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PEER INFLUENCE ON PHYSICAL ACTIVITY IN COLLEGE STUDENTS WITH DIFFERING MOTIVATIONAL PROFILES

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ABSTRACT

The current study examined the role that peer influences play in physical activity behavior of college-aged students with differing motivational profiles, and aimed to determine whether peers impact physical activity behavior directly or indirectly through the shaping of an individual's cognitions such as self-efficacy and outcome expectations. College-aged students (N = 817) completed an online survey on peer influence, motivation, and physical activity. Three hypotheses were tested: 1) self-efficacy and outcome expectations would mediate the effect of peer influence on physical activity, 2) based on previous research by Vlachopoulos et al. (2000), three main motivational profiles would emerge, and 3) the strength and pattern of association between peer influence and physical activity would vary across motivational profiles. A structural equation modeling analysis revealed that a direct model where peer influence, self-efficacy, and outcome expectations were all directly associated with physical activity was a better fitting solution than the proposed meditational model. The relationships among peer influence, self-efficacy, and outcome expectations also varied by motivational profile such that individuals exhibiting moderate levels of extrinsic motivation and a high level of amotivation had a stronger relationship between peer influence and physical activity. These study findings suggest that individuals exhibiting moderate levels of extrinsic motivation and high level of amotivation may be most responsive to interventions incorporating the involvement of peers for increasing physical activity as compared to individuals with more self-determined or intrinsic motivational profiles. Further research is needed to explore the dynamics of the relationship between peer influences and physical activity among college-aged students.

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Chapter 1

Introduction

In recent years, there has been an increase in overweight and obesity in Americans across the lifespan. According to the Centers for Disease Control (CDC) 2007 report 36.7% of Americans are overweight and 26.3% are obese, representing an increase of 10% in obesity rates since 1997 (Centers for Disease Control and Prevention [CDC], 2007). Obesity is associated with numerous problems, such as diabetes, heart disease, cancer, and stroke, and as a result can decrease a person's life expectancy. The risk of weight gain increases during important life transitions. Entering college is one such life transition that has been associated with weight gain and negative changes in health behaviors (Anderson, Shapiro, & Lundgren, 2003). College is a time of social change in which people tend to leave the caring umbrella of their parents and begin a life that is all their own. In fact, in the 20-34 year age range, there has been an increase in overweight and obesity rates from 47.5% to 57.4% for men and 37.0% to 52.8% for women between 1994 to 2002 (Centers for Disease Control and Prevention [CDC], 2008).

Although the relative contribution of physical activity, inactivity, and sedentary behaviors to the prevention and management of obesity, respectively, remains unclear, all are likely to play a role in today's obesity epidemic due to their impact on overall energy expenditure. Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure (World Health Organization [WHO], 2010). Physical inactivity is a state in which body movement is minimal and the energy expenditure approximates resting metabolic rate (Dietz, 1996). Finally, sedentary behavior refers more specifically to engaging in low energy expenditure activities, such

as, watching television or talking on the phone (Must & Tybor, 2005). The distinction among these three inter-related physical activity variables may appear tenuous from a physiological perspective but becomes meaningful from a behavior change perspective in that different or combined intervention strategies may be required to target these different aspects of behavior. Targeting physical activity has been at the center of most intervention efforts to date. Increasing leisure-time physical activity does not only increase the metabolic demand and overall energy expenditure but allows for targeting activities at higher intensity which increase fitness and bring about additional health benefits. To this end, this study aims to understand the motivational and social cognitive factors assumed to impact leisure-time physical activity among college-aged students in Central Pennsylvania.

According to the 2008 Federal Physical Activity Guidelines for Americans, adults should engage in 150 minutes of moderate physical activity or 75 minutes of vigorous aerobic activity a week. In addition, adults should be engaging in strength training activities that use the whole body two days a week to achieve additional health benefits (United States Department of Health and Human Services [USDHHS], 2008). Although research has shown that regular physical activity has multiple physical and mental health benefits to individuals, physical activity levels among the U.S. population remain low. According to the 2007 Behavioral Risk Factor Surveillance Survey from the CDC, college aged students (18-24 yrs) have the highest level of recorded physical activity among the adult population. However, less than 60% of these individuals are meeting recommended guidelines for physical activity with 18.4% indicating no leisure time physical activity in the past month (CDC, 2007). In fact, many young adults are choosing

to engage in activities that do not require them to be physically active, such as watching TV and doing work on their computer, during their free time. Buckworth and Nigg (2004) conducted a study in which they examined the relationship between physical activity, exercise, and sedentary behavior in 493 college students. They found that the students spent approximately 30 hours a week engaging in their operationally defined sedentary behaviors (watching TV, studying, and using the computer). The majority of this time was spent engaged in studying. Unfortunately, the time on the computer for men and time watching TV for women was negatively associated with physical activity (Buckworth & Nigg, 2004).

In order to alleviate the problem of lack of physical activity, researchers have been refocusing their efforts and shifting the emphasis from promoting structured exercise programs to promoting lifestyle physical activity (e.g., walking, stair climbing) and leisure-time physical activity performed in other than structured settings (e.g., home-based or internet-based programs) (Physical Activity and Health, 1996). Clearly, a variety of strategies must be employed to achieve increases in physical activity at the level of public health impact, with the most effective strategies being tailored for individual needs, population sub-group characteristics, or based on social/cultural or physical/built environmental context (National Institutes of Health [NIH], 2009). It has been argued that college represents a unique environment for health promotion efforts, specifically for developing ways to intervene to increase physical activity. The college environment contains an abundant amount of resources for physical activity intervention. A few of the benefits of the college environment is the access to quality exercise facilities, the abundance of different types of physical activities, and the flexibility of schedules for

being able to go exercise at different times. Another unique element to the college experience is the impact that peers and friends have on individuals' behaviors. Prior to college, health behaviors such as physical activity are largely shaped by family influences. After college, individuals begin their careers and start having families which hinders their freedom of engaging in regular physical activity. Still, studies capitalizing on the unique influence of peers in the college-aged population are scarce. This is especially unfortunate given the fact that decreases in physical activity levels occur among students as they transition from the high school to college environments (Bray & Born, 2004). Importantly, it has been well-demonstrated that early positive physical activity habits lead to higher physical activity levels later in life (Nogueira et al., 2009), highlighting the need for a better understanding of factors related to physical activity behavior during college years and for developing appropriate interventions for this at-risk population.

In order to be successful at physical activity promotion efforts, it is important to have a better understanding of the factors impacting an individual's motivation to engage in physical activity, including the role that peer influences may play in shaping individual motivations. Although many different definitions of motivation have been put forth, motivation is generally viewed as the intensity and direction of one's efforts (Sage, 1977). One of the more widely accepted theories of motivation is Deci and Ryan's Self-Determination Theory (SDT). The SDT is a general theory of motivation and personality and it focuses on the degree to which people are able to satisfy their basic psychological needs as they pursue and attain their valued outcomes (Ryan & Deci, 2000). Thus, the theory is concerned with the degree to which human behavior is volitional or self-

determined. Human motivation is viewed as operating along a continuum. On one end of the spectrum, intrinsic motivation represents an individual's motivation to engage in an activity because of the inherent enjoyment of the activity. On the other end of the spectrum, amotivation refers to a person's complete lack of motivation for a particular activity. Extrinsic motivation operates in the middle of the continuum and comprises of being motivated to do an activity for external rewards, sense of obligation, or other outside factors (Deci & Ryan, 1985; 1991).

In spite of its importance with respect to continued participation in physical activity, the role of motivation in determining individuals' engagement in physical activity remains understudied. Although both the physical environment and social support contribute to individuals' engagement in physical activity, the effects of social support on physical activity are mediated by intrinsic and extrinsic motivation (McNeill, Wyrwich, Brownson, Clark, & Kreuter, 2006). Interestingly, Frederick and colleagues (1996) found that gender differences may exist in the relationship between motivation and exercise behavior. In their study, extrinsic motivation predicted adherence only in men, whereas intrinsic motivation predicted satisfaction and competence for both males and females. In addition to gender, individual differences in the underlying motives for physical activity participation may help explain varying levels of physical activity. Indeed, researchers have been interested in examining the variability in types of motivations individuals use to engage in a variety of health behaviors for some time now and in the physical activity domain, in particular, this has led to a renewed focus on motivational profiles.

Motivational profiles refer to a clustering of different motivations for an activity or behavior (i.e., intrinsic and extrinsic motivation can operate at the same time for engagement in the same activity). For instance, Matsumoto and Takenaka (2004) examined exercise motivations in a large group of adults in Japan in relation to the stages of change theory. They found that four distinct motivational profiles emerged. The first was defined as "self-determined motivation" profile because of the high level amount of identified regulation and intrinsic motivation. The second was "moderate" motivation because the individuals' levels of motivation across all categories were relatively close to the middle of the motivation continuum. The third was referred to as the "non-self-determined" group because they had high levels of external regulation and introjected regulation with lower levels of the more self-determined motivation types of motivation (identified and intrinsic). The last group was labeled the "amotivation" group because these individuals had high levels of amotivation with a consistent decrease along the continuum down to the lowest level of motivation being in intrinsic motivation. Matsumoto and Takenaka found an association between "membership" in individual motivation cluster and stages of change. Individuals in the self-determined group were most likely to be in the maintenance stage, that is, they have been continually exercising for more than 6 months; whereas the amotivation group was mostly in the pre-contemplation and contemplation phases.

Although traditionally viewed as an individual-level characteristic, motivation has been shown to be determined to some extent by social factors. In fact, according to the SDT it is the social context that shapes human motivation by facilitating or hampering the processes of active engagement and psychological growth (Ryan & Deci, 2000). Social

support and social influences have been shown to play an important role in shaping health behaviors of college students and adolescents. In 2000, Wallace and colleagues examined exercise behaviors in college students and found that peer social support was a significant predictor of physical activity, particularly in male students. Others have provided support for the role of social and more specifically peer influence on physical activity behavior, competence, and self-motivation (Vazou et al., 2005; Smith et al., 2006). Despite the demonstrated relevance of social and peer influences on physical activity engagement; however, few studies have examined their role in determining physical activity among college students. In fact, the majority of the literature on motivation in the physical activity domain remains fragmented with researchers focusing either on individual level characteristics and physical activity beliefs or on social/environmental factors linked to physical activity. Studies that attempt to incorporate both individual and social influences are underrepresented, and consequently, it remains unclear how the different individual and social predisposing factors may work together or interact in their influence on physical activity. More specifically, it is not known whether peer influences impact physical activity behavior differentially for individuals with different motivational profiles and whether peer influences have a direct impact on physical activity or influence it indirectly by shaping individual's beliefs such as self-efficacy or outcome expectations. A better understanding of the associations among motivational profiles, peer influences, and physical activity behavior in the college-aged population is needed to help facilitate the development of more effective intervention strategies for increasing physical activity in college students. Therefore, this study was developed with three inter-related objectives in mind:

(1) To examine the relationship between peer influences and physical activity in college-aged students and determine the roles that outcome expectations and self-efficacy play in this relationship. *It is hypothesized that outcome expectations and self-efficacy will mediate the relationship between peer influences and physical activity.*

(2) To examine different motivational profiles for physical activity in college-aged students. *It is hypothesized that three distinct profiles similar to those identified by Vlachopoulos et al. (2000) will emerge: 1) a traditional intrinsically motivated profile, 2) a profile with both moderate levels of extrinsic and intrinsic motivation, and 3) an amotivated profile.*

(3) To determine whether the relationship between peer influence and physical activity in college students varies based on different motivational profiles. *It is hypothesized that the relationship between peer influence and physical activity will be stronger for individuals exhibiting a more moderate motivational profile (a profile consisting of moderate levels of all extrinsic motivations and the presence of intrinsic motivation).*

Chapter 2

Literature Review

The proposed research will evaluate the associations between peer influences and physical activity participation in college aged students with differing motivational profiles. The Self-Determination Theory (Deci & Ryan, 1985) and Social Cognitive Theory (Bandura, 1986) are used as the guiding frameworks for this research. In this section, a succinct review of literature related to physical activity in the college-aged population, the SDT approach to motivation, and social cognitive and peer influences on physical activity behavior is provided.

Physical Activity in the College-Aged Population

According to the U.S. Census Bureau's School Enrollment in the United States (2006), there are approximately 20.5 million students enrolled in either a two- or four-year college. Recently, the U.S. government released the first set of federal guidelines for the amount of physical activity that is needed to accumulate health benefits and stay healthy (USDHHS, 2008). These guidelines state that individuals should engage in at least 150 minutes of moderate intensity exercise a week. In addition, they state that to gain additional health benefits and increases in fitness individuals should engage in 300 minutes of moderate intensity activity a week. The benefits of physical activity performed at this level are numerous, including lower risk of many major chronic diseases such as type 2 diabetes and coronary heart disease or psychological benefits such

as improved self-esteem, reduced anxiety and depression. Additional health benefits may be accrued with increasing levels of physical activity (USDHHS, 2008).

Despite a public health push for individuals to be physically active, the number of individuals not engaging in the recommended amounts of physical activity remains low and the level of sedentary behaviors remains high across populations. Although college-aged students (18-24 yrs) report among the highest levels of physical activity in the adult population, less than 60% of the them meet recommended guidelines for physical activity and 18.4% indicate no leisure time physical activity in the past month (CDC, 2007). In another report, Keating et al. (2005) performed a meta-analysis of college student's physical activity behaviors and found that 50% of the individuals were not meeting the current guidelines of performing at least 150 minutes of moderate activity a week. According to the Healthy People 2010, as of 2008, 38% and 31% of the college aged population report engaging in physical activity at moderate and vigorous intensity, respectively; however, these numbers represent a decrease from 41% and 32% in 1997, and the rates of individuals engaging in no leisure time physical activity has decreased slightly over the same time period from 31% to 29% (United States Department of Health and Human Services [USDHHS], n.d.). Other research indicates that only a small proportion of college students are aware of the recommended doses of physical activity they should participate in. McArthur and Raedeke (2009) surveyed 395 female and 241 male undergraduate students and reported that whereas about 50% of the surveyed students were meeting the recommended PA guidelines, only about 40% of the students were actually aware of the guidelines. Recently released objective population-based data on physical activity suggest that actual physical activity participation rates may be much

lower than previously thought, with only 5% of adults meeting the current PA guidelines based on objective physical activity surveillance using accelerometry (Troiano, et al., 2008).

It has been argued that the low rates of physical activity that many college students experience occur as a result of the life change that accompanies the transition into college. Bray and Born (2004) collected data on 145 first year college students regarding participation in vigorous physical activity over the last two months of high school and the first two months of college. They found that 66% of the individuals met physical activity recommendations during the last two months of high school; however, this percentage dropped to 44% for the first two months of college. In addition, they found that those individuals who were classified as being continuously active reported more vigor compared to the continuously inactive and active-inactive groups. Adding further support to the transition into college being problematic for individuals, Han et al. (2008) examined physical activity behavior in women transitioning into college. Baseline assessment took place during the first couple of months in college and included height and weight, demographics, and physical activity. The same assessments were repeated 12 months later. Over the 12-month period, the women reduced their moderate activity by 2 hours and moderate to vigorous activity combined decreased by more than 3 hours per week. Additionally, as would be expected, the percentage of those meeting physical activity recommendations dropped from 82.6% to 65.2%.

Arguably, because the entrance into college has been associated with significant decreases in physical activity levels, this transitional time in life is optimally suited for the introduction of behavior change interventions. The college years are a time when

individuals explore new things, assert their identities, and develop their sense of self-worth. Maximizing physical activity participation rates in students as they enter the college environment would not only bring physical health benefits but also help instill healthy physical activity habits for life as a function of increasing self-determination, self-efficacy, self-esteem, and self-schemata (Malina, 1996; Kjønniksen et al., 2008; Nogueira et al., 2009). Minimizing physical activity attrition and increasing physical activity participation in the transition to college is equally important for the prevention of mental health problems, enhancement of mental health and wellbeing, and possibly better academic performance. Physical activity has been shown to serve as a buffer for commonly experienced life stressors (Salmon, 2000) and it has been associated with better mental health and wellbeing outcomes in college students, an important public health goal in its own right (Taliaferro, Rienzo, Pigg, Miller, & Dodd, 2009**)**. Important to note is also the college and university environment itself which in many respects represents an ideal setting for behavior change interventions, Colleges and universities are institutions with numerous physical activity resources that may facilitate the development and dissemination of intervention efforts. However, for any intervention efforst in these unique environments to work it is necessary to understand the motives by which individuals make their behavioral choices. As theoretical frameworks, the Self-Determination Theory (SDT) and Social Cognitive Theory (SCT) can provide meaningful insights into the underlying motives and beliefs associated with physical activity behavior in college students.

