PEDOMETER USE AS A MOTIVATIONAL TOOL FOR INCREASED PHYSICAL ACTIVITY IN BARIATRIC SURGERY PATIENTS

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PEDOMETER USE AS A MOTIVATIONAL TOOL FOR INCREASED PHYSICAL ACTIVITY IN BARIATRIC SURGERY PATIENTS

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ABSTRACT

Obesity is a significant health care crisis in the United States. It is associated with various physical and mental health problems, decreased quality of life, and significant medical costs. Bariatric surgery has become a popular intervention for weight management but successful, long-term outcomes are largely dependent on patients’ behavioral and lifestyle changes, perhaps most notably, their motivation to engage in consistent physical activity. However, compliance with physical activity recommendations is consistently demonstrated as problematic for this population.

A better understanding of the psychological and theoretical variables that hinder bariatric patients’ motivation for physical activity is necessary in order to better construct interventions to assist this population in behavior change. Unfortunately, theoretically guided interventions focused on influential psychological variables are often absent treatment components within bariatric surgery programs.

The current study applied Social-Cognitive Theory as a framework to conceptualize the problem of motivation for consistent physical activity specific to the post-operative bariatric surgery population. This study looked specifically at the impact of social-cognitive constructs of self-efficacy, goal setting, and objective performance feedback (via the use of pedometers) on motivation for engaging in physical activity. This study was unique not only in the theoretical constructs examined with post-operative bariatric patients, but also in that it used objective feedback devices (pedometers) to

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assist patients in both accurate self-monitoring and recorded activity levels.

Results indicated that self-efficacy did not impact the outcome as originally expected. However, the social-cognitive variable of feedback was demonstrated to be a significant factor in motivation for activity (walking). Overall, the general conclusion was that the performance feedback provided by pedometers can be used as a motivational tool to increase physical activity in the post-operative bariatric surgery population. Findings of this study may help bariatric treatment teams better assist their patients in setting and achieving personal physical activity goals to facilitate a long-term healthy weight and lifestyle.
DEDICATION

To mom and dad
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CHAPTER I
THE PROBLEM

Introduction

Obesity and overweight are ubiquitous problems that impact medical as well as psychosocial well-being. Bariatric surgery as an option to achieve and maintain weight loss has become an increasingly popular treatment intervention for morbid obesity (Ray Nickels, Sayweed, & Sax, 2003). However, even with surgical intervention, the possibility of weight regain and re-establishing weight-related co-morbidities exists when patients are noncompliant with lifestyle change recommendations (see Boccheri, Meana, & Fisher, 2002; Brolin, 1989; Sarwer et al., 2005; Sugarman et al., 1989).

Weight gain and obesity have been linked to physical inactivity (e.g., Hemmingsson & Eckelund, 2007) and related medical (see U.S. Department of Health and Human Services, 1996) and mental health co-morbidities (e.g., Black, Goldstein, & Mason, 1992; Dixon, Mauzey, & Hall 2003; Fabricatore & Wadden, 2004; Kalarchian et al., 2007; Sarwer, Wadden, & Fabricatore 2005). Understanding factors that collectively influence bariatric surgery patients’ motivation to engage in, and comply with, behavioral recommendations that include increased physical activity, can have implications for bariatric patients’ care and long-term health success.

This chapter presents four sections that outline the issues related to obesity and physical inactivity specific to bariatric surgery patients. It also presents a discussion
regarding the purpose and significance for the present study. First, background into obesity and physical inactivity-related problems is addressed. Weight loss surgery as an intervention to this problem is reviewed in section two. Section three presents an introduction to Social Cognitive Theory (Bandura, 1986a, 1997, 2004) and discusses how the health psychology issue of maintaining physical activity recommendations following bariatric surgery can be conceptualized using this theory. Based on specific constructs related to this theory, this section also discusses how pedometers can be used as feedback devices to promote motivation for physical activity in bariatric surgery patients. The final section summarizes the problem statement, purpose and significance of the current study, as well as the contributions made by counseling psychology regarding behavior change in the bariatric population.

Obesity and Physical Inactivity

The prevalence of obesity in the United States doubled from 1986 to 2000 (Buchwald, 2005; Sarwer et al., 2005). Buchwald (2005) reported that approximately two-thirds of the population is overweight while over 50 million of those are classified as obese. Worldwide, over 2.5 million annual deaths can be attributed to obesity (Buchwald).

Physical inactivity has been linked to obesity (e.g., Hemmingsson & Eckelund, 2007; Jansszen, Katzmarzyk, Boyce, King, & Pickett 2004; Wen, Orr, Millett, & Rissel, 2005), as well as other medical issues (U.S. Department of Health and Human Services, 1996). Various co-morbid health conditions related to inactivity and obesity have been reported and include, but are not limited to, coronary heart disease, hypertension, stroke, diabetes, liver disease, respiratory disease, osteoarthritis, obstructive sleep apnea, various
cancers, and depression (see CDC, 2000; NIH, 1991, 1996; Stroebe, 2008). Relatedly, non-fatal but distressing health problems such as shortness of breath, orthopedic problems, and fatigue have been identified (see NIH, 1991). More recent literature (e.g., Buchwald, 2005; Peeters, Barendregt, Mackenbach, Al Mamun, & Bonneux 2003) has indicated that obesity and physical inactivity may soon replace cigarette smoking as the most prominent cause of preventable deaths.

In addition to various health problems, significant medical costs have been related to physical inactivity and obesity. In 2000, The Centers for Disease Control and Prevention (CDC) estimated that health care costs associated with physical inactivity topped $76 billion (http://www.cdc.gov/nccdphp/publications/factsheets/Prevention/obesity.htm). The CDC further estimated that if 10% of adults began a regular walking program, $5.6 billion in heart disease costs could be saved.

In response to the co-morbidities associated with physical inactivity and weight-related problems, the U.S. Surgeon General recommended that all adults accumulate at least 30 minutes of moderate physical activity on most days of the week (U.S. Department of Health and Human Services, 1996). Consistent physical activity has also been recommended by the American College of Sports Medicine (ACSM, 1998), the U.S. Department of Health and Human Services (USDHHS, 2000), and the National Institute of Health (NIH, 1996, see Nigg et al., 2008). Despite these recommendations, more than half of all adults in the U.S. do not engage in adequate amounts of exercise (www.surgeongeneral.gov/topics/obesity/calltoaction/fact_glance.html). Reasons for limited physical activity and obesity vary. They may include environmental influences (see Stroebe, 2008) such as increased reliance on cars for transportation (e.g., French,
Story, & Jeffrey, 2001), and related influences of convenience. Stroebe further
highlighted that while physical inactivity likely contributes to obesity, obesity also makes
physical activity more strenuous and less enjoyable, inhibiting motivation for engaging in
such behavior.

Beyond substantial medical co-morbidities and costs associated with obesity and
physical inactivity, studies have documented negative attitudes, discrimination, and bias
(Fabricatore & Wadden, 2004), as well as decreased quality of life across various
spectrums (e.g., Bocchieri, et al., 2002; Fontaine, Cheskin & Barofsky, 1996; Crosby,
Kosloski & Williams, 2006). Recent studies have also reported a higher prevalence of
depression and other mood disturbances (e.g., Black et al., 1992; Dixon et al., 2003;
Kalarchian et al., 2007; Sarwer et al., 2005), as well as eating disorders (Black et al.,
1992; Kalarchian et al., 2007; Saunders et al., 1998), in obese individuals who are
seeking bariatric surgery.

Traditional treatment approaches to obesity typically have included behavior
modification programs, diet, physical activity, and prescription or over the counter
medications (Adolfsson et al., 2005). These approaches typically require sustained
behavioral change (i.e., consistent exercise) to achieve and maintain weight loss. Long-
term weight management, however, is typically refractory to these traditional
interventions (Buchwald et al., 2004) as weight regain is often observed after the
discontinuation of recommended behavioral and lifestyle changes (Perri et al., 2001). Due
to the increased prevalence of morbid obesity, the failure of diets to produce sustained
results, and the introduction of laparoscopic surgical techniques, bariatric surgery for
morbid obesity increased in popularity (Aggarwal et al., 2005; Ray et al., 2003).
Bariatric Surgery

The Roux-en-Y gastric bypass (RYGB) and laparoscopic adjustable gastric banding (LAGB) are the most frequently performed bariatric surgeries in the US and are associated with dramatic weight loss and significant improvement of medical co-morbidities (Fielding & Fielding, 2008). Specific to the RYGB procedure, the stomach is reduced to hold approximately 2 ounces of content and the remaining stomach and first segment of small intestine are then bypassed [The American Society for Bariatric Surgery (Society of American Gastrointestinal Endoscopic Surgeons, 2000)]. This procedure results in both a restrictive and malabsorptive component that contribute to weight loss (Fielding & Fielding, 2008). In contrast, the LAGB procedure involves the surgical implantation of an inflatable silicone band around the upper portion of the stomach which can be periodically tightened, thereby restricting the amount of food that can be consumed (Fielding & Fielding).

As with the more traditional approaches to weight loss, surgical interventions are also associated with a possible risk of weight regain. Some studies (e.g., Bolin 1989; Sugarman et al., 1989) have suggested that up to 20% of bariatric surgery patients fail to lose a significant amount of weight post-operatively (see also Sarwer et al., 2005). Others have reported that failed outcomes regarding sustained weight loss begin to occur approximately 24 months after surgery (Boccheri et al., 2002). Because food intake and physical activity largely determine weight change after bariatric surgery, patients are usually given a number of behavioral recommendations for diet and exercise (Elkins et al., 2005; Friedman et al., 2007). Therefore, consistent physical activity and the
motivation to sustain such activity long-term, are crucial factors for the maintenance of
weight loss in bariatric surgery patients. However, studies have reported that of the
behavioral recommendations given post-operatively, physical activity is associated with
high levels of patient noncompliance (e.g., Elkins, 2005).

In summary, while consistent physical activity following bariatric surgery is
critical for long-term weight loss and health, many bariatric patients do not comply with
this behavioral recommendation. Various factors including motivation for physical
activity, goal setting, and the degree of confidence patients have in their ability to engage
in and maintain physical activity, may influence compliance with long-term activity
recommendations. Compliance with physical activity recommendations in the bariatric
population is a clear health psychology problem. As such, this problem is conceptualized
in terms of Social Cognitive Theory which offers insight and prediction into individuals’
motivations and behaviors. To better understand this theoretical conceptualization as it
relates to the bariatric population, an overview of Social Cognitive Theory is provided
next. The theoretical overview is followed by discussion of the relation between Social
Cognitive theory and the efforts made by bariatric surgery patients to engage in
consistent physical activity.

Social Cognitive Theory

Albert Bandura’s Social Cognitive Theory (SCT, see Bandura, 1986, 1997, 2004)
is a widely recognized theory describing factors that influence and determine behavior
(Plotnickoff, Lippke, Courneya, Birkett, & Sigal 2008). As the name implies, this theory
acknowledges the social origins and individual thought processes or cognitions associated
with human motivation and behavior (Slocum, 1998).
Central to SCT is the notion of human agency. Broadly defined, this construct encompasses the mechanisms through which people can effect change in themselves (Bandura, 1989). Bandura (2001) further described human agency as the combination of human capacities and potential that aids individuals in exercising some control over their life. Bandura explained that “individuals are neither autonomous agents or conveyers of environmental influences. . . but that people make causal contribution to their own motivation and action within a system of triadic reciprocal causation” (Bandura, 1989, p. 1175).

Within this triadic system, SCT identifies three particular determinants that are reciprocally influential to behavior change (Bandura, 1999), and that therefore, demonstrate the power of SCT to explain human motivation and action (Slocum, 1998). Internal personal factors (in the form of cognitive, affective, and biological events), behavioral patterns, and environmental events all operate as interacting determinates that bidirectionally influence each other (Anderson et al., 2006, Bandura, 1999). The interaction of this system is presented in Figure 1.

Figure 1

The Triadic System in SCT. The relationship between the three major classes of determinants in triadic reciprocal causation. B represents behavior; P the internal personal factors in the form of cognitive, affective, and biological events; and E the external environment. (Bandura, 1986a).
SCT identifies numerous mechanisms and human capabilities through which personal agency operates within this causal system. According to SCT, those mechanisms include an individual’s perceived self-efficacy, goal representations and associated feedback, anticipated outcomes, forethought, and self-regulation among other capabilities (Bandura, 1989; Slocum, 1998). The most central of these mechanisms, and the foundation of human agency, however, is personal self-efficacy (Bandura, 1999).

Self-efficacy is defined as beliefs in one’s capabilities to organize or execute the actions required to produce outcomes (Bandura, 1997, 2004). Self-efficacy beliefs determine a person’s level of motivation which will be reflected in how much they will persevere at a task when faced with obstacles (Bandura, 1989). Furthermore, Bandura noted that all factors that may serve as motivators are rooted in the underlying belief that an individual has the power to produce changes by their actions.

Bandura (1999) explained that self-efficacy holds a pivotal role in SCT not only because of its direct effect on behavior and motivation, but because of its impact through other determinants and human capabilities. For instance, SCT illuminates important connections among self-efficacy and determinants including goal setting and feedback, and the resulting impact on motivation. Bandura and Cervone (1983) acknowledged that people can raise their level of motivation for a behavior by adopting goals. Individuals typically go through a process where they think about possible consequences of their actions, then set goals for themselves, and accordingly plan courses of action that are likely to produce desired outcomes (Bandura, 1999). Goal setting is said to be influenced by individual’s self-efficacy regarding their ability to meet the standards needed to achieve their desired outcomes (Bandura, 1989). Therefore, the stronger a person’s sense
of self-efficacy regarding their actions and goals, the firmer their commitment to
pursuing and achieving those goals (Locke, Frederick, Lee & Bobko, 1984). Relatedly,
according to SCT, obtaining feedback regarding the progress towards one’s goals can
further influence an individual’s motivation toward goal attainment.

Developing goals with explicit, available feedback enables people to monitor their
progress, and is often used to enhance both motivation and performance (Cervone &
Wood, 1995). Therefore, Bandura (1992) concluded, that the combined influence of
goals with ongoing performance feedback substantially heightens an individual’s
motivation (Bandura, 1992) to engage in a behavior.

SCT further states that throughout a goal pursuit, people engage in various self-
regulatory mechanisms that guide their actions toward the achieving the goal (Bandura,
1989). Obtaining performance-related feedback is one avenue for self-monitoring and
self-regulation of such actions. In SCT, self-regulation of behavior and motivation is
often described in terms of a feedback control mechanism. Bandura (1989) noted that if
an individual perceives a discrepancy between his/her performance and his/her own
internal standard for the goal and action, the person will usually act to reduce any
incongruity. A negative feedback control mechanism is evident when a person’s
performance matches his/her personal standard and consequently, the person does
nothing (Bandura, 1989). However, Bandura noted that eventually, a person must exceed
this feedback loop in order to initiate new courses of action. If a person receives feedback
indicating a shortcoming of effort toward their goal, this should then motivate them
toward more effective action (Bandura, 1989, 1999). According to SCT, this motivational
effect does not stem from the actual goals, but from the person’s self-evaluation that is
made conditional on the achievement of the goal (Bandura, 1999). Furthermore, SCT states that progress made toward a goal is self-satisfying and can serves as its own reward and motivator during the goal pursuit process (Bandura, 1999).

*Application of SCT to other populations*

SCT has been used as a theoretical framework for investigating and predicting behaviors associated with various psycho-social problems. Relationships between social cognitive constructs (including but not limited to self-efficacy and self-regulation) and various behaviors have been examined. For example, across various populations, constructs of SCT have been used to conceptualize and predict physical activity (e.g., Annesi, 2004; Doerksen, Umstattd, & McAuley, 2009; Hertz, Petosa, & Lingyak, 2008; Netz & Raviv, 2004; Wallace, Buckworth, Kirby, & Sherman, 2000), career choice and development (e.g., Betz & Hackett, 1983; Lindley, 2006; Lent, Brown, & Hackett, 1994; Lent, Brown, & Larkin, 1984; Lent, Lopez, Lopez, & Sheu, 2008), socio-economic variations and eating behaviors (Ball, MacFarlane, Crawford, Savige, Andrianopoulus, & Worsely, 2009), smoking (Van Zunderf, Nijhof & Engels, 2009), and academic functioning (Bandura, 1996) among others.

As recognized by the Surgeon General, SCT provides a useful framework for organizing, understanding, and promoting physical activity (USDHHS, 1996). Given the utility of this theory to predict physical activity across a wide range of populations, Social-Cognitive factors may also be extended to conceptualize the influences of motivation for sustained physical activity in the bariatric surgery population.

Research suggests that ongoing, conventional behavior modifications (i.e., healthy diet and regular physical activity), in conjunction with bariatric surgery, are necessary for
successful post-surgical weight-loss in this population (Bond et al., 2006). However, bariatric surgery candidates often report numerous unsuccessful and failed attempts at physical activity and other conventional weight loss interventions (Rusch & Andrish, 2007). Reasons for such repeated attempts and failures may be explained by SCT. According to the theory, as a general rule, people will do things that they have seen succeed and will avoid things they have failed at in the past (Bandura, 1999). Due to a history of failures at consistent physical activity, SCT would predict that many bariatric surgery patients will avoid critical recommendations for sustained physical activity. Similarly, SCT states that people with excessive self-doubt and limited self-efficacy regarding their capabilities for a behavior will reduce, or prematurely abort, their efforts toward that behavior or behavioral goal (Bandura, 1989, 1992; Bandura & Cervone, 1983). This component of the theory would then suggest that bariatric patient’s self-efficacy and motivation for future attempts at physical activity would likely be reduced or aborted. An important connection between SCT and bariatric surgery patients is evident in the significance of goal setting and feedback. According to SCT, people can raise their level of motivation for a behavior by adopting goals and obtaining consistent feedback regarding progression toward their goals. As such, SCT would also predict that goal setting and associated feedback regarding progression toward that goal would have a positive impact on bariatric surgery patients’ motivation for continued engagement in physical activity.

In summary, the role of self-efficacy, goal setting, and performance feedback are critical components of motivation and behavior change. These concepts can be examined to better understand the challenge of engaging in consistent physical activity experienced
by many bariatric surgery candidates. SCT suggests that performance feedback influences both self-efficacy and the reinforcement goals. Consequently, feedback is an important variable for behavior change. The connection among these variables has not been widely recognized in the literature pertinent to bariatric patients and physical activity behaviors. Therefore, identifying effective ways for patients to obtain accurate and ongoing feedback regarding progress toward their physical activity goals is an important issue for this population.

**Pedometers as feedback devices**

Various methods have been used to measure patients’ physical activity levels (i.e., self-reports, behavioral observation, and indirect measures such as heart rate, Speck & Looney, 2006). Pedometers can also be used as a low-cost tool for objectively measuring physical activity (specifically walking). In addition to measurement, these devices can provide individuals with feedback regarding progression toward their walking goals. As such, pedometers may then serve as motivational devices for increasing physical activity (Melanson et al., 2004) across various populations.

Studies have used pedometers to assess adherence to exercise and physical activity recommendations across various patient groups (e.g., cardiac, diabetic, general family practice patients; see Chan et al., 2004; Stovitz et al., 2005; Tudor-Locke et al., 2002), including obese and overweight individuals (Bravata et al., 2007). These studies have consistently found that pedometer users generally increase their physical activity levels (Bravata et al) which appears related to the performance feedback the provide.

Although studies suggest that pedometers could be used for increasing physical activity in overweight individuals, there is a dearth of research regarding how these
devices can be used as motivational tools specific to bariatric surgery patients. Therefore, further investigation into how pedometers can best be used to as a feedback device in this population to facilitate increases in exercise self-efficacy and motivation for physical activity, is warranted.

**Problem statement**

Weight regain, and the resurgence of weight related co-morbidities, are noted risks of bariatric surgery (see Boccheri et al., 2002; Brolin, 1989; Sarwer et al., 2005). Bariatric surgery candidates are, therefore, encouraged to maintain consistent physical activity levels and to self-monitor (or document) their daily physical activities in efforts to promote and maintain weight loss and health. However, compliance with activity recommendations has been shown to be problematic (see Elkins et al., 2005; Friedman et al., 2007; Poole et al., 2005).

Using SCT as a theoretical framework for this problem, limited self-efficacy for physical activity likely impedes bariatric surgery patients from engaging in such behavior. In addition, the theory would predict that motivation for physical activity may be further inhibited by a lack of specific goals and consistent feedback regarding progress toward those goals.

