turkey, ham, or pork. Ground beef.	Other cuts of red meat, dry poultry
Dairy proteins	Cottage cheese, string cheese, skim or 1% milk, low fat cheddar or mozzarella cheese.	
Fruit	Grapes, strawberries, melons (try a variety of fresh foods – just chew them really well)	Careful with skins and seeds.
Vegetables	Raw vegetables (try a variety – just chew them really well)	Iceberg lettuce, fibrous vegetables (asparagus, celery), corn, peas
Starches	Hot cereals: cream of wheat, cream of rice, malt-o-meal, and grits.	Whole grain cereals and breads. Soft, gummy breads, breads with nuts. Rice and pasta. Crackers and chips.
Sweeteners	Equal, Sweet-n-Low, Stevia, Splenda,	Sugar, honey, corn syrup, molasses.
Fats (in moderate amounts)	May have low-fat salad dressings, cream cheese, mayonnaise, olive oil, canola oil, peanut oil, butter/margarine, cooking spray.	<b>LIMIT to 1 teaspoon per meal maximum</b>
Beverages	May have caffeine-free, carbonation-free, and sugar-free beverages. Water, Diet Tang, Crystal Lite, sugar-free Kool-Aid, skim and 1% milk.	Beverages with sugar, caffeine, or carbonation. All forms of alcohol.
Spices	Cinnamon, allspice, mace, salt, lemon juice, vinegar, paprika, black pepper, other mild herbs and spices.	Limit and be careful with sugar in foods such as barbecue sauces, chili, steak, ketchup, and horseradish.

## DETERMINING YOUR NUTRITIONAL NEEDS

**FLUIDS:** a minimum of 8 cups daily, (12 would be best)

**PROTEIN:** 60-90 grams daily. (*Duodenal Switch patients need at least 80 grams per day*)

**FAT:** less than 40 grams daily

## Meals Ideas for Solid Foods



Chicken, ham, or tuna Chef salad Lettuce/spinach Carrots, cucumber, etc. Low-fat salad dressing	Omelet Peppers, onions, mushrooms Low-fat cheese Salsa	Baked or grilled fish (with a hint of lemon or lime) Steamed vegetables (Carrots, squash, etc.)
Turkey or Vegetarian Chili Salad Low-fat dressing	Low-fat, Low-sugar yogurt Cream-of-wheat or Oatmeal Peach	Tuna fish Cottage cheese Vegetables or fruit
Ham and bean soup Chef salad Lettuce/spinach Carrots, tomatoes, etc. Low-fat salad dressing	Taco meat (or fat-free refried beans) lettuce, tomatoes, olives Cheese, salsa	Chicken breast Mozzarella cheese Tomato sauce Vegetables
Hamburger (without the bun) Salad Low-fat dressing Apple or other fruit	Meatballs Spaghetti Sauce Parmesan cheese Steamed vegetables	Grilled chicken Steamed vegetables Butter
Egg salad (light mayo) Steamed vegetables Orange or other fruit	Scrambled eggs (w/cheese) Watermelon or other fruit	Veggie burger (patty) Cheese Steamed vegetables

**Remember to weigh your food portions for your meals. Your total meal should equal 4 - 6 ounces of food. If you cannot weigh each meal, at least weigh the meals that you are eating at home.**



### PROTEIN CONTENT OF SELECT FOODS

FOOD GROUP/TYPE	Protein (g)	FOOD GROUP/TYPE	Protein (g)
1 scoop Whey based protein powder in 1 cup skim milk	25	1 cup Lite yogurt	8
1 cup Dry milk powder	24	1 cup Milk (skim or 1%)	8
1 scoop Soy, rice or other vegetable protein powder in water or diet drink	15-23	1 oz Low-fat Mozzarella cheese	8
1 Vegetarian burger (read package label)	7-19	1 slice Cold cuts, 1 frank (95-100% fat free)	4-8
10 fl oz Lentil soup	16	½ cup Kidney, pinto black-eyed peas	7
1 cup Chili with/without beans	16	1 oz Fish, crab, lobster, shrimp	7
10 fl oz Split pea soup	15	1 large Egg	7
¼ cup Soy nuts	15	1 oz Tuna (water-packed)	7
½ cup Low-fat ricotta or cottage cheese	14	½ cup Fat-free refried beans	7
1 serving Instant breakfast with milk	12	1 oz Chicken, white (canned)	7
1 cup Black bean or ham and bean soups	11	1 oz Fresh poultry	7
½ cup Soy crumbles	11	1 oz Lean beef, lamb	7
1 serving Sugar-free hot chocolate (with 8 oz milk)	10	1 oz Pork, veal	7
½ cup Tofu	10	1 slice Low-fat cheese	5-7
½ cup Chick peas, black beans, lima beans, butter beans	10	½ cup Navy beans	6
1 cup Buttermilk	9	1 cup Soy milk	6
1 cup Chunky vegetable beef	9	2/3 oz Mini-Babybel cheese	5
½ cup Soy beans	9	1 slice Soy cheese	4
1 cup Lactose-free or lactose reduced milk	8	1 slice Deli-thin cold cut (95-100% fat free)	2