Self-Determination Theory and Motivational Profiles

In its broadest sense, motivation is defined as the intensity and direction of one's efforts (Sage, 1977). The SDT provides a framework in which motivational processes can be studied systematically. The premise of the theory is that the motives which govern individuals' behavioral choices fall on a continuum ranging from self-determined (or autonomous) to controlling. In addition to the motivational continuum, the theory is posited on the fundamental need for personal competence, autonomy, and relatedness. It is the integration of these three needs that facilitates a person's progression along the continuum towards the more self-determined forms of motivation (Ryan & Deci, 2000). As people feel more competent, autonomous, and connected to others in a particular area (e.g., physical activity) they will begin to incorporate more self-determined forms of motivation into behaviors in that particular domain. The most self-determined form of motivation is intrinsic motivation, that is, motivation to engage in a behavior for the enjoyment of the activity itself. For example, a basketball player playing basketball because they enjoy the game would be considered intrinsically motivated. Extrinsic motivation represents engaging in behaviors for other reasons, usually to achieve some desirable outcomes. Several sub-types of extrinsic motivation are recognized. Identified regulation represents motivation that is at the transition between intrinsic and extrinsic motivation. It refers to being motivated to do an activity because you identify with it, that is, it reflects activities that are performed by choice (i.e., that are self-initiated) and that have some personal relevance or value. For example, an individual playing soccer for motives stemming from identified regulation may do so as a way to stay fit which is

important to them. Introjected regulation is a non self-determined form of motivation and refers to the motivation of wanting to avoid punishment or guilt. An example would be a person going running because if they did not they would feel guilty for being lazy. Thus, it represents external motives that become at least partially internalized but the activity/behavior is not performed completely by choice. The last non self-determined form of motivation is external regulation, or engaging in a behavior for some external reward or due to pressure to do so (e.g., from significant others). An example would be an athlete playing a sport because of the lucrative contract or parental pressure. Finally, amotivation refers to the complete lack of motivation for an activity. This is when a person perceives no internal or external rewards for engaging in a behavior which usually leads to the termination of doing that activity.

In the physical activity domain, the relationship between extrinsic and intrinsic motivation has been conceptualized in two ways: (a) one where extrinsic motivation is seen as complementary to intrinsic motivation (i.e., individuals can possess multiple different motives for engaging in a behavior); or (b) one where extrinsic motivation is seen as undermining intrinsic motivation (i.e., extrinsic and intrinsic motivations are seen as incongruent). Vallerand and Fortier's review (1998) demonstrated that the relationship between intrinsic motivation and extrinsic motivation can be both positive and negative depending on which level of extrinsic motivation is involved. They determined that identified regulation may exert a positive effect on intrinsic motivation. However, external regulation and even introjected regulation would have a negative effect on intrinsic motivation and therefore self-determined behavior. That is, those individuals that value physical activity as important (identified) are likely to internalize the behavior and

engage in greater levels of physical activity. Also, those that do not internally value physical activity (external and introjected) are more likely to refrain from engaging in physical activity even if they have some level of enjoyment unless there are extenuating circumstances (reward or guilt) that push them to engage.

Vlachopoulos et al. (2000) examined this dilemma further by expanding upon Vallerand and Fortier's (1998) argument about individual's having a combination of varying levels of intrinsic and extrinsic motivation (i.e., different motivational profiles) dictating their behaviors. In the Vlachopoulos et al. study, two samples of individuals were provided with a demographic questionnaire and the Sport Motivation Scale. Sample 1 consisted of 353 men and 236 women ranging in age from 18 to 67 (M = 23.35, SD = 7.54) from various sports backgrounds and Sample 2 consisted of 305 men and 250 women ranging in age from 18 to 62 (M = 23.48, SD = 6.56). After completing the questionnaires, the researchers performed an exploratory cluster analysis and identified three profiles in Sample 1. In sample 2 only two main profiles emerged. The first profile consisted of individuals scoring both high on intrinsic and extrinsic motivation, except for external regulation, whereas the second profile was the more typical self-determined profile of having only high intrinsic motivation. One of the main findings from this data was that individuals fitting profile 1 had slightly higher levels of enjoyment, effort, satisfaction and positive affect associated with physical activity participation compared to those with profile 2. Nonetheless, this study did not consider other correlates of physical activity and did not include those individuals who choose not to engage in sports but may still engage in varying levels of physical activity.

Ntoumanis (2002) studied students in British physical education (PE) classes (ages 14-16). Two samples of students, from different schools were examined. Sample A consisted of 122 females and 111 males and in Sample B there were 96 females and 95 males. The authors used the Perceived Motivational Climate in Sport Questionnaire-2 to determine the extent to which the students perceived their PE classes as either more of a cooperative or competitive learning environment. Additionally, the Goudas et al. (1994) assessment tool was used to assess four sub-domains of motivation in the PE context. After performing an exploratory and confirmatory cluster analysis, the researchers were able to identify three distinct motivational profiles (high self-determined, moderately self-determined, and low self-determined). As expected, the high self-determined group evaluated the school environment as being more enjoyable and socially facilitating. Biddle and Wang (2003) investigated adolescent girl's views on motivation and physical self-perception and their physical activity levels and found that five clusters emerged from the data (ranging from High Motivation and Physical Self to Low Motivation and Physical Self), however these failed to significantly distinguish the groups based on physical activity levels, speculating that this was perhaps due to the physical activity measure used (i.e., 7-day recall).

In summary, the most consistent motivational profiles that have emerged from previous studies are the self-determined (highly intrinsic), moderate (fairly equal levels of intrinsic and extrinsic motivation), and amotivated profiles. Before the utility of motivational profiling for increasing physical activity can be considered further, however, some of its distinct advantages and disadvantages must be discussed.

First and foremost, given the underlying analytical approach to identifying distinct motivational sub-groups (performed most commonly through some form of cluster analysis), motivational profiling represents a data driven technique that is bound to vary by sample under investigation. That is, caution must be applied when interpreting findings from any single study regarding different types of motivational profiles. Theoretically, an indefinite number of motivational profiles exist due to individual differences in physical activity motivations. In any study involving profiling, thus, it is up to the investigator to set the parameters on which profiling is based. The results of any single study will therefore be impacted by decisions at multiple levels of the research process, ranging from sampling, data aggregation, to the type of statistical analysis chosen. Sampling from a non-representative population may produce profiles that are not generalizable. Omitting important factors in the assessment phase or aggregating data at an inappropriate level (e.g., not distinguishing between different types of extrinsic motivation) can lead to the development of profiles that are incomplete and may not provide the best representation of motivational sub-groups because of other outside or individual factors (biases) may be driving the differences in motivation. The most reliable and valid findings will stem from studies with large, representative samples that used appropriate statistical techniques and were guided by the collective evidence base (De Bourdeaudhuij & Van Oost, 1999, Wang & Biddle, 2001).

When applied appropriately, however, motivational profiling is useful for understanding exercise behavior because it provides a blue print of what motivates individuals to perform this behavior. Being able to characterize individuals' motivations and other psychosocial characteristics can assist in developing appropriate, individually-

tailored interventions to increase physical activity. For example, motivational profiles can provide clues to the selection of the right tools for tailoring physical activity programs. This tailoring can occur at multiple levels and to varying degrees. An intervention may be tailored for an individual (tailoring both based on personal characteristics and motivational characteristics) or a group of individuals (tailoring based on motivational characteristics of the group one "belongs" to). An example of a group-tailored intervention would be incorporating different intervention strategies based on different underlying physical activity motives. Amotivated individuals, for example, may require an education-based approach to increase the perceived benefits of physical activity and social persuasion (through peers or family support) to increase the normative beliefs related to physical activity. Depending on the structure and composition of different types of extrinsic motivation, individuals with low self-determined levels of motivation would require different intervention approaches. Such tailored interventions could then be delivered in person or remotely through technology such as internet or cell phones.

In spite of the promising potential utility of motivational profiling for intervention tailoring, it must be acknowledged that the majority of existing evidence is rather descriptive. That is, the majority of existing studies have used cross-sectional data and examined differences in motivational factors as they relate to differences in the levels of physical activity at the same point in time. As a result, we have little understanding of the exact causal mechanisms of how intrinsic and extrinsic motivation may determine physical activity levels. Matsumoto and Takenaka (2004) examined motivational profiles in relation to readiness for physical activity behavior change. They found that those individuals who had higher levels of extrinsic motivation and introjected motivation were

more likely to fall into the action stage compared to the self-determined group (high intrinsic and high identified) who were more likely to be in the maintenance stage. It is possible that similar behavioral and experiential processes that facilitate progression along the readiness continuum may co-determine changes in motivation.

Clearly, more research is needed to increase our understanding of the factors influencing motivation for physical activity. In order to increase this understanding, it must be recognized that no individual-focused process exist in isolation from the social context. That is, person-focused approaches to understanding physical activity motivation and behavior (such as SDT) will be insufficient to effectively explain physical activity behavior and must be paired with explanations that incorporate multilevel influences on behavior (King et al., 2002). Similarly, even the best individually-tailored intervention strategies will not be successful unless they take into account the social (and physical) context in which the health behavior (here physical activity) is being performed. Indeed, all prominent health behavior theories, including the SDT, emphasize the importance of considering the interactions between the person and the environment in determining behavior. In this interaction, the social environment plays a particularly important role and has a direct influence on individual motivation and ultimately behavior. During college years, in particular, peer influences are at the center of students' social environment.

Social Cognitive Theory and the Importance of Social Context

The Social Cognitive Theory (SCT) articulates perhaps the most explicitly the principle of person-environment interaction as the fundamental determinant of behavior. The SCT developed from the social learning theory established by Miller and Dollard

(1941) and has been brought into the mainstream of health behavior theories by Bandura (1986, 1997). In the SCT, the social environment is of particular interest as individuals' actions are seen as the result of both the actions of others and individuals' own cognitions (which are also influenced by the social environment). As Bandura states, "people's level of motivation, affective states, and actions are based more on what they believe than on what is objectively the case" (p. 2; Bandura, 1997).

Self-efficacy beliefs form the corner stone of the SCT and self-efficacy is the most consistent individual-level correlate of physical activity behavior across population subgroups (McAuley & Blissmer, 2000). Self-efficacy refers to a person's belief that he/she is capable of performing a behavior to attain a particular goal. An individual's level of self-efficacy is a result of a compilation of experiences with the greatest impact coming from past performances. If a person has been successful in the past, they are more likely to have a greater degree of self-efficacy in the future for performing that particular behavior. For example, an individual starting a new exercise program would have a high degree of self-efficacy in adhering to the program if he/she had successfully adhered to an exercise program in the past. Other factors that contribute to a person's self-efficacy are vicarious experiences, social persuasions, and the interpretation of somatic and affective states. As such, self-efficacy is clearly influenced by the social context. A person's level of self-efficacy has a strong influence on an individual's initial engagement in a particular behavior as well as the log-term maintenance of that behavior.

Self-efficacy has been continuously shown to have a large impact on physical activity across the lifespan. In one of the earlier studies examining the self-efficacy and physical activity relationship, Sallis (1989) surveyed over 2,000 individuals and

determined that self-efficacy was the strongest correlate of vigorous exercise. More recent studies have confirmed this positive relationship across age groups and ethnicities (Dishman, 1994; Dishman et al., 2004; Dishman, Dunn, Sallis, Vandenberg, & Pratt, 2010; Motl, Snook, McAuley, Scott, & Douglass, 2006; Wallace, Buckworth, Kirby, & Sherman, 2000). Furthering the established relationship between self-efficacy and physical activity, McAuley et al. conducted a series of studies, including longitudinal and experimental investigations, of the influence of self-efficacy on exercise adherence rates as well as long-term physical activity participation. They have shown in middle-aged as well as older adults (both healthy and chronically diseased) that intervention strategies based on self-efficacy enhancement produced higher adherence rates (McAuley, Courneya, Rudolph, & Lox, 1994; McAuley, Motl, et al., 2007) and that over a time period of as much as five years, self-efficacy predicts physical activity participation in older adults (McAuley, Morris, et al., 2007). In addition, they demonstrated that self-efficacy increases enjoyment of physical activity in adult as well as college-aged populations (Hu, Motl, McAuley, & Konopack, 2007; McAuley, Motl, et al., 2007).

In addition to self-efficacy, the SCT posits that different types of beliefs called outcome expectations influence behavior. Outcome expectations can be defined as the beliefs that particular actions will lead to a desired outcome (Bandura, 1986). Outcome expectations differ from self-efficacy because they refer to beliefs about desired outcomes of a behavior rather than whether or not the individual feels capable of performing this particular behavior. Outcome expectations have been consistently shown to be a strong determinant of physical activity behavior (Wilcox et al., 2006; Williams et al., 2005). Although self-efficacy is regarded as a more potent influence, at least one

study has suggested that outcomes expectations may be a stronger predictor of physical activity (Resnick, 1998), although it has been argued that the type of measure used may influence the strength of the relationship. The research remains mixed and there is little understanding of the relative importance of outcome expectations and self-efficacy in determining physical activity in the college environment. Williams et al. (2005) found that both young and older adults benefited from positive outcome expectations, but that the association with physical activity was stronger for older adults. In addition to age group differences, it is conceivable that the nature of the social environment one functions in can help explain the age-related differences in how different cognitive beliefs influence physical activity across the lifespan. That is, although it is possible that self-efficacy and outcome expectations have differential impact on physical activity simply as a function of age, it is more likely that changes in the social environment that accompany aging or other life transitions contribute to these differences. The social environments in which older adults and college-aged students function on a daily basis differ dramatically as do the types of social influences that take place in such environments. Additionally, it is possible that self-efficacy and outcome expectations take on varying levels of importance in impacting physical activity as a function of individual differences in motivations for physical activity and/or interacting with peers. Clearly, more research is needed integrating the individual and social correlates of physical activity. Studying these relationships in the college setting may illuminate some of these questions because of the uniqueness of the setting and the types of social influences it exerts on behavior, especially through peers.

Social Support and the Influence of Peers

Social support has been shown to influence individual's behavior with people deemed as important (family, friends, doctors, etc.) having the greatest impact. The positive influence of social support has been shown across a variety of behaviors including academics and healthy eating (Wentzel, 1998; Shaikh et al., 2008). In academics, Wentzel found that teachers, parents, and peers had unique roles in contributing to academic achievement. Teacher support was found to have an impact on class interest and school interest and parental support was positively associated with mastery orientations. Interestingly, in this study, peers had the most positive influence on pro-social goal support. In the case of healthy eating, Shaikh et al. (2008) conducted a meta-analysis on predictors of fruit and vegetable intake. They identified three main factors as predictors of fruit and vegetable intake – these were self-efficacy, social support, and knowledge. These results point to the idea that there is a connection between the person and their social environment that drives health and other behaviors. In this meta-analysis, from a personal level it was important for an individual to have an understanding of the importance of fruit and vegetable intake and also the belief that they can successfully incorporate fruits and vegetables into their diet. In addition, successful eating habits were attained when individuals had the support from their friends and family.

Several studies have also demonstrated that social factors such as social support play an important role in physical activity behaviors. Wallace et al. (2000) examined exercise behaviors among college students using the social cognitive theory. They administered a survey to more than 3,300 undergraduate students assessing physical

activity levels, the stage of change, and enrollment in physical activity classes. They found that over 52% of the students could be categorized as being inactive or irregular exercisers. Interestingly, they found that women were more influenced by family members while men were more impacted by the support from their peers, pointing at potential differences in the role that peer influences may play relative to physical activity behavior.