Previous research has shown that pedometers have been effectively used as self-monitoring and motivational tools for increasing physical activity in various patient populations (e.g., Bravata et al., 2007; Melanson et al., 2004), including overweight individuals. However, there is a gap in the research regarding how pedometers (in conjunction with tenants of SCT) can be used as feedback and motivational tools for physical activity specific to bariatric surgery patients. Therefore, the purpose of this study
is to investigate the impact that the SCT variables of self-efficacy for exercise, goal setting, and objective performance feedback via the use of pedometers, have on post-operative bariatric patients’ motivation for engaging in walking activity.

This study holds significant, real-world value regarding effective intervention and quality of care given to bariatric surgery patients in efforts to promote long-term weight management and positive health outcomes. Findings of this study may help bariatric treatment teams better structure individualized treatment plans for assisting their patients in developing a long-term, physically healthy lifestyle.

Finally, the discipline of counseling psychology warrants acknowledgment for its unique contributions to populations suffering from health related issues. As recognized by the development of Division 38 (Health Psychology), this discipline has become a significant contributor to both the science and practice related to interventions and prevention of a variety of health problems. Specific to health issues related to bariatric surgery patients, nationally distinguished organizations [e.g., National Institutes of Health; American Society for Metabolic and Bariatric Surgery (ASMBS / ASBS)] have recognized the contributions mental health practitioners can make to bariatric patients and programs, noting that these practitioners have become an integral component of many bariatric surgery teams (ASBS, 2004).

It is further noted that the use of theory to conceptualize behavior and guide intervention and treatment, is a cornerstone of the scientist-practitioner model promoted in counseling psychology. Therefore, the expertise of counseling psychology professionals regarding theoretical constructs associated with motivation for behavior change can be used in better evaluating the obstacles to physical activity compliance in
the bariatric population. It is expected that the use of SCT to conceptualize the problem of noncompliance with physical activity, can also be used to guide prediction and effective treatment of this problem, ultimately leading to improved patient care and a worthy contribution to the counseling psychology literature.

The following chapter provides a comprehensive review of the literature illuminating pertinent issues related to obesity, bariatric surgery, and the critical nature of consistent physical activity necessary for successful post-surgical weight-loss outcomes. Further exploration of SCT and how this theory can be used to guide both the conceptualization of the problem and appropriate interventions for increased physical activity and weight loss, is also reviewed.
CHAPTER II
REVIEW OF THE LITERATURE

The current chapter presents a comprehensive review of the medical and psychological literature pertinent to physical activity for weight loss. As conceptualized by Social Cognitive Theory (SCT), this chapter also provides a review of the challenges with engaging in and maintaining physical activity, as experienced by bariatric surgery patients. Guided by specific constructs from SCT (i.e., motivation and feedback), the use of pedometers as motivational and feedback tools is proposed as a means to increase physical activity in this patient population.

This chapter is divided into five sections establishing a foundation for the study. To facilitate a theoretical conceptualization of the problem by the conclusion of this chapter, a review of the pertinent SCT constructs associated with health promotion and physical activity is first provided. This section also reviews the literature that has used SCT as a guiding framework for prediction and intervention of physical activity in various populations. Section two presents a literature review of traditional approaches to weight loss and the problem of weight loss maintenance associated with these approaches. An argument for how these interventions and related research often minimize or omit attention to important psychological constructs related to weight loss behaviors is provided throughout this section. Section three reviews the most common surgical interventions for weight loss and discusses the problem of noncompliance with physical
activity recommendations evidenced by many weight loss surgery patients. Links between theoretical constructs from SCT and bariatric patients’ challenges with consistent physical activity are presented. The fourth section reviews the literature demonstrating how pedometers have been used to address critical SCT constructs (i.e., motivation and feedback) in promoting motivation for physical activity in various patient groups. This section also discusses the use of pedometers with bariatric surgery patients as a way to facilitate important SCT constructs that have been demonstrated to increase motivation and engagement in physical activity. The final section presents hypotheses for the current study.

**SCT and health promotion**

The use of a strong, theoretical model that specifies factors and determinants of behavior change is a central component in developing research and intervention that facilitate health-promoting behaviors (Bandura, 2004). As noted in the previous chapter, SCT posits that personal, environmental, and behavioral factors are reciprocally influential in determining behavior and motivation for behavior change (Anderson, Wojcik, Winett, & Williams, 2006). SCT also specifies mechanisms through which different determinants work and how they may be translated into effective health practice (Bandura, 2004) as people employ some degree of control over their lives (Bandura, 1989, 2001). As such, SCT is one theoretical framework that can guide understanding and intervention for health-promoting behavior change. Such behaviors include engaging in consistent physical activity.

As quality of health is heavily influenced by lifestyle habits, individuals must develop the means to exercise some control over their health behaviors in order to
develop and maintain successful health habits (Bandura, 2004). Identifying physical activity determinants (McAuley & Blissmer, 2000) and understanding the specific mechanisms that contribute to an individual’s success or failure at facilitating health behaviors is necessary in order to implement effective lifestyle change. Health promotion through a social cognitive framework identifies important determinants for a physically healthy lifestyle (Anderson, et al., 2006; Bandura, 2004). Particularly relevant for health-promoting behavior change are the connections among the SCT constructs of self-efficacy, the self-regulation mechanism of goal-setting, and feedback, all of which impact motivation for behavior change. The connections among these constructs, as they relate to health-promoting behaviors, are expanded upon below.

*Self-regulation and goal-setting, self-efficacy, and feedback*

A fundamental premise in SCT is self-regulation (Cervone & Wood, 1995), a process that impacts motivation and behavior change. Self-regulation refers to the processes that enable an individual to guide goal-directed activities over time and across changing circumstances (Karoly, 1993). Specific to exercise and physical activity, self-regulation involves the skills necessary for planning, organizing and managing exercise behaviors. (Bandura, 1997). SCT posits that self-regulatory processes are activated by both goal-setting and having available feedback pertaining to one’s progress toward his or her goals (Bandura, 1996; Cervone & Wood, 1995).

The decision to implement self-regulatory strategies such as goal-setting is influenced by the degree to which a person believes he or she has the capabilities to perform the desired behavioral change (Kitsanta, 2000). This belief is referred to as self-efficacy, and according to Bandura (2004), it is the most critical of the SCT constructs in
regard to its impact on motivation and behavior change. In this theory, motivation for behavior change is said to be rooted in the core belief that an individual has the ability to produce a desired action (Bandura, 1989; Bandura & Locke, 2003). Simply stated, if people believe they have the ability to perform a task, their likelihood of pursuing that task/behavior will increase. Self-efficacy is felt to contribute to motivation most notably through its influence on other determinants including the self-regulatory behavior of goal-setting (Bandura, 1999). Not only does self-efficacy shape a person’s goals (Lord, 1982), it influences effort and perseverance toward the established goal or task (Senecal, Nouwen, & White, 2000).

Bandura (1989) described an inter-connection between goals and self-efficacy summarizing that personal goal-setting is influenced by an individual’s self-appraisal of his or her capabilities to achieve their goals. Consequently, the stronger the perceived self-efficacy for the actions necessary for goal attainment, the higher the goals people set for themselves and the firmer their commitment toward realizing those goals (Locke, Frederick, Lee, & Bobko, 1984). According to Bandura, the theory adds that not only can self-efficacy influence goal setting and behaviors directly, but it can also affect motivation for behavior change and goal establishment indirectly. Self-efficacy can impact goals and behaviors indirectly by influencing other SCT related variables such as outcome expectations for goals, as well as various issues that may facilitate or impede a person’s progress toward reaching their goals. A model for the conceptualization of the constructs discussed is presented in Figure 2.
Bandura and Simon (1977) posited that the degree to which goal-setting creates incentives for performance is partly determined by both the specificity of the goal (with more explicitly defined goals facilitating better regulation of performance as opposed to goals that are more vague), and the proximity of a person’s established goals. Bandura and Simon distinguished between end goals (goals set for the more distant future), and proximal goals (goals that are intended to be met on a more immediate basis). They explained that when focusing on end goals, it becomes easy to put off efforts at change in the present. They noted that proximal goals allow for greater personal agency or control over one’s behavior. Bandura and Simon concluded that implementing control over
behavior in the present (based on proximal goals) increases the likelihood that desired goals and outcomes will be achieved.

Adding feedback to the goal-setting process further increases motivation and task performance (Zegman & Baker, 1983). Bandura (1999) explained that once people commit themselves to valued goals, they seek self-satisfaction from achieving them and intensify their efforts toward those goals as they often experience discontent with substandard performances. Relatedly, Bandura and Simon (1977) stated that feedback indicating negative discrepancies between one’s established performance standards creates a sense of dissatisfaction which consequently, motivates corrective changes in behavior. Conversely, feedback indicating that progress has been made toward a goal typically generates feelings of satisfaction and pride which further facilitates motivational functioning (Bandura, 1978). Therefore, goal feedback focused on a person’s accomplishments typically results in enhanced self-efficacy for that goal (Stretcher et al., 1995). The effects of combining goal development with explicit performance feedback, has also been discussed. Cervone and Wood (1995) stated that the combination of goals with related performance feedback enables people to monitor their progress which can consequently enhance self-efficacy, motivation, and performance (Cervone & Wood, 1995). This combination also affects how a person will sustain a behavior. Typically, people will sustain a behavior when they have both goals and feedback regarding their progress, but having goals without feedback often has little effect on or perseverance toward a goal (Bandura, 1997). According to SCT, motivation does not stem directly from actual goals, but more from the person’s self-evaluation that is made conditional on the achievement of the goal (Bandura, 1999).
To summarize, from the perspective of SCT, health habits are not changed by acts of will, but rather by motivational and self-regulatory skills (Bandura, 2004). Therefore, people must learn to monitor their health behavior and use goals to motivate and guide them (Bandura). The processes of self-efficacy, and self-regulation in the form of goal-setting (Bandura & Simon, 1977), as well as feedback regarding one’s performance, operate collectively as motivational forces for behavior. In regard to physical activity, individuals who believe they can be physically active and who expect favorable outcomes from physical activity, will also be more likely to implement necessary self-regulatory strategies which are essential for adopting and engaging in an active lifestyle (Bandura, 1986, 1997, 2004).

The impact of these and other SCT determinants of behavior change have been tested across a variety of populations in regard to health promoting behaviors. Specific to physical activity, literature reveals that SCT constructs typically explain 40 -55 percent of the variance for such behaviors (Plotnikoff et al, 2008). The following section reviews the literature that has used SCT as a guiding framework for the prediction and intervention of physical activity and weight loss behaviors.

*SCT framework in physical activity and weight loss research*

SCT has been used extensively to successfully explain, predict, and elicit healthy behavior change (Doerksen, Umstattd, & McAuley, 2009). Core constructs of this theory have been tested across various populations (i.e., college students, older adults, diabetic populations, those seeking weight loss, and others) in regard to their impact on health-promoting behaviors (e.g., Anderson, et al., 2006; Benier & Avard, 1986; Keller et al., 1999; Plotnickoff et al., 2008; Williams & Bond, 2002). In both healthy individuals and
those with chronic diseases (McAuley & Blissmer, 2000), self-efficacy is consistently revealed as the most important factor in predicting healthy behaviors (Plotnikoff et al., 2008). In particular, self-efficacy is associated with higher levels of engagement in physical activity (McAuley & Blissmer). A review of the literature highlighting the impact of self-efficacy and other SCT constructs on physical activity and associated weight-loss behaviors is presented next.

Keller et al. (2004) reviewed 27 descriptive studies published between 1990 and 1998 that examined the relation between physical activity and self-efficacy. Keller and colleagues reported a significant relation between self-efficacy for exercise and exercise behavior. They further noted that programs designed to increase self-efficacy in conjunction with other SCT constructs (i.e., outcome expectations) increased individuals’ exercise behavior.

The impact of self-efficacy and other SCT constructs has been frequently investigated in the college student population. Rovniak, Anderson, and Winett (2002) tested the relation between SCT variables and physical activity in a sample of 353 college students. At three different times, students were given questionnaires assessing self-efficacy, outcome expectations, social support, and self-regulatory strategies for exercise. They also completed questionnaires assessing their physical activity levels at these three intervals. Structural equation modeling was used to test the fit of the SCT model. Results revealed a good fit of the model (GFI = .96, AGFI = .92, RMSEA = .06) which explained 55% of the variance at the 8-week follow-up. Of the SCT variables assessed, self-efficacy had the greatest effect on physical activity. Those with higher self-efficacy for exercise were significantly more likely to exercise regularly than those with lower self-efficacy.
The authors further noted that self-efficacy had a strong impact on physical activity largely because it led to greater use of self-regulation strategies including goal-setting and self-monitoring behaviors. While this study provided one of many examples of the strength of the SCT model in predicting exercise behaviors, it was not without limitations. Similar to other studies, Rovniak and colleagues relied on only self-report measures of physical activity. More objective measures to record activity levels may have found different results or inconsistencies in actual levels of activity.

In a similar study using college students, Petosa et al. (2003) monitored SCT variables and vigorous physical activity over a 4 week period. Participants completed questionnaires assessing self-regulation of exercise behaviors, outcome expectations, and social support, as well as a physical activity recall questionnaire. A hierarchical multiple regression model was used to test the SCT variables’ ability to predict physical activity. Together, the SCT constructs accounted for 27% of the variance in physical activity. Similar to the Rovinak et al. study, Petrosa and colleagues’ research was limited by way of using only self-report measures of physical activity. This research limitation (which is consistent across much of the related literature), is a problem that the current research seeks to rectify by way of using pedometers to objectively record physical activity data.

The impact of self-efficacy and other SCT determinants on physical activity has also been studied in different patient populations seeking to improve overall health. For example, Plotnikoff tested SCT’s ability to explain physical activity in a sample of 1,717 adults with Type I and II diabetes. Participants completed demographic, health factors, and physical activity behavior questionnaires. Questionnaires were also used to measure the SCT constructs of exercise goals, self-efficacy for exercise, outcome expectations,
perceived impediment to exercise, and social support. Statistical analysis included descriptive statistics as well as structural equation modeling. Self-efficacy was found to be the main predictor of goals and subsequent behavior in both diabetic groups (diabetes Type I and II groups). Although self-efficacy was mediated by other social cognitive factors, the direct path of self-efficacy to goals was significant, as was also true for the effect on behavior. Overall, the authors interpreted their results as providing additional support for the application of SCT in promoting physical activity in person’s with diabetes. Their findings also support the need to target self-efficacy as a way to influence goal-setting and physical activity behavior change. This conclusion has also been suggested in other research (e.g., Allison & Keller, 2004), and strongly promoted by Bandura (2004).

SCT constructs have also been examined for their impact on physical activity and health-related behaviors of individuals seeking weight-loss. Linde et al. (2006) examined the relation between self-efficacy beliefs, weight loss behaviors (i.e., engagement in exercise, activity and food monitoring), and weight change in a sample of 349 women participating in a weight loss trial. Treatment involved 8 weekly one-hour group sessions that focused on cognitive interventions thought to influence outcome expectations for weight loss. (The authors noted that the cognitive intervention was not the primary focus of the analyses and therefore, provided no further information on the intervention).

Participants completed self-efficacy for exercise and eating questionnaires, as well as questionnaires assessing specific weight loss monitoring behaviors and physical activity levels. Consistent with previous research (e.g., Schwarzer & Renner, 2000), Linde and colleagues found that self-efficacy for exercise and eating behaviors was associated with
weight loss monitoring behaviors (including days of tracking adherence to physical activity plans). The authors also found associations (albeit not as strong) for specific exercise and diet behaviors (i.e., recent exercise and fat intake). Specifically, at week 8, associations between exercise self-efficacy and monitoring behaviors revealed correlations ranging from .18 to .60. Greater engagement in all weight control behaviors (e.g., blocks walked, flights of stairs climbed, fruits/vegetables eaten) was associated with greater weight loss with all effect sizes in the medium to large range (\(ds = .41-.96\)).

Interestingly, the authors reported that self-efficacy beliefs at the end of the active treatment (through 8 weeks) were unrelated to the performance of monitoring behaviors at four months post-treatment. Others have demonstrated similar findings regarding the role of self-efficacy during exercise maintenance (e.g., Oman & King, 1998). The authors concluded that self-efficacy beliefs may elicit a set of weight-control behaviors but their impact on weight depends on the effectiveness of those behaviors. They suggested while many health related self-efficacy measures focus on peoples’ confidence that they can follow through on physical activity and nutritional plans in the face of challenges, future research should use measures that target behaviors shown to be strongly associated with weight loss success, such as walking 10,000 steps per day (as measured via pedometer). While not directly indicated by the authors, such an objective measure could help individuals formulate specific activity goals while also providing a means of performance feedback, two important determinants within the SCT framework associated with behavior change.

Bernier and Avard (1986) also assessed the impact of self-efficacy on weight loss and weight loss behaviors. Using a small sample of women in a 10-week weight loss
program, the authors found that at baseline, higher scores on self-efficacy for weight loss were associated with greater weight loss during treatment. They also found that higher self-efficacy measured at the end of treatment was associated with greater weight loss at a six week follow-up (a result that was in contrast to Linde et al.’s results). Both the Bernier and Avard and Linde et al. studies had limitations, perhaps most notably being the use of only female samples. However, these studies do provide evidence of the critical nature of self-efficacy in the pursuit of weight loss behaviors that include engagement in physical activity.

The impact of other SCT variables on behavior has also been investigated. For example, a study examining the impact of the SCT determinants of self-regulation and goal-setting of overweight individuals attempting to control eating behaviors was conducted by Bandura and Simon (1977). Participants included sixty-six overweight adults. As a way of controlling their eating habits, participants were given wrist counters and instructed on how to use these devices to tally total mouthfuls of food and beverage consumed daily. Participants were assigned to one of four treatment conditions including distal self-monitoring, proximal self-monitoring, distal goal-setting (given progressive weekly subgoals to meet including reducing their food intake by 10% from baseline), and proximal goal-setting (given same goals as the distal group except that the goals were computed for each of 4 specific daily time periods). A control group was also used.

Significant differences were found in the degree of goal attainment between the distal and proximal goal groups. Participants focused on distal goals rarely attained their goals and lost no weight, which was in sharp contrast to those who set proximal goals for themselves. Specifically, participants overate by 12% when they pursued distal goals, but
reduced their food consumption by 6% below their goal limit when they used more immediate, proximal goals. Overall, Bandura and Simon (1977) reported that participants achieved substantial reductions in eating and weight under goal-setting conditions, but continued to overeat and shed no pounds when they failed to set explicit goals for themselves even though they continuously monitored their eating behaviors.

The impact of goal-setting on health-promoting behaviors has been investigated by others. Shilts, Horowitz and Townsend (2003) provided a literature review of studies reported between 1977 and 2003 evaluating the effectiveness of goal-setting for nutrition and physical activity behavior. They identified 13 studies that met their specific inclusion criteria (i.e., adult populations, goal-setting effectiveness design used, published in peer reviewed journal). Eight of those studies demonstrated that goal-setting had a significantly positive effect on physical activity and/or dietary behaviors. The authors noted, however, that none of those studies reported power calculations. As such, the role of statistical power in the non-significant findings of the remaining five studies, is unclear.

The literature pertinent to the role of SCT constructs in health promoting behaviors including physical activity is clear. Across various populations, these constructs positively impact engagement in such behaviors. The impact of self-efficacy, goal-setting, and performance feedback appear particularly important for engagement in physical activity. Traditional weight loss interventions for overweight and obese individuals often focus on nutrition and exercise behavior changes. However, those interventions often neglect important SCT variables which have a positive impact on nutrition and exercise behavior changes. The following section presents an overview of
traditional approaches to weight loss, as well as the problems frequently associated with maintaining weight loss following these interventions. Arguments for the need to incorporate SCT constructs into these weight loss interventions are made throughout this section.

*Traditional weight loss interventions*

Traditional, non-surgical weight loss interventions, used separately or in combination, typically have included behavior modification, diet, physical activity, and/or drug therapy (Adolfsson et al., 2005). Behavioral modification programs train individuals to self-monitor caloric intake and physical activity. These programs often incorporate cognitive restructuring techniques to intervene on thoughts that impact eating and exercise activity (Stroebe, 2008). Similarly, residential weight loss programs are available that provide intensive approaches to behavior modification, while also offering an environment of social support. Commercial weight loss programs also comprise traditional weight loss interventions. Similar to other approaches, these programs typically focus on diet, exercise, and lifestyle change for weight loss (Stroebe, 2008). Examples of such commercially available programs include Weight Watchers ©, Physicians’ Weight Loss©, Jenny Craig © among others.

