Psychosocial Determinants of Physical Activity in a Sample of Undergraduate College Students

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It is reported that only 50.4% of males and 39.9% of females aged 18-30 years report meet the U.S. recommended guidelines for physical activity (PA), with the steepest declines occurring in young adulthood. To explain physical inactivity trends, investigators have proposed theory-based psychosocial factors or determinants for the purpose of identifying modifiable psychological barriers to PA. **Purpose**: The primary aim of this investigation was to explore the relation between PA and psychosocial variables of: 1) motivation (MO); 2) self-efficacy (SE); 3) social support (SS); 4) exercise enjoyment (EE); and 5) body image (BI) in young adult college students aged 18-20 years. A secondary aim was to examine whether young adult males and females differ in psychosocial predictors of PA behavior. **Methods**: This investigation employed a cross-sectional correlational design. Thirty-five males and 55 females ages 18-20 years were recruited to participate. The mean age was 18.7±0.7 years for the combined sample. Ninety seven percent of males and 78.2% of the females enrolled were college freshmen. Total weekly hours of PA (7-Day Physical Activity Recall) served as the dependent variable. The psychosocial predictor variables were assessed using standardized questionnaires. **Results**: For males, EE was significantly ($p<0.05$) correlated to minutes of hard, minutes of very hard, and total minutes of PA. A stepwise multiple regression analyses indicated exercise EE ($R^2=0.174$, $F(1,33)=6.949$, $p=0.013$) was the only predictor variable that explained a significant proportion of variance for males. For females, SE, EE, MO, SS from friends, and BI were significantly correlated to

minutes of PA. The combination of EE, extrinsic MO, SS from friends, and BI explained 43% of the variance in total minutes of PA in females (R^2=0.426, F(4,50)=9.294, p<0.001). **Conclusion**: Results suggest that EE may be the most important predictor variable among those assessed in this investigation for both males and females. This is followed closely by MO, SS from friends, and BI for females. This investigation has identified gender specific trends in determinants of physical activity for the young adult college population. This is an important step to explaining physical activity behaviors in a population that is at risk for sedentary behaviors.

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PREFACE

I would like to thank the following for sharing their time, experience, and expertise during my time at the University of Pittsburgh:

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1.0 INTRODUCTION

1.1 BACKGROUND

Considered a major public health concern, physical inactivity and increased body fatness are linked to metabolic risk factors and chronic disease in both men and women (12, 72). Although most evidence has predominantly focused on adults aged 18 to 64 years, younger adults age 18-20 years are also affected. Specifically, young adults in the U.S. college population have consistently shown low levels of physical activity, high rates of overweight/obesity, undesirable total cholesterol, and high blood pressure. In addition, while activity levels decrease across the lifespan, the steepest declines occur in young adult hood. It is reported that only 50.4% of males and 39.9% of females aged 18-30 years report meeting the recommended guidelines for regular physical activity indicative of this decline (19, 31).

The ACSM/AHA recommends “30+ minutes of moderate physical activity five or more days per week, or vigorous physical activity for 20+ minutes three or more days per week” as the minimum threshold to experience changes in one’s health risk profile (37). Increased levels of physical activity are associated with decreased risks of cardiovascular heart disease (CVD), type 2 diabetes, stroke, colon cancer, breast cancer, and all-cause mortality (100). The outcomes related to these risk reductions include: 1) lower mean arterial blood pressure; 2) improvement of blood lipid profile and C-reactive protein; and 3) enhanced insulin sensitivity (100). Despite the

well-established benefits of physical activity, most adults of all ages participate in insufficient levels to achieve health benefits. The factors explaining low physical activity participation are complex and may involve individual behaviors and attitudes around physical activity.

To explain these increasing physical inactivity trends, investigators (7, 28, 66) have proposed theory-based psychosocial factors or determinants for the purpose of identifying modifiable psychological barriers to physical activity. Understanding such factors could assist in the design, implementation, and promotion of exercise recommendations. This may lead to improved attendance, participation, and increased compliance to exercise programs, as well as contribute to the adoption of healthy lifestyle behaviors that enhance health outcomes in young adults.

1.2 RATIONALE

An important step to developing effective health promotion programs and behavioral interventions designed to increase physical activity is to first understand determinants of physical activity. These are factors that influence participation and include demographic, social, and environmental characteristics. Evidence suggests that determinants of physical activity vary by age and sex (27). Therefore, it is important to explore determinants that may explain the physical activity patterns of young adults, both male and female. Understanding physical activity behavior and reasons why some choose to initiate physical activity or not, may improve how instruction, coaching, or interventions are designed. This in turn may increase affect, enjoyment, participation, and adherence in physical activity, thus improving the overall health of these individuals.

While age and sex are strong demographic determinants of physical activity behavior, these variables are un-modifiable and not subject to manipulation. Five core modifiable determinants of physical activity identified from previous investigations (32, 59, 87, 99) include: 1) self-efficacy (55); 2) social support (24); 3) motivation (28); 4) enjoyment (50); and 5) body image (26). However, few studies have explained the relationship of these variables to physical activity behavior in young adult college students aged 18-20 years. Previous studies have shown that age and gender appear to influence modifiable determinants in adults 18-64 years. However this broad range is far too large to generalize specifically to young adult college students age 18-20 years and the identification of age and gender specific determinants of physical activity have not been thoroughly explained in the young adult college population (27, 77). This would allow for a key set of "target variables" to be designated for interventions aimed at changing physical activity behavior. Therefore, the purpose of this investigation was to examine the relation between previously identified modifiable determinants of physical activity and self-reported physical activity in a sample of male and female college students aged 18-20 years.

1.3 SPECIFIC AIMS

1. The primary aim of this investigation was to explore the relation between self-reported physical activity and modifiable psychosocial variables of: 1) self-efficacy; 2) social support; 3) motivation; 4) exercise enjoyment; and 5) body image in a sample of young adult male and female college students aged 18-20 years.
2. The secondary aim of this investigation was to examine whether young adult males and females differ in psychosocial predictors of physical activity behavior.

1.4 HYPOTHESIS

1. It was hypothesized that higher levels of exercise self-efficacy, social support for exercise, motivation, exercise enjoyment and positive body image would be associated with higher levels of physical activity.
2. It was hypothesized that motivation would to be a more important predictor of male physical activity when compared to females. In contrast, social support and body image were expected to have stronger influences on young adult female physical activity patterns when compared to their young male counterparts.

1.5 SIGNIFICANCE

Young adult college students are an understudied population at risk for sedentary behaviors. The transition from high school into early adulthood is considered a significant transition an individual enters (46) where parental support decreases and independence increases. Impressionable young adults in the college population face many decisions that can be positively or negatively influenced by peers in the form of peer-pressure and social influences. Many of these decisions are related to negative health behaviors including smoking, binge drinking, and physical inactivity (46). While there is some evidence to suggest that individuals will mature (46), this is also a time to develop lifelong habits that can be associated with positive or negative health behaviors.

The present investigation may provide insight to cohort specific determinates of health-related physical activity. Physical activity interventions have demonstrated positive outcomes of

short-term exercise adherence in young adults aged 18-30 (52). Yet only minor success has been shown with attempts to improve long-term maintenance of exercise behavior. Sallis et al., conducted a 15-week behavioral intervention using: 1) Information-based Determinants (providing information); 2) Behavioral and Social Determinants (behavioral management skills or social influences); and 3) Environmental and Policy Determinants (facilities and other resources) (43, 53) to improve physical activity behaviors throughout a college course (73). The intervention contained components designed to affect self-efficacy, social support, perceived barriers, perceived benefits, and enjoyment (73). No significant increases in physical activity were observed in males, and increased activity levels in females returned to baseline by a two year follow up (14, 73). Perhaps a clearer understanding of age and gender specific determinants of physical activity would enhance the success of these programs. Upon completion of this investigation the primary age and gender specific determinants of physical activity of young adults can be considered. This could be incorporated into interventions that focus on improving physical activity behavior in young adults.

2.0 LITERATURE REVIEW

2.1 INTRODUCTION

The purpose of this literature review is to provide a background of knowledge in the areas of health related physical activity and determinants of physical activity behavior. This chapter will introduce the following: 1) current definition of physical activity; 2) health benefits associated with physical activity; 3) trends of physical activity in the U.S. (specifically young adults age 18-30 years); 4) the physical activity recommendations set forth by the American College of Sports Medicine and American Heart Association (ACSM/AHA); 5) strategies or measurement techniques used to asses physical activity and determinants of physical activity; 6) psychosocial determinants of physical activity (self-efficacy, social support, motivation, enjoyment, and body image); and 7) the theoretical models from which they were derived (Transtheoretical Model of Behavior Change (66), Social Cognitive Theory (7), and the Self-Determination Theory (28)). Understanding psychosocial determinants of physical activity may help in the planning, implementation, and promotion of physical activity and related positive health outcomes in young adults.

2.2 PHYSICAL ACTIVITY

Physical activity and living an active lifestyle are essential to both physical and mental well-being. The benefits of physical activity include but are not limited to: 1) improved cardiovascular fitness; 2) reductions in mean arterial blood pressure; 3) reduced abdominal obesity; 4) reduced incidence of illness; and 5) improved psychological outcomes (2, 23, 108).

In 1985, Caspersen et al., published *"Physical Activity, Exercise, and Physical Fitness: Definitions and Distinctions for Health-Related Research"* to offer an interpretive framework of terms for introducing health-fitness research, and understanding the associations between these three concepts (18). For the purpose of this investigation, the term "physical activity" will refer to "*any bodily movement produced by skeletal muscle that results in energy expenditure*" (18). However this is different from "exercise" defined as "*a subset of physical activity that is planned, structured, and repetitive, and has a final or an intermediate objective of the improvement or maintenance of physical fitness*" (18). The third term "physical fitness" is an outcome measure defined as "*a set of attributes that are either health- or skill-related*" (18). This investigation focused on predictors of health-related physical activity, and include the subset "exercise" as well as other forms of physical activity, including but not limited to, leisure, occupational, sports, conditioning, and household activities.

The current 2007 physical activity guidelines set forth by the American College of Sports Medicine and the American Heart Associations (ACSM/AHA) were revised from the 1995 recommendations, "*Physical activity and public health: a recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine*" (61). The former (1995) recommendations stated: "Every U.S. adult should accumulate 30 minutes or more of

moderate-intensity physical activity on most, preferably all, days of the week" as the minimum amount of activity to prevent CVD (61).