The effects of family/friend support has been further supported by Leslie et al. (1999) in which they surveyed a large group of Australian undergraduates. Unlike other studies, Leslie et al. examined a group of universities from different parts of Australia, two universities from an urban area and two universities in a more rural area. A survey assessing demographics, physical activity, social support, self-efficacy, exercise-related enjoyment, and on-campus facilities was administered to the students. Students were categorized into two groups --either sufficiently or insufficiently active based on their self reported physical activity over the past two weeks. The analysis revealed that physical activity levels of males and females were impacted equally by social support and those individuals who had high social support were more likely to have higher levels of physical activity. However, they found that males with low friend support were 45% more likely to fall into the insufficiently active group compared to females who were 23% more likely to be in the insufficient group. In addition, they found that those individuals who were in the insufficient activity category rated only 4 activities as enjoyable as compared to 12 activities rated as enjoyable by the sufficiently active group.

As these studies have shown, social support is a major influence on an individual's behavior. People tend to listen and follow the advice of those people they

consider important. In college, peer influence may be particularly important because there is usually geographical separation from family members and many new personal relationships are formed. This distance and the desire that people have to be accepted by others makes peers an important influence on behavior in general and physical activity in particular.

In spite of the growing research in the area of physical activity and social support, progress in this research domain has been somewhat hindered by the slow development of valid measurement tools of social support and peer influences more specifically. This lack of validated assessment tools can be contributed partially to the inconsistencies in how social support and peer influence have been conceptualized and operationally defined but also to the fact that social influences on physical activity behavior in young adults have been generally understudied.

Social support has been used as an umbrella term and represents a wide range of concepts including (a) belonging, bonding, and binding; (b) attributes that characterize groups, relationships, and/or people, and, (c) interpersonal processes that are social, behavioral, and/or affective in nature (Carron et al., 2003; Vaux, 1988). In general, social support can be defined as assistance by those individuals (family, friends, co-workers, etc.) that are part of a person's social network. This assistance can come in various forms including informational and emotional. No consistent definition of peer influence exists in the literature and the construct has been conceptualized in a variety of ways. Some have defined peer influence very generally, viewing peer influence as the influence that friends and peers have on an individual's behavior without a clear understanding of how such a construct should be operationally defined and measured. Others have approached

peer influence more narrowly, operationally defining it as a special form of social support. For example, Wallace et al. (2000) assessed peer influences using the Social Support and Exercise Survey, simply defining it as the support provided by friends for engaging in exercise, such as actually engaging in exercise with a friend or the friend providing encouragement to exercise. In other studies, peer influence represents the influence of important others outside of the family circle on physical activity (Carron et al., 1996; Hausenblas et al., 1997).

Although defining peer influence narrowly as social support provided by important others outside of the family circle could be viewed as advantageous because it can be rather easily assessed, this approach is limiting as it does not adequately capture the variety of ways in which one's peers may influence an individual's behavior. That is, whereas it is true that tangential support provided by peers (for example in the form of verbally encouraging a friend to exercise) may facilitate physical activity behavior, it is only one of many ways in which peers exercise the power to impact their friends' behavior. In addition to providing instrumental and emotional support for physical activity, peers can influence each other's behavior vicariously by modeling or attitudinally by influencing each other's belief systems (such as contributing to the creation of normative beliefs or shaping outcome expectations). In 2008, Salvy et al. described peer influence as the presence of the peer in the room compared to being alone in their study of physical activity in overweight and lean boys and girls. In another study, Finnerty et al. (2009) measured peer influence with a questionnaire adapted from Sallis et al.'s validated Social Support and Eating Habits/Exercise Survey which contained questions relating to both physical activity and dietary intake and the effect of peers on

these behaviors. For example, some questions that pertained to the physical activity domain were: 1) During the past three months, my friends participated in physical activity or exercise with me and 2) During the past three months, my friends criticized me or made fun of me for being physically active or exercising. In another study, Anderssen and Wold (1992) in their study of young adolescents' leisure-time physical activity habits, assessed peer influences as a function of three factors: 1) the physical activity habits of best friends, 2) perceived best friend's direct support, and 3) the value best friend's placed on physical activity. Based on the previous peer social support literature and the precedence from the Finnerty et al. (2009) and Andersen and Wold (1992) studies, in this study, social support is defined as the instrumental and emotional support for performing physical activity that individuals receive from their entire social network, whereas peer influence is operationally defined as encompassing two main types of influences including the instrumental and emotional support provided by close friends and roommates for engaging in physical activity and modeling of physical activity behavior as a function of their friends' and roommates' physical activity participation.

Whereas several validated measures of different types of social support (including exercise social support) exist for use in adults and older adults, there are few valid measures focusing on the assessment of peer influences in particular. The Social Support and Exercise Survey (Sallis et al., 1987) is a validated 10 item social support scale that measures the support from both family and friends, individually. The scale is designed to have people recall how much support they have received from family and friends over a three-month period. A sample item is "How often have family members offered to be physically active with you". After each item, the participant is to rate both family and

friends using a five-point scale with anchors of (1) never to (5) very often with an additional option (8) does not apply.

Recently, Gruber (2008) developed a questionnaire to better understand the relationship between the influence of friends and peers on eating habits and physical activity. The 50-item questionnaire, FPS-HEPAS, was drawn from multiple validated questionnaires, such as the Social Support and Exercise Survey (Treiber et al., 1991) and the Social Influence on Physical Activity Questionnaire (Chogahara, 1999). The questionnaire was sampled on over 400 undergraduate students (201 males and 219 females) at a predominantly African-American university. The results provided evidence that there is a reverse relationship in regards to positive friend/peer support for men and women. Women tended to feel more encouraged to exercise when their peer group consisted of predominantly men whereas men felt more encouragement when their peer group was made up of more women. Despite the targeting of college students, FPS-HEPAS has not been validated outside of the initial study and because of it substantial length (50 items) it may be of limited use in studies surveying several physical activity correlates. The lack of valid measure of peer influences represents a conundrum for researchers interested in assessing this construct. Until valid and reliable measures exist, researchers may have to resort to alternative ways of assessing this construct and when possible take advantage of statistical approaches such as structural equation modeling that allows for the construction of latent variables based on several indirect indicator measures of the peer influence construct.

Motivational Profiles, Peer Influences, and Physical Activity: Important Caveats

The reviewed literature demonstrated the need to increase our understanding of physical activity behavior in college-aged students who are at increased risk for reducing physical activity as a result of the transition from high school to college. The existing evidence provides important insight to our understanding of what factors may impact physical activity participation with individual motivation at the core. However, it has been emphasized that an approach resting solely on individual-level characteristics to the exclusion of the social environment is unlikely to be successful. It has been argued that the influence of peers may be the most potent aspect of the social environment when it comes to college years and that these influences could be harnessed to make positive changes in physical activity behavior (Okun, Karloy, & Lutz, 2002). Before the rationale for the present study is summarized, there are three potential caveats that should be noted to assist with placing the reviewed literature and the present study into a larger context: (1) potential negative influence of peers, (2) gender and (3) weight status differences.

1. It is important to note that peer influence can have a positive, as well as, a negative influence on behavior. For example, in the area of alcohol abuse, it has been demonstrated that those individuals who associate themselves with drinking peers are more likely to drink themselves (Brosari & Carey, 2001, 2006). In their systematic review, Borsari and Carey (2001) found that peers influence drinking behavior both directly and indirectly. Direct influences were those in which peers offered drinks to others and indirect influences consisted of modeling and descriptive norms. Later Brosari & Carey (2006) also found that individuals engage in more drinking when they feel excluded, when they lack strong relationships, or when drinking is an integral part of

their peer relationship. In the physical activity domain, this negative impact could occur when individuals associate themselves with less active or sedentary peers. This may be especially true when these individuals strive for acceptance from their peers. Sedentary or insufficiently active peers could model inactive behaviors as well as negatively impact individual's outcome expectations associated with physical activity and perceived self-efficacy, both of which could reduce physical activity engagement over time.

2. It has been well-established that men are more physically active than women (CDC, 2008) and this gender gap has been observed among college students (McArthur & Raedeke, 2009). The nature of this disparity is unclear but may reflect among other factors social influences (including the influence of peers). Additionally, at least one study (Frederick et al., 1996) reported gender differences in motivation and exercise behavior such that extrinsic motivation predicted adherence only in men, whereas intrinsic motivation predicted satisfaction and competence for both males and females. Any studies should thus consider the potential influence of gender on physical activity levels as well as on motivational and peer factors.

3. In addition to differences in gender, levels of physical activity have been found to differ between individuals of varying weight status (Davis et al., 2006; Deforche, De Bourdeaudhuij, & Tanghe, 2006). Davis and colleagues (2006) found that overweight and obese individuals were less active than normal weight individuals. Specifically, through the use of accelerometry, they found that normal weight individuals engaged in 21 minutes more of moderate or vigorous activity per day and also a total of around 60 more activity counts per minute than their overweight/obese counterparts. Deforche et al. (2006) examined sports participation and leisure time physical activity in normal weight,

overweight, and obese adolescents. The results showed that normal weight adolescents engage in more sports than overweight and obese individuals; however there was no significant difference in leisure time physical activity. The reasons for these differences are likely complex and it is unclear whether overweight or obese weight status leads to lower physical activity or more inactivity, or whether it is solely that low physical activity (or high inactivity) contributes to overweight and obesity. The relationship between physical activity and weight status remains controversial (Deforche et al., 2006), although a bidirectional relationship between physical inactivity and weight status has been demonstrated in some studies (Williamson et al., 1993; Petersen, Schnohr, & Sorensen, 2004). Thus, it can be expected that weight status differences may exist in the psychosocial correlates of physical activity, including motivation and peer influences.

Summary of the Reviewed Literature and the Present Study

Social context plays a central role in the SDT as originally proposed by Deci and Ryan (Deci & Ryan, 1985, 2000), yet physical activity research on motivation remains biased toward studying motivation as an individual level characteristic with little consideration for social contextual factors that shape individual's motivation for engaging in physical activity. Physical activity studies rooted in the SDT have examined motivation from the perspective of motivational profiles. The underlying rationale for these studies is based in the notion that identifying "optimal" motivations for engaging in physical activity (i.e., profiles that foster physical activity) would allow interventionists to capitalize on individual motivational differences through tailoring of intervention strategies. Studies show that the traditional self-determined profile has the most positive physical activity outcomes; however, the additive effect of higher levels of extrinsic

motivation may also result in activity engagement. Surprisingly, how social factors such as peer influences relate to these motivational clusters and physical activity has not been studied intensely. Peer influences may exert different levels of influence on physical activity depending on particular motivational profiles. The influence may be more pronounced or effects may be more positive for individuals with certain profiles, whereas for others peer influences may have little impact, a negative effect or no effect at all. Additionally, these effects may largely occur as a function of potentially mediating variables such as individual's self-efficacy or outcome expectations. For example, for individuals with a mixed (both intrinsic and extrinsic motivation) profile (Cluster 1 in the Vlachopoulos et al. (2000) study), peer influence would be expected to have little impact or be of little to no importance for physical activity engagement given the very high intrinsic motivation and high introjected regulation motives (i.e., these individuals are likely to perform activity on their own regardless of their peers because they enjoy the activity and/or gain outcomes from it that are desirable and personally meaningful). These individuals would also be expected to have high self-efficacy and positive outcome expectations associated with physical activity. For individuals with a traditional self-determined profile (Cluster 2 in Vlachopoulos et al. (2000) study) peer influence would likely have even less impact than the mixed profile because they are high on intrinsic motivation and below the mean on extrinsic motivation (integrated regulation, introjected regulation and extrinsic regulation) and amotivation. Finally, for the moderate profile (Cluster 3 in the Vlachopoulos et al. (2000) study) peer influence would likely have the most impact on physical activity, either positive or negative depending on their peers. These individuals are a blend of the two previous profiles, that is, they have a moderate

amount of both extrinsic and intrinsic motivation. They score in the moderate range on all factors except amotivation which is well below the mean. Thus, external reasons for participating in physical activity would play a more vital role. If surrounded by active peers, for example, these individuals would want to be more active to possibly avoid shame or simply to fit in with their peers. The complexity of these different motivations and how peers can influence them leading to different behavioral choices (e.g., engaging in physical activity) informed the design of the current study.

The primary purpose of the present study is to examine the relationship between peer influences and physical activity in college-aged students and whether this relationship is direct, indirect (mediated by self-efficacy and outcome expectations), and/or determined by differences in motivation. Better understanding of motivational profiles of college students and the role that peer influences play in influencing physical activity behavior in this population would provide useful information for appropriate tailoring of physical activity interventions in the college setting. This study is novel in that it integrates two important areas of physical activity research, the self-determination theory (which has been primarily applied to study individual motivation) and the social cognitive theory (which emphasizes the role of social environment in shaping individual's beliefs and perceptions) with respect to understanding the role of peer influence in physical activity behavior. More specifically, in this study, peer influence is conceptualized as consisting of both the traditional social support (informational, instrumental, tangible, and emotional) provided by peers as well as incorporating a modeling of behavior by peers that may impact an individual's behavior.

This study objective is three-fold. First, to examine the relationship between peer influences and physical activity in college-aged students and evaluate the role that outcome expectations and self-efficacy play in this relationship. Previous research has shown that peers can influence individual's health behaviors both positively and negatively (Gruber, 2008; Brosari & Carey, 2001, 2006), and that peers exert their influence both directly as well as indirectly by shaping individual's beliefs or self-perceptions (Dishman et al., 2004; Brosari & Carey, 2001). Thus, it is hypothesized that peer influences will be associated with physical activity indirectly, through the mediation of self-efficacy and outcome expectations, after accounting for differences that may be due to demographic factors such as age, gender, and body mass index.

Second, the proposed research will examine different motivational profiles for physical activity in college-aged students. Previous research has demonstrated considerable individual differences in motivation for physical activity and subsequent research on motivational profiling has sought to identify the most consistent and replicable motivational sub-types (Vlacopoulos et al., 2000; Ntoumanis, 2002; Biddle & Wang, 2003). It is expected that this study will arrive at motivational profiles similar to the Vlachopoulos et al. (2000) study where three main sub-types emerged: a self-determined group (high on intrinsic motivation and identified regulation), a moderate group (balanced intrinsic and extrinsic motivation, but low on amotivation), and an amotivated group.

Third, the study will determine whether the relationship between peer influence and physical activity in college students varies based on different motivational profiles. Specifically, the proposed mediated model will be examined within each motivational

profile. Previous research has demonstrated that different groups of individuals are affected uniquely by social factors (Wallace et al., 2000; Salvy et al., 2008) and that peer influence can have a mediating effect on extrinsic motivation and drinking behavior (Knee & Neighbors, 2002). It is hypothesized that the pattern and strength of associations between peer influence and physical activity will be stronger for motivational clusters that have higher levels of introjected and external regulation, such that peer influence will be more strongly associated with physical activity in individuals with a moderate profile compared to self-determined and amotivated profiles but that the proposed meditational model of peer influence on physical activity through self-efficacy and outcome expectations will generally hold regardless of differences in motivation.

Chapter 3

Method

Study Design

This study utilizes a cross-sectional internet survey to examine the relationship between peer influences and physical activity in college-aged students.

Participants

One-thousand one-hundred and thirteen Pennsylvania State University (PSU) undergraduate students accessed the cross-sectional online survey. Eight-hundred and seventeen individuals completed at least 50% of the survey, seven-hundred and ninety-one completed 67%, and seven-hundred and eighty-four completed the entire survey. Where the selected statistical approach allowed, data from all participants were used regardless of missing responses. After reviewing the responses, 3 individuals were removed from the analysis because they were older than the age inclusion criterion. Only those individuals that were Pennsylvania State University (PSU) University Park campus undergraduate students between the ages of 18-25 were eligible to participate. The participants were recruited through e-mails and listservs between July and August 2009. No compensation for completing the study was offered however each person who completed the survey was entered into a drawing to win one of twenty $25 shopping gift cards.