A major problem with traditional treatments of obesity is the failure to maintain long-term weight loss (McGuire et al., 1999; Stroebe, 2008). Failure to maintain weight loss occurs most notably after the discontinuation of recommended lifestyle changes such as exercise (Perri et al., 2001). In fact, for many obese individuals who have dieted, weight regain sometimes supersedes pre-intervention body weight (Aggarwal et al., 2005). Fielding and Fielding (2008) reported that only 2% of those engaging in diet
modification can keep 50 lbs. off for 1 year, and 95% of dieters eventually regain weight. This may be most notable in dieters who choose to partake in significant calorie restriction. For instance, very low-calorie diets (VLCDs) which typically contain 400 to 800 kilocalories per day, have been publicized as having dramatic success in treating weight loss, but in the absence of consistent behavioral modifications such as exercise, most patients experience weight regain within one year (NIH, 1991).

Additional weight loss options include the use of prescription medications (i.e., Meridia® and previously discontinued medications such as Phen-Phen® and Redux®), as well as over-the-counter weight loss medications (i.e., Dexatrim®, Hydroxycut®, Alli®). Prescription medications have traditionally been based on the effects of stimulants for appetite control, while newer medications have worked to suppress appetite by other chemical means and by blocking the absorption of fats in the intestine (Aggarwal et al., 2005; Fielding & Fielding, 2008; Li et al., 2005). However, the safety and efficacy of prescription medications for weight loss have not been established beyond two years (Aggarwal et al., 2005). In addition, as side effects can be associated with medications, their long-term use for weight loss and weight maintenance is not likely a feasible option. Therefore, an effective, long-term weight control treatment must consider a reasonable life-long behavior change plan that an individual can manage (Volek, VanHeest, & Forsythe, 2005).

According to Stotland, Larocque, and Kronick (2006), a primary treatment for obesity is the combination of exercise and modification in eating, the success of which is dependent on an individual’s adherence to the behavior change plan. Weight loss interventions that combine diet, exercise, and support (i.e., support groups, follow-up
phone contacts) have evidenced some degree of short-term weight loss success, but are also notoriously known for failure in maintaining long-term weight loss (McGuire et al., 1999). Numerous studies (e.g., Head & Brookhead, 1997; McGire et al., 1999; Perri & Fuller, 1995; Perri, Neezu, & Viegener, 1992) have documented the importance of physical activity maintenance for sustained weight management and the resulting problem of weight regain following the discontinuation such behavior changes. Such studies are reviewed below.

Head and Brookhead (1997) examined health outcomes following the discontinuation of weight loss interventions. They sampled 252 participants who returned to an obesity day treatment program at the Duke University Diet and Fitness Center (after being discharged between 2 and 42 months prior). A questionnaire evaluating lifestyle, high risk situations for relapse, and relapse prevention strategies used at home following discharge was administered to all returning patients. Assessment of patients’ perceived weight loss success at home and their obstacles to maintaining weight loss were also conducted. Participants were categorized as “successful” if they gained less than 5 pounds or continued to lose weight following discharge.

Results revealed that 40% were successful while the remainder gained weight. Weight gain ranged from 5 to 77.8 pounds. Time elapsed since treatment significantly accounted for 7% of the variance in weight change ($F = 19.89, p < .0001$) indicating that more elapsed time since treatment discharge was associated with weight regain. ANCOVAs comparing differences between the “most successful” and “least successful” groups revealed significant differences in “planning and monitoring” exercise and meals, ($F = 8.15, p < .005$), indicating that the successful group implemented such planning
strategies more than those who did not have weight loss success. This study supports the consensus in the literature that maintaining weight loss after discontinuing behavioral changes (i.e., exercise) is problematic. It also illuminates the impact that SCT constructs such as self-regulatory skills have on physical activity. Although this study implicitly addressed constructs associated with SCT, it was limited in that no concrete theoretical guide or direction was used in conceptualizing or developing weight loss outcomes and/or interventions. In addition, clarification of how the participants self-monitored, set their plans, and how or if they were provided consistent feedback may have created a better understanding of how the outcomes were achieved. Such information could also be used to more effectively shape future interventions for weight loss and weight management.

McGuire et al. (1999) attempted to identify predictors of weight gain in a sample of 714 adults. This team used the National Weight Loss Registry to identify individuals who reported having had longer-term weight losses in the past. Identified registry participants were followed over a period of one year. At entry into this registry, participants completed a series of questionnaires inquiring about previous and current weight, weight-loss efforts, physical activity levels, and mood. Similar assessments were completed at one year follow-up. At follow-up, 35% of the sample was classified as weight gainers, 59% were weight maintainers, and 6% was classified as continued weight losers. Gainers and maintainers were found to have decreases in energy expenditure through physical activity. Overall, gainers and maintainers significantly decreased the amount of calories expended through physical activity including walking. This study provided data consistent with other research (e.g., Perri & Fuller, 1995; Perri, Nezu, & Viegner, 1992) regarding the problem of weight regain following the discontinuation or
reduction of physical activity and lifestyle changes. However, similar to other studies, this research was not guided by theory, therefore making a clearer understanding of the psychological variables influencing the problem, as well as possible treatment interventions, difficult to discern.

It is clear that traditional weight loss approaches are not generally effective in producing long-term weight loss success. This lack of long-term success is typically associated with individuals eventually discontinuing important behavior changes including physical activity. Reasons for the discontinuation of physical activity that often result in weight regain are complex (see Head & Brookhart, 1997). Due to factors that include generally poor long-term outcomes with traditional weight loss methods, the presence of significant obesity related co-morbidities (Sarwer et al., 2005), and the development of minimally invasive surgical techniques, the utilization of bariatric surgery for weight reduction for morbidly obese individuals has rapidly expanded (Ray et al., 2003). A discussion of the most popular surgical weight loss procedures to date, and the critical nature of compliance with physical activity recommendations and other behavioral changes associated with these procedures, is discussed next.

*Surgical interventions and compliance issues*

The American Society for Bariatric Surgery [(Society of American Gastrointestinal Endoscopic Surgeon, 2000), see http://www.asbs.org/html/lab_guidelines.html] presented criteria that potential surgical patients are required to meet to be considered a possible surgical candidate. First, all patients must demonstrate a history of previous attempts at weight loss. Second, prospective surgical candidates must have either a BMI of 40 or greater, or a BMI greater than 35 in conjunction with significant
medical co-morbidities. Patients meeting these criteria may then choose to pursue surgical options to weight loss. Several options for surgical weight loss exist. However, the two most frequently performed bariatric surgeries in the US are the Roux-en-Y gastric bypass (RYGB) and laparoscopic adjustable gastric banding (LAGB), both of which are known to lead to quick and dramatic weight loss and are associated with significant improvement of many debilitating medical co-morbidities (Fielding & Fielding, 2008). Risks of both surgeries are outlined by ASMBS and include potential operative and post-operative complications, as well as weight regain.

Better sustained post-operative weight loss and significant health improvements have made bariatric surgery an effective treatment for obesity, but most experts agree that psychosocial and behavioral factors also contribute to successful long-term outcomes (Sarwer et al., 2005). Responsible bariatric surgery programs inform their patients that surgery works successfully only in conjunction with behavioral and lifestyle changes. Therefore, long-term weight loss maintenance following bariatric surgery is dependent on patients’ compliance with diet and exercise recommendations. Patients who are not compliant with incorporating standard behavioral recommendations not only put themselves at risk for diminished weight loss and weight regain, but also for such problems as vitamin and mineral deficiencies and protein malnutrition (Rusch & Andris, 2007). Some studies have reported that failed outcomes (i.e., weight regain) begin to occur approximately 24 months after surgery (Boccheri et al., 2002). In support of these claims, an independent panel at the 2004 ASBS (now known as American Society for Metabolic and Bariatric Surgery, ASMBS) consensus conference noted that preoperatively, bariatric surgery patients need to be motivated and willing to embrace a
revised lifestyle (i.e., diet and exercise components) and that postoperatively, lifestyle changes should continue to be reinforced by the bariatric team (Buchwald, 2005). Therefore, responsibility for successful post-operative outcomes rests with both the bariatric patients, and the bariatric treatment team. Treatment teams need to individually assess for challenges to long-term compliance with behavior recommendations and subsequently, provide appropriate education and intervention to each patient. Bariatric patients need to accept the critical nature of long-term lifestyle changes and be receptive to engaging in the interventions designed to help them sustain such changes.

Rusch and Andris (2007) acknowledged that although some bariatric surgery patients follow postoperative behavioral recommendations for consistent physical activity, some fail to do so, making weight regain and the re-emergence of weight-related health problems an increasing risk. Research on the prevalence of bariatric surgery patients’ noncompliance with behavioral recommendations is rather limited. However, some recent studies have also documented bariatric patients’ noncompliance with recommendations specific to exercise and follow-up appointments (e.g., Elkins et al., 2005; Friedman et al., 2007; Poole et al., 2005; Rusch & Andris, 2007). For example, Elkins and colleagues followed 100 RYGBS patients over the course of one year. Via chart review, this team gathered data regarding patients’ noncompliance with behavior change recommendations at 6 months and 12 months post-operatively. The majority of their sample reported noncompliance in at least one area, with lack of exercise and snacking being the most frequently reported compliance issues. Specific to exercise, 40% of the sample reported not engaging in exercise at six months post-surgery. This remained generally consistent across time as 41% reported not engaging in exercise at 12
months post surgery. The behavioral recommendation for exercise had the highest rate of noncompliance at 12 months when compared to all other behavioral recommendations. Limitations of this study included a restricted sample in regard to geographic location and ethnic diversity (i.e., Caucasian population in central Texas). Despite possible generalizability problems, such a large amount of noncompliance with exercise found in this sample is suggestive of a troubling problem in bariatric surgery patients.

Compliance with pre and post-surgical follow-up appointments is also an important factor in maintaining appropriate weight loss and health following bariatric surgery. Gould, Beverstein, Reinhardt, and Green (2007) noted that follow-up appointments hold patients accountable to themselves and their providers to continue healthy lifestyle changes necessary for weight loss maintenance. Gould et al. sampled patients from their bariatric program who completed RYGB over three years previously and divided this sample into 3 groups according to follow-up status. Group one included 34 patients who attended all routinely scheduled follow-up appointments within 3 to 4 years following surgery. Group two included 41 patients who attended every appointment for one year following surgery, while group three (n=10) included those who had been lost prior to one year following surgery. (Gould and colleagues acknowledged that many participants in group three were able to be located and reached via phone in order to participate in this study). Results revealed a significant difference in excess weight loss between group one patients and groups two and three at three years follow-up. Patients who consistently attended scheduled clinic visits following RYGBS had significantly greater weight loss than those who were lost to follow-up shortly after surgery.
The authors speculated that consistent follow-up may help in sustaining weight loss and healthy lifestyle changes by holding patients accountable to themselves and their health care providers. Similarly, it may be speculated that patients who are not compliant with recommendations for follow-up appointments may also be noncompliant with other recommendations such as engaging in consistent physical activity. While not addressed in this study, it is possible that the feedback provided at follow-up appointments regarding the patients’ health and progress toward health goals (i.e., BMI, weight loss, lab work) may have served as a motivational tool for ongoing behavior change, a premise that would be suggested by SCT.

Other studies (e.g., Friedman et al., 2007) examined compliance with preoperative psychological recommendations (i.e., seeking out individual psychotherapy, obtaining a psychotropic medication evaluation, and modifying or eliminating certain health behaviors such as alcohol or nicotine intake). Using 837 pre-surgical patients, Friedman and colleagues reported that 68 patients in their sample were given psychological / behavioral treatment recommendations prior to surgery and of those, 38 were compliant. They reported that patients were more likely to follow through on less complicated recommendations that required less time commitment and effort. They further noted that patients were less likely to comply with recommendations that required significant behavioral changes such as smoking cessation and initiation of individual psychotherapy. As with similar research, this study did not address important psychological constructs related to behavior change. It is possible that an additional reason for noncompliance with more complicated recommendations was that patients may have lacked the self-efficacy and / or motivation to engage in such behaviors, a
premise that is consistent with SCT. This could be at least partly dependent on the patients’ previous efforts / failures at such behavior changes. Understanding how previous failure experiences may impact individuals’ self-efficacy to continue performing those behaviors may explain the propensity for people to withdraw from developing and pursuing goals.

To conclude, compliance with physical activity recommendations is crucial for the maintenance of weight loss in bariatric surgery patients. Reasons for patients’ noncompliance with behavioral recommendations vary and are complex. Little has been done to better understand the impact of psychological / behavioral determinants of physical activity change specific to these patients. As previously discussed, SCT offers a theoretical guide for understanding and predicting behavior change and has been used in research and practice with numerous medical patient populations, as well as with more general populations. Extending knowledge of the impact of SCT constructs such as self-efficacy, goal setting, and performance feedback to bariatric surgery patients’ pursuit toward healthy behaviors including physical activity, is warranted. The following section discusses the links between important theoretical constructs from SCT and bariatric patients’ challenges with physical activity compliance. A case is made for the use of SCT constructs as a guide for the development of intervention strategies to increase physical activity in this patient population.

SCT and compliance with bariatric surgery recommendations

The connections among the SCT constructs of self-efficacy, goal-setting, and performance feedback have been shown to be particularly relevant for engagement in physical activity and other health-promoting behavior changes. However, the available
literature on the impact of SCT variables specific to bariatric surgery patients’ challenges with physical activity is quite limited. Weight loss self-efficacy of bariatric surgery patients has been recently evaluated (e.g., Fink, 2007), but the focus has been primarily on changing eating behaviors, with a dearth of information available on the impact of self-efficacy on exercise behaviors. Given the limited use of theory applied to this population, the current study uses SCT as a theoretical guide to understand the problem of physical activity compliance. Relatedly, SCT is used to predict patient behavior based on the theory’s constructs, and to better develop interventions for consistent physical activity in this patient population.

Self-efficacy, goal-setting, and performance feedback are primary mechanisms of motivation and behavior change. Bandura (1999) noted that as a general rule, people do things that they have seen succeed and feel they can accomplish and avoid those things that they have seen fail. In addition, Bandura and Locke (2003) stated that when performance feedback toward goals is framed as failure experiences or goal shortfalls, self-efficacy can plummet, self-set goals can decrease, and overall performance deteriorates. These SCT variables, and related issues associated with these variables, can be used to conceptualize the challenges bariatric patients have with physical activity compliance.

Specifically, many obese individuals seeking bariatric surgery have made several unsuccessful efforts at sustaining weight loss (Buchwald, 2005) through traditional interventions that often include physical activity. Rusch and Andrish (2007) stated that repeated failures at weight loss interventions could possibly interfere with patients’ motivation and confidence regarding their ability to yet again, engage in those critical
lifestyle changes, therefore making compliance with behavior change recommendations difficult. Therefore, it stands to reason that SCT would predict that many bariatric patients with a history of failed weight loss attempts have limited self-efficacy for engaging in consistent physical activity and related behavior changes. According to this theory, low self-efficacy would then negatively impact one’s motivation to engage in self-regulatory weight-loss strategies such as goal-setting (Bandura, 1999), further compounding challenges toward positive behavior change. This relationship is demonstrated in research.

Kitsantas (2000) tested the influence of self-efficacy on self-regulation strategies with 3 small groups of college students. Group one had no history of weight problems, group two consisted of obese individuals who had tried to lose weight but failed, and group three consisted of previously obese individuals who lost a significant amount of weight and kept it off for at least 6 months. Participants completed questionnaires measuring their self-regulation strategies (including goal setting and planning) for weight loss and their self-efficacy to implement those strategies. Analysis of variance and Tukey’s post hoc analyses revealed that the overweight participants used significantly fewer self-regulation strategies for weight loss and indicated significantly lower self-efficacy perceptions than the other groups. While this research was limited by the small sample sizes (11 per group), it does provide some support to the argument that failure experiences at weight loss can negatively impact self-efficacy and self-regulatory behaviors and consequently, motivation for behavior change in obese individuals. It further highlights the importance of SCT constructs in explaining and predicting weight
loss behaviors in obese individuals, constructs which are often neglected when developing interventions for weight loss.

In applying SCT to improving motivation for physical activity in the bariatric surgery population, additional aspects pertaining to goals and goal-setting should be considered, namely proximity, clarity, and available feedback regarding progress toward goals. As previously discussed, Bandura and Simon (1977) demonstrated that explicitly defined, proximal goals (i.e., clear goals set for the immediate future) allow for more control over one’s behavior and often result in better goal attainment and outcome. Therefore, effective interventions to facilitate physical activity in the bariatric surgery population should include strategies for patients to effectively define specific, proximal goals.

As discussed at length in previous sections, critical to goal-setting and resulting motivation for behavior change, is the ability to obtain feedback regarding one’s progress toward a goal. Bandura (1997) stated that people will maintain physical activity when they establish goals and obtain feedback related to progress toward goals. More specifically, Bandura and Locke (2003) discussed that performance feedback framed as a gain toward goal attainment will increase self-efficacy and self-satisfaction, and will raise a person’s self-set goals thereby facilitating both motivation and performance. However, Bandura and Locke also noted that in the pursuit of difficult challenges people need to be able to override discouraging negative feedback that may be received. They explained that individuals who proactively use such discrepancies between their set performance standards and their actual performance, become motivated to reduce the discrepancy and mobilize their efforts to work toward achieving their goals. Those who are overwhelmed
with self-doubts (i.e., low self-efficacy) will prematurely give up in the face of challenge and will not be successful goal achievers (Bandura, 1997).

Given a frequent history of failed attempts at weight loss, as well as other challenges such as physical limitations, many bariatric surgery patients have limited self-efficacy for physical activity and other healthy behavior changes. SCT would predict that these patients likely avoid goal-setting, and if they do set activity standards for themselves, they have little motivation to consistently self-regulate, seek feedback regarding goal progress, or persevere in the face of challenges. Given that self-efficacy, goal-setting, and feedback are critical determinants of motivation and behavior change, SCT would suggest that interventions developed to facilitate physical activity in bariatric surgery patients should be constructed around these essential variables. Specifically, SCT would propose introducing mechanisms that assist patients in clearly defining physical activity goals while also providing the means to obtain immediate, objective feedback regarding progress toward those goals. Therefore, finding an effective means of both objectively measuring physical activity and providing accurate feedback toward activity goal progress is critical, as theoretically, such feedback would contribute to self-efficacy that would enhance motivation and behavior change.

Recommendations for increased physical activity are frequently given to various patient populations including those with cardiac problems (e.g., Braith, 1998), bariatric surgery patients (e.g., Elkins et al., 2005), and others. Various methods have been used to measure levels of physical activity and adherence to activity recommendations for these patients. Such methods have included the use of self-reports, behavioral observation, electronic sensors, and indirect measures such as heart rate, all of which have been found
to have advantages as well as limitations (Speck & Looney, 2006). Problems with self-reporting bias with these measures have been most frequently addressed (e.g., Bassett, Cureton, & Ainsworth, 1999; Mestek, Plaisance, & Grandjean, 2008; Scott, Eves, French, & Hope, 2008). The use of a standard, objective measure of physical activity would provide more accurate measures of activity, and could also be used to formulate activity goals that could contribute to motivation for such behaviors.

Pedometers can be used as a standard tool for accurately and objectively measuring physical activity (specifically walking), while also providing continuous feedback on activity performance. Such feedback could also be used to help patients in setting realistic yet challenging goals, as they would be able to see their daily step counts and make adjustments to goals for the upcoming days or week. Theoretically, the SCT determinants of goal-setting and feedback would ultimately increase motivation for behavior change and would improve performance toward goal attainment.

The following section reviews how pedometers have been used to provide objective feedback while facilitating other important SCT constructs that contribute to motivation for, and engagement in, increased physical activity. Based on available literature specific to the use of pedometers with overweight individuals, this section also discusses how pedometers may be used to facilitate motivation for physical activity behavior in the bariatric population.