## Vitamin & Mineral Supplementation

A multi-vitamin is a **MUST** to assure adequate nutritional intake. Since food is consumed in such small amounts, it may be difficult to consume all the nutrients the body needs to function at its best. If you have the gastric bypass, the body does not absorb vitamins and minerals like it used to; thus it is critical to take a multi-vitamin daily to prevent deficiencies from occurring.

Chewable or liquid vitamins may be needed for the first 2 - 4 weeks. Once you begin the regular phase, you can consume non-chewable vitamins or continue the chewable ones, if desired.

### When looking for a vitamin, determine:

- If the vitamin has a USP symbol. The USP mark represents that the manufacturer has rigorously tested and verified the supplement to assure the following:
  - What's on the label is in fact in the bottle—all the listed ingredients in the declared amount.
  - The supplement does not contain harmful levels of contaminants.
  - The supplement will break down and release ingredients in the body
  - The supplement has been made under good manufacturing practices.
- If the vitamin meets 100% of the RDA (Recommended Daily Allowance)
- If the vitamin has added sugar. If yes, then avoid it or look for a sugar-free variation.

Recommended Vitamins By Surgery Type				
Surgery	Multivitamin	Calcium Citrate	Iron	Vitamin B12
<i>Bandication</i>	Yes	1000 – 1200 mg/day	None	None
<i>Imbrication</i>	Yes	1000 – 1200 mg/day	None	None
<i>Lap Band</i>	Yes	1000 – 1200 mg/day	None	None
<i>Gastric Sleeve</i>	Yes	1000 – 1200 mg/day	None	None
<i>Gastric Bypass</i>	Yes	1500 mg/day	18 mg/day	1000 mcg/week
<i>Duodenal Switch</i>	ADEK Multivitamin	1800-2400 mg/day	18 mg/day	None

### Tips to Increase Nutrient Absorption:

#### Iron:

- Do not take with calcium supplements, it will compete for absorption in the body
- Take Vitamin C with iron supplement, to increase the absorption

#### Vitamin B-12:

- Sublingual B-12 is better absorbed than regular pills
- Monthly injections of B12 allows for better absorption

#### Calcium:

- Choose calcium citrate, as it does not need stomach acid to be absorbed
- Do not take with iron supplement, it will compete for absorption in the body
- Choose a calcium supplement that contains vitamin D

## IDEAS FOR EATING AWAY FROM HOME

- Eating away from home includes at the home of others and restaurants. Some suggestions to make it work for you after surgery are included below with the goal of maintaining and developing your new healthy habits.
- Before going out have a meal plan in mind. You will make wiser choices if you go with a plan somewhat set up. You can go to the website for the restaurant you are going to and look up the nutritional information. You can also request this at the restaurant.
- It is suggested to choose a child-size portion, an appetizer, or a half portion. Be ready with an explanation of your needs for the waiter or host. You will receive a card explaining that you are a post-weight loss surgery patient and that medically you need to have smaller portions
- Avoid special sauces and dressings with unknown ingredients. Ask for the sauce/dressing off or served on the side. You could bring your own salad dressing if desired.
- Avoid fried foods. Remember to ask how the food is prepared. If something is fried request the food be baked or steamed. You can request nutrition information if available and choose accordingly.
- Be careful with salad bars. If you visit the salad bar while waiting for your dinner, you can easily consume an extra 300 to 700 calories or more! Many items have mayonnaise or high fat dressings on them.
- Share a meal with another person. Ask for another plate and take small amounts from your companion's meal. You do not have to eat it all. Take some home.
- Be careful if you include any alcohol drinks. It is absorbed faster after this surgery and contains a lot of calories. Avoid the carbonation in beer. If you decide to treat yourself have a small glass of wine and sip it very slowly.
- Restaurant foods that are well tolerated include fish, cottage cheese, eggs, applesauce, egg-drop soup, and other broth soups. Pizza is not well tolerated.
- Avoid processed starches such as pasta, bread, crackers, croutons, and other high carbohydrate, simple carbohydrate foods. Always eat your protein first and opt for sandwiches or other meat without the bun or bread.
- Fast Food doesn't have to mean "Bad Food." Grilled chicken sandwiches, baked potatoes, and small hamburgers minus the mayo. There are many choices that won't hurt your diet.