Procedure

An online survey was administered to PSU undergraduates attending the University Park campus on the internet over the course of a month according to the protocol approved by the Pennsylvania State University Office of Research Protection. The commercially available survey website Survey Monkey was used to administer the survey. Informed consent was provided on the second page of the online survey after the eligibility screening question. Survey length and other details related to the current study were addressed on the informed consent page. In accordance with the recommendations for online survey research included in the Checklist for Reporting Results of Internet E-Surveys (CHERRIES, Eysenbach, 2004), the following procedures were utilized: (1) SSL encryption to protect the data; (2) open survey to allow all who go to the site to access the survey; (3) a progress bar to let participants know how much of the survey they have completed; (4) voluntary survey set up to allow visitors the choice of exiting the site without filling the survey; (5) response rates indicator for the investigator to examine completeness of surveys and the number of views; and (6) checking of IP addresses, e-mail addresses, and duplicate or suspicious responses to make sure the same individuals were not completing the survey more than once.

Measures

The survey consisted of a total of 153 questions that address various aspects of motivation, physical activity, peer influence, and social cognitive determinants. In addition, select demographic questions were included to characterize the sample. The final survey consisted of a total of 19 pages in which 14 of the pages contained the actual survey questions.

Demographics and other background information. Basic demographic information located on page 16 of the survey (i.e., the last page that solicits study data from participants) solicited information about age, sex, height, weight, ethnicity, racial background, year in school, and capability to perform normal physical activity.

Physical activity. Two physical activity instruments were used. The Godin Leisure-Time Exercise Questionnaire (LTEQ, Godin & Shepherd, 1985) comprises 2 questions about exercise. The first question is broken into 3 parts (strenuous exercise, moderate exercise, and mild exercise) and asks the participant to answer, on average, how many times per week he/she engages in these types of activities for at least 15 minutes during his/her free time. The last question asks the participant again to consider a 7 day period and answer how often they engage in any regular activity during their free time that makes them sweat. The total score is computed by multiplying weekly physical activity with intensity scores (9 METs for strenuous, 5 METs for moderate, and 3 METs for mild) resulting in a total score which is expressed in total METs. The LTEQ has been used widely to assess physical activity and has been shown to be both valid and reliable across population subgroups, including college students (Rauh et al., 1992; Sallis et al., 1993; Farmanbar, Niknami, Heydarnia, Hajizadeh, & Lubans, 2009).

The Aerobics Center Longitudinal Study Physical Activity Questionnaire (ACLS-PAQ; Kohl et al., 1988) consists of two parts. The first part is comprised of a list of 14 moderate to vigorous activities that the subject will answer yes or no to depending on whether or not they engage in the particular activity on a regular basis. For any yes response, the participant then is asked to estimate the amount of activity they engage in,

including duration and frequency. In this study, two items were removed (household activities and lawn work and gardening) due to the target population being comprised of college students and the primary interest in leisure-time physical activity. The responses are converted to estimates of energy expenditure (MET hours per week) and summed across all activities. Kohl et al. (1988) demonstrated that ACLS-PAQ is a valid and reliable measure of physical activity and the measure has been used in samples ranging from older to college-aged adults (Stofan et al., 1998; DiPietro et al., 2004). In the present study, both the LTEQ and ACLS total MET equivalents were used as indicator measures to construct a latent physical activity variable using structural equation modeling. In this approach, a measurement model is fit to the data using confirmatory factor analysis procedures to verify the existence of an underlying latent physical activity factor. Subsequently, this latent factor (from here on referred to simply "physical activity") is used in the test of the hypothesized structural models (i.e., direct versus indirect models described in more detail in the Data Analysis section).

Motivation. The Behavioral Regulation in Exercise Questionnaire-2 (BREQ-2; Markland & Tobin, 2004) is a 19-item scale that is an extension of the BREQ (Mullan et al., 1997) which was developed to assess self-regulation in exercise consistent with SDT. The original BREQ contained 4 subscales that measured intrinsic, identified, introjected, and external regulation. The BREQ-2 added another subscale by addressing amotivation. Sample items of the measure include "I exercise because other people say I should" and "I don't see why I should have to exercise". Each item is rated on a five-point scale anchored by (0) 'Not true of me' and (4) 'Very true of me'. The BREQ-2 is a valid and reliable measure of motivation for college-aged, middle-aged, as well as older adults

(Markland & Tobin, 2004; Wilson & Rodgers, 2004). Cronbach's alphas for the Markland & Tobin study ranged from .73-.86 for the five scales and for the Wilson & Roger's study the alphas ranged from .79-.87. In the present, study Cronbach's alphas ranged from .80-.90.

Other physical activity correlates. The Outcome Expectations for Exercise Scale (OEE; Resnick et al., 2000) is a 9-item scale developed to gauge individuals' outcome expectations for exercise. A sample item of the scale is "Exercise makes me feel better physically". Each item is rated on a five-point scale anchored by (1) 'strongly agree' to (5) 'strongly disagree'. Studies have shown the OEE to be both reliable and valid in older adults of various racial backgrounds (Harnirattisai & Johnson, 2005; Resnick et al., 2001). Although the measure has not been validated in college students per se, it has been used in younger samples and the examination of the item content of the measure suggests that it is suitable for college students. The internal consistencies of the OEE were .70 and .89 in previous studies (Harnirattisai & Johnson, 2005; Resnick et al., 2001). Cronbach's alpha for the current study was .89.

The Exercise Self-efficacy Scale (EXSE, McAuley, 1993) is a 6 question scale developed to assess a person's beliefs about their ability to continue exercising regularly (3 or more times per week for at least 30 minutes) from 2 weeks up to 12 weeks. An example of an item is "I am able to continue exercising for at least 3 times per week at moderate intensity for 30+ minutes without quitting for the NEXT 2 WEEKS." Each statement is rated on scale ranging from 0% confident to 100% confident, with 10% increments in between. The EXSE has good reliability and validity and has been used

with samples of older, middle-aged, and young adults (McAuley et al., 2003; Motl et al., 2006). Cronbach's alpha for this study was .97.

Peer Influence and Social Support

To assess the construct of peer influence several measures were utilized. The Social Support for Exercise Survey (SSES, Sallis et al., 1987) is a 13-item scale developed to measure support from family members and friends on exercise over the past 3 months. In the current study, 10 of the 13 items were used to measure social support for exercise. The 3 items referring to family rewards and punishment were omitted, due to the nature of the study and its aim to address peer influence. Sample items of the survey include "During the past 3 months, my family or friends exercised with me" and "During the past 3 months, my family or friends offered to exercise with me." Each item is rated on a five point scale anchored by (1) 'none' to (5) 'very often'. In addition, there is the option of does not apply. In the present study, Cronbach's alphas were .94 and .93 for the friend and family social support scales, respectively.

To construct a measure of peer influence, the friends subscale score of the SSES was used along with two additional questions asked separately for close friends and roommates. These questions asked about the size of the students' peer network ("How many close friends/roommates do you have?") and their peers' physical activity levels ("How many of your close friends/roommates engage in leisure time physical activity on a regular basis (3 or more days a week of at least 30 minutes of activity)?"). The responses were averaged across close friends and roommates and an overall score (PEER score) was obtained by dividing the physical activity level score by size of peer network.

The two resulting indicator measures (friends SSES and PEER score) were used as indicator measures to construct a latent peer influence variable (from here on referred to as "peer influence") using confirmatory factor analysis within a structural equation modeling (SEM) framework. As described above, in SEM a measurement model specifies a latent variable based on indicator measures and CFA procedures. Subsequently, a structural model is tested using the newly constructed latent variables. This statistical approach offers numerous advantages when compared to more "traditional" approaches where direct raw scores are used. First and foremost, incorporating multiple indicators for the same construct (i.e., LTEQ and ACLS for "physical activity" and SSES and PEER for "peer influences"), minimizes measurement error because the variance and covariance matrices are used to model error terms. Additionally, the SEM approach allows for more robust interpretations in the face of multicollinearity, it can handle non-normal and incomplete data, and allows for testing models overall rather than coefficients individually (as would be the case in a linear regression approach). Moreover, multiple dependent variables can be modeled at the same time allowing for modeling of mediating variables without being restricted to an additive model (such as in regression where the dependent is a function of the variable 1 effect plus variable 2 effect plus variable 3 effect, etc.). Another important advantage of the SEM approach (as compared to a regression approach) is the ability to assess alternative models using relative model fit indices to determine the best fitting model. In the process of model testing using SEM, goodness-of-fit tests are used to determine if the pattern of variances and covariances in the data is consistent with a structural (path) model specified by the researcher. Notably, the possibility exists that other unexamined

models may fit the data as well as the tested models or better. That is, the accepted model is only a non-disconfirmed model, highlighting the need for theory-based model development. Further details of the SEM approach used in this study are outlined within the *Data Analysis* section.

The Short Form C of the Marlowe-Crowne Social Desirability Scale (Reynolds, 1982) was administered to assess social desirability. The Short Form C is being used to determine whether individuals are responding honestly or in a manner that presents them in a more favorable manner. The current scale is a modified form of the original 33 item Marlowe-Crowne scale. It was developed as a brief version of the Marlowe-Crowne scale to measure the effect of social desirability on response bias in self-report studies. A sample item in the scale is "It is sometimes hard for me to go on with my work if I am not encouraged." After each item, the respondent either puts True or False. Internal consistency of the Short Form C has been considered acceptable, ranging from .68 to .89 across studies (Barger, 2002; Fischer & Fick, 1993; Reynolds, 1982). The internal consistency of the scale in this study was acceptable (Cornbach's $\alpha = .67$). All analyses were adjusted for social desirability.

Data Analysis

The data were analyzed in a series of steps using the Statistical Package for the Social Sciences (SPSS) computer version 16.0 and Mplus Version 5.1 statistical software (Muthen & Muthen, 2007).

Quality control and data checking. Data were downloaded directly from the internet and checked for missing data and erroneous data by examining descriptive

statistics and score ranges of all variables. Subsequently, all data were examined for violation of basic statistical assumptions (i.e., normality, multicollinearity, and homoscedascity). To assess these assumptions, the distribution of the physical activity (LTEQ, ACLS), self-efficacy, outcome expectations, and peer influence (SSES, PEER) data was examined. After removing outliers (> 2 *SD*), the kurtosis and skewness statistics were within the recommended ± 2 value across all variables, indicating that the data adequately resembled normal distribution. The plot of residuals for all key variables indicated independence of variances, thus satisfying the homoscedascity assumption.

Identification of systematic differences. To examine whether significant differences exist in main outcome variables (physical activity, peer influence, self-efficacy, and outcome expectations) based on demographic (gender, age, race/ethnicity) characteristics, independent sample t-tests, $\chi 2$ tests (in the case of categorical variables), and one-way Univariate (ANOVA) or Multivariate Analyses of Variance (MANOVA) were conducted. Variables on which dependent outcomes were found to differ significantly were used as covariates in subsequent analyses. To examine the nature of missing data (i.e., missing at random, partially at random, or non-random), similar analyses were performed to identify potential significant differences in demographic and health variables between those who completed the entire survey and those who dropped out prior to survey completion.

Specific Aim 1:

The relationship between peer influences and physical activity was tested within the structural equation modeling (SEM) framework using the Mplus 5.1 statistical software (Muthen & Muthen, 1998-2007). This statistical modeling program uses general latent

modeling framework that accommodates both continuous and categorical latent variables. It is particularly suitable for this study as it allows for the analysis of cross-sectional data using a combination of latent and observed variables and accommodates modeling with missing data (for illustrative purposes, observed variables are typically depicted in rectangles and latent variables in circles). Because of the time-dependent nature of mediated relationships (i.e., causal factor needs to precede intermediate factor which needs to precede the outcome), mediation cannot be determined from cross-sectional data (Maxwell & Cole, 2007). However, using cross-sectional data is acceptable when the goal of mediation analysis involves "proof of concept" testing of a new hypothesis such as in this study. The limitations of cross-sectional data for mediation analysis and proper interpretation of the results are discussed in more detail in the Discussion section.

The pattern of missing responses was as follows: 22.8% for peer (roommates), 23.9% for peer (close friends), 15.4% for exercise self-efficacy, 24.7% for outcome expectations, 26.1% for BREQ-2, 27.2% for SSES (family), 27.8% for (friend), 13.8% for LTEQ, and 29.9% for ACLS. The examination of the pattern of missing data indicated that the data may be missing partially at random. The majority of missing data appeared to be at random for different parts of the questionnaires but some individuals (16 %) began the survey and stopped shortly into it which resulted in some of the later questions being omitted. Full-information maximum likelihood with Huber-White covariance adjustment, (FIMLR) estimator in Mplus 5.1 was used to handle missing data, which is an optimal method for the treatment of missing data in SEM and gives robustness in presence of non-normality and non-independence of observation such as in the case of data missing partially at random (Arbuckle, 1996; Enders, 2001; Enders & Bandalos, 2001). The

full information estimator uses all of the information of the observed data to estimate mean and variance for the missing portions of a variable given the observed portion(s) of other variables (Wothke, 1998).

Subsequent testing of the hypothesized models within the SEM framework is essentially conducted in two steps, although in Mplus both proceed simultaneously. First, a measurement model is specified and tested for fit using confirmatory factor analysis. In this study, the overall measurement model comprised of two correlated latent variables peer influence and physical activity which were each measured by two continuous factor indicators (SSES and PEER score for peer influence; LTEQ and ACLS for physical activity). Second, a structural model is tested. The structural model describes three types of relationships in one set of multivariate regression equations: the relationships among factors (i.e., peer influence and physical activity), the relationships among observed variables (e.g., LTEQ and ACLS), and the relationships between factors and observed variables that are not factor indicators (e.g., a relationship between peer influence and self-efficacy).

In this study, we compared two hypothesized models. In Model 1 (direct effects model), the structural model specified direct effects of peer influence, self-efficacy, and outcome expectations on physical activity. In Model 2 (indirect effects model), the structural model specified (a) direct effects of peer influence on exercise self-efficacy and outcome expectations but not on physical activity; and (b) direct effects of self-efficacy and outcome expectations (which were allowed to co-vary) on physical activity. Both models were also subsequently tested adjusting for relevant covariates.

Model-data fit was assessed using standard indices: the chi-square statistic (Kessler & Greenberg, 1981); the standardized root mean square residual (SRMR, which should approximate or be less than .08 for a good fitting model) (Bollen, 1989; Hu & Bentler, 1999); the root mean square error of approximation (RMSEA, with values approximating .06 or less being indicative of a close fit) (Browne & Cudeck, 1993); comparative fit index (CFI, which should approximate or be .95 or better for a good fitting model) (Bentler, 1990; Hu & Bentler, 1999). All path coefficients and correlations are reported as standardized estimates.

Specific Aim 2:

Confirmatory or k-means cluster analysis was performed to create groups based on BREQ-2 scores (amotivation, extrinsic regulation, introjected regulation, identified regulation, and intrinsic regulation). In previous research, two types of cluster analyses, hierarchical and partitioning, have been used commonly to create groups (Aldenderfer & Bashfield, 1984). The first is the exploratory analysis which creates clusters by sorting individuals into groups based solely on their selected scores. This method can lead to the development of numerous groups. The latter, the confirmatory analysis, creates a select number of groups based on a number provided by the investigator. Recently, a two-stage cluster analysis has been used when different constructs are being combined together to form groups (Hair et al., 1998). For the current study, a confirmatory cluster analysis was used to create the groups on the basis of the BREQ-2 scores. Based on previous research on motivational profiles, it was expected that three clusters would be sufficient to classify individuals into clusters based on the BREQ-2 scores so that individuals within clusters are similar in some respect and unlike those from other clusters.

Confirmatory analysis is generally preferred over an exploratory approach when conducting confirmatory analysis of theory-based or previously existing findings (which is the case for motivational profiles). Group differences in all main outcomes across the clusters were then analyzed using a series of one-way univariate (ANOVAs) and multivariate analyses of variance (MANOVAs).

Specific Aim 3:

To assess whether the relationship between peer influence and physical activity varies by motivational profile, first, bivariate correlations among all measures were computed within each motivational cluster group. The direction and strength of the associations were then compared. Subsequently, the SEM analysis outlined in hypothesis 1 was repeated within each motivational cluster category using a multiple group analysis option in Mplus. This option tests the fit of the hypothesized model within each specified sub-group (i.e., motivational profile). Changes in the strength and direction of observed relationships were then examined across the three clusters.