**Pedometers as motivational tools for physical activity**

Pedometers are a low-cost objective measure of walking activity. They may be especially effective as a tool for monitoring activity level, as well as a motivational device used for increasing physical activity (Melanson et al., 2004). Studies have used
pedometers to assess exercise and intervention adherence in various populations including sedentary individuals (e.g., Chan et al., 2004), cardiac patients (e.g., Evangelista et al., 2005), general family medicine patients (e.g., Stovitz, et al., 2005), diabetic patients (e.g., Tudor-Locke, et al., 2002), and obese older women (e.g., Jensen et al., 2004) among others. All studies noted above reported an increase in physical activity (total steps taken) over baseline for those who consistently wore a pedometer. In addition to increased physical activity, most of these studies also reported specific health-related improvements (such as decreases in blood pressure, BMI, waist circumference, etc).

Specific to overweight and obese individuals, the Journal of the American Medical Association (JAMA) published a meta-analysis of 26 studies investigating the association of pedometer use and changes in BMI, blood pressure, and overall physical activity (Bravata et al., 2007). Most participants in the included studies were overweight and were relatively physically inactive at baseline. Eight of the studies were randomized control trials (RCT) where participants wore pedometers and were encouraged to view and record daily step counts, while the controls wore pedometers that concealed the daily step counts. Six additional RCT studies used pedometers with visible step counts in both trial cohorts, while 12 studies used single group observations.

Overall, results revealed that pedometer users significantly increased physical activity by 26.9% over baseline, and significantly decreased their BMI and systolic and diastolic blood pressure. Although this review did not discuss theoretical underpinnings or determinants of the changes in participants’ physical activity behavior, important SCT constructs associated with motivation and behavior change had a clear influence on the results in this review. Such influences were implied by Bravata’s team as they
acknowledged that establishing step goals and keeping step diaries (examples of self-regulatory and self-monitoring behaviors) appeared to be key motivational factors for engaging in physical activity. No significant improvement in physical activity (i.e., step count) was found in the few studies reviewed where pedometer users did not establish a daily step goal. This was in sharp contrast to increases of more than 2000 steps per day for pedometer users who did set daily step goals. Similarly, Bravata et al. found that participants in studies that did not require step monitoring via a step diary did not significantly increase their activity over baseline, whereas participants receiving interventions that required the use of a diary, did. Intervention duration and physical activity counseling were not significant predictors of increased daily step counts. Bravata’s team noted that may have been due to the heterogeneity of the counseling provided in the various studies (i.e., counseling sessions with a dietician, goal-setting sessions, emails).

Although this meta-analysis included individuals deemed as overweight or obese, it was limited in that it did not appear that any study included bariatric surgery patients. In addition, participants in most studies were women under the age of 60, therefore making generalizability across age and sex problematic. Bravata’s team also acknowledged that pedometer users may have increased their physical activity just by virtue of knowing that they were being monitored. However, the authors noted that this type of Hawthorne effect would have likely affected both the intervention and control groups in a similar manner. They further cautioned that due to various intervention components in some of the studies (i.e., use of pedometers, step goals, diaries, counseling), the extent to which each of those interventions contributed to the outcomes
is unclear. However, as noted from previous research that has tested the ability of SCT constructs to explain the variance for physical activity, studies have consistently shown that SCT constructs typically account for a sizeable portion of the variance (e.g., Petosa, et al., 2003; Plotnikoff et al., 2008; Rovniak et al., 2002). Based on SCT, a confident argument can be made that the feedback available from pedometers in these studies appeared to be at least one primary contributor to adjustments made to personal goal-setting, which collectively influenced the participants’ motivation and engagement in physical activity.

The uncertainty of whether walking or another intervention (i.e., diet modifications, counseling) accounted for weight loss and improved health in pedometer users was addressed in a meta-analysis conducted by Richardson et al. (2008). Richardson and colleagues examined the effects of pedometer based walking interventions in overweight and obese, sedentary individuals. Individuals in these studies were not given any form of dietary or general counseling interventions and were not asked to keep daily step logs. Interventions lasted a minimum of four weeks. Nine studies met inclusion criteria for a total of 307 participants.

Richardson and colleagues found that pedometer based walking programs alone (i.e., without dietary change) resulted in a modest amount of weight loss in overweight and obese individuals (i.e., approximately one pound every 10 weeks). They noted that longer program interventions led to greater weight loss. In discussion of these results, Richardson and colleagues acknowledged that such modest weight losses may be discouraging to participants seeking to lose weight and could lead to drop out. As a result, they called for the inclusion of a dietary intervention (i.e., calorie monitoring,
dietary education) to facilitate weight loss. While not addressed in this study, such modest weight loss results could have an impact on self-efficacy for weight loss behaviors which could consequently, impact motivation to continue those behaviors. In regard to limitations, the authors reported that although a dietary component was not included in any of the reviewed studies, participants may have decreased caloric intake on their own making the real cause of weight loss unclear. They further noted these studies were based on pre-intervention / post-intervention comparisons, rather than comparison with randomized groups leading to difficulties in interpretation.

A dearth of literature exists regarding physical activity monitoring and the use of pedometers in the bariatric surgery population. One available study investigating physical activity in this population was conducted by Bond et al. (2004). This study used post-operative bariatric patients but self-reports of physical activity were obtained without any objective measure of true activity levels. Consequently, this study added to the physical activity research that has been limited by both self-reporting bias, as well as outcomes of physical activity that are difficult to discern.

To conclude, various studies suggest the applicability of pedometers for overweight or obese individuals attempting to increase activity levels. However, there is a limited amount of research regarding how pedometers can be used as monitoring and motivational tools for behavioral change specific to bariatric surgery patients. As pedometers have been demonstrated to provide feedback and consequently, have contributed to motivation and performance for physical activity in overweight populations and other patient populations, it can be concluded that this knowledge can also be extended to bariatric surgery patients. The following section provides a summary
of how the use of these devices, in conjunction with a strong theoretical guide, can facilitate important SCT determinants that may influence behavior change in the bariatric population.

**Application of pedometers and SCT to bariatric patients**

In order to develop effective physical activity interventions specific to the bariatric surgery population, consideration of at least two factors is warranted. First, the lack of information specific to physical activity in this population speaks to the need for theory driven research and practice in this area. Second, the use of research from other populations that have found success with pedometer use in increasing physical activity can be used to inform research in the bariatric population.

As addressed throughout this chapter, physical activity promotion as conceptualized by SCT, suggests that self-efficacy will drive motivation and behavior. Further, self-efficacy can be promoted through the development of goals, and by obtaining supportive feedback regarding goal progress. Research has demonstrated that the use of pedometers can have a motivational effect for physical activity in different patient populations (e.g., Bravata et al. 2007). Studies have also demonstrated that pedometers provide direct feedback regarding an individual’s activity goal / performance which, according to SCT, can increase motivation to achieve those goals and to formulate new goals. In turn, this creates increased self-efficacy for physical activity which further promotes motivation and effective performance. If pedometers have been shown to have such a motivational impact in other populations, it is assumed that this effect could be translated to the bariatric population.
It has been documented that many bariatric surgery patients have decreased self-efficacy for physical activity and other weight loss behaviors due to a previous history of failures at such interventions (Buchwald, 2005; Rusch & Andrish, 2007). According to SCT, limited self-efficacy can have a negative impact on the subsequent development of personal goals and perseverance toward goals in the face of obstacles, resulting in decreased motivation and performance (Bandura, 1986, 1997, 2004). An SCT approach would suggest the need to increase self-efficacy for physical activity through the development of realistic and specifically set goals to be accomplished in the proximal future. In order for goals to have any effect, the theory would suggest that ongoing performance feedback would be needed during goal pursuit. Accurate and consistent feedback regarding physical activity performance could be easily obtained through the use of a pedometer. As patients obtain feedback regarding their performance, they can also make adjustments to their goals and set new goals based on this feedback. According to SCT, the interconnections between goal-setting and performance feedback contribute to self-efficacy, which ultimately impacts motivation for behavior change. Based on research with other populations and the theoretical premises suggested by SCT, the use of pedometers with the bariatric surgery population appears to be a potentially effective intervention for consistent engagement in physical activity.

It should, however, be recognized that the bariatric population (at least the more recent post-operative patients) may have particular physical limitations or other challenges that may make achieving certain degrees of activity unrealistic. Such issues may also impact the accuracy with which the pedometers collect data. For instance, it is noted that the typical recommended number of steps for healthy adults is about 10,000
per day (see Tudor-Locke & Bassett, 2004; Tudor-Locke & Myers, 2001). This is equivalent to approximately five miles of walking per day. Given the potential medical complications and mobility restrictions for some morbidly obese individuals, a daily step goal of 10,000 may not be realistic.

Application of the recommended 10,000 steps to overweight individuals was addressed by Schneider, Bassett, Thompson, Pronk, and Bielak (2006). Specifically, they examined the effects of a 10,000 daily step exercise prescription on 56 sedentary, overweight/obese adults. Participants were instructed to wear their assigned pedometers during all waking hours except when bathing. They were given an activity prescription that led towards the goal of eventually accumulating 10,000 steps per day (i.e., a goal of 7,000 daily steps for week one, 8,000 for week two, 9,000 for week three, and 10,000 per day thereafter). Adherence to the step prescription was defined as averaging 9500 or more daily steps from week 4 to week 36. Participants were also asked to submit an activity log on a biweekly basis. Body composition and cardiovascular risk factors were determined at baseline, 20 weeks, and 36 weeks.

Significant improvements in step adherers were noted in mean values for walking (i.e., total steps taken as compared to baseline values), body weight, BMI, percentage body fat, waist and hip circumference hip circumference among other related factors. Non-adherers showed little or no change in these variables. Scheider and colleagues concluded that adherence to a 10,000 step exercise prescription had a marked effect on activity and health outcomes of previously sedentary, overweight/obese adults. However, they also noted that as only one third of the sample was able to adhere to the 10,000 step prescription, this particular step goal may not be feasible for all adults. Consequently, the
potential for additional failure experiences could result, thereby impeding motivation for activity. It is also noted that while this sample included overweight individuals, it did not include bariatric surgery candidates, and therefore, generalizability is questionable.

In regard to the current study, it should be noted that the general recommendation for 10,000 daily steps may not be realistic for bariatric surgery patients who often have significantly higher BMIs and physical co-morbidities. Therefore, walking goals for this population need to be appropriate and realistic. Efforts to develop realistic activity goals, while avoiding inadvertently deterring patients from obtaining their goals, are heavily considered in this study. Consistent with SCT, goal development in this study focuses on the importance of setting goals that are both achievable and set in the proximal future (as described by SCT), while also being consistent with the Akron General Bariatric Program recommendations for increasing physical activity. Therefore, participants in both the treatment and control groups are given weekly goals of increasing their average daily step counts by 1,000. (For instance, if a patient’s average daily steps in week one was 5,000, their goal for average daily steps during week two will be 6,000). Overall, by the end of the study, the goal for each participant is an increase of 3,000 steps over baseline.

The goal of a 1,000 daily step increase (each week) was derived from both SCT’s theoretical principles (i.e., to avoid creating potential failure situations by establishing challenging but realistic goals), and from the Bariatric Surgery Program’s activity recommendations. The Akron General Program instructs bariatric patients to walk 10 minutes (3 times per day) beginning the day after surgery. Patients are instructed to walk 20 minutes nonstop at two weeks following surgery. They are to increase to thirty minutes of walking at least four to five days per week, then 40 to 50 minutes at least four
to five days per week. These recommended increases in walking are roughly at ten minute increments. As a person typically walks a mile in about 20 minutes which is approximately 2,000 steps, one half mile would be approximately 10 minutes of walking or 1,000 steps. As ten minutes (or about 1,000) steps is generally consistent with the increases in walking recommended by the bariatric team at Akron General, it was decided that weekly goals for participants in this study would be to continue this incremental increase in walking activity (i.e., 10 minutes per week). Average daily steps for each week and step goals will be calculated at the end of every week and documented on participants’ activity log. This process is further outlined in chapter three.

Conclusion and Hypotheses.

Weight regain and the associated re-emergence of weight-related health concerns are noted risks of bariatric surgery. As increased physical activity is associated with positive changes in weight, BMI, and lean body mass, bariatric surgery patients’ participation in consistent physical activity both pre and post surgically, is critical to long-term maintenance of weight loss and optimal health.

Pedometers, and specifically the objective feedback that these devices provide, have been successfully used in various patient populations for both activity monitoring, and as a motivational tool for engaging in walking activity. However, a dearth of research exists regarding how pedometers may be used in these ways to facilitate physical activity specific to bariatric surgery patients, where physical activity is critical for long-term weight loss success and overall health. Given the available research on other patient populations, it is presumed that pedometers could be also used for similar purposes in the bariatric surgery population.
Given the lack of available research regarding bariatric patients and the use of pedometers for activity promotion, SCT can provide a strong theoretical guide for understanding the problem and constructing appropriate research and intervention. The self-efficacy component of SCT has been shown to be a predictive factor in the engagement of physical activity (Keller et al., 1999) as well as an overall influencing factor in the motivation for physical activity (Bandura, 2004). Although scant, some literature (see McAllen, 2009) has addressed the importance of self-efficacy for various behavior changes in bariatric patients, but has neglected to incorporate other important determinants of motivation, specifically goal-setting and objective performance feedback (as provided by pedometers) in their investigations. As discussed, bariatric surgery patients tend to have a history of failed attempts at weight loss behaviors, including exercise (e.g., Rusch & Andrish). This undoubtedly impacts their desire to set additional and pursue new activity goals, which is an issue likely due to low self-efficacy for exercise and related weight loss behaviors. While this is a widely held belief, no available research to date has fully investigated how important SCT determinants for motivation and behavior change (specifically self-efficacy for exercise, goal-setting, and obtaining objective performance feedback) could be enhanced in this population to promote, rather than hinder, motivation for physical activity.

Interestingly, research on the use of pedometers to increase physical activity in other patient populations has demonstrated positive results. In particular, research has demonstrated how these devices promote goal-setting while also providing consistent performance feedback toward goals, which theoretically, promotes self-efficacy and motivation for behavior change. As such, the use of pedometers as a physical activity
intervention for the bariatric surgery population could have a critical impact on patient’s self-efficacy and overall behavior change for physical activity. No study has yet conceptualized bariatric patients’ challenges for physical activity engagement from an SCT perspective while also using a measure of physical activity that also provides objective and continuous performance feedback. This study, therefore, offers unique theoretical and research design contributions to the literature.

The purpose of this study is to examine how pedometers can be used to promote important SCT determinants of motivation and consequently, increase physical activity in the bariatric surgery population. Specifically, this study investigates how objective feedback provided by pedometers may be used in conjunction with goal-setting to positively influence self-efficacy for physical activity and ultimately, to increase physical activity in this population.

In this study, physical activity is operationally defined as daily step-counts associated with walking activity. Specific hypotheses are as follows:

1. Pre-test self-efficacy for exercise is positively related to goal attainment.
2. The feedback group has higher self-efficacy for exercise at post-test as compared to the non-feedback group.
3. Together, change in self-efficacy and feedback are a stronger predictor of goal attainment than either change in self-efficacy or the feedback condition alone.
CHAPTER III

METHODOLOGY

The method of exploring the current research question is reviewed below. Measures and procedures used for gathering participant demographics and data, as well as the statistical hypotheses and related analyses, are described in this chapter.

Participants

The current study initially sought out a patient sample from Akron General Medical Center. IRB approval was granted and the enrollment of post-operative bariatric patients began in March of 2010. However, limited patient availability (primarily due to a low number of patients scheduled for surgery and problems with patient attrition following enrollment), led to a very sporadic enrollment process. This warranted the need to extend the patient sample to an additional bariatric surgery site. Consequently, IRB approval was sought out, and granted, at Parma Community General Hospital. The IRB approved the study in August of 2010 and enrollment of patients at that site promptly began. It is noted that the study protocol at both sites were identical in regard to procedure and data collection, with only one exception. Potential review of the participants’ charts (to retrieve information such as elapsed time since surgery, changes in BMI and weight since surgery, etc., if later warranted) was written into the IRB protocol for the Akron General site and included an authorization for use and disclosure of medical information form. Chart access for potential review was not written into the
Parma General protocol. As such, potential chart reviews could not be conducted for Parma General participants.

*Enrollment and attrition of participants*

Initial enrollment proceeded with a goal of enrolling 100 participants (50 in the feedback/treatment group and 50 in the non-feedback/control group) to satisfy sample size recommendations that would sufficiently test logistic regression coefficients, as suggested by Wright (1995). Ongoing problems with participant attrition (i.e., patients losing pedometers, not returning for data download, and withdrawing prior to data completion), as well as the challenge of adequate patient availability at both sites, resulted in a data collection process that continued through the end of April of 2011. After 14 months of data collection, 121 participants had been enrolled. However, 21 could not be used due to the attrition problems noted above. Data screening (further discussed in Chapter four) resulted in the removal of an additional seven participants. Given the consistent challenge of collecting complete and valid data that resulted in a data collection process that had already extended for over a year, it was determined that data collection would be concluded with the final number of participants being 93, slightly below the recommended sample size.

Forty-eight of those participants were randomly assigned to the pedometer feedback group (i.e., treatment group) and forty-five were randomly assigned to the non-feedback group (i.e., control group). Sixty-four participants (69%) were enrolled from Akron General Medical Center’s (AGMC) bariatric program, and 29 (31%) were enrolled from Parma Community General Hospital (PCGH). In regard to sex, 68 (73%) participants were female and 25 (27%) were male. Twelve participants reported having
some form of ongoing orthopedic problems (however, it is likely that orthopedic
information was under-reported, highlighting limitations often associated with bariatric
patients). The age range for all participants was 28 to 71 years and the mean age across
the sample was 50.4 years (SD = 9.9). A summary of participant demographic
information is found in Table 1 below.

Table 1

Demographic Information for the Total Sample and Individual Groups

<table>
<thead>
<tr>
<th></th>
<th>Total N=93</th>
<th>Feedback Group N=48</th>
<th>Non-Feedback Group N=45</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGMC Participants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AGMC</td>
<td>64 (69%)</td>
<td>36 (39%)</td>
<td>28 (30%)</td>
</tr>
<tr>
<td>PCGH Participants</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PCGH</td>
<td>29 (31%)</td>
<td>12 (13%)</td>
<td>17 (18%)</td>
</tr>
<tr>
<td>Males</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Males</td>
<td>25 (27%)</td>
<td>14 (15%)</td>
<td>11 (12%)</td>
</tr>
<tr>
<td>Females</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Females</td>
<td>68 (73%)</td>
<td>34 (37%)</td>
<td>34 (37%)</td>
</tr>
<tr>
<td>Reported Orthopedic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reported Orthopedic</td>
<td>12 (13%)</td>
<td>6 (6%)</td>
<td>6 (6%)</td>
</tr>
<tr>
<td>Mean Age</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Mean Age</td>
<td>50.4 years (SD = 9.9)</td>
<td>49.6 years (SD = 10.2)</td>
<td>51.4 years (SD = 9.6)</td>
</tr>
<tr>
<td>Gastric Bypass Procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric Bypass Procedure</td>
<td>72 (77%)</td>
<td>37 (40%)</td>
<td>35 (38%)</td>
</tr>
<tr>
<td>Lap Band Procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lap Band Procedure</td>
<td>5 (5%)</td>
<td>2 (2%)</td>
<td>3 (3%)</td>
</tr>
<tr>
<td>Gastric Sleeve Procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric Sleeve Procedure</td>
<td>10 (11%)</td>
<td>7 (8%)</td>
<td>3 (3%)</td>
</tr>
<tr>
<td>Did not report Procedure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Did not report Procedure</td>
<td>6 (6%)</td>
<td>2 (2%)</td>
<td>4 (4%)</td>
</tr>
</tbody>
</table>
Procedure

All participants underwent a bariatric surgical procedure (i.e., Roux-En-Y gastric bypass, Lap-Band, or Gastric Sleeve surgery). Eligible participants were two weeks post-surgery, up to several years post-surgery, and identified walking as their primary form of physical activity. Participants were randomly assigned into a treatment (feedback) group, or a control (non-feedback) group. Treatment group participants wore pedometers that provided visible feedback of daily step counts. Those in the control group also wore pedometers, but feedback of daily step counts were concealed across the entire course of the study.

Participants meeting criteria for this study were approached by a member of the research team during bariatric-related dietary, psychological, and/or medical appointments (which included program recommended bariatric support group meetings), at both sites. Participants were given general information about the study. Interested participants were either enrolled by the author at that time, or were contacted by the author at a later date to further review the study details, and to arrange for a time to meet for enrollment at an upcoming bariatric-related appointment/meeting. If an interested participant was not scheduled to return for a follow-up appointment/meeting within a reasonable amount of time, an appointment to enroll the patient was then scheduled for a convenient date/time.