More recent evidence has supported the role of duration and intensity as an additional stimulus of cardiovascular conditioning (i.e. dose-response) (37). The term dose-response refers to the "relation between physical activity and health benefits, in particular, lowering of risk of cardiovascular disease and premature mortality" as a function of intensity, duration, and/or frequency of the activities performed (37). Recent findings suggest that moderate intensity activity (3.0 to 6.0 METs) reduce the risk of cardiovascular and other chronic diseases. However, longer duration or higher intensity (>6.0 METs) physical activity is associated with even greater health risk benefits (37). These developments prompted the current recommendations (37), "*to promote and maintain health, all healthy adults aged 18-65 yr need moderate-intensity aerobic (endurance) physical activity for a minimum of 30 min on five days each week or vigorous-intensity activity for a minimum of 20 min on three days each week*" (37). This equates to an energy expenditure of 1000 kcal·wk^{-1} of moderate physical activity which has been associated with reduced incidence of CVD and premature mortality (67).

2.2.1 Physical Activity in College Age Adults

According to the national Behavioral Risk Factor Surveillance System (BRFSS), approximately half (50.6%) of U.S. adults aged 18 to 65 are meeting the revised 2007 physical activity recommendations (19). Physical activity trends have fluctuated within the past few decades, and current levels are still considered below an acceptable level of participation (13). Brownson et al., suggests that "over the past 20 years, we have seen steady decreases in work-related activity, transportation activity, activity in the home, and increased sedentary behavior, all resulting in a

decrease of total physical activity" (13). Collectively, increasing rates of obesity and chronic disease related to unhealthy lifestyle choices including lack of physical activity continue to remain a major public health concern (37).

Young adults aged 18-20 years are an often-understudied population, compared to children/adolescents, middle-aged/older adults, and special populations. Young adults appear in fewer investigations exploring "determinants" or factors that influence physical activity behavior, in addition to fewer behavioral interventions specifically targeting physical inactivity and overweight/obese young adults (63). The benefits of studying this population who are transitioning to adulthood are significant considering physical activity participation as a young adult (18 years) has been shown to influence physical activity participation later in life (94, 95). Multiple publications have reported that less than half of young adults (18-30 yrs) are regularly active (4, 19, 25). Data from an investigation of general health risk behaviors among college students has shown that 44% of students report participating in vigorous exercise defined as "at least 20 minutes of an activity that makes you breathe hard and sweat (such as jogging, bicycling, etc.)" for 3 or more days a week (25). More recent investigations have yielded similar results. According to the American College Health Association (ACHA), the 2009 National College Health Assessment II estimated 50.4% of males and 39.9% of females aged 18-30 met the 2007 ACSM/AHA recommendations for exercise, and >30% of college students were considered overweight or obese (4).

Increased prevalence of additional cardiovascular risk factors has also been documented in young adults. During a 2002 investigation of 226 college students, 29% of students aged 18-26 had undesirable total cholesterol, 10% had high systolic blood pressure, 11% of students had

high diastolic blood pressure, and greater than 50% consumed diets high in saturated fats, in addition to a family history risk of cardiovascular disease (86).

The factors surrounding a spontaneous change or decrease in physical activity across the lifespan are numerous. However, a pattern of consistent sharp declines in physical activity among young adults between the ages of 18-24 years has been observed. Data suggest that changing patterns in young adults begin when they are considerably more active as youth (≤17 years), and transition throughout the less active middle-age (35-64 yrs) and older adulthood (65+ years) periods (88). Therefore, using young adults within a targeted college population for behavioral interventions designed to increase or even maintain current physical activity levels may help to prevent or delay sedentary behavior into later adulthood.

2.2.2 Assessment of Physical Activity

Multiple strategies or measurement techniques have been developed to assess and quantify physical activity. Doubly labeled water and indirect calorimetery are considered the criterion measurement techniques for the assessment of physical activity. These techniques incorporate the measurement of energy expenditure, measured as kilocalories per day (kcal/day) (82). However, these techniques are costly, time consuming, and not appropriate for large groups. Direct observation, wearable physiologic sensors (i.e. heart rate monitors, pedometers, accelerometers, armbands, etc.), and surveys/recall instruments are widely used, and demonstrated as valid physical activity assessment techniques (82).

Objective measures of physical activity can be assessed using direct observation of individual movement, or with the assistance of mechanical devices such as pedometers and accelerometers. Direct observation provides the greatest accuracy, however, it imposes the

greatest burden on the researcher and is not practical in most research settings (82). Pedometers and accelerometers have shown relatively high correlations to oxygen consumption (r = 0.62 to 0.93) and direct observation (r = 0.80 to 0.97) (82). These devices are user friendly, relatively inexpensive, and easily administered in the sample population. However, monitoring equipment requires additional time and resources. These techniques also lack specificity with respect to exercise modality and intensity; therefore less ideal for larger population based investigations (48).

Surveys and questionnaires are one of the oldest and commonly used methods to assess physical activity in population-based studies (38, 48, 76). Several scales have demonstrated validity (r = 0.40 to 0.97) (48, 38) and reliability (r = 0.67 to 0.96) (48) when validated against criterion measures (38, 76). Developed to assess patterns of physical activity for a wide range of populations, multiple scales have targeted specific age, gender, and ethnic groups. In epidemiological research, physical activity recall by questionnaire is the most practical method for assessing physical activity (106). This is due to a lower cost and time burden for both the researcher and participants, as well as for its effectiveness in measuring physical activity patterns among larger groups of individuals (106).

A widely used and accepted self-report instrument is the Stanford 7-Day Physical Activity Recall Scale (7D-PAR) (11, 76). It is considered to be easily administered, and provides detailed information about activity patterns and types of activity performed. In an attempt to measure total physical activity, the 7D-PAR assesses seven-day total physical activity by separating weekends from weekdays, and assesses work and leisure activities separately. A trained interviewer can assist participants in listing time spent in activity categories, which include: 1) sleep; 2) moderate activity; 3) hard activity; and 4) vigorous activity. The 7D-PAR

has been validated in young adults, and used in investigations examining determinants of physical activity in male and female college students (38, 73). When comparing interview administered 7D-PAR total minutes of activity per week to a TriTrac-R3D accelerometer, intra-class correlations were (r = 0.94 to 0.96) for moderate, (r = 0.97) for hard, and (r = 0.97) for very hard intensity activities, respectively (38). Estimates of average total daily energy expenditure and physical activity energy expenditure have also been validated against the criterion doubly labeled water. No significant differences were found between the 7D-PAR and doubly labeled water for a sample of young adults aged 17-35 years (105).

In addition to the standard activity categories, Rating of Perceived Exertion (RPE) using the Adult OMNI-Walk/Run RPE Scale (101) can be used for an additional intensity dimension (Appendix N). While limited, RPE has provided an intensity dimension in physical activity surveillance (60, 83). A Physical Activity Index (intensity of exercise x volume of exercise) was developed using the product of RPE and measured step count from pedometers (83). The added measure of intensity that RPE provided increased the accuracy of estimating energy expenditure (83).

2.2.3 Assessment of Cardiorespiratory Fitness

Maximal oxygen consumption (VO_{2max}) is a widely accepted and objective index of cardiorespiratory fitness (93). The most widely accepted laboratory measure of VO_2max is indirect calorimeter (42). However, this technique is costly, time consuming, and requires technical supervision making it impractical for population-based investigations (42). An alternative to laboratory testing is the use of a Non-exercise (N-Ex) prediction equation to estimate VO_2max (42). This equation uses variables such as age, gender, BMI, percent body fat,

and physical activity level to predict fitness. While prediction equations are not as accurate compared to exercise testing, particular regression models have demonstrated moderately strong validity (r = 0.78 to 0.81) when compared to indirect calorimetery (16, 42). The well-validated University of Houston prediction equation (42) was used in this investigation to broadly classify participants into poor, moderate, and good cardiorespiratory fitness categories.

2.3 THEORETICAL MODELS OF BEHAVIOR CHANGE

Physical activity patterns and trends are unique to each individual and tend to fluctuate between adoption, maintenance, and relapse back to sedentary behavior (75). Theoretical models can help to explain the relationship between psychosocial factors and health-related physical activity behaviors. From these, it is felt that various psychological determinants drive exercise behavior (7, 28, 66). Previous investigations (27, 73, 81) have used a combination of the Transtheoretical Model of Behavior Change (66), Social Cognitive Theory (7), and the Self-Determination Theory (28) to understand why individuals might be resistant to physical activity behavior change. There is an extensive and expanding body of literature dedicated to identifying and exploring the relationship between determinants and health-related physical activity patterns. Recent developments have shown varying patterns between specific age groups and sex groups (27). However, to date there is insufficient data on specifically the young adult population to completely understand these differences.

Age and sex are considered the most consistent demographic determinants of physical activity behavior (99). However, these variables are fixed (un-modifiable). Modifiable psychosocial characteristics such as self-efficacy, social support, motivation, enjoyment and

body image have previously been related to physical activity behavior, and considered mediators of physical activity behavior (9, 77, 99). Trost et al., identified multiple categories of determinants which included: 1) demographic and biological factors; 2) social and cultural factors; 3) physical activity characteristics; 4) psychological, cognitive and emotional factors; 5) behavioral attributes; and 6) physical environment factors (Appendix A) (99). Personal factors such as self-efficacy and social support have demonstrated the most consistent association with physical activity (9, 77, 99).

Modifiable psychosocial variables with the highest correlations to physical activity derived from the previously mentioned constructs are well documented in the literature for adult populations (18-64 years) and include: 1) self-efficacy for exercise (55); 2) social support for exercise (24, 98); 3) intrinsic and extrinsic motivation (28, 87); 4) exercise enjoyment (12, 50); and 5) ratings of one's body image (26, 44). Evidence suggests that motivation for exercise, for males is the opportunity for competition, while females are more influenced to exercise by social support and rating of one's body image (27, 45). Previous investigations targeting young adults have not identified clear trends related to college age specific determinants of physical activity (14, 99). Therefore, it is necessary to explore factors that explain exercise behavior, and impact overall health of young adults.

2.3.1 Transtheoretical Model of Behavior Change

In an attempt to explain the process of behavior change, Prochaska and DiClemente developed the *Transtheoretical Model of Behavior Change (TTM)* (66). The TTM uses key transtheoretical constructs of stages and processes of change to explain behavior change (65). The TTM was originally developed for psychotherapy to identify readiness to change addictive behaviors such

as smoking. The success of smoking cessation programs utilizing this construct prompted the adoption of the model using alternate behaviors such as diet and physical activity.

Recognizing that neither behavior nor behavior change is static, rather dynamic and changing, the original TTM incorporates the five "Stages of Change" to a linear model (65) (Appendix B). This 5-stage process includes:

1. *Precontemplation*: Individuals who have no intent on making a behavior change in the near future. They are unaware of any need to change.
2. *Contemplation*: Individuals who are aware of the problem and understand the need for change. These individuals have yet to make a commitment to take action.
3. *Preparation*: This includes intent to make a particular behavior change within the next month. For example, individuals who have started regular exercise programs and experienced failure might be making small behavior changes in "preparation" for making a commitment to be physically active.
4. *Action*: Individuals who have altered their behavior and made their desired behavior change. Criteria for this stage includes, modifying behaviors for a period of 1 day to 6 months (i.e. joining a gym and exercising, taking regular walks, playing sports, etc).
5. *Maintenance*: The primary aim of this stage is to prevent relapse. Individuals who have continued their behavior change for a period longer than 6 months are considered to be in the maintenance stage.