Chapter 4

Results

Sample Description

The age range of the computed sample (N = 817) was from 18-25 years. Descriptive information for the total sample is presented in Table 1. As can be seen, the sample was mainly white, non-Hispanic, and female, with representation across different number of years in college. There were significant differences by gender for physical activity (across both measures: LTEQ and ACLS) and self-efficacy. Men had significantly higher levels of self-efficacy (t = 2.243, df = 781, p < .05), ACLS (t = 2.343, df = 750, p < .05) and LTEQ (t = 10.295, df = 755, p < .001) compared to women. Age was not significantly associated with any of the main variables except for the LTEQ with a correlation value of r (751) = -.134, p <.001. Additionally, there were significant differences by BMI status for LTEQ, F (3,721) = 3.386, p < .05, and self-efficacy, F (3,763) = 5.039, p < .01. Normal weight individuals had significantly higher LTEQ scores than obese individuals. For self-efficacy, both normal weight and overweight individuals had higher levels than obese individuals. Self-efficacy, F (4,766) = 6.648, p < .01, and LTEQ, F (4,740) = 3.240, p < .05, varied significantly across racial categories with Non-Hispanic White individuals having significantly higher levels than African-Americans and Asians. However, interpretation of these differences is hindered by the low numbers of individuals in varying BMI categories, racial, and ethnic categories.

Covariates

The unequal distribution of the sample by gender and weight status did not allow for testing of the direct and indirect models for each gender or weight status category. Thus, gender and BMI were considered as covariates. To account for the additional observed associations with age, all subsequent analyses have been adjusted for gender, age, and BMI. Two additional correlates were included in the analysis of direct and indirect models, social desirability and family social support to arrive at conservative estimates in the model testing. All models were also initially tested adjusting for race and ethnicity; however, these adjustments had no impact on the direction or magnitude of the relationships under investigation. Therefore, the results are reported only for analyses with adjustment for gender, age, BMI, social desirability and family social support.

TABLE 1

Demographic Statistics for the Total Sample

	N	*%*
Gender		
Male	173	22.2
Female	607	77.8
Ethnicity		
Hispanic or Latino	19	2.4
Non-Hispanic or Latino	757	97.6
Race		
American Indian or Alaskan Native	2	.3
Asian	40	5.2
Black or African American	28	3.6
Native Hawaiian or other Pacific Islander	2	.3
White	699	90.7
Year in School		
1st	44	5.6
2nd	144	18.5
3rd	228	29.2
4th	307	39.4
5th+	57	7.3
	Mean	(*SD*)
Age	20.28	(1.19)
Height	65.69	(4.85)
Weight	144.46	(29.63)
BMI	23.36	(3.91)

Direct versus Mediated Modeling

Hypothesis 1. Self-efficacy and outcome expectations will mediate the relationship between peer influence and physical activity.

To address hypothesis 1, structural equation modeling (SEM) was performed using the Mplus statistical software. First, confirmatory analysis was used to arrive at two

latent variables, physical activity and peer influence. Subsequently, a structural equation model was tested comparing the direct and indirect models described in the Data Analysis section. In Mplus, these two analytical steps are performed simultaneously. The two-factor measurement model provided a good fit to the data ($\chi^2 = 0.752$, $df = 1$, $p = 0.3858$, CFI = 1.000, RMSEA = 0.000, SRMR = 0.008). The correlation between the two latent variables was statistically significant and moderate to large in magnitude ($\beta = 0.749$, $p < .001$).

The SEM analysis for the direct model (hypothesizing direct paths from exercise self-efficacy (EXSE), outcome expectations (OEE), and peer influence on physical activity) represented an acceptably fitting model ($\chi^2 = 16.242$, $df = 5$, $p = 0.0062$, CFI = 0.935, RMSEA = 0.048, SRMR = 0.025). Although the chi-square statistic was statistically significant, two of the three fit statistics were indicative of a good fit to the data (i.e., SRMR < .08, RSMEA < .06). In this direct model, peer influence ($\beta = 0.533$, $p < .001$) and exercise self-efficacy ($\beta = 0.212$, $p < .001$) were significantly and uniquely associated with physical activity. The association between physical activity on outcome expectations was non-significant ($\beta = 0.114$, $p = .312$). Exercise self-efficacy, outcome expectations and peer influence were all significantly correlated with correlation coefficients ranging from 0.38 – 0.54 ($p < .001$). The model accounted for 51.3% of the variance in physical activity.

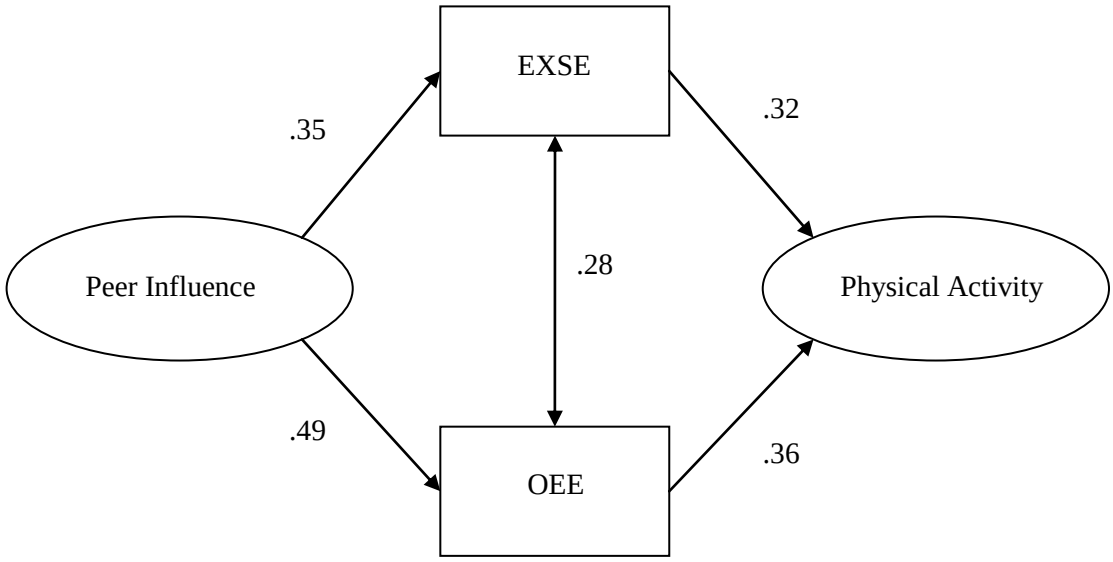
Subsequently, the direct model was analyzed adjusting for age, sex, BMI, family social support, and social desirability. The fit of the model decreased somewhat ($\chi^2 = 60.047$, $df = 15$, $p = 0.000$, CFI = 0.881, RMSEA = 0.056, SRMR = 0.031), with two of

the three fit indices still satisfying the criteria of an acceptable fit and with minimal changes to the strength and direction of the hypothesized relationships. Specifically, in the adjusted model, physical activity was significantly associated with peer influence (β = 0.437, $p < .01$), exercise self-efficacy (β = 0.164, $p < .01$), and outcome expectations (β = 0.162, $p < .05$). Age and sex significantly co-varied with physical activity (βs = -0.128 and -0.391, $p < .01$, for age and sex respectively). Peer influence was significantly associated with sex (β = -0.123, $p < .01$), family social support (β = 0.512, $p < .001$), and social desirability (β = 0.132, $p < .01$). Exercise self-efficacy was significantly associated with sex (β = -0.080, $p < .05$), BMI (β = -0.088, $p < .05$), and family social support (β = 0.242, $p < .001$). Finally, outcome expectations were significantly associated with social desirability (β = 0.080, $p < .05$), BMI (β = -0.088, $p < .01$), and family social support (β = 0.301, $p < .001$). The adjusted direct model accounted for 60.1% of the variance in physical activity.

The SEM analysis of the unadjusted mediated model resulted in inadequate fit (χ^2 = 245.937, df = 15, p = 0.000, CFI = 0.886, RMSEA = 0.067, SRMR = 0.052), although all estimated paths in the model were statistically significant and in the hypothesized directions (see Figure 1). The unadjusted mediating model accounted for 32% of the variance in physical activity. The addition of covariates (age, sex, BMI, family social support, social desirability) did not improve the model fit (χ^2 = 73.714, df = 16, p = 0.000, CFI = 0.896, RMSEA = 0.061, SRMR = 0.037), although all estimated paths remained statistically significant (see Figure 2). The adjusted mediated model accounted for 50.6% of the variance in physical activity.

FIGURE 1

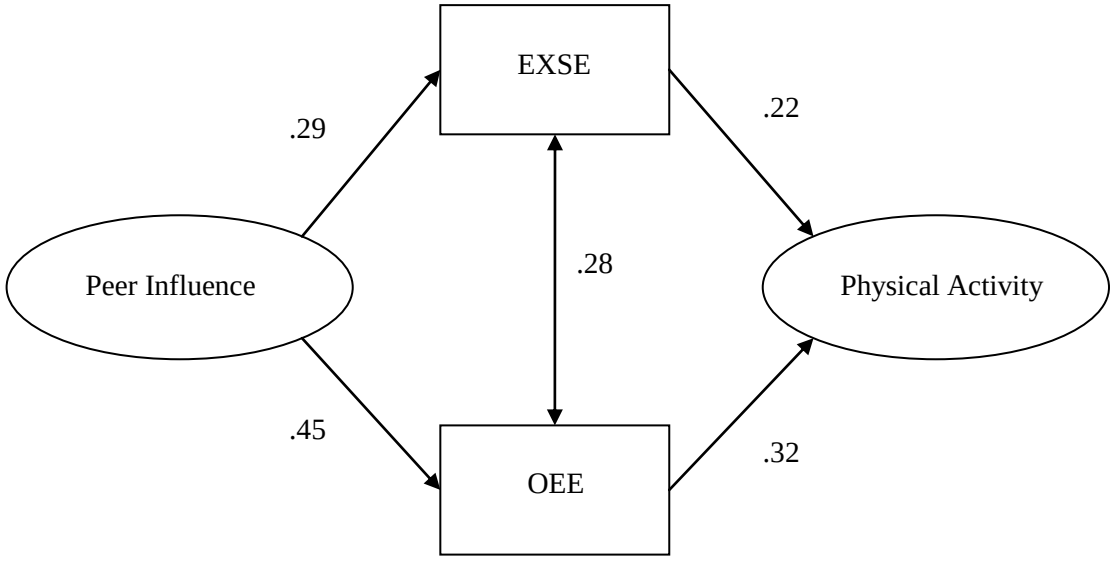
Mediated Model – unadjusted



Note. EXSE = Exercise Self-efficacy; OEE = Outcome Expectations. All paths are statistically significant at $p < .001$.

FIGURE 2

Mediated Model – adjusted for age, sex, BMI, family social support, social desirability



Note. EXSE = Exercise Self-efficacy; OEE = Outcome Expectations. All paths are statistically significant at $p < .001$.

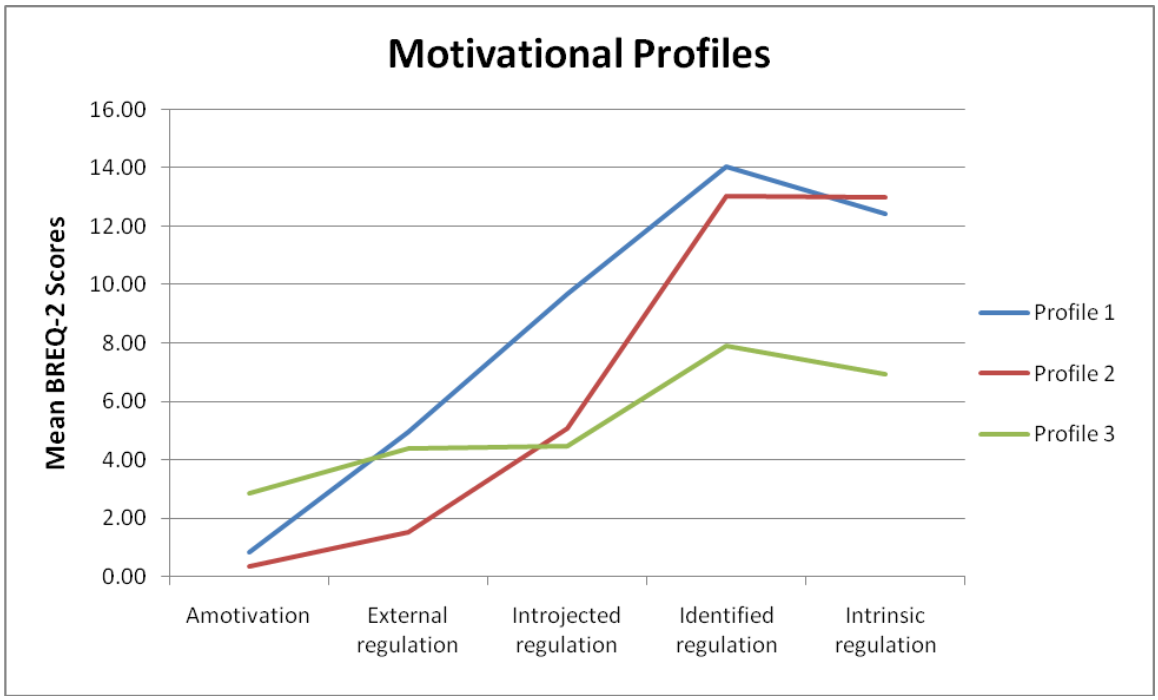
Development of Motivational Profiles

Hypothesis 2. Three distinct motivational profiles will emerge.

For this study, k-means clustering was used for 2-4 groups. Due to large disparities in group size for k-means clustering for cluster sizes of 2 and 4, 3 clusters was chosen as the best solution for the data. The 3 cluster solution appeared appropriate also due to observed significant differences between the two high intrinsic profiles. Specifically, amotivation and external regulation differed significantly between the two more similar high intrinsic profiles and the difference in external regulation remained statistically significant even after Bonferroni correction at the .01 level. Figure 3 displays a breakdown of the motivational profiles across the SDT spectrum. Profile 1 represents a combination of high intrinsic motivation and moderate extrinsic motivation (means for Amotivation = 0.82, External Regulation = 4.94, Introjected Regulation = 9.67, Identified Regulation = 14.06, and Intrinsic Regulation = 12.43). Profile 2 was a more traditional self-determined high intrinsic motivation group (means for Amotivation = 0.33, External Regulation = 1.50, Introjected Regulation = 5.08, Identified Regulation = 13.05, and Intrinsic Regulation = 13.00). Finally, Profile 3 was a moderately extrinsically motivated group with the highest level of amotivation of the three groups (Amotivation = 2.86, External Regulation = 4.38, Introjected Regulation = 4.46, Identified Regulation = 7.90, and Intrinsic Regulation = 6.92).

FIGURE 3

Motivational Profiles across the SDT spectrum based on BREQ-2 Subscale Scores



After the profiles were constructed, descriptive data was analyzed for the three profiles which are presented in Table 2. One-way Multivariate Analysis of Variance (MANOVA) was conducted to examine the group differences across clusters for the physical activity measures (METs expended per week based on the ACLS and the weekly METs expended based on the LTEQ). The overall multivariate effect was statistically significant, F (6,1452) = 18.887, $p < .001$, $\eta_p^2 = .072$, and both physical activity measures differed across groups ($p < .001$). Means and standard deviations for all three clusters are depicted in Table 3. Motivational profiles 1 and 2 were similar in physical activity, but significantly higher than profile 3.

One-way ANOVA with BMI as dependent variable indicated that the motivational clusters differed on this variable, F (2,772) = 3.607, $p < .05$, such that individuals in profiles 2 (M = 23.00, SD = 3.26) and 3 (M = 23.89, SD = 4.97) differed with the respect to BMI but profile 1 (M = 23.25, SD = 3.28) did not differ significantly for the other two groups. Subsequently, one-way MANOVA was conducted to examine the group differences across clusters for all remaining psychosocial variables (exercise self-efficacy, outcome expectations, family and friend social support, and total peer score). The overall multivariate effect was statistically significant, F (10, 1164) = 31.659, $p < .001$, $\eta_p^2 = .214$, and all the psychosocial measures differed across groups ($p < .05$). More specifically, family support was significantly different at $p < .01$ across all profiles with mean differences of 3.16 between profiles 1 and 2, 7.60 between profiles 1 and 3, and 4.43 between profiles 2 and 3. For all other psychosocial variables, profiles 1 and 2 did not differ significantly; however, both were significantly different from profile 3. Means and standard deviations for these variables are presented in Table 4.