At the time of enrollment, all participants received an informed consent form that provided additional information regarding the study (see Appendix A). An authorization for use of medical information form (see Appendix B) was also given to Akron General participants only, as use of medical information (found within medical charts) was not
included in the Parma General protocol. Basic participant data and demographics were also recorded on an enrollment and demographics sheet (Appendix C) for all participants. Participants then completed an 18-item self-efficacy for engaging in regular physical activity questionnaire (Appendix D). These questionnaires / information sheets were completed in the bariatric or counseling departments, (or support group meeting rooms on hospital premises), depending on where the patient appointment took place.

Following completion of the questionnaires, participants were randomly issued an OMRON HJ-720IT pedometer. (Pedometers had been previously blinded by the author with tape and labeled with a “T” or “C” to indicate assigned group placement of either the treatment or control group. Pedometers were placed face-down in a box or on top of a table, to conceal group placement. Participants were asked to choose a pedometer and learned of their group placement upon turning the pedometer over). As noted in the information sheet / consent form, participants agreed to wear the pedometers during all waking hours. They were instructed to begin wearing the pedometer when they woke up beginning the morning after being issued the pedometer, and instructed to remove the pedometer each night, just prior to going to bed.

The first 7 days of pedometer data were used for the purpose of gaining baseline data on participants’ general walking activity. Therefore, participants in both groups were instructed to continue with their normal daily walking activity during week one. All pedometers in both groups were blinded (i.e., tape marked with the author’s signature across the back, concealed the step count window). This was done in an effort to prevent patients from viewing any step count feedback prior to the end of baseline data gathering. All participants in the treatment group agreed to keep the pedometers blinded (taped) for
one week. Participants in the treatment group only, were instructed to remove the tape before going to bed on day seven. A date was given to each treatment group participant regarding the day of tape removal, and each participant was given a reminder phone call the day before the required tape removal.

Participants in the control group were informed that they were not to remove the tape at any time during the entire four weeks of data recording. They were however, told that their data would be available to them at the completion of the study.

At the time of tape removal (un-blinding) for the treatment group, step count feedback was made readily visible. Total step counts for each day during the previous week was also retrievable (as this information was stored on the pedometer). Participants in only the treatment group documented their actual step counts from days one through seven onto their activity log (Appendix E). Participants then followed the instructions on their activity log for calculating their average step count for the week. The activity log instructed treatment group participants to add the seven daily steps counts together (for the baseline days recorded), and to divide by seven to establish their average daily step count for week one (baseline). They were instructed to record this number on their activity log. Participants in the treatment group were then instructed to document their daily step goal for week two. The development of weekly step goals are discussed below.

In order to facilitate motivation for physical activity, SCT highlights the importance of goal-setting and establishing goals that are both achievable and set in the proximal future. Therefore, participants in both groups were informed that their goal for each new week was to increase their average daily step counts by 1,000. (However, only treatment group participants were instructed record this number into an activity log). The
goal of 1,000 steps was derived from both theoretical principles (i.e., establishing challenging but realistic goals to avoid creating potential failure situations) and from the Akron General Bariatric Surgery Program’s recommendations for how to increase activity levels. The Akron General Program instructs their patients to walk 10 minutes (3 times per day) beginning the day after surgery. At two weeks post-surgery, patients are instructed to walk 20 minutes nonstop (at least three to four days per week). Shortly thereafter, they recommend that patients walk for thirty minutes nonstop four to five days per week, then 40 to 50 minutes four to five days per week. Patients in this program are not given a limit on walking activity unless there is a medical indication for either monitoring or reducing activity.

These recommended increases in walking are roughly at 10 minute increments. On average, a person walks a mile in about 20 minutes. A mile is approximately 2,000 steps. One half mile equates to approximately 10 minutes of walking and therefore, would be calculated as approximately 1,000 steps. As ten minutes (or about 1,000 steps) is generally consistent with the increases in walking recommended by the bariatric team at Akron General, it was decided that the weekly goals for participants in this study would be to continue this incremental increase in walking activity (i.e., 10 minutes per week/1000 steps), across three weeks. Consequently, by the end of the study, the goal for each participant would be an increase of 3000 steps over baseline. It is noted that the bariatric team at Parma Community General Hospital reviewed this step increase procedure and although they did not indicate a recommended progressive walking increase specific to their own program, they agreed to the protocol set forth in this study. Therefore, recommended weekly increases in walking remained the same for both sites.
Each day during week two (the first feedback / treatment week), treatment group participants recorded their daily steps in their activity log. At the end of the week, they again calculated their average daily steps for the week and recorded it. They then documented their average daily step goal for week three, which was an additional 1,000 steps to their average of the previous week. They also did this for week four. Participants in both groups were instructed to discontinue wearing their pedometers after the four week period. It is noted that even if the participants continued to wear their pedometer after the 4 week period (as they awaited data collection / data download), only the data stored during the treatment phase (first 4 weeks) was used for purposes of this study.

All participants were informed that data from the pedometers needed to be downloaded onto the bariatric surgery staff’s computer immediately following the completion of data recording. All efforts were made to gather pedometer data when the participant was scheduled to return for a “treatment as usual” follow-up with the dietician, surgeon, or counselor/psychologist. If the patient was not scheduled to see any of these providers within a reasonable amount of time following the four weeks of data recording, an appointment date specific for data downloading was given. (It is noted that the pedometers used in this study stored data for 42 days. Beginning on day 43, the pedometer begins to replace each stored day with the current day’s data).

At the time of data collection (i.e., pedometer download), the participants were asked to complete the same self-efficacy for physical activity questionnaire that they completed prior to being issued the pedometers. At that time, participants in both groups also completed two questions to assess both compliance with keeping pedometers
blinded, and if they actually wore the pedometers as instructed (see appendix F). All data from this study remains confidential and is kept locked in a secure office.

**Materials**

*Enrollment and demographic questionnaire*

Bariatric research staff completed the enrollment and demographic questionnaire. This questionnaire provided general patient information (including date of birth, pedometer / participant number issued, etc), the type of bariatric surgery the patient received, and related information.

*Self-Efficacy for Engaging in Regular Activity Questionnaire*

The Cancer Prevention Research Center (CPRC, © 1991) developed a scale measuring the confidence individuals have in their ability to engage in consistent exercise throughout the week, despite encountering situations that could potentially interfere with exercise (see, www.uri.edu/research/cprc/Measures). The Self-efficacy for Engaging in Regular Activity Questionnaire is comprised of 18-items representing six categories (see Appendix D). Limited data are available for this measure beyond what is provided on the CRPC website. The six categories and associated alphas were reported as negative affect (.85), excuse making (.83), exercising alone (.87), inconvenience of exercise (.77), resistance from others (.85), and bad weather (.84).

Shorter forms of this original scale offer more extensive analysis and data. Marcus et al. (1992) developed a similar five-item instrument designed to measure confidence in one’s ability to engage in consistent exercise despite facing challenging situations. Those items represented categories that included negative affect, resisting relapse, and making time for exercise, all of which were represented in the longer
version, and which have been shown to be important factors in other research (e.g., Sallis et al., 1988). Specifically, those five items (representative of challenging situations) included engaging in exercise / physical activity when tired, in a bad mood, not having enough time, being on vacation, and when the weather was bad. Internal consistency was reported to be 0.82 (n = 917) and total scores on the self-efficacy items differentiated participants at different stages of change.

Sarkin et al. (1988) used a similar 6-item instrument. Sarkin’s team added an item that addressed individuals’ confidence for engaging in activity when under a lot of stress. Each item was rated on a 1 (not at all confident) to 5 (completely confident) scale. Sarkin and colleagues reported good psychometric properties including an average loading of .79 with a comparative fit index of .97 and an internal consistency reliability estimate of .88.

To conclude, while limited data are available for the longer version of the self-efficacy measure, various smaller versions have been adapted from it that contain strong reliability statistics. Due to the potential value in deriving additional information between groups when using the longer (original version), the original version was used in this study. It is noted that for the current study, three additional questions that specifically reflected confidence for engaging in consistent physical activity (without reference to confronting other obstacles), were added to the end of the questionnaire. Internal consistency analyses for the use of the scale in the current sample was conducted and found to have a high internal reliability (.95).

* Omron pedometer

As of March 2010, the Omron HJ-720ITC was the latest and most technologically
advanced pedometer sold by Omron Healthcare Inc (www.omronhealthcare.com). It is noted that Omron continues to update their pedometers on a near annual basis (personal communication, November 25, 2008). While no data are currently available on the accuracy of this particular Omron pedometer, studies have shown that piezoelectric (i.e., battery operated electronic) pedometers such as Omron pedometers, consistently evidence more accuracy in step counting across various walking speeds than spring-levered pedometers (see Melanson et al., 2004).

Melanson and colleagues examined the effects of age, obesity, and walking speed on the accuracy of spring-levered pedometers (Ymax model), a piezoelectric pedometer (Omron HF-100 model) and two other pedometer models (Walk-4-Life and Step Keeper). All pedometers performed generally ineffectively at the slowest walking speed (i.e., only 7.5% to 56.4% of actual steps were recorded for walking speeds of 1.0 mph), but performed well at higher walking speeds. As compared to the other forms of pedometers, they found that overall, the Omron pedometer was significantly more accurate and more sensitive to step counting at slower walking speeds, (1.0 mph = 56.4 ± 33.8%, and 1.8 mph = 97.8% ± 9.6%). Given these findings, Melanson and colleagues concluded that the Omron/piezoelectric pedometers are likely more appropriate for individuals who ambulate at slower speeds (i.e., possibly obese and elderly individuals).

Activity log

All participants in the treatment group received an activity log that provided specific instructions for how to obtain, calculate, and record activity levels and activity goals for each of the four weeks. Control group members did not self-monitor activity.
Statistical hypotheses and analyses

Hypotheses for the current study and statistical analyses performed on the data gathered are outlined below:

1. Pre-test self-efficacy for exercise is positively correlated with walking goal attainment (increase of 3000 steps over baseline). These data were analyzed using point-biseral correlation.

2. The feedback group has higher self-efficacy for exercise at post-test as compared to the non-feedback group. These data were analyzed using a one-way ANCOVA. (Post-test self-efficacy scores as a function of feedback group membership using the pre-test self-efficacy scores as a covariate).

3. Together, change in self-efficacy and feedback is a stronger predictor of goal attainment than either change in self-efficacy or the feedback condition alone. These data were analyzed using logistic regression with goal attainment the dichotomous criterion variable (yes/no) and change in self-efficacy calculated using the residuals from a simple regression (see Figure 3).
Figure 3

Conceptual model of the impact of SCT constructs on performance outcomes (goal attainments).
CHAPTER IV
RESULTS

Descriptive statistics

A total of 121 participants initially enrolled in the study. However, participant attrition and subsequent data screening resulted in a total N of 93 participants used for data analysis. Participant attrition and data screening resulting in this final participant count are summarized below.

Prior to completing the four weeks, four participants dropped out of the study and seven participants reported losing their pedometers before completing the required four weeks of data collection. Two pedometers were broken, resulting in irretrievable data, and three participants did not return their pedometer for the downloading process. Data from two participants were not included due a sizeable limit in recorded data (i.e., over the course of the required 28 day walking period, those pedometer readings indicated that the pedometer was worn for no more than 17 days). Three participants did not complete the required, post-test self-efficacy questionnaire and were therefore, excluded. These attrition problems decreased the sample size from 121 to 100. Data screening, (as discussed next), further reduced the sample size to 93.

Issues of invalid and missing data were addressed in the data screening process of the 100 remaining participants who provided data during each of the four weeks. The
current study used a minimum cut-off point of 600 steps per day to determine valid, daily walking data. Previous research (e.g., Baker et al., 2008, Rowe et al., 2004) established a minimum cut-off point of 1,000 steps per day to determine valid, daily data. However, the samples used in those studies included adult community members and middle school students. No previous research was found indicating an a priori established cut-off point for the bariatric population. Given the clinical population of the current study (often associated with physical limitations and a history of very restricted physical activity), as well as the clinical experience of the author and a committee member who have extensively worked with the bariatric population, it was determined that a 1,000 step cut-off was likely too high for this clinical population. As such, the 600 daily step count was established as a more realistic cut-off point for these bariatric participants. (The development of a 600 step cut-off point is further discussed in Chapter Five). One participant did not meet this cut-off criterion and therefore, those data were not included.

Data screening further revealed that six participants had at least one particular week where three or more days of walking data were missing. A review of the literature revealed that previous pedometer research required a minimum of five days of valid data per week, in order for a participant’s data to be included. According to Baker et al., (2008), a minimum of five days of data per week would provide a sufficient estimate of weekly activity, while also coping with individual variability within the sample. Thus, Baker et al. corrected for one to two days of missing data each week from a participant, by replacing those days with the mean of the remaining days for the week (for the particular participant). This approach to deal with missing data was also suggested by Kang et al. (2005). Following these previously set approaches, any participant in the
current study who provided less than 5 days of valid walking data per week were not included. Data sets from individual participants that were incomplete, yet includable (i.e., at least five or six days of walking data was available) were also addressed in a way consistent with Baker et al. As such, missing data for an individual who provided at least five days of valid data was replaced by inputting that individual’s own step mean for the remaining week.

At the time of pedometer download, each participant was asked two questions that assessed compliance with keeping the pedometer blinded / covered as instructed depending on group assignment, as well as if the participant actually wore the pedometer daily, for four weeks. Eighty-three participants (89.2%) stated that they kept their pedometers covered, as instructed according to group assignment. Four participants (4.3%) acknowledged that they briefly removed the tape to look at their step counts at some point during the time the pedometer was to remained covered. Six participants (6.5%) gave no response. Similarly, when asked if they wore their pedometers every day, all day as instructed, 71 (76.3%) reported complying with wearing their pedometers all day for four weeks. Twenty-one (22.6%) reported non-compliance to some degree (ranging from forgetting to wear the pedometer for over half of a day, to forgetting to wear the pedometer for up to 3 days). One participant did not respond.

Compliance was further assessed by comparing participants’ responses to the inquiry of whether or not they wore their pedometer daily as instructed, to the objective data recorded by their pedometer. Two participants (both from the feedback group) reported wearing their pedometer every day, while their pedometer recordings indicated one complete day of not having worn the pedometer.
Although not a direct compliance issue, some related and noteworthy descriptive data include discrepancies found within the treatment group’s step count data downloaded from each pedometer, and each individual’s self-documented step counts (recorded in their activity logs). Participants in the treatment group had access to their daily step counts and were given specific instructions to calculate their weekly averages at the end of each week (which was used to assist them in formulating their step goal for the following week). Using the downloaded data, weekly step averages were calculated for each participant in the treatment group and compared to the self-documented step averages reported by each individual in their activity log. At each of the four weeks, ten to fifteen participants did not report / include weekly averages in their activity logs. In addition, nine to twelve discrepancies between this author’s weekly step averages (as calculated from the downloaded data), and participants’ self-documented / reported averages were found at each of the four weeks. It is noted that these discrepancies ranged from quite small (i.e., a 12 step discrepancy), to quite large (i.e., a 2,312 step discrepancy). In addition, it is noted that when discrepancies were found, participants’ self-documented weekly averages were observed to be both higher and lower than the actual weekly averages. This suggested that the discrepancies were not necessarily deceptive (i.e., purposely reporting higher step counts than were actually obtained), in an effort to impression manage.

Basic descriptive statistics were also completed for the Self-Efficacy for Regular Activity Questionnaire. As a method of data screening, data frequencies were conducted and revealed missing values for some items on this questionnaire. Participants had the tendency to leave certain questions blank, or write in “n/a” for items that may not have
applied to them. (For example, one item on this questionnaire inquires about participants’ exercise at the gym. However, when the author of this study inquired about “n/a” or blank responses for this question, those participants reported that they exercised at home and did not utilize a gym/exercise facility). A total of one-percent of the data on this post-test measure was missing. Missing values were not eliminated because the measure’s reliability is based on all of the items included in the measure. Given this, and having only one-percent of missing data, correction for all missing data followed the suggestion reported by Tabachnick and Fidell (2001). These authors suggested replacing missing values for each individual participant by the mean for that participant. Tabachnick and Fidell further noted that based on such a small percentage of missing values, replacing those missing data with each individual’s average would have very little impact.

Tests of the hypotheses

The following section presents the results of the tests of the statistical hypotheses. The first hypothesis stated that pre-test self-efficacy for exercise is positively correlated with walking goal attainment. This hypothesis was tested two ways. First, this hypothesis was tested with goal attainment (i.e., increase of 3000 steps over baseline) as a dichotomous variable (met goal yes =1, no = 2). Second, the hypothesis was tested using the average weekly step count at week four as a proxy for goal attainment. The first approach resulted in a point biserial correlation of .18 (p < .05), indicating that higher pre-test self-efficacy for exercise scores were positively related to meeting the overall step goal. Similarly, a small, positive Pearson’s correlation was found between pre-test self-efficacy scores and average weekly steps at week four (r = .24, p = .05). This
indicated a significant linear relationship where higher pre-test scores were positively related to week four step averages. Table 2 reports the correlation matrix for these variables.

Table 2

Correlation Matrix for Pre-Test Self-Efficacy for Exercise, Meeting Overall Step Goal, and Average Steps at Week 4

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Step Goal Met</td>
<td>.45**</td>
<td></td>
<td>.18*</td>
</tr>
<tr>
<td>2. Average Week 4</td>
<td></td>
<td>.24*</td>
<td></td>
</tr>
<tr>
<td>3. Pre-test Self-efficacy</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* p < .05
** p < .01

In summary, results of the point biserial correlation revealed that the null hypothesis was rejected and that higher self-efficacy scores at pretest were related to participants reaching their final step goal of 3,000 steps over baseline. Results using the Pearson’s correlation also led to rejection of the null hypothesis. In this case, higher pre-test self-efficacy scores were related to higher step averages at week four. While the strength of these relationships was small, a significant relationship was found between the correlated variables.

In an attempt to gather further information regarding the relationship between self-efficacy for exercise (at pre-test) and walking performance, additional correlation analyses between pre-test self-efficacy and average step counts at weeks one, two, and three, were also conducted. No relationship was found for any of the additional
correlations, as all results were non-significant. The correlation matrix for these variables is found in Table 3.

Table 3

*Correlation Matrix for Pre-Test Self-Efficacy for Exercise and Average Steps at Week One, Week Two, and Week Three*

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Average Week One</td>
<td>.87*</td>
<td>.79*</td>
<td>.04</td>
</tr>
<tr>
<td>2.</td>
<td>Average Week Two</td>
<td>—</td>
<td>.85*</td>
<td>.12</td>
</tr>
<tr>
<td>3.</td>
<td>Average Week Three</td>
<td>—</td>
<td>—</td>
<td>.11</td>
</tr>
<tr>
<td>4.</td>
<td>Pre-test SE</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Note: no significant relationship was found for self-efficacy and averages steps at each week. Relationships among the three weeks were found, but were not the focus of this analysis. *correlation significant at the .01 level

As a final post hoc analysis, a Pearson’s correlation between post-test self-efficacy for the entire sample (including the feedback and non-feedback groups) was conducted. A small, positive correlation was found between post-test self-efficacy for exercise and average weekly steps at week four (r = .18, p = .05). This indicated that post-test self-efficacy for exercise was significantly and positively related to step counts at week four for the entire sample.

Hypothesis two stated that the feedback group would have higher post-test self-efficacy scores as compared to the non-feedback group (using pretest self-efficacy scores as a covariate). A one-way between subjects ANCOVA was conducted to examine the effect of group membership (feedback vs no feedback) on post-test self-efficacy scores,
covarying the effect of pre-test self-efficacy. When controlling for pre-test self-efficacy, the main effect for group membership on post-test scores was not significant (F (1,90) = 2.202, p = .141). Thus, hypothesis two was not supported. Pre and post-test mean scores and standard deviations are presented in Table 4 followed by the ANCOVA table for this analysis in Table 5.