Since behavior change is not always successful on a first attempt, the "Spiral Pattern of Change" (Appendix B) better illustrates a dynamic movement within the construct. An individual can enter the chain at any stage, and may "relapse and recycle" throughout the stages (65). However, the linear modeling or listing of category stages is still used for ease of

presentation and consistency in the literature. Physical activity behavior may be converted into a questionnaire form and fits ideally into the theoretical constructs of the TTM to assess one's stage or readiness to change (become physically active).

Wyse et al., demonstrated concurrent validity for the stages of change model when they successfully predicted stage membership in young adults age 16-21 years through the assessment of self-reported behavioral and psychological parameters (110). The scale discriminated effectively ($F > 7.34$, $P < 0.01$) between the Exercise Behavior Change Categories of Precontemplation/Contemplation ($n = 49$), Preparation ($n = 87$), and Action/Maintenance ($n = 108$) in self-reported levels of exercise behavior for both males and females (110). A Meta-Analysis conducted by Marshall and Biddle, confirmed that activity levels increase as individuals move through to higher stages of the model (54). This suggests that researchers can employ the Transtheoretical Model of Behavior Change into intervention strategies that are specific to individual stage membership. This information can be used to increase specificity and effectiveness of interventions designed to increase physical activity behaviors.

The TTM can also be used in conjunction with other theoretical models (i.e. Social Cognitive Theory) to form a more complete understanding of one's beliefs and reasons for action, and to predict exercise behavior.

2.3.2 Social Cognitive Theory

Developed by Bandura in 1977, the Social Cognitive Theory (SCT) explains the adoption, initiation, and maintenance of health behavior (21). It is based on the notion that "behavior change is made possible by a personal sense of control" (21). It is this 'can do' attitude that makes one successful in accomplishing behavior change goals. The SCT has been applied to

several dimensions of behavior including school achievement, emotional disorders, mental and physical health, career path decisions, and sociopolitical change (21). Key constructs derived from the SCT include self-efficacy, social support from friends and family, and outcome expectancies (21).

2.3.2.1 Self-Efficacy

Self-efficacy defined as "one's belief or confidence in their ability to perform a specific behavior", is one of the most consistent predictors of physical activity independent of age and gender (56). It has been shown to enhance or impede motivation, and is one of the strongest psychosocial determinants of physical activity (21). Bandura has identified four sources of self-efficacy including: 1) personal accomplishment or mastery; 2) vicarious experience (i.e. when a model that is similar to the individual accomplishes a specific behavior or task); 3) verbal persuasion (i.e. health coaching); and 4) emotional arousal (7). Personal mastery has been shown to be the strongest source of self-efficacy, however each source is considered to be important within the model (21).

In this investigation Exercise Self-Efficacy has been assessed using a scale developed by Marcus et al., (52) (Appendix G). This brief 5-item questionnaire is one of the most commonly used assessments of self-efficacy designed to assess confidence in one's ability to exercise under conditions that might affect participation. This instrument is considered reliable with internal consistency demonstrated as ($r = 0.76$) (52).

2.3.2.2 Social Support

Social support from family and friends has been positively correlated with physical activity in a wide range of populations (17, 50, 91). Socializing with family and friends that exhibit healthy behaviors tends to encourage health related behaviors. However this relationship is mediated by age, race, gender, and type of activity (occupational, leisure, or sport). Social support appears to be a more important determinant of physical activity in women. In a review of biracial young to middle-aged adults (mean age 38 ± 8.9 years), self-reported physical activity and social support for exercise suggested that regardless of activity type (occupational, leisure or sport), work status, or race, activity level was positively related to "family" support for exercise (98). In contrast, only sports activities were positively related to "family and friend" support. In this investigation social support for exercise has been measured using the Social Support for Exercise Scale (74) (Appendix H). This scale includes two subscales designed to differentiate between friend and family support for physical activity. Sallis et al., found this scale to be correlated with exercise habits, providing evidence of concurrent and criterion-related validity (r = 0.61 to 0.91) (74).

2.3.3 Self-Determination Theory

The Self-Determination Theory (SDT) (28) uses motivation and personality to explain behavior and development. Initially, the SDT was used to explain behavior as being "proactive and engaged or, alternatively, passive and alienated" (69). This theory can be applied to multiple domains including health care, education, occupation, sport/athletics, religion, and psychology (69). Concentrating primarily on *intrinsic motivation* (the satisfaction of performing the actual

behavior itself, exclusive of external reward or consequences), the SDT can be applied to long-term maintenance of physical activity (69). *Extrinsic motivation* defined as "performing behaviors in order to obtain rewards or outcomes separate from the behavior itself" (70), is considered a positive motivating factor that contributes to the overall drive to perform a particular behavior. Displayed in Appendix C, the self-determination continuum integrates multiple forms of motivation to determine behavior that include:

1. *Amotivation*: Lack of intent to act (no action at all or acting without intent) is the result of not understanding the value of an activity, lack of competency, or presence of an undesirable outcome (70).
2. *Intrinsic Motivation*: Characterized by *intrinsic regulation*, is a highly autonomous form of motivation that promotes behavior or action based on interest, enjoyment, or inherent satisfaction. For the purpose of this investigation, individuals who were motivated to be physically active mainly by enjoyment, defined as "desire to have fun, pursue interests, be stimulated" (70) were considered to be intrinsically motivated.
3. *Extrinsic Motivation*: This form of motivation covers the intermediate ranges of autonomy and includes:

   a) *External Regulation*: This subdivision of extrinsic motivation includes acting or performing a specific activity in order to satisfy an external demand or reward (70).

   b) Identified Regulation: Accepting or experiencing a sense of value for a specific behavior or action characterizes this more autonomous form of extrinsic motivation (70).

Additionally, when individuals are primarily motivated by body-related reason, they are considered to have extrinsic motivation.

2.3.3.1 Motivation

In this investigation motivation to be physically active has been measured using the Situational Motivation Scale (SIMS) (35) (Appendix I). The SIMS has demonstrated internal consistency values of: (Cronbach's α); 1) Intrinsic motivation (r = 0.95); 2) Identified regulation (r = 0.80); 3) External regulation (r = 0.86); and 4) Amotivation (r = 0.77) (35).

2.3.3.2 Exercise Enjoyment

Exercise enjoyment can be defined as positive feelings such as pleasure, liking, or fun (36), and has been shown to influence continued participation in physical activity in both young and older adults (12, 36, 50 85). An investigation of Australian college students revealed that lower enjoyment of activity was a significant independent predictor of inactivity in both males and females (50). In a health care-based physical activity intervention, exercise enjoyment appeared to positively influence participation and adherence to activity programs, and act as a mediator of exercise level (36). Additionally, enjoyment has been shown to be one of the most powerful determinants of physical activity in select male cohorts (85). Exercise enjoyment has been assessed using the Physical Activity Enjoyment Scale (PACES) (Appendix J) that determines "the extent to which an individual experiences a particular physical activity as enjoyable at a given point in time" (44).

2.3.3.3 Body Image

An early and widely accepted definition of body image developed by Schilder, stated that body image is the "reflection or picture an individual has of his or her body and the qualitative self-identity attached to this perception" (79). Body image is one of the more interesting determinants of physical activity because it impacts multiple areas in our lives. One's perception of body image can affect decisions of "daily habits, patterns of food choice, choice in clothes, confidence in public, and even influence mood" (33). It has been suggested that children with high "body anxiety" (negative body image) participate in fewer athletic activities, and avoid physical activity as an adult (80). One of the many benefits of regular physical activity/exercise is a positive change in body composition characterized by a decrease in fat mass and an increase in lean muscle mass, resulting in a more positive body image and overall mental well-being. In this investigation the Contour Drawing Rating Scale has been used to measure Body Image (Appendix K). Seven-day test-retest reliability for self-ideal ratings using the Contour Drawing Rating Scale was ($r = 0.79$) (97). In addition, the scale has been validated against body weight parameters ($r = 0.71$) (97).

2.4 SUMMARY OF LITERATURE REVIEW

Despite the strong evidence supporting the importance of physical activity in the guidelines for health related physical activity, there remains a trend of sedentary behavior within the U.S. population. College students (specifically young adults age 18-30 years) are not meeting the current guidelines for physical activity and have increased risks for CVD, metabolic disorders,

and other chronic diseases. Young college aged adults appear in fewer research investigations examining health related behaviors and remain an understudied population at risk for sedentary behaviors.

To explain and better understand declining trends in physical activity, theoretical models including: 1) Transtheoretical Model of Behavior Change (66); 2) Social Cognitive Theory (7); and 3) Self-Determination Theory (28) have explored determinants of physical activity behavior and behavior change. Five modifiable determinants of physical activity demonstrated as having particularly strong relationships to physical activity include: 1) self-efficacy (52); 2) social support (74); 3) motivation (35); 4) enjoyment (44), and 5) body image (97).

Considered valid and reliable, questionnaires and scales have been developed to assess physical activity and determinants of physical activity. The Stanford 7-day Physical Activity Recall (76) was used to assess total physical activity (min/wk). This scale has been used in multiple investigations assessing physical activity patterns in young adults and is particularly useful in assessing sleeping patterns, moderate, and vigorous activities separately. Additionally, the Exercise Self-Efficacy Scale (52), Social Support for Exercise Scale (74), Situational Motivation Scale (SIMS) (35), Physical Activity Enjoyment Scale (PACES) (44), and the Contour Drawing Rating Scale (97) were used to assess the determinants of physical activity in this investigation. It is anticipated that this data would include the use of these correlates as identified variables (determinants) for future behavior interventions that target improving physical activity behaviors among undergraduate college students.

3.0 METHODS

This cross-sectional study identified psychosocial variables associated with exercise behaviors in undergraduate college students. The primary aim of this investigation was to explore the relation between physical activity and modifiable psychosocial variables of: 1) self-efficacy; 2) social support; 3) motivation; 4) exercise enjoyment; and 5) body image in young adult college students ages 18-20 years. A secondary aim of this investigation was to examine whether young adult males and females differ in psychosocial predictors of physical activity behavior. All investigational procedures were approved by the University of Pittsburgh Institutional Review Board (IRB).