TABLE 2

Demographic Statistics for the Profiles (Number of respondents and means)

Profile	*1*	*2*	*3*
	N	*N*	*N*
Gender			
Male	53	76	44
Female	194	206	207
Ethnicity			
Hispanic or Latino	7	7	5
Non-Hispanic or Latino	238	274	245
Race			
American Indian or Alaskan Native	2	0	0
Asian	12	8	20
Black or African American	5	12	11
Native Hawaiian or other Pacific Islander	1	0	1
White	223	260	216
Age			
18	19	21	18
19	46	47	49
20	79	78	67
21	79	102	81
22	19	26	27
23+	5	8	7
BMI Category			
Underweight (less than 18.5)	8	11	13
Normal Weight (18.5-24.9)	181	201	164
Overweight (25-29.9)	44	55	45
Obese (30 or greater)	11	12	22

TABLE 3

Means and Standard Deviations for Physical Activity Variables

Variable	Motivational Profile	*N*	Mean	*SD*
ACLS	1	237	52.68	27.97
	2	260	52.66	29.76
	3	236	29.64*	25.36
LTEQ	1	244	71.36	24.82
	2	273	66.65	24.85
	3	238	46.19*	23.08

**. Profiles 1 and 2 were significantly different from Profile 3 at p < .01.*

TABLE 4

Means and Standard Deviations for Social Support, Self-efficacy, and Outcome Expectations

Variable	Motivational Profile	*N*	Mean	*SD*
sses_fam_total	1	184	31.01**	10.35
	2	218	27.85**	9.76
	3	186	23.41**	9.20
sses_friend_total	1	184	32.67	10.54
	2	218	31.95	9.54
	3	186	25.97*	8.80
exse_total	1	184	9.70	2.02
	2	218	9.41	2.34
	3	186	6.97*	2.63
oee_total	1	184	41.54	3.63
	2	218	41.06	3.72
	3	186	35.09*	4.67

Note. SSES = Social Support for Exercise Scale; EXSE = Exercise Self-efficacy; OEE = Outcome Expectations.

**. The mean difference is significantly different at p < .05 for Profile 3 compared to Profiles 1 and 2.*

***. The mean difference is significantly different at p < .05 across all profiles.*

Direct Modeling with Motivational Clusters

Hypothesis 3. The pattern and strength of associations between peer influence and physical activity will vary across motivational clusters, such that peer influence will be more strongly associated with physical activity in individuals with a moderate profile compared to self-determined and amotivated profiles.

First, bivariate correlations were computed to examine the associations between the constructed peer scale and the friend subscale from the SSES and physical activity for each profile. Profile 1 showed significant correlations ($p < .01$) among both of the support scales (PEER and SSES) and the physical activity variables (LTEQ and ACLS) except for an associate between the LTEQ and the PEER scale which was not significant (see Table 4). For profile 2, the only significant correlations were for ACLS and the support scales ($p < .01$). Finally for profile 3, all of the variables were found to be significantly correlated with each other at $p < .01$. Table 4 displays the correlations among the variables.

TABLE 5

Pearson Correlations and Significances for Physical Activity Variables and Peer/Friend Support Variables

	PEER	SSES
PROFILE 1		
LTEQ – correlation	0.056	0.202**
Sig. (2-tailed)	.449	.002
ACLS – correlation	0.338**	0.214**
Sig. (2-tailed)	.000	.001
Physical Activity	0.720**	
Sig. (2-tailed)	.007	
PROFILE 2		
LTEQ – correlation	0.074	0.019
Sig. (2-tailed)	.284	.757
ACLS – correlation	0.193**	0.251**
Sig. (2-tailed)	.004	.000
Physical Activity	0.419**	
Sig. (2-tailed)	.003	
PROFILE 3		
LTEQ – correlation	0.308**	0.196**
Sig. (2-tailed)	.000	.002
ACLS – correlation	0.214**	0.193**
Sig. (2-tailed)	.003	.003
Physical Activity	0.737**	
Sig. (2-tailed)	.000	

**. Significant at p < .05*
***. Significant at p < .01*

TABLE 6

Results of the multiple group analysis for the direct model with covariates

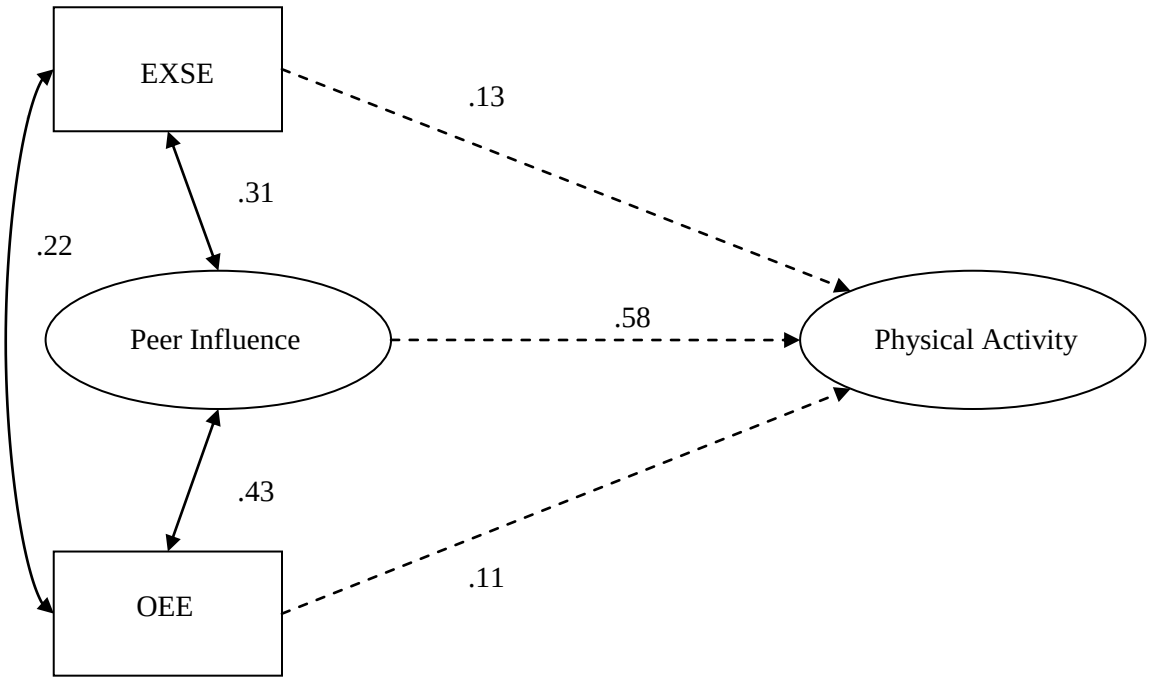
Independent Variables	R^2change	β	S.E.	Critical value	*p*-value
PROFILE 1 (Total $R^2 = 0.120$)					
EXSE	0.017	0.131	0.100	1.314	0.189
OEE	0.002	0.116	0.127	0.915	0.360
Peer influence	0.107	0.327	0.237	1.379	0.168
Gender	0.242	-0.492	0.111	-4.422	0.000
Age	0.044	-0.210	0.085	-2.466	0.014
BMI	0.017	0.132	0.093	1.428	0.153
Family social support	0.014	0.117	0.117	1.003	0.316
Social desirability	0.006	0.079	0.087	0.906	0.365
PROFILE 2 (Total $R^2 = 0.332$)					
EXSE	0.021	0.144	0.094	1.528	0.126
OEE	0.009	0.095	0.097	0.980	0.327
Peer influence	0.125	0.353	0.144	2.459	0.014
Gender	0.188	-0.434	0.097	-4.464	0.000
Age	0.028	-0.167	0.093	-1.802	0.072
BMI	0.000	0.022	0.096	0.227	0.821
Family social support	0.001	-0.035	0.114	-0.309	0.757
Social desirability	0.009	0.093	0.090	1.033	0.301
PROFILE 3 (Total $R^2 = 0.111$)					
EXSE	0.027	0.164	0.099	1.660	0.097
OEE	0.004	0.064	0.148	0.435	0.664
Peer influence	0.475	0.689	0.291	2.371	0.018
Gender	0.112	-0.334	0.122	-2.749	0.006
Age	0.017	-0.132	0.112	-1.184	0.236
BMI	0.008	-0.087	0.096	-0.903	0.367
Family social support	0.037	-0.193	0.207	-0.934	0.350
Social desirability	0.009	-0.094	0.108	-0.865	0.387

Subsequently, the SEM analysis described in hypothesis 1 was repeated using motivational cluster membership as a grouping factor using the multiple group analysis option in Mplus. Since the proposed meditational model did not fit the data well, the multiple group analysis was conducted only for the direct model. Figures 3-5 depict the estimated paths within the direct model for each motivational cluster group. As can be seen, in only one profile was peer influence associated significantly with physical activity (see Table 5).

After adjusting for covariates, the relationships changed for the models. As stated previously, gender, age, BMI, social desirability and family social support were used as covariates. For profile 1, the significance of peer influence on physical activity remained non-significant; however, age (p = .014) and sex (p = .000) were significant indicators. For profile 2, the relationship between peer influence and physical activity changed from non-significant to significant (p = .014). In addition, sex was also a significant covariate of physical activity (p = .000). For Profile 3, peer influence remained significantly associated with physical activity (p = .018) and similar to the other two profiles sex was a significant covariate (p = .006). Subsequently, the explained variance in physical activity increased for each model (profile 1 – 46.9% to 65.3%, profile 2 – 22.6% to 42.4%, and profile 3 – 53.9% to 66.7%).

FIGURE 4

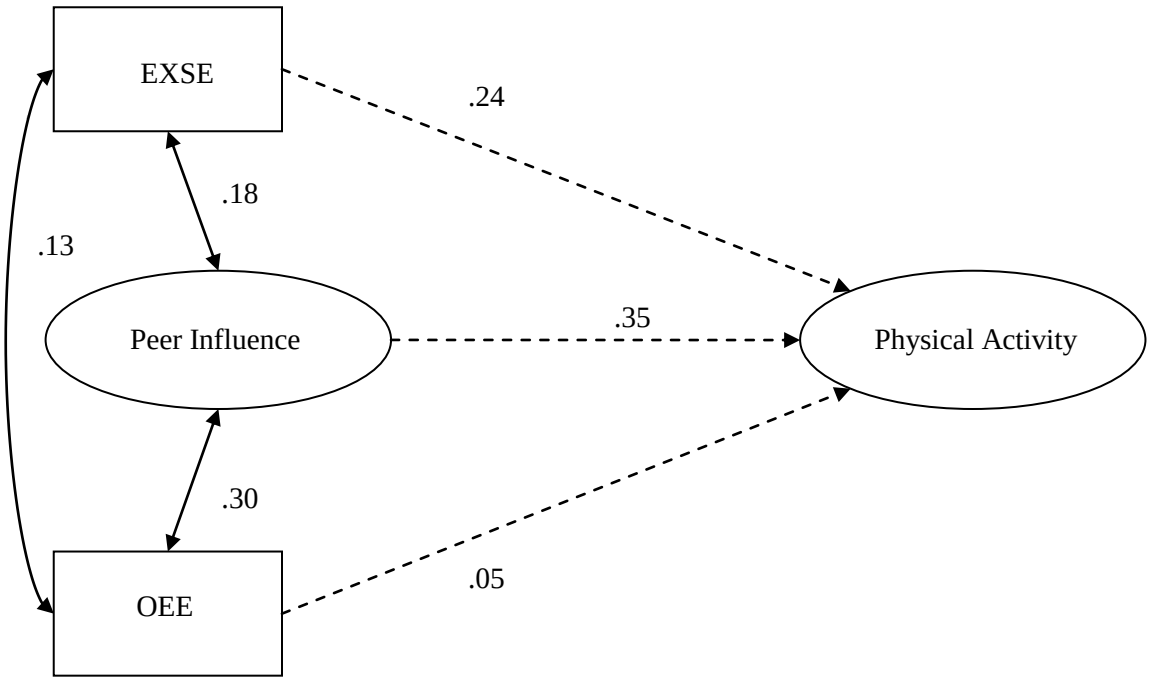
Direct Model – unadjusted - Profile 1 (High Intrinsic and Moderate Extrinsic)



Note. EXSE = Exercise Self-efficacy; OEE = Outcome Expectations. All paths were non-significant on physical activity at $p < .05$.

FIGURE 5

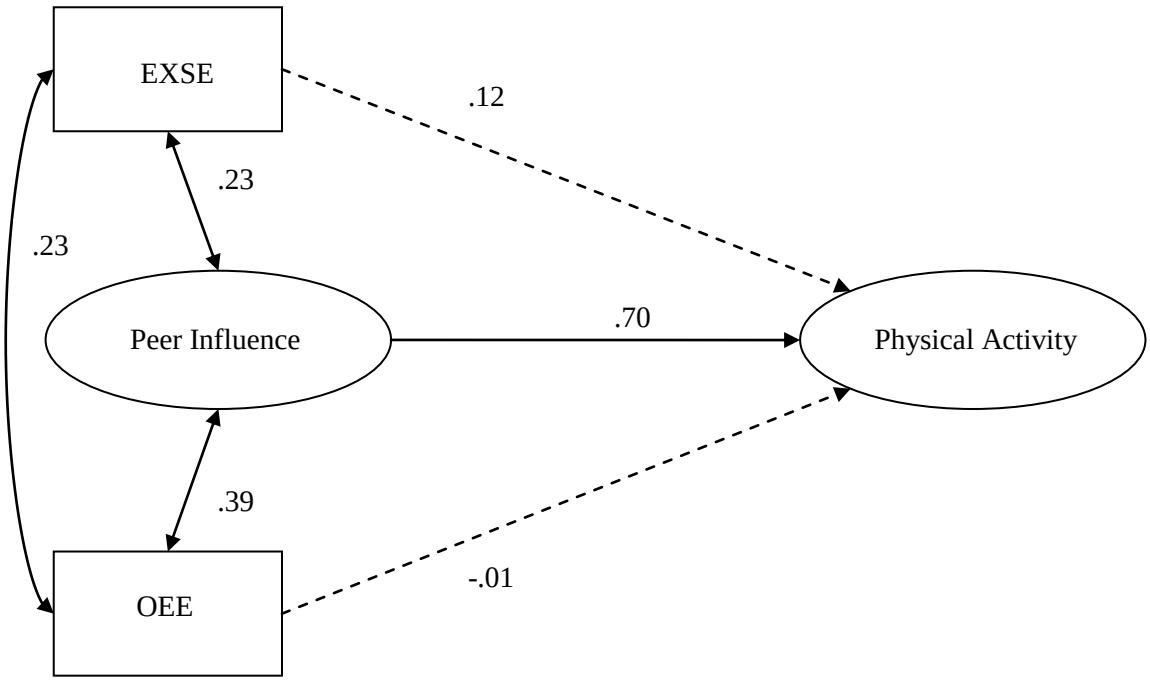
Direct Model – unadjusted - Profile 2 (High Intrinsic)



Note. EXSE = Exercise Self-efficacy; OEE = Outcome Expectations. All paths were non-significant for physical activity at $p < .05$.

FIGURE 6

Direct Model – unadjusted - Profile 3 (Moderate Extrinsic and Amotivated)



Note. EXSE = Exercise Self-efficacy; OEE = Outcome Expectations. Peer influence significant with physical activity at $p < .01$.