Table 4

*Pre – and Post-test Mean Scores and Standard Deviations as a Function of Group Membership*

<table>
<thead>
<tr>
<th>Source</th>
<th>Pre-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Treatment Group</td>
<td>71.8</td>
<td>16.1</td>
</tr>
<tr>
<td>Control Group</td>
<td>73.9</td>
<td>13.7</td>
</tr>
</tbody>
</table>

Table 5

*Analysis of Covariance of the Effect of Group Membership on Post-Test Self-efficacy Scores, Covarying for Pre-Test Self-Efficacy Scores*

<table>
<thead>
<tr>
<th>Source</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>$\omega^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Covariate (Pre-test SE)</td>
<td>1</td>
<td>8208.1</td>
<td>38.5</td>
<td>.300</td>
</tr>
<tr>
<td>Group Membership</td>
<td>1</td>
<td>469.5</td>
<td>2.20*</td>
<td>.024</td>
</tr>
<tr>
<td>Error</td>
<td>90</td>
<td>213.2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>92</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*P < .05
A post hoc analysis was conducted in an effort to further explore and understand the lack of significant difference of post-test self-efficacy between the two groups. An independent samples t-test was conducted to further compare means on the post-test self-efficacy scores for the feedback and non-feedback groups. Results revealed no significant difference of self-efficacy scores among the two groups, t (df = 91) = 1.87, p > .05 (two-tailed).

The third hypothesis stated that together, the change in self-efficacy (from pre-testing to post-testing), and group membership (feedback vs no feedback) is a stronger predictor of goal attainment than either change in self-efficacy or the feedback condition alone. Data were analyzed using logistic regression with goal attainment the dichotomous criterion variable (yes / no) and change in self-efficacy calculated using the residuals from a simple regression.

A forward step logistic regression was used to predict whether or not participants met the overall step goal attainment of 3,000 steps over baseline (by week four). The predictor variables included pre-test and post-test change in self-efficacy, group membership, and the interaction of change in self-efficacy and group membership. The initial -2 Log Likelihood statistic was 63.45, indicating a poor fit to the model. As such, none of the three predictors were significant in predicting the 3,000 step goal attainment as a dichotomous variable. Thus, hypothesis three was not supported. The results for the logistic regression are found in Table 6.
Table 6

Logistic Regression Predicting Step Goal Attainment

<table>
<thead>
<tr>
<th>Predictor</th>
<th>Score</th>
<th>df</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Change in self-efficacy</td>
<td>.759</td>
<td>1</td>
<td>.384</td>
</tr>
<tr>
<td>Interaction</td>
<td>.438</td>
<td>1</td>
<td>.438</td>
</tr>
<tr>
<td>Group</td>
<td>3.615</td>
<td>1</td>
<td>.057</td>
</tr>
<tr>
<td>Overall statistics</td>
<td>4.323</td>
<td>3</td>
<td>.229</td>
</tr>
</tbody>
</table>

In considering the logistic regression results, it is important to note that only ten participants (10.7%) actually met the step goal of 3,000 steps over baseline. Given this low number, it was determined that additional analysis using the change in step counts from baseline (week one to week four), was warranted. Specifically, influences to step count change during this time was investigated. Consistent with the hypothesis, a hierarchical regression analysis was conducted to determine if the interaction of change in self-efficacy and group membership would account for variance in step-counts above and beyond that accounted for by group membership and self-efficacy alone. Group membership was entered as step one and accounted for 18% of the variance. Change in self-efficacy was entered as step two and was non-significant. The interaction between group membership and change in self-efficacy was entered as step three and was significant accounting for 4.7% of the variance. Although a significant outcome was found for this interaction, the hypothesis was not supported, as the interaction was not a stronger predictor than group membership alone. These results are found in Table 7.
Table 7

Hierarchical Regression Analysis Predicting Change in Steps from Week 1 to Week 4

<table>
<thead>
<tr>
<th>Step</th>
<th>Predictor variable</th>
<th>β</th>
<th>ΔR²</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Group Membership</td>
<td>.426*</td>
<td>.182*</td>
</tr>
<tr>
<td>2</td>
<td>Change in Self-Efficacy</td>
<td>-.021</td>
<td>.000</td>
</tr>
<tr>
<td>3</td>
<td>Interaction of Group Membership And Change in Self-Efficacy</td>
<td>.368</td>
<td>.047*</td>
</tr>
</tbody>
</table>

*p < .05

*Exploratory analyses*

As previously indicated, by week four, only 10 of the participants met the overall goal of 3,000 steps over baseline. (It is noted that eight participants in the feedback group and two in the non-feedback group reached this goal). However, it was found that 58 participants (62%) were able to increase their step counts over baseline by week four. As such, it was determined that additional exploratory analyses were warranted regarding differences in average steps between both groups.

Step means for both groups were calculated for weeks one, two, three, and four. The trend of average steps taken for the groups across each of the four weeks, is represented in Figure 4. As evidenced in the figure, the trend depicts that the feedback group progressively increased in step counts each week, as compared to the non-feedback group. The non-feedback group progressively decreased in step counts from week two to week three, and from week three to week four.
Figure 4

Change in Step Counts Across Groups for Weeks 1 through 4

Given the visible difference in step trend across the four weeks for each group, significance testing was warranted. An independent samples t-test was conducted comparing the mean steps taken for both groups at each of the four weeks. The results revealed no significant differences between the groups at weeks one, two, or three. However, a statistically significant difference was found between the groups at week four, $t_{(df=91)} = 1.983$, $p < .05$ (one-tailed), indicating that the feedback group walked significantly more steps than the non-feedback group during the final week of data collection.

Although the feedback group did not meet the overall goal of 3,000 steps over baseline, this group did increase step counts by 1,561 over baseline. Conversely, at week four, the non-feedback group decreased their step counts by 237 steps from baseline. A
repeated measure t-test comparing the change in step counts from week one (baseline) to week four was conducted for both groups. No significant difference was found for the non-feedback group between week one and week four. However, a significant difference between week one and week four was found for the feedback group \( t (df = 47) = 5.248, p < .01 \) (two-tailed). This indicates that at week four, the feedback group demonstrated a significantly increased change in step count over baseline. Step count means for both groups across each of the four weeks, as well as effect sizes, are located in Table 8 below.

Table 8

<table>
<thead>
<tr>
<th>Week</th>
<th>Feedback Group</th>
<th>Non-Feedback Group</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>4878 (sd = 2621)</td>
<td>5431 (sd = 2457)</td>
<td>( d = .218 )</td>
</tr>
<tr>
<td>2</td>
<td>5582 (sd = 3071)</td>
<td>5427 (sd = 2440)</td>
<td>( d = .056 )</td>
</tr>
<tr>
<td>3</td>
<td>6043 (sd = 3526)</td>
<td>5155 (sd = 1927)</td>
<td>( d = .325 )</td>
</tr>
<tr>
<td>4</td>
<td>6439 (sd = 3755)</td>
<td>5158 (sd = 2354)</td>
<td>( d = .420 )</td>
</tr>
</tbody>
</table>

Summary

In summary, significant positive correlations were found for pre-test self-efficacy scores and reaching the 3,000 step goal, as well as for self-efficacy scores and increasing step counts at week four. However, the effect for both was quite small. When controlling for pre-test self-efficacy, no significant main effect for group membership on post-test scores was found. Change in self-efficacy from pre to post-test, group membership, and the interaction of these two variables were not significant predictors of reaching the 3,000 step goal. However, of these three variables, group membership was
found to be the only significant predictor of change in step counts from week one to week four. The following chapter provides a more detailed interpretation of these results and also discusses implications for future research.
CHAPTER V
DISCUSSION

This chapter offers further interpretation of the findings of this research and also discusses limitations. A brief summary of the problem statement and the purpose of this research study is found below. This summary is followed by four sections which discuss the following: issues related to the clinical sample, basic and exploratory analyses, outcomes of the hypotheses testing, and implications. Connections to SCT are addressed throughout these sections.

Summary of the problem and purpose of the research

Bariatric surgery has become an increasingly popular treatment for morbid obesity (Ray Nickels, Sayweed, & Sax, 2003) and effective post-surgical outcomes have been reported for these surgical procedures. For instance, Perugini and colleagues (2003) reported an average weight loss of 60% of excess body weight 18 months following gastric bypass surgery. Following a systemic review of the literature, O’Brien and Dixson (2003) found a 56% excess weight loss five years post-operative, for lap band surgery patients.

While statistics such as these demonstrate exciting outcomes, post-operative success is observed only in conjunction with patient compliance with diet, physical activity, and medical recommendations. Failure to comply with such critical behavioral recommendations is known to predict both unsatisfactory weight loss (Pessina et al.,
2001), and the resurgence of various weight related co-morbidities (see Boccheri et al., 2002; Brolin, 1989; Sarwer et al., 2005). Compliance with activity / exercise recommendations has been shown to be especially problematic in this population (see Elkins et al., 2005; Friedman et al., 2007; Poole et al., 2005), and clearly has a negative impact on weight control and health which is observed in other weight loss surgery statistics. For instance, Bond and colleagues (2009) reported that up to 25% of patients fail to achieve adequate weight loss or do not maintain adequate weight loss for at least 5 years post-surgery. Relatedly, Christou et al., (2006) noted that some patients regain substantial amounts of weight even within the first 12 to 24 months post-surgery.

Various factors appear to collectively influence bariatric surgery patients’ motivation to engage in, and comply with, behavioral recommendations for consistent physical activity. Given the critical nature of physical activity in maintaining health and weight loss post-surgically, this study sought to further investigate some of those potential factors. Specifically, as conceptualized from a Social Cognitive framework, this study investigated how post-operative bariatric patients’ motivation for physical activity was influenced by access to objective feedback of activity levels, goal setting, and self-efficacy for exercise. It is believed that understanding the influence of these factors on motivation for physical activity may offer insight and prediction into physical activity compliance by these patients.

Pedometers have been used to assess physical activity recommendation adherence in various patient populations (see Chan et al., 2004; Stovitz et al., 2005; Tudor-Locke et al., 2002). These studies have consistently found that pedometer users generally increase their physical activity levels (Bravata et al.), which appears related to the ongoing
feedback they provide regarding activity levels. The current study investigated how pedometers could be used to facilitate post-operative bariatric patients’ motivation for physical activity through the Social-Cognitive constructs of goal setting, performance feedback, and self-efficacy.

_Pertinent issues related to the clinical sample_

_Demographics_

Some notable demographic information stood out within this sample. For example, the majority of the participants were woman (73%) and those who obtained the gastric bypass procedure (77%). Although men and those who obtained bariatric procedures other than gastric bypass (i.e., laproscopic banding, gastric sleeve) appear under-represented, the demographic data in the current study are actually consistent with national statistics on both gender and procedure type in regard to weight loss surgery patients (see Santry et al., 2007).

Additional issues exist regarding the representativeness and generlizeability of this sample to the bariatric population. For one, it is well documented that post-operative compliance with behavioral recommendations for exercise, nutrition, and attending follow-up appointments (see Elkins et al., 2005; Gould et al., 2007) is problematic with this patient population, and typically, the more compliant patients experience positive health and weight loss results. It should be noted that individuals enrolled in this study where those who voluntarily attended a post-operative support group, or a medical or psychological follow-up appointment. Given the participants’ voluntary compliance with appointments and / or support group meetings in addition to voluntarily enrolling in a study examining physical activity, it may be that this patient sample was somewhat more
compliant and motivated than the bariatric population as a whole. This may have had an impact on the sample’s overall step counts, perhaps producing higher step counts than what may be considered average for this population.

In addition, pre-surgically, the bariatric population is often plagued with orthopedic problems which contribute to limited physical activity. Although improved ambulation and other medical problems are related to successful weight loss following surgery, orthopedic problems can be persistent even after significant weight loss (King et al., 2011). Only 6 participants from each group reported orthopedic problems. Therefore, it is possible that participants in the current sample may have under-reported ongoing physical problems that may have compromised their ability to maintain higher amounts of physical activity.

Valid and missing data

A dearth of data exists regarding physical activity levels of post-operative bariatric patients. The physical activity information that is reported for this population, is consistently presented in the form of self-reports as opposed to objective data, calling into question both the accuracy and honesty of such reports. Some sporadic, but objective literature pertaining to physical activity is, however, available for pre-operative patients. For example, King, Belle, Eid, et al. (2008), found that 54% of their sample of 757 pre-operative bariatric patients fell within the sedentary (<5,000 steps/day), or the low activity range for walking (5,000 to 7499 steps/day). They further noted that most of their sample accumulated their physical activity from activities of daily living, as few patients reported engaging in a regular pre-operative exercise routine. However, generalizing such data to post-operative patients would not be prudent without supporting research.
Given the gap in the objective research regarding any a priori instituted minimal cut-off points for post-operative bariatric patient’s walking activity, establishing cut-off points for valid walking data in this sample was a challenge. Previous research (e.g., Baker et al., 2008, Rowe et al., 2004) established a minimum cut-off point of 1,000 steps per day to determine valid, daily steps for adult community members and middle school students. It is not likely, however, that these populations accurately represent the history of both the physical limitations and restricted physical activity (see King et al., 2011) that is frequently observed in the bariatric clinical population. It is noted that the author of the current study and one committee member have had rather extensive, direct experience working with this clinical population often addressing issues of lifestyle changes and physical activity. This experience consistently suggested that step counts for the bariatric population are often well below that of the general population. Given the frequent physical limitations of this population, the author and committee member’s experience with the walking struggles of bariatric patients, and review of the data in this study that revealed various instances of individual participants consistently walking below 1,000 steps across the course of the four weeks (i.e., between 600 and 900 steps), it was determined that the previously established 1,000 step cut-off for general community members would not be generalizable to the bariatric population. As such, it was decided that a 600 daily step count would be a more realistic minimal cut-off point for valid step counts. Future research is needed to establish and empirically validate a minimum daily step cut-off for post-operative bariatric patients.

Relatedly, and as discussed in Chapter Four, previous research (e.g., Baker et al., 2008; Kang et al., 2005) suggested that a minimum of five days of valid data per week,
be included for data analysis. Following these previously set approaches, only participants who provided 5 or more days of valid walking data per week, were included in this study, (with valid, minimum daily steps being less than or equal to 600). Missing data for any individual participant (i.e., days when step counts were not recorded or were below 600 steps), were replaced by inputting the mean of the remaining week for that individual, as was also suggested by the above researchers. Again, it will be important to empirically evaluate the appropriateness of the decisions made in this regard.

**Basic and exploratory analyses**

A total of 10 (10.7%) participants met the overall step goal of increasing their steps by 3,000 over baseline (8 in the feedback group and 2 in the non-feedback group). Various explanations for such a small percentage of those obtaining this goal may exist.

First, challenges that may be rather unique to this clinical population should be considered alone, and also in relation to SCT. As previously discussed, many bariatric patients have a long history of failed attempts at appropriate and consistent exercise which contributes to ongoing weight and health issues. This can be a significant source of frustration for this particular patient population. Support of this issue was acknowledged by Rusch and Andrish (2007) who discussed that repeated failures at weight loss interventions (including exercise) could interfere with patients’ motivation and confidence (i.e., self-efficacy) regarding their ability to yet again, engage in those critical behavioral changes. Relatedly, Bandura acknowledged that those who are overcome by self-doubts about their performance capabilities are typically easily dissuaded by their failures. This may have been the case for both the treatment and control groups which resulted in very few meeting the overall increased step goal. Specific to the non-
feedback group, perhaps familiar feelings associated with the difficulty of maintaining consistent exercise (for four continuous weeks) was a factor. In regard to the feedback group, perhaps seeing objective data informing them that they were falling short of their step goals increased their self-doubt about their ability to reach their goals for an entire month’s time. This may have impacted their effort to reach the predetermined step goal of increasing by 1,000 steps per week. Various SCT constructs (i.e., self-efficacy and feedback) likely had an impact on, or were impacted by the step goals. Those issues will be discussed in a later section.

A related consideration of why only 10.7% of the participants met the overall step goal could be explained by the conceptualization of goal setting specific to SCT. The theory suggests that readjustment of goals may be necessary in light of a person’s progress (Bandura, 1986, 1989). This may include maintaining, lowering, or even raising the challenge of their goals. It is possible that due the history of physical/orthopedic limitations and failures at previous exercise goals, the originally established goal of 1,000 added steps per week (with an overall increase of 3,000 over baseline at the conclusion of the study), may have been too challenging for some of these patients. While these step goals may appear quite reasonable for the general population, it is possible that such goals could have been interpreted as too daunting here. Perhaps setting lower step goals may have been more realistic to achieve for these patients, and consequently, may have had a different impact on both proximal and end goal attainments. Similarly, it should be noted that the proximal goal (1,000 step increase per week) and end goal (3,000 step increase over baseline) were predetermined, standardized goals for the entire sample. Bandura (1989) noted that when individuals set goals for themselves, they are more likely
to maintain effort to reach the desired outcome and consequently, will be more successful. He also noted that people choose how much effort to put forth and how long to persevere at a self-determined goal, based largely on their self-beliefs or self-efficacy for engaging in that activity. The participants in this study were likely functioning from different levels of overall fitness, exercise self-efficacy, and ability to properly ambulate. Therefore, it is possible that the goal attainment results may have been different had each participant been able to set her or his own, individual proximal and distal goals.

Also, regarding goal setting and goal attainment, Bandura and Simon (1977) emphasized the importance of explicitly defining goals, as clearly set goals facilitate better incentive for performance. A possible methodological limitation of this study was that the end goal of 3,000 steps over baseline was rather vaguely presented to the participants. Participants were clearly instructed to strive for a 1,000 step increase each week (proximal goal), but were not specifically told that the end goal was 3,000 steps over baseline. It is possible that not having a firm understanding of the end goal may have impacted their effort toward meeting that goal. However, the impact of this may have been small as Bandura and Simon emphasized the importance of defining explicit proximal goals (even more so than distal), noting that such goals help individuals implement control over behavior in the present, thereby increasing their likelihood that desired goals and outcomes will be achieved.

While only 10.7% of participants met the overall step goal, it is noted that 58 participants (62%) did in fact, increase their step counts over baseline. It is possible that while the predetermined step goal increase of 3,000 over baseline may have been too daunting and consequently, may have somewhat dissuaded participants from persevering
toward that goal. However, it appeared that having a known goal in place still may have acted as a motivational tool, as participants continued to work toward step improvement to some degree. Such low numbers of participants reaching the overall step goal, yet over 60% percent having increased their step counts over baseline made the effect of some of the originally hypothesized analyses difficult to interpret. Therefore, at times, change in step counts from week one to week four was used as a proxy for the overall 3000 step increase goal.

As a whole, the feedback group consistently displayed a trend of increased step counts each week and concluded the study with an average of 1,561 increased steps over baseline, an outcome that was also found in previous pedometer research with the overweight individuals (see, Bravata et al., 2007). Interestingly, as compared to the feedback group, the non-feedback group demonstrated a higher step count during the baseline week. However, this group then displayed a consistent trend of decreased step counts each week and concluded the study with an average of 237 steps below baseline. SCT constructs as well as other environmental, internal, and behavioral factors may explain this step trend found in the non-feedback group. Participants in the non-feedback group were aware of the treatment group conditions (i.e., being permitted to see their steps every day from weeks two through four). Knowing the difference between groups and that the treatment group may be motivated by viewing their step counts may have in itself, initially created motivation for walking in the non-feedback group via a sense of competition and knowing they may be at a disadvantage due to not being able to observe their step counts. This group’s consistent trend of decreasing steps from the baseline week on appears to be consistent with explanations from SCT. Bandura (1999) stated that
goals without feedback will have little positive effect on a person’s perseverance toward their goal. As the non-feedback group was instructed to make effort to increase their step goals by a half of a mile each week (approximately 10 minutes / 1,000 steps), they received no feedback about their progress and did not self-monitor in any systematic way (i.e., did not keep an activity log). In this case, and consistent with the theory, it appears that while these participants started off motivated to engage in walking (perhaps due to a sense of competition), they did not continue to persevere toward their increased step goals, and ultimately ended with step counts below what was established at baseline. Conversely, and as applied to the feedback group, SCT explains that both goal setting and feedback regarding goal progress will typically lead to increased motivation to pursue that goal. Although the feedback group did not reach their overall step goal, they did persevere to the point where their step counts increased at each week following baseline. Specific SCT constructs (feedback, self-efficacy, goal-setting, etc) that may have influenced their motivation for walking are further discussed in the sections reviewing the outcomes of the hypothesis testing.