3.1 SUBJECTS

Thirty-five males and fifty-five females ages 18-20 years were recruited for this investigation. The mean age was 18.7±0.7 years for the combined sample. Ninety seven percent of males and 78.2% of the females enrolled were college freshmen. The distribution of race reflected the University of Pittsburgh student body with 67.8% of the total sample described as White/Caucasian. To be eligible to participate, subjects were: 1) healthy; 2) male and female, aged 18-20 years; and 3) willing to undergo one testing session at the scheduled time and date in the Center for Exercise and Health-Fitness Research at the University of Pittsburgh. Subjects

were excluded from participation if they: 1) had an orthopedic, cardiovascular and/or metabolic condition (i.e. coronary artery disease, prior myocardial infarction, peripheral vascular disease, chronic obstructive pulmonary disease, and diabetes mellitus) that would limit participation in physical activity; 2) possessed implanted devices (such as a cardiac defibrillator); 3) knowingly pregnant; 4) participated in collegiate (NCAA) athletics; and/or 5) unable to participate in all laboratory visits due to time or other conflicts. No exclusion criteria are based on race, ethnicity, gender, or HIV status. Prior to data collection, all participants read an informed consent document (Appendix O) that explained the nature of the research, its risks, benefits, and rights as a potential research subject. Ample time was provided for potential participants to ask questions prior to approval and signature of consent forms.

Descriptive characteristics including: 1) age; 2) gender; and 3) race; were assessed for demographic purposes by a questionnaire. In addition, other health behaviors including tobacco, drug/alcohol, and time spend sitting watching television/computer screen, were assessed by a questionnaire (Appendix M). Subject characteristics including demographics and anthropometrics can be seen in Table 1.

Table 1. Subject Characteristics

Characteristics	Males (n = 35)	Females (n = 55)	Total (n = 90)
Demographic			
Age (yrs)	18.5±0.6	18.7±0.7	18.7±0.7
Freshmen	97.1%	78.2%	85.6%
Race/ethnicity			
White	62.9%	70.9%	67.8%
African American	5.7%	10.9%	8.9%
Hispanic	5.7%	0.0%	2.2%
Asian American	25.7%	7.3%	14.4%
Other	0.0%	10.9%	6.7%
Living on Campus (%)	94.3%	89.1%	91.1%
Employed (%)	20.0%	29.1%	25.6%
Anthropometrics			
Height (cm)	175.7±7.5	163.6±7.3	168.3±9.5
Weight (kg)	72.8±10.4	62.6±8.3	66.6±10.4
BMI (kg/m^2)	23.3±3.0	23.4±2.9	23.3±2.9
% body fat	13.4±4.4	26.2±5.8	21.2±8.2
Waist circumference (cm)	79.8±7.1	72.4±11.0	68.5±7.8
Systolic Blood Pressure (mmHg)	117.5±7.6	109.1±10.1	112.3±10.1
Diastolic Blood Pressure (mmHg)	71.1±6.7	66.8±8.1	68.5±7.8

Values are Means ± Standard Deviation (SD) or n (%)

3.2 RECRUITMENT PROCEDURES

Subject recruitment utilized University of Pittsburgh and University of Pittsburgh Medical Center Audix system, advertisements distributed across the University of Pittsburgh and surrounding community, in addition to fliers posted in select campus locations. Potential subjects contacted the principal investigator concerning their interest in the study, and a preliminary phone screening followed, in addition to the scheduling of the laboratory visit. Subjects received ten to twenty dollars compensation for their participation in this research investigation.

3.3 RESEARCH DESIGN

This investigation employed a cross-sectional correlational design. Total weekly hours of physical activity served as the dependent variable. The predictor variables were assessed using standardized questionnaires in a counterbalanced fashion and include the following measures: 1) self-efficacy; 2) social support; 3) motivation; 4) enjoyment; and 5) body image, which will be described in a section 3.5.

3.4 LABORATORY SESSION

During a single visit to the Center for Exercise and Health-Fitness Research (CEHFR), participants underwent blood pressure and anthropometric measures in addition to the completion of a questionnaire packet. Potential risks/benefits and underlying rational for the investigation were explained to all subjects where upon written consent to participate was obtained. Following IRB consent, blood pressure and anthropometric measures were conducted for descriptive purposes. Immediately following the anthropometric measure, a packet containing questionnaires regarding demographic, psychosocial determinants of physical activity, and self-report physical activity were completed (Appendix G-M). The psychosocial variables assessed were related to five core variables, and include questions regarding: 1) self-efficacy (52); 2) social support (74); 3) motivation (35); 4) enjoyment (44), and 5) body image (97). Shown in Appendix L, the five scales range from 1 to 20 items in length and consist of brief question and answer statements. As previously explained, the five scales have demonstrated high levels of

internal consistency, reliability (r = 0.76 to 0.85), and validity (r = 0.61 to 0.91) (35, 44, 52, 74, 97).

3.5 ASSESSMENTS

3.5.1 Blood Pressure Measures

Upon arrival to the session and completion of the informed consent documents, subjects sat quietly for 5 minutes in a chair with back support. An appropriate size cuff was wrapped firmly around the subject's upper arm at heart level, aligned with the brachial artery using the protocol adopted from the National High Blood Pressure Education Program (NHBPEP) (96). The bell of the stethoscope was placed below the antecubital space over the brachial artery. Systolic and diastolic values were recorded consistent with the Korotkoff sounds. Two measurements were conducted with a minimum of two to three minutes separating each measure. The measure of blood pressure helps to identify the health of the sample population and is compared to national averages in Chapter 4.

3.5.2 Anthropometric Measures

In an effort to better understand the sample population's health risk profile, anthropometric measures to assess body size and body composition were performed by a trained exercise physiologist. A participant's standing Height (cm) without shoes was measured using a calibrated stadiometer. The mean of two measures was obtained with the subject stepping off the

scale for each trial. Body weight (kg) was measured on a calibrated physician's balance beam scale. Weight was measured to the nearest 0.2 kg. Height and weight was used to calculate the subject's body mass index (BMI) (kg/m^2).

Body Composition (percent fat and lean body mass) was assessed using the Tanita Body Fat analyzer (Tanita Corporation, Skokie, IL). This leg-to-leg bioelectric impedance analysis (BIA) scale provides a quick, easy, and accurate estimate of percentage of body fat, fat mass (kg) and fat-free mass (kg). Rubiano et al., demonstrated that the mean percent fat estimations from the Tanita BIA and dual-energy X-ray absorptiometry (DXA) do not differ, with a high correlation of ($r = 0.90$, $P < 0.001$) between Tania BIA and DXA (71). The resistance to current flow (impedance) through tissues reflects the relative amount of fat present (109). After age and height were entered into the analyzer, participants removed their shoes and socks. Subjects stood on the scale for approximately 10 seconds to obtain the body composition assessment. These procedures were completed with the analyzer in standard mode for a non-athletic population.

Waist circumference (cm) was measured using a protocol modified from Callaway et al., (15). A flexible, inelastic tape measure was placed on the skin surface without compressing the subcutaneous adipose tissue. Subjects stood with arms at their sides, feet together, and abdomen relaxed for the waist measure. A horizontal measure was obtained at the narrowest part of the torso (above the umbilicus and below the xiphoid process (15).

3.5.3 Non-Exercise VO_{2max} Prediction Equation

As an index of cardiorespiratory fitness, maximal oxygen consumption (VO_{2max}) was estimated using the University of Houston Non-exercise (N-Ex) prediction model (42). Age, gender, physical activity rating (PA-R) (Appendix D) and percent body fat were entered into a regression

equation (Appendix D) to predict VO_{2max}. The PA-R scale assesses exercise habits on a 7 point scale; with 0 points representing the least amount of activity and 7 the highest.

3.5.4 Physical Activity Assessment

For its usefulness in evaluating physical activity of young adults on a college campus, a survey questionnaire is ideal for its low cost, ease of data collection, and short turnaround time for availability of results (49). The Stanford 7-day Physical Activity Recall Scale (7-D PAR) (76) (Appendix E) was used during the physical activity interview to assess self-reported regular physical activity. This instrument estimates both work-related and non-work-related physical activity. For each day of the past week, participants reported approximate number of hours and minutes they spent sleeping, participating in moderate, hard, and very hard physical activity. During the interviewer (PI) administered 7-D PAR, subjects were given verbal descriptors (Appendix F) for each activity category including moderate, hard, and very hard. The 7-D PAR has demonstrated adequate test-retest reliability (0.73) (76), and validity compared to direct measures of physical activity (92). This instrument allows for a comparison of determinants between various intensities and modes of physical activity. Time spent sleeping is represented by 1 MET, light activity (1.5 METs), moderate (4 METs), hard (6 METs), and very hard (10 METs). These values were calculated for the previous seven days, multiplied by their respective MET values, and then totaled (75). Total kilocalories of energy expenditure per day (kcal/kg/d) was determined by dividing weekly energy expenditure by seven, and multiplying by body weight (70kg). RPE-minutes were calculated by multiplying the reported RPE assigned to each activity by the minutes spent at the activity (RPE-Minutes = RPE x minutes). For example, walking at an OMNI-RPE of 3 for 30 minutes would be recorded as 90 RPE-Minutes. The RPE-

minutes for each activity were totaled for each day. The seven daily RPE-minutes were added together and represented total weekly RPE-minutes.

3.5.5 Assessment of Exercise Self-Efficacy

Exercise self-efficacy measures confidence to perform a given exercise related task under difficult situations. Exercise self-efficacy was assessed using a scale developed by Marcus et al., (52) (Appendix G). This brief 5-item questionnaire assesses confidence in one's ability to exercise under conditions that might affect participation. Internal consistency has been demonstrated to be ($r = 0.76$) (52). Instructions for completing the form were verbally reviewed by the test administrator and reviewed upon competition. Scores were calculated by computing the mean of all five items for each client. Scores can range from 1 (not at all confident) to 5 (extremely confident) for each of the five situations. A total score could range from 1 to 5 points, with one representing lowest efficacy to exercise, and five representing the highest (most confident).

3.5.6 Assessment of Social Support

Social support for exercise was measured using the Social Support for Exercise Scale (74) (Appendix H). Sallis et al., found this scale to be correlated with exercise habits and previous evidence has demonstrated concurrent and criterion-related validity ($r = 0.61$-0.91) (74). This scale includes two subscales designed to differentiate between friend (peers) (5-item) and family (member of household) (15-item) support for physical activity. Subjects rated the frequency of support from family and friends on a 5-point likert scale [1 (none) and 5 (very often)] for each

item on the questionnaire. A total sum of all subscales was recorded. A lower score represented less support, while a higher score represented higher support.

3.5.7 Assessment of Motivation

Motivation to be physically active was measured using the Situational Motivation Scale (SIMS) (35) (Appendix I). This 16-item scale will assess four subscales of motivation that include: 1) Intrinsic motivation; 2) Identified regulation; 3) External regulation; and 4) Amotivation. Internal consistency has been demonstrated to be ($r = 0.85$) (35). The questionnaire assesses reasons for participating in exercise on a 7-point likert scale (1 corresponds not at all to motivational factor and 7 corresponds exactly to motivational factor). A total sum of each subscale was recorded. Subscale 1. (Intrinsic motivation) was used to represent Intrinsic motivation while Subscales 2. (Identified regulation) and 3. (External regulation) were combined to represent extrinsic motivation. Lower scores are associated with less motivation, while higher scores are associated with higher motivation.