Name: \_\_\_\_\_ Date: \_\_\_\_\_

### Wellness Journal

Vitamins: \_\_\_\_\_

Fluids: \_\_\_\_\_

Total Fluid Intake: \_\_\_\_\_

### Food Journal

Time	Food	Situation	Mood	Ounces	Protein
	BREAKFAST				
	Total for this meal:				
	LUNCH				
	Total for this meal:				
	DINNER				
	Total for this meal:				
Total for the day:					

### Exercise Journal

Time	Type of Activity	Minutes/Steps

## Post-op Follow-up Timeline

**Week 1:** Follow-up with Physician Assistant or Nurse Practitioner for wound check

**Month 1:** Follow-up with Physician Assistant or Nurse Practitioner and Dietitian  
Please bring your food diary to this appointment

**Month 2:** Meet with Exercise Trainer to set up exercise program

**Month 3:** Follow-up with Nurse Practitioner for Weight Loss Evaluation

**Month 4:** Follow-up with Physician Assistant or Nurse Practitioner and Dietitian  
Please bring your food diary to this appointment

**Month 5:** *Mind/Body Connection & How it Effects Post-Operative Success* (Follow-up Class)

**Month 6:** Follow-up with Doctor/Labs (if needed)

**Month 7:** Follow-up with Dietitian and Metabolic Re-test with Exercise Trainer  
Please bring your food diary to this appointment

**Month 8:** *Healthy Choices for a Healthy Lifestyle* (Follow-up Class)

**Month 9:** Follow-up with Physician Assistant or Nurse Practitioner and Dietitian  
Please bring your food diary to this appointment

**Month 10:** Follow-up with Exercise Trainer to reassess fitness program

**Month 11:** Follow-up with the Dietitian to reassess your dietary regimen

**Month 12:** Follow-up with Doctor/Labs (if needed) and Exercise Trainer

**Yearly:** Follow-up with Provider/Labs (if needed)

*\*Please remember that the education fee you pay at the time of surgery covers visits with the dietitian and exercise trainers. You can utilize these services more often than the appointments listed on this follow-up timeline and beyond your first year of surgery as well.*

## Support Groups

Support is an essential part to your success through this weight loss journey. We have a variety of support groups throughout the valley. To receive reminders about support group, please update your email address with our office. For a list of upcoming support groups, go to [www.bmiut.com](http://www.bmiut.com). You can also like us on Facebook to receive updates on events.

<b>General Support Group (All weight loss surgery patients)</b>	
<i>When</i>	<i>Location</i>
1st Wednesday of the month at 5:30 pm	Davis Hospital and Medical Center 1600 West Antelope Dr. Classroom 2 Layton, UT 84041
3rd Tuesday of the month at 5:30 pm	Bariatric Medicine Institute 1046 East South 100 East Salt Lake City, UT 84102
3rd Wednesday of the month at 5:30 pm	Bariatric Medicine Institute – Lehi Office 3300 North Running Creek Way Building G Suite 250B Lehi, UT 84043

Please note that support groups are subject to change, so be sure to check the website for any changes to the dates and/or locations.

## Resources for Weight Loss Success

### Weight Loss Surgery

- Books:  
*Before & After: Living Well After Weight Loss Surgery* By: Susan Maria Leach
- Websites:  
[www.obesityhelp.com](http://www.obesityhelp.com)

### Emotional/Behavioral

- Books:  
*Eating the Moment* By: Pavel G. Somov  
*Feeding the Hungry Heart* By: Geneen Roth  
*Mindless Eating* By: Brian Wansink  
*Why Can't I Stop Eating* By: Debbie Danowski & Pedro Lazaro, MD

### Exercise

- Books:  
*The Female Body Breakthrough* By: Rachel Cosgrove, BS, CSCS

### Nutrient Facts

- Books:  
*Biggest Loser Complete Calorie Counter*

### Nutrition

- Books:  
*Culinary Classics* By: David Fouts  
*Cooking for Weight Loss Surgery Patients* By: Dick Stucki  
*Cooking with CJ: Post-Bariatric Surgery Cuisine for the Entire Family* By: C.J. Walters  
*Eating Well after Weight Loss Surgery* By: Patt Levine  
*Extraordinary Taste: A Festive Guide for Life After Weight Loss Surgery* By: Shannon Owens-Malett  
*Recipes for Life After Weight Loss Surgery* By: Margaret Furtado  
*The High-Protein Cookbook* By: Linda Eckhardt & Katherine Defoyd  
*Walk From Obesity Cookbook*
- Websites  
[www.cookinglight.com](http://www.cookinglight.com)  
[www.allrecipes.com](http://www.allrecipes.com)  
<http://www.unjury.com/reg/recipes.shtml>  
[www.kraftthehealthyliving.com](http://www.kraftthehealthyliving.com)  
[www.lapband.com](http://www.lapband.com)

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