Outcomes of hypothesis testing

First hypothesis

Pre-test self-efficacy for exercise was hypothesized to be positively correlated with achieving the overall walking goal of 3,000 steps over baseline. When statistically tested with goal attainment being a dichotomous variable (met goal yes/no), results revealed a significant, positive correlation between self-efficacy and meeting the step goal (r = .175). Although the result was statistically significant, the effect was quite small with only 3% of the variance in step goal achievement being related to high self-
efficacy scores. Therefore, a large proportion of the variance was influenced by other factors. It is likely that other determinants of behavior change within the social-cognitive triadic system (i.e., internal, behavioral, and environmental elements), may have been potentially stronger influences in obtaining the overall step goal. For instance, previous exercise histories, level of support for exercise, demographic variables, length of time since having had bariatric surgery, or any other obstacles that may impede lifestyle-related behavioral changes, could have had a greater influence on the participants’ motivation for achieving the 3,000 step goal. In addition, given this population’s history of failures at weight loss and maintaining consistent exercise, bariatric surgery patients may require more comprehensive interventions designed to increase self-esteem and motivation. In other words, set goals and feedback may not be enough to produce sufficient self-efficacy and motivation. This clinical group may require additional interventions (perhaps ongoing coaching and other supportive interventions) to facilitate self-efficacy for exercise and consequently, motivation and perseverance for reaching their exercise goals.

The statistical result of the first hypothesis of this study appears somewhat inconsistent with both the tenets of SCT and previous research. The theory explains that all factors that may serve as motivators for behavior change are rooted in self-efficacy beliefs (Bandura, 1989), and relatedly, researchers (e.g., Plotnikoff et al., 2008) have noted that self-efficacy is consistently revealed as the most important factor in predicting healthy behaviors across various studies. Therefore, to possibly further account for the discrepancy of results from this study and both previous research findings and the theory itself, the validity of the Self-Efficacy for Regular Physical Activity measure used in this
study may be questioned. First, this measure has been frequently used with the general population as well as other patient populations. However, there is a dearth of literature available regarding its use with bariatric surgery patients across varying spans of time since surgery. While this measure was found to have a high internal reliability (.95), it is possible that the measure may not be sensitive to the issues of self-efficacy for exercise pertinent the bariatric patient population. Consequently, this could have impacted the results in this study that examined self-efficacy as a predictor variable. Perhaps more importantly, while reliable, the instrument may not be a valid measure of what was intended to be measured. The current study was interested in participants’ self-efficacy to engage in physical activity. This measure, however, focuses on how confident individuals are to engage in physical activity when faced with certain obstacles (i.e., inclement weather, no access to exercise equipment, no exercise partner, etc). As such, the measure may have assessed something clearly different than one’s overall self-efficacy for exercise. For one example, a participant may have felt confident that she or he had the ability to exercise if the weather is bad outside, or when their gym is closed, but may not have believe in her or his ability to engage in consistent physical activity overall.

Given that only 10.7% of participants actually met the 3,000 step goal over baseline, but that 62% of participants were in fact, able to increase their step counts over baseline by week four, it was decided to also test the first hypothesis using the average weekly step count at week four as a proxy for goal attainment. Similarly, a significant, positive correlation was observed (r = .24), but only 5.6% of the variance in increased step counts was related to self-efficacy scores.
Additional post hoc analyses were conducted in an attempt to further understand the relationship of pre-test self-efficacy and walking increases. Correlations for pre-test self-efficacy and step averages at weeks one, two, and three were conducted and revealed no significant relationship. This outcome was again, inconsistent with SCT, as the theory suggests that increased self-efficacy (with feedback and goal setting) would have a positive impact on walking increases and goal attainment over the weeks.

Again, the ability of the self-efficacy questionnaire to adequately measure this construct in the bariatric population is questionable and may have impacted the results of the second correlation analysis as well as the post hoc results. Despite this potential limitation, however, the present results still warrant statistical interpretation. As such, similar to the first analysis, while self-efficacy for exercise does appear related to increased step counts at week four, at this time, this construct does not appear to be a major influence in increasing those step counts. Reasons for increased step counts or ongoing motivation to increase step counts may have been influenced by other SCT factors, as well as possible extraneous factors. It is possible that participants may have been motivated by simply knowing that someone (i.e., the author of this study and perhaps more importantly, some members of the bariatric treatment team) would review their results and in an attempt at impression management, made effort to increase their steps. It should be noted, however, that the control group may have also be influenced by a desire to impression manage. Therefore, even though the control group’s step counts consistently decreased from baseline, due to knowing they were being monitored, that group may have also purposely made effort to engage in additional walking (Conversely, it is possible that the control group’s steps may have decreased even further across the
four weeks, had they believed that their walking was not being objectively monitored).

Previous research has also addressed the potential motivating effect of believing performances would be evaluated. For example, in a study using pedometers with an overweight participant sample, Bravata and colleagues (2007) discussed the possibility of a Hawthorne effect influencing their results. This team suggested that while participants using pedometers increased their walking by 26.9% over baseline, to some degree, they may have increased their activity due to knowing they were being monitored.

Second hypothesis

SCT suggests that goal-setting in conjunction with consistent feedback regarding a person’s progress on physical activity goals would likely improve an individual’s self-efficacy for that activity. As the feedback group could access visible data on their activity levels at any time during weeks two through four (unlike the non-feedback group), it was predicted that post-test self-efficacy scores for the feedback group would be higher than the scores for the non-feedback group, when covarying the effect of pretest self-efficacy. This second hypothesis was not supported as the main effect for group was not significant. In fact, a t-test revealed no significant difference between the groups at post-test and basic descriptive changes interestingly revealed a very slight decrease in self-efficacy scores for the feedback group and a very slight increase in self-efficacy for the non-feedback group. The lack of observed impact of feedback on self-efficacy appears somewhat inconsistent with the tenets of SCT. As such, reasons for this lack of consistency with the theory warrant examination and are addressed.

Bandura (1989) explained that individuals must have a strong sense of self-efficacy to sustain effort needed to succeed, and that self-doubts can quickly set in after
some sense of failures. As previously discussed, a frequent problem specific to the bariatric population is a history of failed attempts at consistent exercise which leads to frustration and self-doubt regarding their ability to engage in physical activities. It is possible that individuals in the feedback group may have developed a familiar sense of self-doubt when failing to meet either the weekly step goal increase of 1,000 steps and/or the overall 3,000 step increase. As such, this may have impacted their perception of self-efficacy for exercise at post-testing.

Bandura also suggested that a combination of goal-setting and feedback on progress toward goals will have a positive impact on both self-efficacy and motivation. Based on the outcome of these data, it appears that although self-efficacy was not impacted as anticipated for the feedback group, motivation for exercise remained apparent as this group consistently increased its steps each week. One possible reason for this may be found within Bandura’s (1989) explanation regarding the influence and strength of feedback controls where an individual’s perceived discrepancies between their actual performance and their internal standards for performance triggers a desire to reduce the inconsistency. Participants in the feedback group may have not improved on self-efficacy for exercise, but continued to be motivated to decrease the discrepancy between the set walking goal and previous performances. This feedback control may have been more influential than self-efficacy for the feedback group. Therefore, this may have explained ongoing motivation for increased steps each week in the feedback group as compared to the non-feedback group.

Methodological issues within the study, particularly, not having adequate standardization of self-efficacy test administration, may be another possible explanation
for the non-significant main effect of group membership on self-efficacy. Participants were given general instructions to complete the post-test upon the follow-up visit, but some may not have put forth adequate effort in reading or answering the questions, as they may have been more focused on discussing the downloaded pedometer results which was a known part of that visit.

Finally, as previously noted, the validity of the self-efficacy for physical activity measure for this particular clinical population may be questionable. Therefore, it may have contributed to the lack of a significant effect of group membership on this variable.

Third hypothesis

SCT suggests that the combination of goal setting with performance feedback on an activity/behavior will positively influence self-esteem for that activity leading to improved motivation for behavior change and goal pursuit. Consistent with these theoretical premises, in the current study, it was hypothesized that the interaction of change in self-efficacy for physical activity (from pre to post-testing) and group membership (i.e., feedback vs no feedback) would be a stronger predictor of goal attainment than either change in self-efficacy or the feedback condition alone. Results revealed a poor fit to the model as none of those variables were significant in predicting goal attainment. A possible reason for no significant predictor being found is that there may have been insufficient power for this particular analysis. In other words, it is possible that an effect could not be found due to a limited sample size. The goal of this study at its inception was to enroll 100 patients (50 in each group), to follow a general rule of thumb for sample size for a logistic regression analysis. As described previously, due to ongoing problems with attrition, a final sample size of 93 was used, falling seven
participants short of the intended goal for sample size. Given the small effect sizes seen here, it is unlikely as well that adapt power for the logistic regression would have been achieved even with 50 participants per group.

As previous noted, although only 10 participants actually met the increase of 3,000 steps over baseline goal, many participants did in fact increase step counts from baseline to week four. Given these observations, a hierarchical linear regression analysis was used to determine if the same variables noted above (across different levels), could predict a positive change in step count from baseline to week four. As a function of using a continuous dependent variable rather than goal achievement as a dichotomous variable, this test had more statistical power. Despite this, group membership was a significant predictor of overall change in step count, accounting for 18% of the variance. Therefore, the SCT construct of feedback had a significant impact on increasing physical activity (more so than the interaction of feedback and change in self-efficacy). Given the emphasis placed on self-efficacy in the SCT model, (with motivation being rooted in self-efficacy according to Bandura, 1989), the findings of this analysis were somewhat inconsistent with what the theory predicts. Again, it is possible that self-efficacy did not have the expected impact on increased steps counts (in conjunction with feedback) due to potential validity problems with the self-efficacy measure. (As previously noted, the questionnaire used in this study measured a person’s confidence for exercising when faced with an obstacle, which may not have adequately assessed one’s belief that they have/had the ability to consistently engage in physical activity).
Implications

Implications for bariatric programs and patients

The findings of this study are significant to the future treatment and outcomes to both bariatric surgery patients and bariatric surgery programs. The information evinced by this research can be used to initiate more comprehensive efforts at breaking the cycle of patients’ failed attempts at exercise and weight management (which all too commonly lead to weight regain and a host of co-morbidities associated with weight gain and obesity).

Quality bariatric programs encourage their patients to engage in consistent physical activity to maintain health and weight. However, given that up to 25% of bariatric patients regain weight following surgery, it appears that many programs are missing a critical piece in regard to the recommendations they give to their patients. Although recommendations regarding the type and extent of ongoing physical activity are often given, these recommendations are undoubtedly devoid of addressing perhaps the most important exercise issue for these patients. That is the issue of how to effectively manage the obstacles that make compliance with exercise recommendations so challenging for bariatric patients. In other words, bariatric programs inform their patients that they need to change their patterns of behavior from inactive to active, but may neglect to address strategies for changing what has often been a life-long pattern of inactivity, exercise inconsistency, self-doubt, and low motivation for behavior change.

Results of this study suggest the positive impact of having access to consistent, objective feedback regarding one’s progress toward physical activity goals. Research studies and bariatric programs have primarily relied on patients’ self-reports as a means of measurement and monitoring activity levels in these patients. Although likely more
effective than employing no self-regulatory methods, self-reports are limited by individual bias and inaccuracies. This claim was supported by Bond and colleagues (2010) who found that even more than pre-operative patients, post-operative bariatric patients frequently perceived that they had met physical activity recommendations, despite data from objective measurements indicating clear inconsistencies regarding their compliance with those activity recommendations. In particular, Bond and colleagues found that 55% of their post-operative participants reported being compliant with the recommendations, compared to only 5% of those who were actually compliant based on objective accelerometer measurements.

Based on past research (i.e., Bravata et al. 2007) and the findings of the current study, consistent, objective feedback not only allows patients to have an accurate understanding of their true physical activity level, it also serves as a motivational tool for ongoing physical activity. Bandura and Cervone (1983) suggested that pursuing a goal without information regarding progress toward that goal has no motivational impact for a person. The performance of the non-feedback group in the current study supported this premise. Given this information, bariatric programs should consider issuing objective feedback devices to their patients to assist in activity motivation and to minimize errors in patients’ perceived versus actual activity levels. Issuing such devices may be a financial expense for bariatric programs, but the assistance in exercise maintenance those devices provide may ultimately reduce medical and emotional expenses for their patients, while also improving outcomes for bariatric programs. It is noted that during data download, several participant’s (primarily in the feedback group), mentioned that they felt wearing the pedometer was motivating and that they intended to continue to wear it even though
their participation in the study had concluded. Several patients also noted that they intended to encourage some of their pre-operative friends to consider purchasing a pedometer to assist them with exercise prior to surgery.

Relatedly, as demonstrated in SCT theory and supported by past research, setting realistic, clearly defined, proximal and distal exercise goals in conjunction with feedback regarding progress toward those goals, facilitates self-efficacy for exercise and perseverance toward goal attainment. A limitation of the current study was having set a standardized, pre-determined walking goal for all of the participants. While 62% of participants did increase their step counts over baseline, only 8 from the feedback group and 2 from the non-feedback group met the overall step goal. This result is interpreted as having had established too lofty of a goal for many of the participants. Consideration of these findings, as well as the unique history of physical challenges and failed attempts at exercise for this patient population, is imperative when discussing physical activity goals for bariatric patients in the future. Insensitivity to the history and challenges of each individual patient by instituting universal exercise recommendations that may be more appropriate for the general population, could inadvertently impede self-efficacy and perseverance toward goal attainment for many bariatric patients. Despite even significant weight loss post-surgically, bariatric patients may need to slowly progress from lower set step goals in order to facilitate a sense of pride in their accomplishments and motivation for setting and reaching additional activity goals, consistent with SCT.

Bariatric surgery programs are burdened with a myriad of medical, insurance, scheduling, and institutional challenges of running a successful program and understandably, may not have the time or adequate education regarding the psychological
and theoretical underpinnings of patients’ obstacles that affect their weight loss outcomes. However, in order to provide quality care and best practices, these important issues should not be minimized or overlooked. Therefore, a true multidisciplinary team approach to patient care is warranted with expertise regarding the theoretical constructs that may impede or facilitate patients’ physical activity progress being delegated to the psychology / mental health team members. The mental health team members can work more closely with bariatric patients in evaluating their current levels of self-efficacy for exercise, while also assisting them in identifying and implementing individualized, short-term and long-term exercise goals and feedback mechanisms regarding those goals, all of which are issues known via theory and research to be important factors in exercise compliance.

**Implications for future research**

While the findings of this study offer much in regard to clinical utility specific to post-operative bariatric surgery patients, the findings also highlight issues warranting further investigation and replication. First, there is a clear gap in the literature regarding walking standards for this particular patient population. Daily walking recommendations (i.e., 10,000 steps per day), as well as the number of steps per day that are considered valid (i.e., at or above an established minimum cut-off point of 1,000), have been documented for the general population. However, average daily step counts and minimum cut off points have not been established for the post-operative bariatric population. Some research (e.g., King et al. 2008) has suggested that bariatric patients accumulate much of their walking / exercise via basic activities of daily living. This information in conjunction with frequent lingering orthopedic limitations, makes
extending walking / step standards from the general population to the bariatric population, unrealistic. Since no established, objective data exists regarding physical activity levels of post-operative bariatric patients, future research should focus on empirically validating daily step standards and a minimum cut-off for daily steps, for this population.

In addition to validating walking standards for this clinical population, future research should consider efforts to validate measures of exercise self-efficacy for the bariatric population. The current study administered the Self-Efficacy for Regular Exercise measure which previous research demonstrated to be a valid measure of self-efficacy for the general population. However, no previous research was found which demonstrated validity of this instrument when used with bariatric patients across varying post-operative time spans. Results of the current study were inconsistent with both previous research outcomes and tenets of SCT regarding the influence of self-efficacy on behavior change. As self-efficacy is the cornerstone construct in SCT and as self-efficacy for exercise is a long-term challenge for many bariatric patients, it is possible that the measure used in this study was not sensitive to the self-efficacy related issues salient to this particular clinical population. In order to more accurately assess both the predictive power of self-efficacy for exercise, as well as this construct’s relationship to other outcome variables for this clinical population, further assessment of the validity of this measure for post-operative bariatric patients is warranted.

This study revealed that of the SCT variables that were evaluated, having access to consistent feedback was the strongest predictor of increasing step counts over baseline. Although not statistically assessed individually, it appeared that having a goal to work
toward had some degree of impact on the results (even though the established goal may have been too lofty in this case). According to SCT, this would be logical assumption as the combination of having a set goal and receiving feedback toward goal progress increases both self-efficacy and motivation to accomplish the goal. Therefore, in order to be more consistent with the tenets of SCT, and to gain a clearer understanding of the impact of goal setting for this clinical population, future research may want to consider evaluating the impact of goal setting in at least two different ways. First, the current study instructed both groups to increase their weekly step counts by 1,000 (or to increase their walking by 10 minutes each week which would be the general equivalent of 1,000 steps). Future pedometer research should consider evaluating the impact of setting a clear step goal as suggested in SCT, versus vaguely instructing participants to increase their activity. Such research may find that the interaction of specific goal setting and feedback may be more predictive of goal attainment than feedback with very vague activity instructions, or feedback with no suggestion of an activity increase. Second, future research may want to replicate the current study, but with individual activity goals being set by each participant after they have established and observed their own baseline walking data. Having patient set their own walking goals may give insight into patient’s beliefs regarding their ability to increase their steps (based on their set goal increases), and may perhaps result in higher percentages of participants meeting their goals and persevering toward new goals. Similarly, goal attainment should be evaluated each week and as presented in SCT, participants should be able to adjust their goals accordingly, if warranted.
The most notable outcomes in this study included participants in the feedback group consistently increasing their step counts across each of the four weeks, and that feedback was the single predictor in increased step counts from baseline. However, an extraneous influence to the increased step counts may have been present. Participants’ motivation to increase their walking may have been affected to some degree, by their desire to please or impress the author of this study and perhaps members of the bariatric team (who patients would see for post-operative follow-up appointments to discuss medical issues and compliance with behavioral recommendations). The degree to which this phenomenon was influential in potentially confounding the results of the treatment and control groups is both unknown and difficult to adequately assess. Therefore, future research using objective data with this patient population may want to consider a qualitative piece, perhaps open-ended questions or follow-up interviews conducted by non-bariatric staff members, to assess patient’s perceptions of how their were influenced by thinking their individual performance may be “evaluated.” Relatedly, if future research does find that patients are also motivated for activity by knowing that their data may be reviewed by bariatric staff members, programs may want to consider how to actually incorporate a process of consistent data review, as long as their patients remain open cases.

The consistent increase in step counts for the treatment group suggests that pedometers can be successfully used as a means to monitor and motivate physical activity in post-operative bariatric surgery patients across a period of four weeks. However, it is uncertain if this sample would have continued to increase their step counts at week five and after, or if they would have eventually been able to maintain a reasonable intensity of
activity, long-term. Long-term maintenance of consistent physical activity is critical for the bariatric surgery population. As such, future research warrants a lengthier intervention/treatment period to assess the long-term impact that feedback and goal setting have on motivation for activity. In addition, it may also be prudent to consider other related theories when pursuing a similar study with a longer data gathering/treatment period. A suggestion would be to have the intervention/treatment continue for a period of 6 months or longer. This would be consistent with the length of time to reach a maintenance phase of behavior change, as is discussed in the transtheoretical model of behavior change (see Prochaska & DiClemente, 1983; Prochaska, DiClemente, & Norcross, 1992). Ultimately, bariatric programs want their patients to maintain an appropriate weight and level of health for the rest of their lives. In order to achieve this, patients must not only change their lifestyles and negative behavior patterns, but they must maintain those changes. Consequently, a similar study with a minimum of a 6 month treatment phase could not only assess for impact of feedback on behavior change, but could assess if a patient has in fact, entered the maintenance phase of behavior change that should theoretically, facilitate long-term health and weight management.

Understanding that the ultimate outcome for post-operative bariatric patients is to maintain life-long behavior changes that include consistent physical activity, future studies should investigate the extent to which additional SCT variables may facilitate not only short-term, but long term behavior changes. Therefore, further research investigating the impact and predictability of social support, forethought, and outcome expectations (as has been studied in previous research with non-bariatric samples), is warranted. Given the long history of self-doubt and failures at controlling weight and maintaining exercise, it
may be that cognitive interventions consistent with SCT, along with social support mechanisms that could be put in place, may also assist patients in moving into the maintenance phase of their behavior change. Overall, identifying and instilling all pertinent SCT mechanisms that may assist patients in employing a degree of control in their lives (see Bandura 1989, 2001) that may help break the cycle of relapses and failures, is critical.