3.5.8 Assessment Exercise Enjoyment

Exercise enjoyment was assessed using the Physical Activity Enjoyment Scale (PACES) (44) (Appendix J) that determines “the extent to which an individual experiences a particular physical activity as enjoyable at a given point in time” (44). Factoral validity and convergent evidence for construct validity indicate that the PACES is a valid measure of physical activity enjoyment (44, 57). Subjects rated their feelings about physical activity on a seven point likert scale for 18 items.

A sum of all items together for a final score ranged from a possible 18 (lowest enjoyment) to 126 (highest enjoyment). Higher scores reflect greater enjoyment.

3.5.9 Assessment of Body Image

The Contour Drawing Rating Scale was used to measure Body Image (Appendix K) (97). Seven-day test-retest reliability for self-ideal ratings using the Contour Drawing Rating Scale was moderately strong (0.79) and the scale has been validated against body weight parameters (0.71) (97). This scale consists of a nine-figure silhouette rating used to measure body perception. Subjects indicated which figure best represents their body shape, as well as the figure that best represents their desired body shape. Each body shape was given a number, which is reported as the body image score.

3.6 DATA ANALYSES

Separate analyses were done by sex for males and females, as previous evidence has supported that the relative contribution of predictor variables may differ by gender (27). As the first step in data analyses, descriptive statistics were computed for demographics, BMI, the five predictor variables, and the dependent variable of physical activity. Distributions of variables were examined within each gender to identify any instances of outliers and/or evidence of severe violation of the assumption of normality.

Prior to regression analysis, bivariate correlations between all pairs of variables were computed for the male and female subsamples. Finally, separate simultaneous multiple

regression analyses were carried out for the male and female samples. Total weekly hours of physical activity served as the primary dependent variable. A secondary analysis replaced total weekly hours of physical activity as the dependent variable with; 1) total minutes of physical activity without minutes of walking; and 2) RPE-minutes. The predictor variables include motivation (intrinsic and extrinsic), self-efficacy, social support (family and friends), enjoyment, and body image. All statistical analyses were conducted using SPSS (program version 18.0), with an alpha level of $p < 0.05$.

3.6.1 Power Analysis

Self-efficacy, social support, and social influences were found to be significant predictors of physical activity in several previous studies (3, 6, 90). The Strauss et al., study found that self-efficacy alone explained 10% of the variance in physical activity (90). It seemed reasonable to posit that the remaining four predictors in the current study (motivation, social support, exercise enjoyment, and body image) would explain at least an additional 7% of the variance. Given an alpha of .05, and an effect size (R-squared) of .17, it was found that a sample size of 72 participants would be required to reach power of 80%.

4.0 RESULTS

The purpose of this investigation was to identify psychosocial variables associated with exercise behaviors in undergraduate male and female college students. The dependent variable in this investigation was total weekly minutes of physical activity. The relation between self-report physical activity and modifiable psychosocial variables of: 1) self-efficacy; 2) social support; 3) motivation; 4) exercise enjoyment; and 5) body image will be explained separately for males and females in the following sections.

4.1 SUBJECT CHARACTERISTICS

Ninety apparently healthy college males (n=35) and females (n=55) aged 18 to 20 years were recruited from the University of Pittsburgh to participate in this investigation. Of this cohort, 86% were college freshmen. A summary of descriptive characteristics for all subjects is provided in Table 1.0 (Chapter 3, Methods). Sixty-seven percent of participants described themselves as white, with 14.4% of the total population reporting Asian American, 8.9% African American, 2.2% Hispanic and 6.7% other. Subjects presented with primarily healthy body weight, BMI, percent body fat, and waist circumference measurements when compared to the ACSM 2009 Guidelines (5) for young adults of the same age.

Cardiorespiratory fitness (Table 2) was estimated using the University of Houston Non-exercise prediction model (42). The mean ± standard deviation (SD) estimated maximal oxygen consumption was 52.4±3.2 ml·kg·min^{-1} for males and 38.5±4.7 ml·kg·min^{-1} for females, placing them in excellent and good fitness categories, respectively (5).

Table 2. Estimated Fitness Categorization

	Male (n = 35)	**Female (n = 55)**	**Total (n = 90)**
VO_2max (ml·kg·min^{-1})	52.4±3.2	38.5±4.7	43.9±8.0
ACSM Fitness Category			
Very Poor	0 (0.0%)	5 (9.1%)	5 (7.8%)
Poor	0 (0.0%)	8 (14.6%)	8 (27.8%)
Fair	1 (2.9%)	11 (20.0%)	12(36.7%)
Good	9 (25.7%)	24 (43.6%)	33 (13.3%)
Excellent	18 (51.4%)	7 (12.7%)	25 (8.9%)
Superior	7 (20.0%)	0 (0.0%)	7 (5.6%)

Values are Means ± Standard Deviations (SD), or n (percent)

Additionally, health behaviors were assessed during the questionnaire portion of the screening. This included providing estimated total minutes per day of: 1) cell phone use (texting, games, web, social media, and music); and 2) screen time (TV and computer use) (Table 3). A monthly record of tobacco, alcohol, and marijuana was also obtained for descriptive purposes.

Table 3. Health Behaviors

	Male (n = 35)	Female (n = 55)	Total (n = 90)
TV, Computer (hrs·day^{-1})			
None	2 (5.7%)	5 (9.1%)	7 (7.8%)
1hr or less	13 (37.1%)	28 (50.9%)	41 (45.6%)
2-3 hrs	14 (40.0%)	14 (25.5%)	28 (31.1%)
4-5 hrs	4 (11.4%)	4 (7.3%)	8 (8.9%)
≥ 6 hrs	2 (5.7%)	4 (7.3%)	9 (6.7%)
Cell phone, Texting (hrs·day^{-1})			
None	1 (2.9%)	0 (0.0%)	1 (1.1%)
1hr or less	7 (20.0%)	7 (12.7%)	14 (15.6%)
2-3 hrs	12 (34.3%)	24 (43.6%)	36 (40.0%)
4-5 hrs	11 (31.4%)	10 (18.2%)	21 (23.3%)
≥ 6 hrs	4 (11.4%)	14 (25.5%)	18 (20.0%)
Smoke cigarettes (past 30 days)	4 (11.4%)	2 (3.6%)	6 (6.7%)
Drink alcohol (past 30 days)	28 (80.0%)	38 (69.1%)	66 (73.3%)
Marijuana (past 30 days)	12 (34.3%)	4 (7.3%)	16 (17.8%)

Values are n (percent)

Subjects reported less cigarette use (11.4% of males; 3.6% of females) within the past 30 days compared to 2010 national averages (22.8% of males and 17.4% of females) for young adults aged 18-24 years (20). Reported alcohol use (73.3%) for the total sample was slightly greater than the 2009 National Survey on Drug Use and Health (NSDUH) reported findings of 61.8% among young adults aged 18-25 years (20). Marijuana use (17.8%) reported in the present investigation is consistent with the 2009 NSDUH (21.2%) for young adults aged 18-25 years (20).

The overall health status of the sample population appears to be average or above average for young adult college students 18-20 years of age. Additionally, the health behaviors of the sample population are fairly consistent with previously reported national averages.

4.2 PHYSICAL ACTIVITY RECALL

Minutes per week spent engaged in moderate, hard, and very hard physical activity for the seven-day period preceding the day of the investigator-administered interview was collected. Total minutes of physical activity per week for each category can be seen in Table 4. The mean total physical activity was 524 minutes per week and 393 minutes per week for males and females, respectively. These values meet and exceed the current ACSM/AHA recommendations (37) for minutes of physical activity per week. In addition, 60.0% of subjects reported 30+ minutes of moderate physical activity five or more days per week, just above the 2009 national average of 50.6% (BRFSS, 2009). However, minutes of total physical activity were lower than values reported by Sallis et al., for young adult males (966.0 mins·wk^{-1}) and females (553.8 mins·wk^{-1}) in the original 7D-PAR validation studies (11, 76). In addition, Salmon et al., reported nearly identical findings for total minutes of self-report physical activity in young adults aged 18-30 years (78). Reporting 456±378 mins·wk^{-1} for the combined sample (78) compared to 444.4±261.5 mins·wk^{-1} for the combined sample in this investigation.

Table 4. Seven Day-Physical Activity Recall Results

	Male (n = 35)	**Female (n = 55)**	**Total (n = 90)**
Moderate (min·wk^{-1})	171.2±120.8	193.7±129.2	184.9±125.8
Hard (min·wk^{-1})	237.0±221.4	104.8±114.5	156.2±175.7
Very Hard (min·wk^{-1})	116.8±185.9	94.9±194.4	103.4±109.4
Total (min·wk^{-1})	524.0±271.9	393.3±243.5	444.5±261.5

Values are Means ± Standard Deviations (SD)

An estimate of daily total energy expenditure was calculated using the data collected from the physical activity recall. An appropriate MET value (Moderate = 3METs, Hard =

6METs, and Very Hard = 9METs) (76) was assigned to each intensity level resulting in an overall estimate of energy expenditure (kcals/day) for each subject. The data are presented for male and females in Table 5. The energy expenditure noted presently is consistent with previously reported data in young adult males and females using the 7D-PAR (11, 76). The original 7D-PAR validation study reported estimated energy expenditure to range from 2,837 kcal·day^{-1} to 3,614 kcal·day^{-1}, and from 2,332 kcal·day^{-1} to 2,496 kcal·day^{-1} for young adult males and females, respectively (11).

Table 5. Estimated Kilocalories per Day for Males and Females

	Male (n = 35)	**Female (n = 55)**	**Total (n = 90)**
Sleep (kcal·day^{-1})	610.9±123.4	517.2±86.5	551.8±100.3
Activity			
Light (kcal·day^{-1})	1882.7±288.5	1614.9±232.9	1717.8±278.0
Moderate (kcal·day^{-1})	130.3±99.2	107.8±67.6	114.5±79.8
Hard (kcal·day^{-1})	148.6±137.0	142.7±186.0	158.6±318.7
Very Hard (kcal·day^{-1})	106.9±148.5	191.3±345.2	166.9±318.7
Total (kcal·day^{-1})	2879.2±402.6	2573.9±429.2	2709.7±561.0

Values are Means ± Standard Deviations (SD)

In addition to the standard outcomes of the 7D-PAR, participants were asked to assign a rating of perceived exertion for each of the activities reported in an effort to capture a wider range of exercise intensity. The RPE-minutes were then calculated by multiplying the RPE for each activity reported by the minutes for each activity (RPEminutes = RPE x minutes). The RPE-minutes for each activity were totaled for each day. The seven daily RPE-minutes were added together and represented total weekly RPE-minutes. RPE-minutes ranged from 590 per week to 6480 per week for males and 210 per week to 6400 per week for females. The mean±SD may be viewed in Table 6.