Post-Hoc Analyses for Alternative Explanation

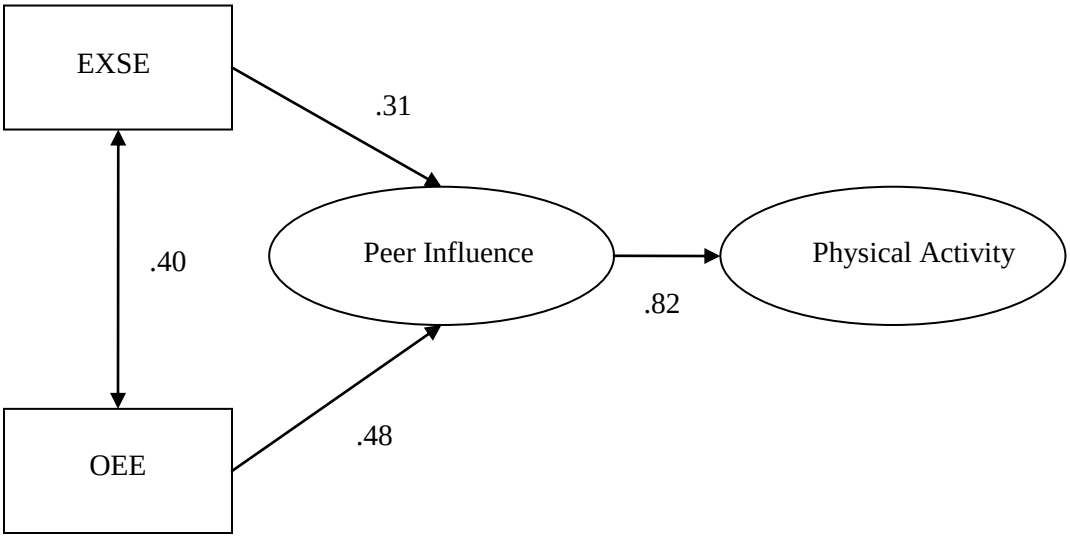
After examining the pattern of observed bivariate correlations among all variables, further analyses were conducted to test an alternative explanation for the dynamics of the existing relationships. That is, an alternative indirect model was tested with peer influence mediating the relationship between self-efficacy and outcome expectations on physical activity.

The change in relationship provided better model fit indices compared to the original mediated model and produced a fit similar to the direct model. The fit indices for

the unadjusted model provided a good fit to the data similar to the direct model (χ^2 = 17.655, *df* = 7, *p* = 0.0136, CFI = 0.939, RMSEA = 0.040, SRMR = 0.028). The unadjusted model, accounted for 67.9% of the variance in physical activity. For the adjusted model, the fit indices decreased somewhat (χ^2 = 58.051, *df* = 17, *p* = 0.000, CFI = 0.892, RMSEA = 0.050, SRMR = 0.032). The adjusted model accounted for 75.3% of the variance in physical activity. Similar to the previous model, all of the paths were significant for both the unadjusted and adjusted direct model. Figure 6 depicts the unadjusted new mediated model.

FIGURE 7

New Mediated Model – Peer influence as the mediator



Note. EXSE = Exercise Self-efficacy; OEE = Outcome Expectations. All paths are statistically significant at $p < .001$.

Chapter 5

Discussion

The current research was designed to examine the relationships among peer influence, motivational profiles, and physical activity in college students. In particular, the study addressed three hypotheses. First, it was predicted that self-efficacy and outcome expectations would mediate the relationship between peer influences and physical activity behavior. Second, it was predicted that three main motivational profiles would emerge from the data in accordance with other literature. Third, it was expected that peer influence would be more strongly associated with physical activity for individuals with a "moderate" motivational profile (e.g., profile consisting of moderate to higher levels of external motivation with some intrinsic motivation and amotivation) compared to more intrinsically motivated or amotivated individuals.

Demographic Differences

As is evidenced by previous research, there are sex and weight differences in individuals' physical activity habits (Trost et al., 2002; MacArthur & Raedeke, 2009; Davis, 2006). Differences emerged in the current data as well with men engaging in more physical activity than females; however, contrary to previous findings normal weight individuals engaged in less physical activity as measured by the ACLS compared to overweight individuals and physical activity levels were nearly identical between the two groups based on the LTEQ scores (normal weight: 65.23 & overweight: 63.45). It must be noted that the sample distribution by weight status was uneven, with significantly more participants in the normal weight (N=508) as opposed to the overweight (N=130)

category. It may also be the case that the overweight individuals reported significantly higher levels of physical activity than what would otherwise be actually observed with objective assessment methods as compared to the normal weight respondents (Jackicic, Polley, & Wing, 1998). Reassuringly, across both physical activity measures, the underweight and obese individuals reported the lowest physical activity levels; the low numbers of individuals in these groups makes it difficult to interpret the potential impact weight status can carry on the results. The analyses examining the proposed causal models in this study were adjusted for differences in BMI as well as socially desirable responding, which should reduce the effects of self-report bias on the results.

Additional differences were observed based on demographic characteristics. Men had significantly higher levels of exercise self-efficacy compared to women and normal weight and overweight individuals had higher levels of exercise self-efficacy compared to obese individuals. It must be noted that the majority of the individuals were normal weight females. In addition to sex and weight, differences were observed by race and ethnicity; however, because the majority of the sample was Non-Hispanic White, it is difficult to reliably interpret these differences. However, other studies provide support for racial and ethnic differences in physical activity pointing to other wider social-cultural factors that may underpin differences in physical activity and its correlates. (Ransdell & Wells, 1998; Gordon-Larsen, Adair, & Popkin, 2002; McArthur & Raedeke, 2009). More research is needed on demographical differences and what potential interventions may work best for each group.

Direct vs. Mediated Modeling

The initial analysis was designed to evaluate the differences between direct and mediated modeling for peer influence, exercise self-efficacy, outcome expectations, and physical activity. It was hypothesized that exercise self-efficacy and outcome expectations would mediate the relationship between peer influence and physical activity. Contrary to the hypothesis, the data favored a direct model. This is contrary to other research that supports the role of self-efficacy as an important determinant of physical activity. For example, in the older adult literature, self-efficacy has been consistently shown to be associated with and predict physical activity and exercise adherence (McAuley, et al., 1994; McAuley, Motl, et al., 2007). In addition, self-efficacy increases enjoyment of physical activity in adult as well as college-aged populations (Hu, et al., 2007; McAuley, Motl, et al., 2007). Recently also, Maglione and Hayman (2009) examined physical activity correlates of low income college students using the Health Promotion Model. They surveyed 95 individuals and found that those with higher self-efficacy had higher levels of physical activity. Importantly, commitment to a physical activity plan mediated the effects of social support and self efficacy on physical activity behavior in that study. For walking, McNeill et al. (2006) conducted a similar study in which they examined the mediating effect of self-efficacy on social support and physical activity in adults. They found that the relationship was not significant; however, they did find self-efficacy to have an indirect mediating effect through intrinsic motivation. Interestingly, careful inspection of the pattern of the relationships among the variables in the present study indicates that the direction of the hypothesized mediation may have been miss-specified. That is, self-efficacy and outcome expectations were consistently

associated with peer influence and peer influence had a consistent relationship with physical activity. In other words, it is possible that individual perceptions of self-efficacy and outcome expectations may actually determine how one perceives and benefits from peer influences when it comes to physical activity. To examine this possibility, an alternative model stipulating this direction of relationships was tested and indeed fit the data acceptably with fit indices comparable to the direct influence model. In a recent study conducted in the substance use domain, Myers et al. (2009) examined the relationship between acculturation and substance use of Hispanic youth in alternative high schools. They surveyed 741 Hispanic youth in California and found that peer social influence mediated the relationship between lifetime and current alcohol use, current cigarette use, and current hard drug use, supporting the idea that peer influence may be an important process variable that mediates the influence of other individual psychological factors (in this study outcome expectation and self-efficacy) on behavioral outcomes.

Alternatively, instead of a mediating effect, cognitions such as self-efficacy and outcome expectations may exert a moderating effect on physical activity. In a recent intriguing paper, Dishman and colleagues examined longitudinally whether self-efficacy for overcoming barriers moderates the relationship between declines in physical activity and perceived social support in high school girls. (Dishman, Saunders, Motl, Dowda, & Pate, 2009). The study tested several alternative hypotheses using latent growth curve modeling, including direct, indirect (i.e., mediated), or moderated effects. Self-efficacy, social support, and physical activity measures were completed in the 8th, 9th, and 12th grades by a cohort of 195 Black and White girls. Self-efficacy tended to be stable across the observation period and moderated the relationship between physical activity and

perceived social support, such that girls who maintained a perception of strong social support showed smaller declines in physical activity if they also had high self-efficacy. Interestingly, the inverse was also true. That is, girls having high self-efficacy had a greater decline in physical activity if they perceived declines in social support. This finding must be replicated by other studies but offers a compelling set of hypotheses for further investigation.

Motivational Profiles in College Students' Physical Activity Behavior

In the second specific aim, it was hypothesized that three main profiles would emerge from the data similar to the study conducted by Vlachopoulos and colleagues (Vlachopoulos et al., 2000). As hypothesized, three profiles did emerge from the data. However, these profiles were not as unique and distinctive as expected. Two of the profiles that emerged were very similar with the only apparent difference occurring at the higher levels of extrinsic motivation in Profile 1. Profile 3 appeared to be a moderate profile where the values across all types of motivations were comparable, with higher levels of amotivation than in the other two profiles. This profile was very similar to Vlachopoulos et al.'s amotivated profile. It must be noted that with the similarities between profiles 1 and 2, a two profile evaluation may have been an equally appropriate choice. After re-running the analyses for two profiles, similar significant differences emerged for demographic variables (sex and race) and the main variables (kcal, self-efficacy, and outcome expectations). Moreover, a significant difference between the two profiles emerged for BMI. The two profile solution has been documented in previous studies (Vlachopoulos et al., 2000). Interestingly, solutions with higher number of

clusters have been reported in the literature (Biddle & Wang, 2003; Ullrich-French & Cox, 2009). The variability in the number of clusters underscores the notion that cluster analysis represents a data driven technique that may reflect differences in samples under investigation as well as substantive differences based on theoretical assumptions. A researcher must have a strong theoretical rationale and select appropriate cluster analytic techniques when identifying motivational profiles. The research in this appears ripe for cross-sample investigations of motivational clusters using meta-analytic methods, for example. In this approach, data from multiple studies can be combined to identify motivational profiles across different samples, thus reducing the influence of sample-specific characteristics. More sophisticated methods such as latent class analysis which is discussed later on could also help clarify some of the inconsistency surrounding motivational phenotypes. Further studies are needed to determine the most representative motivational profiles in specific populations.

In addition to the development of the profiles, further analyses were conducted to evaluate the differences among the profiles. As would be expected the two profiles with high intrinsic values (Profiles 1 and 2) had higher levels of physical activity as compared to Profile 3 which has been found previously (Matsumoto & Takenaka, 2004). Furthermore, levels of social support were higher for individuals in the two intrinsically motivated profiles as compared to the moderate-amotivated profile. In contrast to what would be expected, higher levels of outcome expectations were observed in Profile 3 as compared to the other profiles.

Peer Influence on Different Motivational Profiles

For the final aim, it was hypothesized that the pattern and strength of associations will differ across the motivational profiles. After conducting a multiple group analysis of the direct model, some differences in the pattern of the relationships emerged, although it must be pointed out that the sample size for at least one of the clusters may have been too low to adequately test for these differences. Both in the correlation analysis and the multiple group SEM analysis, the relationship between peer influence and physical activity appeared to be strongest in profile 3. Compared to the other two profiles, individuals with the third motivational profile exhibit a moderate level of extrinsic motivation and have the highest level of amotivation, and therefore also lowest physical activity levels. Although not assessed in this study, one could also speculate that a greater proportion of individuals with Profile 3 may thus also be in the early stages of change when it comes to physical activity. It is conceivable that readiness to change may partially determine the level of influence peers are likely to have on one's physical activity behaviors. Put differently, the relationship between peer influence and physical activity may be of greatest importance in the initial stages of exercise/physical activity adoption. As individuals become more committed to their behaviors and more skilled, they may no longer require the same level of social support or other factors such as self-efficacy, outcome expectations, or body image may gain in importance. In a recent study, Salvy et al. (2009) found that overweight children reported more physical activity in the presence of peers than lean children while both groups reported high physical activity in the presence of friends. This finding provides support to the idea that peer influence maybe more impactful with those individuals that do not engage in physical activity on a

regular basis and also suggest that the relationships may be further complicated by other individual-level characteristics such as weight status. The analyses in this study controlled for the effects of BMI, however, this may not have been appropriate if BMI is proven to be causally implicated in the relationship between peer influence and physical activity. Future studies should examine such possibilities.

Health Recommendations and Intervention Importance

The public health recommendations suggest that adults should engage in 150 minutes of moderate physical activity per week or 30 minutes per day, 5 days per week (USDHHS, 2008). Numerous physical activity interventions are currently being utilized trying to get individuals to meet these recommendations and are having mixed results (Zabinski, Calfas, Gehrman, Wilfley, & Sallis, 2001; Woods, Mutrie, & Scott, 2002; Kahn et al., 2002). The current study informs intervention development among college-age students by establishing a link between peers and personal motivations toward physical activity. By understanding the underlying motivations of these individuals and how the social environment impacts their motivations (here through peers), different sources of information can be utilized to enhance important physical activity determinants. For example, this study suggested that individuals with moderate level of extrinsic motivation and high level of amotivation compared to the other groups may particularly benefit from the influence of peers. For these individuals, a peer-based intervention could be designed that harnesses the power of peers to enhance individual level of self-efficacy (e.g., by modeling, verbal persuasion, contingent feedback etc.) and help shape positive and realistic outcome expectations. Currently available technologies

such as the internet or the cell phone also allow for tailoring of specific aspects of intervention programs or intervention materials and their delivery and would thus be well suited for intervention tailoring based on motivational profiling. As part of these interventions, motivations for physical activity could be assessed at the entry into the program which then could be tailored to target those facets believed to benefit individuals with specific motivational profiles. Such individually tailored interventions would be expected to have a higher degree of effectiveness and better long-term impact than one-size-fits-all interventions because they offer the opportunity to make physical activity information personally relevant and meaningful and capitalize on particular motivational needs of individuals. Utilizing different e-health technologies, these interventions could then be delivered in large scale to populations at risk, yet would offer a level of tailoring that was traditionally available mostly in face-to-face programs. Such large-scale interventions could potentially have an impact at the population level, ultimately reducing the number of individuals not meeting the recommended physical activity levels. To fulfill this vision and reach such possibilities, it is important for researchers to continue to examine individual differences in motivation for physical activity in representative samples of college students around the country as well as conduct intervention studies within college populations. Additionally, future studies are needed to examine the relationships that exist between motivational profiles, social environment, and physical activity in other populations (e.g., older adults and individuals with disabilities) where rates of physical activity engagement are low as well.

Limitations and Future Directions

The findings of the study must be interpreted in the context of its limitations, with the most serious being: 1) the use of self-report survey data, 2) a non-representative sample of the overall college population, 3) survey taken over the summer and administered only once, and 4) using cluster analysis rather than latent class analysis to examine motivational profiles and their correlates.

Survey research relying on self-report may be riddled with recall, social desirability, and selection biases. Several attempts were made to minimize such threats to the validity of this study. First, the majority of survey items were based on previously validated questionnaires. Nonetheless, despite the use of validated physical activity measures (LTEQ and ACLS), the physical activity values may not be truly representative of the students' actual physical activity levels. It would be beneficial for future researchers to use a validated objective measure of physical activity, such as the accelerometer, to arrive at objective estimates of daily physical activity. Second, social desirability was assessed and included in the analyses as a covariate. Third, the sample was recruited broadly across different units at the University Park campus (i.e., within and outside of the Kinesiology student body) so as to obtain a sample with adequate distribution across years spent in college, gender, race/ethnicity, and motivations for physical activity. The recruitment efforts were only partially successful in this regard, with the sample being equally distributed across years spent in college but over-represented by women, White and non-Latina students. Recruiting for physical activity studies is also likely to attract individuals with some pre-existing motivation towards

physical activity. In this sense, the study sample could be considered homogenous and non-representative of the college-aged population. In future studies, researchers should strive to balance the study population by gender, race, and ethnicity to allow for broader generalization of findings. Concealing the physical activity focus of the study may also yield a more representative sample with respect to motivations towards physical activity

The third limitation of the study was that this was a cross-sectional survey administered during the summer. In cross-sectional studies, causal direction of relationships cannot be assumed and true mediation cannot be effectively tested. Thus, caution must be applied when interpreting the results. A more appropriate test of mediation would require prospective data with sequential assessment of predictors, mediators, and outcomes. Some even argue that true mediation cannot be asserted until additional conditions are satisfied. Namely, experimental designs may be necessary where subjects are randomly assigned to different levels of the independent variable as well as the mediating variable(s) (MacKinnon, Fairchild, & Fritz, 2007). In addition, by administering the survey over the summer, most college students were away from the campus and not with their usual college peers. Similarly, seasonal effects may have impacted participant reporting and some of the relationships under study. A prospective examination of the relationships of interest would provide a more persuasive test of the hypotheses. It would be also beneficial to compare the activity levels of students across different phases of the academic year and evaluate how peer groups change and influence behavior differently across these different phases.