Finally, this study focused on post-operative patients. Although the findings provided clinical useful data that can be used in the direct treatment of these patients, it should be known that motivation for activity interventions should ideally start prior to surgery, when patients are pre-operative. Therefore, future research using pedometers to continue to investigate motivation for behavior change in the pre-operative bariatric population is warranted. Relatedly, future research using pre and post-operative patients should consider a broadened view of types of physical activities that these patients may engage. Due to orthopedic issues, ambulation problems, and even patient preference, some patients engage in swimming pool work outs, strength training, and / or low impact aerobics for physical activity. Therefore, finding objective means to measure and provide feedback for activities other than walking (noting some devices such as accelerometers already exist), would be advantageous.

Summary

Bariatric surgery has become a popular intervention for morbid obesity. However, the success of bariatric procedures is based largely on the extent to which patients comply with recommendations for behavioral and lifestyle changes. Compliance with consistent physical activity is frequently cited as the most challenging of those
behavioral recommendations. Contributing to this challenge are often long histories of unique physical, psychological, and social/environmental obstacles. Understanding the critical psychological and theoretical underpinnings that impede bariatric patients’ motivation for consistent physical activity can facilitate the structuring of more comprehensive and effective interventions aimed at improving long-term outcome for this population. Unfortunately, in many bariatric programs, evaluation and direct interventions for such theoretically influential variables are often missing components of discussions pertaining to behavior change.

The current study applied SCT as a framework to conceptualize the problem of motivation for consistent physical activity in the post-operative bariatric surgery population. Specifically, this study investigated the impact of SCT variables (self-efficacy, goal setting, and objective performance feedback via pedometers), on patients’ motivation for engaging in physical activity. Results indicated that the SCT variable of feedback is a critical factor in motivation for exercise. Participants who received objective feedback regarding their progress toward set goals, consistently increased their step counts across each of the four weeks. In addition, feedback was the only predictor of increased step counts. Self-efficacy did not impact the outcome as originally expected, but this may have been due to methodological and instrument validity problems. Relatedly, limitations regarding having had the same pre-determined walking goal for all the participants may have affected the results. However, the general conclusion found was that pedometers (and the performance feedback they provide) can be used as motivational tools to increase physical activity in the bariatric surgery population.
The findings of this study have clinical significance for bariatric surgery programs in regard to how they may consider conceptualizing and forming specific treatment interventions designed to increase exercise and motivation for exercise in their patients. This could ultimately lead to best care practices and improved patient outcomes. This study also highlights the vital contributions to both science and practice that counseling psychology professionals can give to bariatric programs and patients. Their expertise regarding theoretical constructs associated with motivation for behavior change can be used to assist programs in evaluating patients’ challenges regarding compliance for increased physical activity. Similarly, these professionals can further assist patients and medical staff members in formulating appropriate, individualized treatment plans that effectively address the psychological and theoretical issues that may have impeded behavior change in the past.
REFERENCES


APPENDICES
APPENDIX A

STANDARD CONSENT FORM

Title:  Pedometer Use as a Motivational Tool for Increased Physical Activity in Bariatric Surgery Patients

Principal Investigators:  Nicole Hunka, M.A.
Research Team:  Alan Gilbertson, Ph.D, Kim Knopp, RD, Cathy Burke, RN., BSN, Walter Chlysta, M.D.

Introduction:
Physicians at Akron General Medical Center study the nature of illness and disease and attempt to develop improved methods to diagnose and treat such conditions. This is called clinical research and you are being invited to participate in such a research study.

In order to decide whether or not you should agree to participate in the current study, you need to understand enough about the risks and benefits to make an informed decision. This process is called informed consent. This consent form gives detailed information about the current research study. Please ask the investigator or research team to discuss any information you do not understand so all of your questions can be clarified. If you decide to participate, you will get a copy of this consent form to keep as a record.

Information about the research.
Physical activity is known to be an important component of weight loss, maintenance of weight loss, and good overall physical and emotional health for bariatric surgery patients. Due to these benefits, many bariatric programs encourage their patients to engage in physical activity both pre and post surgically. Members of the bariatric surgery team at Akron General Medical Center are interested in learning more about the physical activity patterns of bariatric surgery patients before and after surgery.

The use of physical activity to promote physical and emotional health is also highly recommended to other patient populations, such as those with heart conditions, diabetes, etc. Pedometers, (small devices that measure a person’s daily amount of steps taken), have been used to measure physical activity in these and other patient populations. However, no available research has addressed the use of pedometers with overweight individuals who are seeking, and who have undergone, bariatric surgery.

You are being invited to participate in this study because the Akron General Medical Center bariatric surgery program has identified you as being a patient has completed surgery within the
past two months to 5 years. If you choose to participate in this study, you will be asked to complete and complete the following:

1. A brief questionnaire inquiring about some basic personal information (i.e., age, type of bariatric surgery, etc)
2. A brief questionnaire pertaining to your activity / exercise.
3. Agree that your primary form of activity / exercise is or will be walking.

You will then be issued a pedometer with a piece of tape covering the window or step counter. The morning after being issued the pedometer, you will attach the pedometer to the waist band at the front of your pants. In order to accurately measure your daily amount of activity (walking steps), you will be asked to wear it everyday (from the time you wake up, until the time you go to bed at night).

If you are in group “A” you will be instructed to remove the tape after the 7th full day of wearing the pedometer. (You will be given a reminder phone call the day before this is to be done). You will continue to wear the pedometer daily, for an additional 3 weeks. You will also be asked to record the number of steps that you took for each week you wore the pedometer. You will do this on an activity log that will be provided to you. If you are in group “B,” you will continue to wear your pedometer without removing the tape or recording your steps. Both groups will be given an appointment date to return with your pedometer so the research team can download the data recorded on the pedometer. Our best efforts will be made to coordinate this data collection appointment with an upcoming appointment you may have already scheduled with the dietician, surgeon, and / or counselor/psychologist.

Risks and Discomforts.
There are no known risks associated with the research procedure (i.e., no risks in regard to completed forms or wearing a pedometer). You will not be asked to engage in any activity not approved by your physician or that would be contraindicated to your health care.

Benefits
The information we gather from this study will help us to better understand how bariatric surgery patients’ health can be affected by physical activity and how pedometers can be used to assess and promote walking activity. This information may help us provide better treatment recommendations for bariatric surgery patients in the future. Please note that if you complete this study, you will be permitted to keep the pedometer issued to you, free of charge (MSRP $49.99).

Confidentiality
Part of this study entails recording information regarding your basic health and medical history. This information will be taken from your medical chart that is kept in the bariatric center. Health information may include things such as height, weight, body mass index, medical illnesses in the past and present including diabetes, high blood pressure, and other related information. All of this information will be kept confidential among the researchers and will not be shared with anyone else.

Know that your identity will never be revealed to anyone outside the research team during or after the study. If the study results are published or presented at a conference, no individual participant will be identified in any way.
Questions about the research.
You are encouraged to contact the principal investigator, Nicole Hunka, M.A. (330-807-4432) with any questions regarding this research and/or your participation in it.

Voluntary participation.
Your participation in this study is voluntary. If you decline to participate, this will in no way affect your future treatment or benefits here at Akron General Medical Center. You are free to discontinue participation in this study at any time without fear of consequence or loss of medical care.

Consent to Participate.
Understand that by signing this consent form, you do not give up any legal rights, but do indicate that you have been informed about the research study in which you are agreeing to participate. You will be given a copy of this form for your records.

* I have read this consent form or had it read to me and my questions have been answered. I agree to take part in this research study.

Participant Name:______________________ Date/Time: ______________________

Authorized Representative ________________________ Date/Time: ______________________
APPENDIX B

AUTHORIZATION FOR USE AND DISCLOSURE OF YOUR MEDICAL INFORMATION AND RESEARCH

Study Title:  Pedometer Use as a Motivational Tool for Increased Physical Activity in Bariatric Surgery Patients

Protected Health Information (PHI) is any personal health information through which you can be identified. Federal Privacy Laws (HIPAA) require that the study investigator explain to you in detail what information will be obtained about you during the study, how the information will be used, and with whom it will be shared. This information is provided below. By signing this form, you are authorizing the use and disclosure of your health information collected in connection with your participation in this research study. Your health information will only be used for purposes explained in the consent form.

The study investigator may use the following sources of health information: information from your health history; related physical examinations, hospital stay, psychiatric diagnoses, and treatment. Information from these sources will only be used in connection with this study as described in the consent form.

Study records that identify you will be kept confidential as required by law. Federal Privacy regulations provide safeguards for privacy, security and authorized access. Except when required by law, you will not be identified by any direct personal identifier in study records that may be disclosed outside of Akron General Medical Center (AGMC). Any records disclosed outside of AGMC will be assigned a unique code number. The key to the code will be kept in a locked file in the Department of Psychiatry and Behavioral Sciences offices at AGMC.

Protected health information created or obtained for the purposes of this study will not be accessible to you while this study is in progress. Once the trial has been completed, you will have the right to access this information.

There is no scheduled date at which your PHI that is being used or shared for this research will be destroyed. Research is an ongoing process, during which information may be analyzed and re-analyzed in light of scientific and medical advances or reviewed for quality assurance, oversight, or other purposes. However, information will only be collected from your medical record for the duration of the study.

Your participation in this research study is voluntary. However, if you decide not to sign this form, you will not be able to participate in the research study. You may cancel your authorization at any time by providing written notice to the principal investigator of the study. Information that was collected before you withdrew authorization will continue to be used by the principal investigator as described in the original consent and authorization form. If you cancel your
authorization and withdraw from the study, you will not be penalized or lose any benefits to which you are otherwise entitled.

You hereby authorize your physicians/medical facilities to release to Nicole Hunka, M.A. your medical records for the duration of the study. You understand and acknowledge that the medical record may contain information regarding psychiatric disorders, drug/alcohol abuse, HIV test results, a diagnosis of AIDS or an AIDS related condition and you expressly consent to the release of any such information contained in the records. You agree further that a photocopy of this authorization shall be as effective as the original

_________________________________________                   _________________________
Authorized Representative                   Date

_________________________________________                   _________________________
Signature                   Date
APPENDIX C

ENROLLMENT AND DEMOGRAPHIC QUESTIONNAIRE

Name. _______________________________  Date Enrolled ____________

D.O.B ___________________  Age: _______  Phone #: _______________________

Pedometer # _________  Enrolled at: _____Support group  _____Appointment  _____Other

Has the participate been advised by their physician to avoid/limit their physical activity (walking)?
Yes ________
No ______

Is walking his/her primary form of exercise / activity? _____Yes  _____No

Are there physical problems that may limit his/her ability to walk? If so, describe.
______________________________________________________________________________
______________________________________________________________________________

Does the participant report keeping a “daily” food journal?  _____Yes  _____No

Participant Group:
_____ T: Treatment. Date to start wearing pedometer__________. Date given to unblind _____
_____ C: Control

Bariatric Surgery
_____ RenY  _____ Lap Band  _____ Sleeve

127
Medical History

Height (most recent). _______________ (Date of chart documented Ht). _______________
Weight (most recent). _______________ (Date of chart documented Wt). _______________
BMI (most recent). _______________
APPENDIX D

SELF-EFFICACY FOR ENGAGING IN REGULAR ACTIVITY QUESTIONNAIRE

Read the following items. In the box, enter the number that best expresses how confident you are to exercise when other things get in your way, based on the 5-point responses below.

1 = Not at all confident, 2 = Somewhat confident, 3 = Moderately confident, 4 = Very confident, 5 = Completely confident

I am under a lot of stress. .........................................................

I am depressed. .................................................................

I am anxious. .................................................................

I feel I don’t have the time. ...................................................

I don’t feel like it. ...............................................................

I am busy. .................................................................

I am alone. .................................................................

I have to exercise alone. ..................................................

My exercise partner decides not to exercise that day. ..............

I don’t have access to exercise equipment. ..........................

I am traveling. .............................................................

My gym is closed. ..........................................................
My friends don’t want me to exercise.                      □

My significant other does not want me to exercise.         □

I am spending time with friends or family who do not exercise. □

It’s raining or snowing.                                    □

It is cold outside.                                         □

The roads or sidewalks are snowy.                          □

In general, I am confident I have the ability to engage in consistent physical activity. □

I am confident I can engage in consistent physical activity despite any past tries at activity that did not last long. □

I am confident I can set physical activity goals and consistently work toward obtaining those activity goals. □
**APPENDIX E**

**ACTIVITY LOG**

**Directions for Week 1.**
- Wear your pedometer everyday, all day. Continue your normal walking routine (however much or little that may be).
- *At the very end of day 7,* remove the tape from your pedometer.
- Go back through the pedometer and then record the actual number of daily steps taken for each of the previous days (Days 1 – 7).
- Add up the total steps for those 7 days and place in the “Total Steps for week 1” box.
- Divide by 7. Place number in “Average Daily Steps for week 1” box.
- Add 1,000 to that number. Place in the “Next Week’s Goal” box.

<table>
<thead>
<tr>
<th>Dates</th>
<th>Week 1</th>
<th>Pedometer readings (steps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1:</td>
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<td>Day 2:</td>
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<td>Day 3:</td>
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<td>Day 5:</td>
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<td>Day 6:</td>
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<td>Day 7:</td>
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<tr>
<td>Total Steps for Week 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Average Daily Steps for Week 1</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>NEXT WEEK’S GOAL:</strong></td>
<td></td>
<td>Average daily Steps for Week 2 (add 1,000 steps to the number in the above box).</td>
</tr>
</tbody>
</table>
**Directions for Week 2.**

- Wear your pedometer everyday, all day.
- You are working toward achieving your week 2, average daily step goal.
- Record your total daily steps at the end of each day (days 8 - 14)
- At the end of the week, add up the total steps for the days 8 - 14.
- Divide by 7. Place that number in the “Average Daily Steps for week 2” box
- Add 1,000 to that number. Place in the “Next Week’s Goal” box

<table>
<thead>
<tr>
<th>Dates. Week 2</th>
<th>Pedometer readings (steps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 8:</td>
<td></td>
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<td>Day 9:</td>
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<td>Day 10:</td>
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<td>Day 11:</td>
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<td>Day 12:</td>
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<td>Day 13:</td>
<td></td>
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<tr>
<td>Day 14:</td>
<td></td>
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</tbody>
</table>

Total Steps for Week 4

Average Daily Steps for Week 4

**NEXT WEEK’S GOAL:**
Average daily Steps for Week 3
(add 1,000 steps to the number in the above box).
### Directions for week 3.

- Wear your pedometer everyday, all day.
- You are working toward achieving your week 3, average daily step goal.
- Record your total daily steps at the end of each day (days 15 - 21)
- At the end of the week, add up the total steps for the days 15 - 21.
- Divide by 7. Place that number in the “Average Daily Steps for week 3” box
- Add 1,000 to that number. Place in the “Next Week’s Goal” box

<table>
<thead>
<tr>
<th>Dates. Week 3</th>
<th>Pedometer readings (steps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 15:</td>
<td></td>
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<td>Day 16:</td>
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<td>Day 20:</td>
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<td>Day 21:</td>
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<tr>
<td><strong>Total Steps for Week 3</strong></td>
<td></td>
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<tr>
<td><strong>Average Daily Steps for Week 3</strong></td>
<td></td>
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</tbody>
</table>

**NEXT WEEK’S GOAL:**

Average daily Steps for Week 4 (add 1,000 steps to the number in the above box).
Directions for Week 4.

- Wear your pedometer everyday, all day.
- You are working toward achieving your week 4, average daily step goal.
- Record your total daily steps at the end of each day (days 22 - 28)
- At the end of the week, add up the total steps for the days 22 - 28.
- Divide by 7. Place that number in the “Average Daily Steps for week 4” box.
- After completing day 28, discontinue wearing your pedometer and return to AGMC for your scheduled follow-up / data collection appointment.

<table>
<thead>
<tr>
<th>Dates. Week 4</th>
<th>Pedometer readings (steps)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 22:</td>
<td></td>
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<tr>
<td>Day 23:</td>
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<td>Day 24:</td>
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<td>Day 27:</td>
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<td>Day 28:</td>
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<tr>
<td>Total Steps for Week 4</td>
<td></td>
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<tr>
<td>Average Daily Steps for Week 4</td>
<td></td>
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</tbody>
</table>
APPENDIX F
FOLLOW-UP QUESTIONS

Please answer the following question honestly.
You will not be penalized in any way for your responses.

1. During the time you were instructed to keep your pedometer covered with tape (so you could not see the steps counts), did you ever remove the tape (even briefly), to look at the step recordings?
   _____ NO
   _____ YES

   If yes, when (what day(s)).

2. Did you wear the pedometer everyday, all day, as instructed?
   _____ NO
   _____ YES

   If not, about how long or how often did you wear the pedometer?
March 9, 2010

Nicole Hanka, MA
Akron General Medical Center
400 Wabash Avenue
Akron, OH 44307

Dear Nicole:

RE: 10009. Pedometer Use as a Motivational Tool for Increased Physical Activity in Bariatric Surgery Patients

The Institutional Research Review Board at Akron General Medical Center has determined that the above study meets the requirements for expedited review. The IRBB has followed the requirements of the Common Rule for the expedited review procedures. A member of the committee reviewed the above research protocol. The protocol and informed consent dated March 9, 2010 are granted expedited approval.

You are now approved to begin this study at Akron General Medical Center. This approval is for one year and expires on March 9, 2011.

HHS regulations and Institutional Research Review Board guidelines require that any changes in research methodology, protocol design or principal investigator have the approval of the IRBB before implementation and continuation of the protocol. You must promptly report any protocol deviations and any serious adverse that occur in your study subjects during the study or within 30 days of completion of the study, even if the event was not considered to be related to study participation. The IRBB further requests an annual progress report and a final report at the conclusion of the study.

A signed copy of the informed consent document must be given to the research subject and also placed on the subject’s medical record. You must also document in the progress notes that the subject was enrolled in a research study.

If you have any questions concerning this approval, please call the IRBB office at 330-344-6947.

Sincerely,

Norma Durbin, RN, MBA
IRRB Coordinator
Assurance #FWA00001299 (Expires 10/1/2010)

[Signature]

*Member of Akron General and VHA • Major teaching hospital for Northeastern Ohio Universities Colleges of Medicine and Pharmacy, Equal Opportunity Employer
APPENDIX H

HUMAN SUBJECTS APPROVAL: PARMA COMMUNITY GENERAL HOSPITAL

August 24, 2010

Nicole Hunka, MA, PC
2220 High Street #207
Cuyahoga Falls, Ohio 44221

RE: Your followup submission of 8/24/2010 regarding study number 10-003: Pedometer Use as a Motivational Tool for Increased Physical Activity in Bariatric Surgery Patients (University of Akron)

Dear Nicole Hunka:

Thank you for your response to requests from a prior review of your application for the new study listed above. Your study is eligible for expedited review under FDA and DHHS (OHRP) 7. Individual or group behavior designation.

This is to confirm that your application is now fully approved. The protocol is approved through August 2010 with the amendment to protocol dated August 23, 2010. The data set associated with this study is considered limited, therefore a Data Use Agreement is required and is on file with the IRB. A copy of this Agreement is enclosed. The consent form as submitted (8/24/2010) has been approved. The study patient recruitment flyer, 8/19/10, is approved. You must obtain signed written consent from all subjects.

- Enclosed please find the IRB approved, date-stamped informed consent document. This is the only informed consent document to be used. No other informed consent document should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject must be given a copy of the signed informed consent document.
- All protocol amendments and changes to approved research must be submitted to the IRB and not be implemented until approved by the IRB except where necessary to eliminate apparent immediate hazards to the study subjects.
- Significant changes to the study site and significant deviations from the research protocol must be reported to the IRB.
- A Continuing Review Report/Renewal Request must be submitted six weeks prior to the expiration of the approval period, unless closed before that date. The study cannot continue after 8/25/2011 until re-approved by the IRB.

You are granted permission to conduct your study as most recently described effective immediately. The study is subject to continuing review on or before 8/25/2011, unless closed before that date.

Please note that any changes to the study as approved must be promptly reported and approved.

Contact Elaine Connelly, RN, IRB/Special Projects Coordinator (440-743-4543) if you have any questions or require further information.

Sincerely,

James L. Sechler, MD, FACC
IRB Chair