Table 6. Total RPE-minutes

	Male (n=20)	Female (n=33)	Total (n=53)
RPE-minutes	3140.2±1787.4	2150.4±1906.6	2523.9±1907.6
Max score	6480	6400	6480
Min score	590	210	210

Values are Means ± Standard Deviations (SD)

During the 7D-PAR, subjects were asked to report hours spent sleeping at night and throughout the day. Male subjects reported a mean of 8.20(±0.87) hours of sleep per night with an average of 0.24(±0.27) hours spent napping during the day, for a total of 8.43(±0.89) hours of sleep per day. Female subjects reported similar hours of sleep with a mean of 7.88(±0.76) hours of sleep per night and an average of 0.33(±0.42) hours spent napping during the day, for a total of 8.21(±0.76) hours of sleep per day. These values are consistent with previous reports using the 7D-PAR (76) and the current recommendation of 7-9 hours of sleep per night for adults (58).

4.3 PSYCHOSOCIAL DETERMINANTS

The assessment of 1) self-efficacy; 2) social support; 3) motivation; 4) exercise enjoyment; and 5) body image was performed using standardized questionnaires via investigator interview described in previous Sections (3.4). The mean (±SD) scores for the male and female sample are presented in Table 7.

Table 7. Descriptive Statistics for Independent Variables

	Males (n = 35)	Females (n = 55)	Total (n = 90)
Self-efficacy	3.29±0.64	2.87±0.61	3.03±0.65
Social Support-Family	28.69±7.72	33.51±13.29	31.63±11.64
Social Support-Friend	12.77±4.50	15.58±5.32	14.49±5.18
Motivation-Intrinsic	5.71±0.92	5.15±1.12	5.37±1.08
Motivation-Extrinsic	8.91±1.61	9.55±1.72	9.31±1.70
Motivation-Total	16.16±2.11	12.27±2.33	16.23±2.23
Exercise Enjoyment	104.97±12.78	100.20±13.44	102.06±13.32
Body Image	0.86±0.77	1.00±0.745	0.94±0.75

Values are Means ± Standard Deviations (SD)

4.4 BIVARIATE CORRELATIONS BETWEEN INDEPENDENT VARIABLES

To examine the relationship between predictor variables, Pearson Product-Moment correlations are presented in Tables 8-9. For males, self-efficacy was significantly correlated with exercise enjoyment (r=0.397) and body image (r=-0.307). Additionally, exercise enjoyment was significantly correlated with support from friends (r=0.315) and body image (r=-0.364).

Table 8. Pearson Correlations between all Independent Variables for Males

		1	2	3	4	5	6
1. Self-Efficacy	Pearson Correlation Sig. (1-tailed)	-					
2. Enjoyment	Pearson Correlation Sig. (1-tailed)	.397** .009	-				
3. Motivation	Pearson Correlation Sig. (1-tailed)	-.007 .484	.058 .371	-			
4. Support Friend	Pearson Correlation Sig. (1-tailed)	.116 .253	.315* .032	.071 .344	-		
5. Support Family	Pearson Correlation Sig. (1-tailed)	.177 .155	.212 .111	.096 .291	.005 .489	-	
6. Body Image	Pearson Correlation Sig. (1-tailed)	-.307* .037	-.364* .016	.015 .466	-.018 .459	.061 .363	-

*(*p<0.05, **p<0.01)*

For females, self-efficacy was significantly correlated with exercise enjoyment (r=0.608) and total motivation (r=0.325). Exercise enjoyment was significantly correlated with total motivation (r=0.408) and support from family (r=0.399). Total motivation was significantly correlated with support from both friends (r=0.408) and family (r=0.352), and social support from friends was significantly correlated with support from family (r=0.501).

Table 9. Pearson Correlations between all Independent Variables for Females

		1	2	3	4	5	6
1. Self-Efficacy	Pearson Correlation Sig. (1-tailed)	-					
2. Enjoyment	Pearson Correlation Sig. (1-tailed)	.608** .000	-				
3. Motivation	Pearson Correlation Sig. (1-tailed)	.325** .008	.408** .001	-			
4. Support Friend	Pearson Correlation Sig. (1-tailed)	-.059 .336	.173 .104	.408** .001	-		
5. Support Family	Pearson Correlation Sig. (1-tailed)	.064 .322	.399** .001	.352** .004	.501** .000	-	
6. Body Image	Pearson Correlation Sig. (1-tailed)	.114 .204	.020 .441	.125 .182	-.154 .131	.032 .409	-

*(*p<0.05, **p<0.01)*

4.4.1 Bivariate Correlations between All Independent and Dependent Variables

To determine the association between physical activity and the psychosocial determinants, Pearson Product-Moment correlations are presented in Tables 10 and 11. For males, only exercise enjoyment was significantly correlated ($p<0.05$) with minutes of hard (r=0.315), minutes of very hard (r=0.331), and total minutes (r=0.417) of physical activity. There was no significant association between self-efficacy, motivation, social support, or body image with physical activity.

Table 10. Pearson Correlations between Physical Activity and Independent Variables for Males

		Minutes of Moderate	Minutes of Hard	Minutes of Very Hard	Total Minutes
Self-Efficacy	Pearson Correlation	-.070	.184	.150	.221
	Sig. (1-tailed)	.345	.146	.195	.101
Enjoyment	Pearson Correlation	-.149	.315*	.331*	.417*
	Sig. (1-tailed)	.197	.033	.026	.006
Motivation	Pearson Correlation	.045	.121	.102	.189
	Sig. (1-tailed)	.398	.244	.279	.139
Support Friends	Pearson Correlation	-.244	.260	.074	.154
	Sig. (1-tailed)	.079	.065	.336	.188
Support Family	Pearson Correlation	-.151	-.157	.148	-.094
	Sig. (1-tailed)	.193	.184	.198	.296
Body Image	Pearson Correlation	-.162	-.018	.121	-.004
	Sig. (1-tailed)	.176	.459	.244	.491

*(*p<0.05, **p<0.01)*

For females, self-efficacy was significantly correlated to minutes of hard (r=0.251) and total minutes (r=0.258) of physical activity. Exercise enjoyment was significantly correlated ($p<0.05$) to moderate (r=0.284), very hard (r=0.257), and total minutes (r=0.418) of physical activity. Motivation was significantly correlated to minutes of very hard (r=0.245) and total minutes (r=0.379) of physical activity. Social support from friends was significantly correlated to minutes of hard physical activity (r=-0.237), and body image was significantly correlated to minutes of very hard physical activity (r=-0.242). There was no association between support from family and physical activity for females.

Table 11. Pearson Correlations between Physical Activity and Independent Variables for Females

		Minutes of Moderate	Minutes of Hard	Minutes of Very Hard	Total Minutes
Self-Efficacy	Pearson Correlation	.141	.251*	.082	.258*
	Sig. (1-tailed)	.152	.032	.276	.029
Enjoyment	Pearson Correlation	.284*	.133	.257*	.418**
	Sig. (1-tailed)	.018	.167	.029	.001
Motivation	Pearson Correlation	.205	.158	.245*	.379**
	Sig. (1-tailed)	.066	.125	.035	.002
Support Friends	Pearson Correlation	-.056	-.237*	.130	-.037
	Sig. (1-tailed)	.341	.041	.172	.393
Support Family	Pearson Correlation	.090	-.133	.136	.094
	Sig. (1-tailed)	.257	.167	.160	.248
Body Image	Pearson Correlation	.026	.039	-.242*	-.161
	Sig. (1-tailed)	.425	.389	.038	.121

*(*p<0.05, **p<0.01)*

4.4.2 Alternate Independent Variable-Motivation Subscales

Motivation subscales of extrinsic and intrinsic motivation derived from the SIMS scale were added as two separate independent variables. This allowed for a more complete representation of motivation within the model. To understand the relationship between the new predictor variables, Pearson Product-Moment correlations are presented in Table 12 and 13 for males and females.

When the motivation subscales were added for males, self-efficacy was significantly correlated ($p<0.05$) to enjoyment ($r=0.397$), intrinsic motivation ($r=0.373$), identified regulation ($r=0.408$), external regulation ($r=-0.338$), amotivation ($r=0.399$), and body image ($r=-0.307$). Enjoyment was significantly correlated ($p<0.05$) intrinsic motivation ($r=0.452$), identified regulation ($r=0.520$), amotivation ($r=-0.554$), body image ($r=-0.364$), and social support from friends ($r=0.315$). Intrinsic motivation was significantly correlated ($p<0.05$) to identified

regulation (r=0.481), and social support from family (r=0.359). External regulation was significantly correlated (p<0.05) to amotivation (r=0.441), and social support from family (r=-0.289). Finally, amotivation was significantly correlated (p<0.05) to body image (r=0.350).

Table 12. Pearson Correlations between all Independent Variables for Males (Including Motivation Subscales)

		1	2	3	4	5	6	7	8
1. Self-Efficacy	Correlation Sig. (1-tailed)	-							
2. Enjoyment	Correlation Sig. (1-tailed)	.397** .009	-						
3. Intrinsic Motivation	Correlation Sig. (1-tailed)	.373* .014	.452** .003	-					
4. Identified Regulation	Correlation Sig. (1-tailed)	.408** .007	.520** .001	.481** .002	-				
5. External Regulation	Correlation Sig. (1-tailed)	-.338* .024	-.269 .059	-.217 .105	.245 .078	-			
6. Amotivation	Correlation Sig. (1-tailed)	-.399** .009	-.554** .000	-.127 .233	-.249 .074	.441** .004	-		
7. Body Image	Correlation Sig. (1-tailed)	-.307* .037	-.364* .016	-.122 .242	-.174 .159	.032 .429	.350* .020	-	
8. Support Friend	Correlation Sig. (1-tailed)	.116 .253	.315* .032	.167 .168	.111 .263	-.011 .474	-.115 .255	-.018 .459	-
9. Support Family	Correlation Sig. (1-tailed)	.177 .155	.212 .111	.359* .017	.248 .075	-.289* .046	.030 .433	.061 .363	.005 .489

*(*p<0.05, **p<0.001)*

When motivation subscales were added for females, self-efficacy was significantly correlated (p<0.05) to enjoyment (r=0.608), intrinsic motivation (r=0.427), and identified regulation (r=0.300). Enjoyment was significantly correlated (p<0.05) intrinsic motivation (r=0.468), identified regulation (r=0.502), and social support from family (r=0.399). Intrinsic motivation was significantly correlated (p<0.05) to identified regulation (r=0.234), and social support from family (r=0.242). Identified regulation was significantly correlated (p<0.05) to external regulation (r=0.340), and social support from family (r=0.304). External regulation was

significantly correlated ($p<0.05$) to amotivation ($r=0.232$), and social support from friends ($r=0.440$) and social support from friends was significantly correlated to social support from family ($r=0.501$).