The last main limitation is using traditional cluster analysis rather than a more powerful statistical method, latent class analysis. Latent class analysis (LCA) is a statistical technique that is used to create clusters (latent classes) from multivariate data. Similarly to cluster analysis, the LCA model allows the researcher to preselect the number of clusters to be created. These clusters can then be compared to other models of varying numbers of clusters to determine the best fit model. However, the LCA has distinct advantages: (1) LCA does not rely on traditional modeling assumptions, such as, linearity and homogeneity; (2) when using LCA variables may be used in original metric and do not have to be standardized; and (3) LCA takes into account both observed and unobserved values, thus it can accommodate modeling with missing data and it also minimizes measurement error.

A couple of additional limitations to the study are the omission of integrated regulation which is not part of the BREQ-2 and the design of peer influence. The addition of integrated regulation could potentially change the overall structure of the motivational profiles. Subsequently, integrated regulation has been shown to be a contributing predictor to exercise behavior (Wilson, Rodgers, Loitz, & Scime, 2006). Wilson et al. (2006) conducted 3 studies in which they evaluated the effectiveness and value of adding in additional integrated regulation questions to the BREQ. The results indicated that the additional questions enhanced the BREQ and provided evidence for the role of more self-directed extrinsic motivations as facilitators of exercise behavior.

Additionally, the measure of peer influence used in this study, although constructed partially based on a validated social support measure, has not been validated in other studies. Although it extends the previous conceptualizations of peer influences

by accounting for both the social support provided by peers as well as the role modeling of physical activity behavior, it may lack two important additional elements: the addition of the actual (objectively assessed) physical activity data for the peers (rather than self-reports by the subjects) and the re-administration of these measures on more than one occasion to examine the reliability of these measures over time. Salvy et al. (2008) has recently administered peer measures several times each day via a pager over the course of seven days in order to examine their hypothesis that the presence of peers and friends would be associated with more physical activity. They found that youth engaged in more physical activity when in the presence of peers and friends compared to when alone. Arguably, however, it may matter more what individuals believe to be true about their peers and their behaviors than what is objectively the case. That is, the perceived physical activity levels of peers may ultimately have more impact on students' behaviors. Finnerty's examination of peer acceptance using the Sallis Social Support Scale provided some evidence for this, demonstrating that those individuals who felt accepted by others engaged in more physical activity (Finnerty et al., 2010).

The strengths of the study include a large sample size and the use of structural equation modeling to incorporate missing data and arrive at latent independent and dependent variables and thus minimizing measurement error. The study attempted to link two areas of physical activity research that have been typically disconnected, that is, motivation and social cognitive influences. The study of peer influences is especially overlooked in spite of a number of sub-populations (including college students) that spend the majority of their time in the circles of their friends and peers, and in spite of the large evidence from psychological literature on interpersonal behavior. This body of

literature has demonstrated in important ways that individual behavior, motivations, cognitions, and emotions, are largely defined by our interactions with others and the perceptions, actions, and expectations of significant others. The study provided support for the relationship between self-efficacy, outcome expectations, and peer influence, and demonstrated that all are important and unique indicators of physical activity. Additionally, the study revealed that peer influences may take on varying levels of importance in determining physical activity based on underlying physical activity motivations or perhaps based on exercise/physical activity stage, having important potential implications for the design of peer-based physical activity interventions. Similarly to tailoring physical activity interventions based on a person's stage of change, examination of individuals' motivational profiles would allow for further refinement of individualized intervention strategies to achieve higher effectiveness and short-term as well as long-term impact. The use of advanced statistical techniques such as latent class analysis could eventually lead to the development of social cognitive and motivation typologies to segment populations and capitalize on their unique needs or vulnerabilities in the process of designing large-scale interventions. The combination of individualized interventions and large scale interventions molded out of the combined social cognitive and motivation typologies together with healthy eating habits could go a long way in decreasing the large proportion of overweight and obese individuals. Subsequently, by increasing physical activity and reducing individuals' weight, there will be a decrease in the number chronic health conditions such as diabetes and heart disease. For these reasons, future studies in this area are called for.

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Appendix A

Godin Leisure-Time Exercise Questionnaire

1. Considering a 7 day period (a week), how many times on average do you do the following kinds of exercise for **more than 15 minutes** during your **free time**?

Times Per Week

a) **Strenuous Exercise** (heart beat rapidly) _____
(i.e. running, jogging, hockey, football, soccer, squash, basketball, cross country skiing, judo, roller skating, vigorous swimming, vigorous long distance cycling)

b) **Moderate Exercise** (not exhausting) _____
(i.e. fast walking, baseball, tennis, easy cycling, volleyball, badminton, easy swimming, alpine skiing, popular and folk dancing)

c) **Mild Exercise** (minimal effort) _____
(i.e. yoga, archery, fishing from river bed, bowling, Horseshoes, golf, snow-mobiling, easy walking)

2. Considering a 7 day period (a week), during your leisure time, how often do you engage in any regular activity long enough to work up a sweat (heart beats rapidly)?

1	2	3
Often	Sometimes	Never/Rarely

Appendix B

Aerobics Center Longitudinal Study Physical Activity Questionnaire

In this section we would like to ask you about your current physical activity and exercise habits that you perform regularly, at least once a week. Please answer as accurately as possible. Circle your answer or supply a specific number when asked.

During the **last month**, which of the following moderate or vigorous activities have you performed **regularly**? *(Please circle **YES** for all that apply and **NO** if you do not perform the activity; provide an estimate of the amount of activity for all marked YES.* ***Be as complete as possible.)***

Walking (other than on treadmill)

NO YES _____

How many sessions per week? _____

How many miles (or fractions) per session? _____

Average duration per session? _____ (min)

What is your usual pace of walking? (*Please circle one*)

CASUAL or STROLLING (<2 mph)	AVERAGE or NORMAL (2 to 3 mph)	FAIRLY BRISK (3 to 4 mph)	BRISK or STRIDING (4 mph or faster)

Stair Climbing

NO YES_____

How many flights of stairs (1flight = 10 steps) do you climb **UP** each day? _____

Jogging of Running

NO YES_____

How many sessions per week? _____

How many miles (or fractions) per session? _____

Average duration per session? _____ (min)

Treadmill

NO YES _____

How many sessions per week? _____

Average duration per session? _____ (min)

Speed?_____(mph) Grade?_____(%)

Bicycling

NO YES_____

How many sessions per week? _____

How many miles (or fractions) per session? _____

Average duration per session? _____ (min)

Swimming Laps

NO YES_____

How many sessions per week? _____

How many miles (or fractions) per session? _____

(880 yards = .5 miles)

Average duration per session? _____ (min)

Aerobic dance/Calisthenics/Floor exercise

NO YES_____

How many sessions per week? _____

Average duration per session? _____ (min)

Moderate Sports

(e.g., leisure volleyball, golf (not riding), social dancing, doubles tennis)

NO YES_____

How many sessions per week? _____

Average duration per session? _____ (min)

Vigorous sports

(e.g., racquetball, singles tennis)

NO YES_____

How many sessions per week? _____

Average duration per session? _____ (min)

Other vigorous sports or Exercise Involving Running

(e.g., Basketball, soccer)

NO YES_____

Please specify:_____

How many sessions per week? _____

Average duration per session? _____ (min)

Other Activities

NO YES_____

Please specify:_____

How many sessions per week? _____

Average duration per session? _____ (min)

Weight Training

(machine or free weights)

NO YES _____

How many sessions per week? _____

Average duration per session? _____ (min)

1. How many times a week do you engage in vigorous physical activity long enough to work up a sweat? _____(*times per week*)

Appendix C

Peer Physical Activity Questions

1. Do you have any roommates? YES NO
2. How many roommates do you have? _____
3. How many of your roommates engage in leisure time physical activity on a regular basis (3 or more days a week of at least 30 minutes of activity)? _____
4. Do your roommates encourage you to be physically active? YES NO
5. How often do you engage in physical activity with your roommates (per week)? _____
6. How often do your roommates ask you to join them when they engage in physical activity (per week)? _____
7. Do you have any close friends? YES NO
8. How many close friends do you have? _____
9. How many of your close friends engage in leisure time physical activity on a regular basis (3 or more days a week of at least 30 minutes of activity)? _____
10. Do your close friends encourage you to be physically active? YES NO
11. How often do you engage in physical activity with your close friends (per week)? _____
12. How often do your close friends ask you to join them when they engage in physical activity (per week)? _____

Appendix D

Behavioral Regulation in Exercise Questionnaire-2

We are interested in the reasons underlying peoples' decisions to engage, or not engage in physical exercise. Using the scale below, please indicate to what extent each of the following items is true for you. Please note that there are no right or wrong answers and no trick questions. We simply want to know how you personally feel about exercise. Your responses will be held in confidence and only used for our research purposes.

	Not true for me		**Sometimes true for me**		**Very true for me**
1) I exercise because other people say I should	0	1	2	3	4
2) I feel guilty when I don't exercise	0	1	2	3	4
3) I value the benefits of exercise	0	1	2	3	4
4) I exercise because it's fun	0	1	2	3	4
5) I don't see why I should have to exercise	0	1	2	3	4
6) I take part in exercise because my friends/family/partner say I should	0	1	2	3	4
7) I feel ashamed when I miss an exercise session	0	1	2	3	4
8) It's important to me to exercise regularly	0	1	2	3	4
9) I can't see why I should bother exercising	0	1	2	3	4
10) I enjoy my exercise sessions	0	1	2	3	4
11) I exercise because others will not be pleased with me if I don't	0	1	2	3	4

12) I don't see the point in exercising	0	1	2	3	4
13) I feel like a failure when I haven't exercised in a while	0	1	2	3	4
14) I think it is important to make the effort to exercise regularly	0	1	2	3	4
15) I find exercise a pleasurable activity	0	1	2	3	4
16) I feel under pressure from my friends/family to exercise	0	1	2	3	4
17) I get restless if I don't exercise regularly	0	1	2	3	4
18) I get pleasure and satisfaction from participating in exercise	0	1	2	3	4
19) I think exercising is a waste of time	0	1	2	3	4

Appendix E

Outcome Expectations for Exercise Scale

Please respond to the following statements regarding your feelings about exercise.

Mark your answer by circling the appropriate number:

1	2	3	4	5
strongly agree	agree	neither agree nor disagree	disagree	strongly disagree

Exercise…

1. Makes me feel better physically.	1	2	3	4	5
2. Makes my mood better in general.	1	2	3	4	5
3. Helps me feel less tired.	1	2	3	4	5
4. Makes my muscles stronger.	1	2	3	4	5
5. Is an activity I enjoy doing.	1	2	3	4	5
6. Gives me a sense of personal accomplishment.	1	2	3	4	5
7. Makes me more alert mentally.	1	2	3	4	5
8. Improves my endurance in performing my daily activities.	1	2	3	4	5
9. Helps to strengthen my bones.	1	2	3	4	5

Appendix F

Multidimensional Outcome Expectations for Exercise Scale

The following items reflect your beliefs or expectations about the benefits of regular exercise or physical activity. Please respond to the following statements marking your answer honestly and by choosing the appropriate number/statement. Remember to read each question carefully.

1) **Exercise will improve my ability to perform daily activities**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

2) **Exercise will improve my social standing**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

3) **Exercise will NOT improve my overall body functioning**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

4) **Exercise will help manage stress**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

5) **Exercise will strengthen my bones**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

6) **Exercise will NOT improve my mood**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

7) **Exercise will increase my muscle strength**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

8) **Exercise will make me more at ease with people**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

9) **Exercise will NOT aid in weight control**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

10) **Exercise will improve my psychological state**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

11) **Exercise will NOT provide companionship**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

12) **Exercise will improve the functioning of my cardiovascular system**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

13) **Exercise will increase my mental alertness**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

14) **Exercise will increase my acceptance by others**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

15) **Exercise will give me a sense of personal accomplishment**:

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Appendix G

Exercise Self-Efficacy Scale

The items listed below are designed to assess your beliefs in your ability to continue exercising at least three time per week basis at moderate intensities (upper end of your perceived exertion range), for **30+** minutes per session in the future (not including warm-up and cooldown). Using the scales listed below please indicate how confident you are that you will be able to continue to exercise in the future.

For example, if you have complete confidence that you could exercise at least three times per week at moderate intensity for **30+** minutes for the next 12 weeks without quitting, you would **circle 100%**. However, if you had no confidence at all that you could exercise at your exercise prescription for the next 12 weeks without quitting, (that is, confident you would not exercise), you would **circle 0%**.

Please remember to answer honestly and accurately. There are no right or wrong answers.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

NOT AT ALL CONFIDENT MODERATELY CONFIDENT HIGHLY CONFIDENT

---

1. I am able to continue to exercise at least three times per week at moderate intensity for **30+** minutes without quitting for the NEXT 2 WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. I am able to continue to exercise at least three times per week at moderate intensity for **30+** minutes without quitting for the NEXT 4 WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. I am able to continue to exercise at least three times per week at moderate intensity for **30+** minutes without quitting for the NEXT 6 WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

4. I am able to continue to exercise at least three times per week at moderate intensity for **30+** minutes without quitting for the NEXT 8 WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. I am able to continue to exercise at least three times per week at moderate intensity for **30+** minutes without quitting for the NEXT 10 WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. I am able to continue to exercise at least three times per week at moderate intensity for **30+** minutes without quitting for the NEXT 12 WEEKS.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Appendix H

Social Support for Exercise Survey

Below is a list of things people might do or say to someone who is trying to be regularly physically active. If you are not trying to be active, then some of the questions may not apply to you, but please read and give an answer to every question.

Please rate each question **twice**. Under family, rate how often anyone living in your household has said or done what is described during the last three months. Under friends, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

Please write one number from the following rating scale in **each space**:

(1) never (2) rarely (3) a few times (4) often (5) very often

(8) does not apply

During the past three months, my family (or members of my household) or friends:

	Family	Friends
1. Been active with me.	1._____	1._____
2. Offered to be physically active with me.	2._____	2._____
3. Gave me helpful reminders to be active ("Are you going to exercise tonight?")	3._____	3._____
4. Gave me the encouragement to stick with my physical activity program.	4._____	4._____

5. Changed their schedule so we could be active together.	5._____	5._____
6. Discussed physical activity with me.	6._____	6._____
7. Planned for physical activity on recreational outings.	7._____	7._____
8. Helped plan activities around my activity routine.	8._____	8._____
9. Asked me for ideas on how *they* can get more physically active.	9._____	9._____
10. Talked about how much they like to be active.	10._____	10._____

Appendix I

Short Form C of the Marlowe-Crowne Social Desirability Scale

In the following section, please respond with either True or False for each statement.

0	1
False	True

1. It is sometimes hard for me to go on with my work if I am not encouraged.

2. I sometimes feel resentful when I don't get my way.

3. On a few occasions, I have given up doing something because I thought too little of my ability.

4. There have been times when I felt like rebelling against people in authority even though I knew they were right.

5. No matter who I'm talking to, I'm always a good listener.

6. There have been occasions when I took advantage of someone.

7. I'm always willing to admit it when I make a mistake.

8. I sometimes try to get even rather than forgive and forget.

9. I am always courteous, even to people who are disagreeable.

10. I have never been irked when people expressed ideas very different from my own.

11. There have been times when I was quite jealous of the good fortune of others.

12. I am sometimes irritated by people who ask favors of me.

13. I have never deliberately said something that hurt someone's feelings.