Table 13. Pearson Correlations between all Independent Variables for Females (Including Motivation Subscales)

		1	2	3	4	5	6	7	8
1. Self-Efficacy	Correlation Sig. (1-tailed)	-							
2. Enjoyment	Correlation Sig. (1-tailed)	.608** .000	-						
3. Intrinsic Motivation	Correlation Sig. (1-tailed)	.427** .001	.468** .000	-					
4. Identified Regulation	Correlation Sig. (1-tailed)	.300* .013	.502** .000	.234* .043	-				
5. External Regulation	Correlation Sig. (1-tailed)	.033 .407	.139 .155	.030 .414	.340** .006	-			
6. Amotivation	Correlation Sig. (1-tailed)	.024 .431	-.195 .077	.027 .421	-.119 .193	.232* .044	-		
7. Body Image	Correlation Sig. (1-tailed)	.114 .204	.020 .441	.072 .301	.210 .062	.023 .433	.038 .391	-	
8. Support Friend	Correlation Sig. (1-tailed)	-.059 .336	.173 .104	.141 .152	.182 .091	.440** .000	.116 .200	-.154 .131	-
9. Support Family	Correlation Sig. (1-tailed)	.064 .322	.399** .001	.242* .038	.304* .012	.188 .084	.117 .198	.032 .409	.501** .000

*(*p<0.05, **p<0.01)*

To determine the association between physical activity and the subscales of motivation, Pearson Product-Moment correlations are presented in Table 14. For males, total minutes of physical activity was significantly correlated ($p<0.05$) to identified regulation ($r=0.437$), and amotivation ($r=-0.289$). For females, total minutes of physical activity was significantly correlated ($p<0.05$) to intrinsic motivation ($r=0.260$), identified regulation ($r=0.391$), external regulation ($r=0.282$), and total motivation ($r=0.375$).

Table 14. Pearson Correlations between Physical Activity and Independent Variables (Including Motivation Subscales)

Male		**Total Minutes of PA**
Intrinsic Motivation	Pearson Correlation Sig. (1-tailed)	.246 .080
Identified Regulation	Pearson Correlation Sig. (1-tailed)	.437** .005
External Regulation	Pearson Correlation Sig. (1-tailed)	-.018 .460
Amotivation	Pearson Correlation Sig. (1-tailed)	-.289* .049
Total Motivation	Pearson Correlation Sig. (1-tailed)	.169 .170
Female		
Intrinsic Motivation	Pearson Correlation Sig. (1-tailed)	.260* .046
Identified Regulation	Pearson Correlation Sig. (1-tailed)	.391** .005
External Regulation	Pearson Correlation Sig. (1-tailed)	.282* .033
Amotivation	Pearson Correlation Sig. (1-tailed)	-.070 .328
Total Motivation	Pearson Correlation Sig. (1-tailed)	.375** .007

*(*p<0.05, **p<0.01)*

4.5 REGRESSION ANALYSES

Separate stepwise multiple regression analyses were performed for the male and female samples. Total weekly hours of physical activity served as the dependent variable. The predictor variables include self-efficacy, social support, total motivation, enjoyment, and body image. Social support from family and social support from friends were treated as separate variables. Tables 15 through 18 present the unstandardized regression coefficients (B), their standard errors (SEB), the standardized regression coefficients (ß), the *p* values, and cumulative R^2 for each model.

When total minutes of physical activity were predicted in males (Table 15), only exercise enjoyment explained a significant proportion of variance (p=0.013). In this model, enjoyment accounted for 17% of the variance in total minutes of physical activity (R^2=0.174, F(1,33)=6.949, p=0.013). For females, only enjoyment explained a significant proportion of variance in total minutes of physical activity (p<0.001). In this model, enjoyment explained 18% of the variance in total minutes of physical activity (R^2=0.175, F(1,53)= 11.245, p<0.001).

Table 15. Multiple Regression Analyses Explaining Total Physical Activity

Model 1	**Unstandardized Coefficients**		**Standardized Coefficients**	***p***	**Cumulative R^2**
	B	**SEB**	**ß**		
Males					
Enjoyment	8.873	3.366	.417	.013	.174
Females					
Enjoyment	7.581	2.261	.418	.001	.175

4.6 ADDITIONAL ANALYSES

A stepwise multiple regression was executed using all of the psychosocial determinant predictor variables including the intrinsic and extrinsic motivation subscales for males and females (Table 16). Only extrinsic motivation explained a significant proportion of unique variance for males (p=0.008). In this model, extrinsic motivation accounted for 20% of the variance in total minutes of physical activity (R^2=0.196, F(1,33)=8.067, p=0.008). For females, the combination of enjoyment (p<0.001), extrinsic motivation (p<0.001), support from friends (p=0.004), and body

image (p=0.034) explained 43% of the variance in total minutes of physical activity (R^2=0.426, F(4,50)=9.294, p<0.001).

Table 16. Stepwise Multiple Regression Models Explaining Physical Activity (Including Motivation Subscales)

	Unstandardized Coefficients		Standardized Coefficients	*p*	Cumulative R^2
	B	**SEB**	**ß**		
Males					
Extrinsic motivation	149.685	52.702	.443	.008	.196
Females					
Enjoyment	7.548	1.977	.417	.000	.175
Extrinsic motivation	92.834	22.062	.506	.000	.291
Support_friends	-16.880	5.604	-.369	.004	.372
Body Image	-77.704	35.630	-.238	.034	.426

4.6.1 Alternate Dependent Variables- Total Physical Activity Excluding Minutes of Walking

Previous studies have shown that most subjects overestimate their physical activity when using recalls (22). In the present investigation 94% of subjects reported walking as a form of physical activity during the physical activity recall. This accounted for an average of 129.9±109.9 minutes of walking per week and 68% of total minutes of moderate activity reported. Much of this self-reported walking served as a method of transportation rather than a structured bout of planned physical activity. This frequent walking might account for the elevated total minutes of physical activity in this sample. Therefore, an alternative to total minutes of physical activity was calculated using total minutes of physical activity, and excluded minutes of recorded walking.

With walking removed from the dependent variable, a stepwise regression analysis was executed for both male and female samples (Table 17).

Table 17. Stepwise Multiple Regression Models for Minutes of Physical Activity Excluding Minutes of Walking

	Unstandardized Coefficients		Standardized Coefficients	*p*	Cumulative R^2
	B	**SEB**	**ß**		
Males					
Enjoyment	-676.195	356.418	.470	.004	.197
Females					
Extrinsic Motivation	64.235	21.444	.381	.004	.145

Enjoyment remained the single significant contributing predictor as the stepwise regression model explained 20% of the variance (R^2=0.197 (N=35, p=0.110) in total minutes of physical activity for males. For females, extrinsic motivation became the lone predictor of the stepwise regression model (R^2=0.145, F(1,53)=8.9, p=0.004), explaining 15% of the total variance in physical activity.

4.6.2 Alternate Dependent Variables- RPE-Minutes

In an attempt to more accurately express or account for exercise intensity, RPE-minutes (calculation method in Section 3.5.5) were calculated as an alternative to total minutes of physical activity. While using RPE-minutes as the dependent variable, the regression model remained the same for males, but changed for females (Table 18).

Table 18. Stepwise Multiple Regression Models Explaining RPE-Minutes

	Unstandardized Coefficients		Standardized Coefficients	*p*	Cumulative R^2
	B	**SEB**	**ß**		
Males					
Enjoyment	91.154	30.253	.579	.007	.298
Females					
Extrinsic Motivation	44.040	20.628	.297	.041	.212
Body Image	644.840	198.524	.454	.003	.317
Enjoyment	-952.157	343.179	-.385	.010	.389

For males, only enjoyment explained a significant proportion of variance. Enjoyment accounted for 30% of RPE-minutes (R^2=0.298, F(1,19)=9.078, p=0.007). For females, extrinsic motivation, body image, and enjoyment explained a significant proportion of variance. The model including these three variables explained 39% of the variance in RPE-minutes (R^2=0.389, F(3,32)=7.802, p<0.001).

4.7 SUMMARY

Exercise enjoyment was the only predictor variable significantly correlated (p<0.05) to minutes of physical activity for males. In contrast, the female's physical activity was significantly correlated (p<0.05) to self-efficacy, enjoyment, total motivation, social support from friends, and body image. The best prediction model for total minutes of physical activity included the motivation subscales for both males and females. For males, extrinsic motivation accounted for 20% of the variance in total minutes of physical activity (R^2=0.196, F(1,33)=8.067, p=0.008). For females, the combination of enjoyment, extrinsic motivation, support from friends, and body

image explained 43% of the variance in total minutes of physical activity (R^2=0.426, F(4,50)=9.294, p<0.001).

Results suggest that exercise enjoyment may be the single most important predictor variable among those assessed in this investigation for both males and females. This is followed closely by motivation, social support from friends, and body image for females. These variables will be discussed further in Chapter 5.

5.0 DISCUSSION

5.1 INTRODUCTION

The primary aim of this investigation was to explore the relation between self-report physical activity and modifiable psychosocial variables of: 1) motivation; 2) self-efficacy; 3) social support; 4) exercise enjoyment; and 5) body image in a sample of young adult male and female college students. A secondary aim of this investigation was to examine whether young adult males and females differ in psychosocial predictors of physical activity.

When self-efficacy, enjoyment, total motivation, social support, and body image served as independent variables, exercise enjoyment was the lone predictor of total minutes of physical activity for the male and female samples. However, social support from friends, extrinsic motivation, and body image also appeared as significant predictors for the female sample when motivation subscales were considered as the independent variables. The following sections will provide an interpretation of these results and will discuss the strengths, limitations, and application of these findings.

5.2 MALES

5.2.1 Relationships between Physical Activity and Psychosocial Determinants for Males

For males, exercise enjoyment was significantly ($p<0.05$) correlated to minutes of hard, minutes of very hard, and total minutes of physical activity. This is consistent with previous investigations that reported enjoyment of physical activity to be a significant predictor of participation in walking, moderate activity, vigorous activity, and total physical activity in adults (12, 50, 78). This has also been demonstrated in specific cohorts. For example, Sorensen et al., reported enjoyment to be the most powerful determinant of physical activity in Finnish male police officers (85). In a health care-based physical activity intervention, exercise enjoyment was associated with exercise level (days of exercise), and enjoyment appeared to be a mediator or exercise level (36). Exercise enjoyment has also appeared to positively influence participation and adherence to physical activity programs (12, 50). The definition of enjoyment might hold some keys to understanding the strong association between enjoyment and participation in physical activity. Enjoyment is defined by positive feelings such as pleasure, liking, and fun (36). One theory proposes that individuals who experience more exercise enjoyment do so because they experience greater “like” for the activity or program (104). This is supported by Wankel, who found that participants of a male employee fitness program reported greater “liking” of the program activities than did dropouts of the program, while the dropouts experienced greater “dislike” for the activities (104). This would suggest that individuals are more motivated or inclined to participate in activities they enjoy rather than activities they do not enjoy. The diverse assortment of physical activity options available to students combined with the importance of exercise enjoyment in males may help to explain college student’s physical activity patterns. If

males are more open to “liking” or trying new forms of physical activity, the college setting should provide a sufficient variety of options to encourage participation. In the present study this may explain the high total amount of physical activity observed in the male sample.

Self-efficacy, total motivation, social support, and body image were not significantly correlated to physical activity for the male population. While it has been proposed that self-efficacy and social support may impact enjoyment (29, 36), Dishman et al., demonstrated that enjoyment can influence self-efficacy, and self-efficacy may influence enjoyment (29). The findings of the present investigation support the hypothesis that social support and body image are less of an important factor in explaining participation in physical activity for males. This is similar to Ryan et al., who demonstrated the intrinsic motives of enjoyment were more strongly associated with adherence to physical activity programming, than body-related motives such as body image (70).

Total motivation was not significantly correlated to physical activity in the male sample. However, when motivation subscales, were included in the comparison, identified regulation was significantly correlated to total minutes of physical activity. Identified regulation represents participation in an activity that is valued or for personal growth (28). Vlachopoulos and Karageorghis, use identified regulation as an example of participation in physical activity for the purpose of gaining physical and mental health benefit with interactions occurring between motivation subcategories and exercise enjoyment (103). Conversely, amotivation has been negatively correlated to total minutes of physical activity. This would be expected because amotivation indicates the absence of motivation or lack of intent to act (28).

In the present study, exercise enjoyment and identified regulation were significantly correlated to physical activity. Whether interactions within the determinants themselves have the

potential to confound the present findings are points to be considered, and warrant further discussion. Furthermore, a lack of significant determinants identified in the male sample may be attributed to sample size and insufficient statistical power. This will be discussed in a later section of this chapter.

5.2.2 Regression Model for Males

A stepwise multiple regression analyses indicated exercise enjoyment (R^2=0.174) was the only predictor variable that explained a significant proportion of variance for males when total motivation was used for the motivation variable. These findings are consistent to the correlation matrix between the independent variables and physical activity, where exercise enjoyment was the only predictor significantly correlated with physical activity. While enjoyment was hypothesized to be part of the prediction model, it was not expected to be the lone predictor.

Extrinsic motivation (R^2=0.196) became the only predictor variable to significantly explain a portion of the variance in total minutes of physical activity when intrinsic and extrinsic motivation subscales were added to the independent variables. The interactions between extrinsic motivation, intrinsic motivation, and enjoyment may explain these findings. Previous literature has identified significant interactions between identified regulation and intrinsic motivation (103). Additionally, high levels of identified regulation have been associated with high levels of intrinsic motivation (103), and intrinsic motivation has been shown to be correlated to exercise enjoyment (28, 103). Competition is a significant perceived benefit of physical activity in young men (27), specifically when engaged in game or sport type physical activities. It is thought that competition can influence motivation level (67). Individuals that are highly competitive in nature or “high need achievers” (107) exhibit greater intrinsically motivated behaviors (67). Sport and

game like physical activities may provide an outlet for competitive feelings and may contribute to the relationship between physical activity, motivation, and enjoyment. In the present investigation, intrinsic motivation was significantly correlated to enjoyment, consistent with the previous investigations mentioned above. Finally, the intercorrelations between motivation subscales, and the intercorrelations between motivation and enjoyment may suggest possible confounding effects (103) on the ability to predict physical activity.

Results of the present investigation are similar to those of Project GRAD (73), a 15-week intervention course that shares 4 common independent variables (self-efficacy, social support from family, social support from friends, and exercise enjoyment) with the present investigation. Similarly, both investigations used the 7D-PAR to assess self-report physical activity. Upon completion of the Project GRAD "course", exercise enjoyment, self-efficacy, and perceived benefits contributed significantly to the male regression models that explained changes in total physical activity, vigorous activity, and moderate activity (73). In both investigations exercise enjoyment was a significant contributor to physical activity participation. Project GRAD also identified self-efficacy as an important predictor for males. The proposed explanation for this was the high activity level at baseline (73). However, participants in the present investigation also reported higher levels of physical activity. Differences between Project GRAD and the present investigation include student's age and grade level. Project GRAD recruited senior students, with a mean age of 24.23±1.95 years. The course content emphasized preparing students for transition into the workforce and responsibilities following college. Therefore, it seems one should proceed with caution when comparing exercise determinants of young students (18-20 years) entering college life to older (~24 years) students preparing for life after college.

5.3 FEMALES

5.3.1 Relationships between Physical Activity and Psychosocial Determinants for Females

Consistent with previous reports in the adult population (32, 59, 87, 99) self-efficacy, exercise enjoyment, total motivation, social support from friends, and body image were significantly correlated with physical activity in females. Self-efficacy reflects one's confidence to perform a specific task (i.e. be physically active), and is one of the strongest correlates of physical activity in the current psychosocial literature (56, 21). In the present investigation, self-efficacy was significantly correlated to minutes of hard physical activity and total minutes of physical activity for females. This is consistent with the Social Cognitive Theory (7), and previous investigations (21) that show self-efficacy to be a significant predictor of physical activity behavior in adult populations. Self-efficacy has also been shown to be lower in sedentary cohorts and elevated in highly active cohorts (73). Sources of self-efficacy can come from personal accomplishment or mastery, influences from another individual's accomplishments, or verbal persuasion (7). In the present investigation, individuals with greater confidence to be physically active complied to the model, and were more physically active.

Exercise enjoyment was significantly correlated to minutes of moderate, very hard and total minutes of physical activity in the females. These results are consistent with Booth et al., who reported that enjoyment influences participation in physical activity for both young and older adults (12). Leslie et al., also reported lower enjoyment of physical activity to be a significant predictor of physical inactivity in college students (50). While in the male sample it was suggested that exercise enjoyment may be related to extrinsic motivation, enjoyment can

also be viewed as a form of intrinsic motivation (28) due to the positive feeling of pleasure, like, and fun associated with enjoyment (36).

Motivation plays an important role in physical activity participation (70). Following the Self-Determination Theory (28) as a guideline, subscales were used to represent intrinsic and extrinsic (combination of identified regulation and external regulation) and total motivation to be physically active. For females, intrinsic motivation, identified regulation, and total motivation were significantly correlated to total minutes of physical activity. These findings support Standage et al., who found intrinsic motivation, identified regulation, and amotivation to be significantly correlated to total minutes of moderate physical activity (87). Behavior can be directed by internal (intrinsic motivation) and external (extrinsic motivation) influences. This is much like situational factors young adults face in the college setting on a daily basis. These factors include, but are not limited to, coercion, persuasion, and seduction, which have been shown to influence behavior (87).

It was hypothesized that social support would be an important predictor of physical activity for females. This was found to be true in the present investigation. Social support may be important to females' physical activity participation for a variety of reasons. In the university setting, new friendships and social circles are formed. Factors such as relationships and social contact have positive outcomes on physical activity adherence (36). Friends provide encouragement to one another (104) and social networks appear to be important for engaging in physical activity (1). There are many opportunities to be physically active in the university setting (i.e. clubs, recreation centers, intramurals, etc…). However, there are also many negative health behavior options as well (i.e. binge drinking, smoking, sedentary activities). Several

lifestyle choices are made during these first years of independence and the social norms, actions, and beliefs of one's friends will influence behavioral decisions.

Social support from family did not appear as a significant predictor. For those students living on campus, this was probably due to the limited contact a student has with family members throughout a college semester. This suggests family support is not a contributing factor for young adults while they attend a college or university program.

The relation between body image and physical activity is less clear compared to the other psychosocial determinants (99). In the present investigation, body image was inversely associated with total minutes of physical activity for females. Subjects who rated a greater difference between perceived body shape and desired body shape reported less physical activity. Consistent with Silva and Klatsky, individuals with high "body anxiety" (negative body image) will participate in less physical activity (80). This suggests that a more negative body image may prevent females from being physically active. One factor surrounding this issue is the university setting itself, specifically the stress and peer-pressure associated with the social standards in young adults who are just beginning a college program. These emotions may surface from any experience within campus, but particularly present in a gym, exercise class, and/or weight room setting due to its focus on physical fitness and development (34). In a fitness-related setting, such body image issues become problematic and potentially difficult to overcome.

5.3.2 Regression Models for Females

For females, the best model to predict total minutes of physical activity included enjoyment, extrinsic motivation, social support from friends, and body image (R^2=0.426). These findings support the primary aim of this investigation as all variables were hypothesized to be significant

predictors of physical activity. Similar to previous research, enjoyment (50), motivation (28), social support (24), and body image (80) were significant psychosocial predictors of physical activity. The results also compare favorably to Project GRAD (73), where social support from friends and self-efficacy were significant contributors to the regression model that explained total activity and vigorous exercise change, respectively (73).

In the present investigation, intrinsic motivation was significantly correlated to physical activity in females. According to the Self-Determination Theory (28) this would suggest that higher levels of physical activity are a result of interest, enjoyment, or inherent satisfaction. However, extrinsic motivation was the only motivation category variable to enter the model when motivation subscales were included. While a negative body image may act as a deterrent for exercise in some individuals (80), body dissatisfaction can also act as a motivating factor (40) specifically for women (34). Ingledew and Sullivan, proposed that physical activity performed for weight management is primarily extrinsically motivated (41). They extend this theory by concluding that extrinsic motivation can "undermine" intrinsic motivation. This may explain the presence of extrinsic motivation and body image in the current model. This would suggest female participants in this investigation were been extrinsically motivated to exercise to improve their physical appearance and body image.

5.4 MALES VERSUS FEMALES

The difference in associations (correlations) between males and females may be explained by first discussing the correlation matrices between the independent variables and physical activity. To review: 1) Self-efficacy and enjoyment were more highly correlated for females than for

males; 2) External regulation was significantly correlated with total minutes of PA for females, but not for males; and 3) External regulation and support from friends were significantly correlated for females, but not for males. Additionally, when comparing the means for males and females on the independent and dependent variables, significant differences were as follows: 1) Mean value for males on total minutes of PA, self-efficacy, and intrinsic motivation was significantly higher for the male versus female sample; 2) Mean values for external motivation and support from friends/family were significantly higher in the female compared to male sample.

In the present study, the nature of these interactions is considered complex and should be considered when differences were observed between the male and female samples. There is little argument that college life introduces new and varying levels of stress into young adults lives. Specifically, first year students are coping with new social, environmental, and academic demands. While men and women report similar levels of stress, the reported stressors affect men and women differently (84). Women appear to be less effective in coping with stressors compared to men. It is suggested that men confront stress in an active, problem-focused manner compared to women who tend to be less active and avoidant (84). These findings may be clinically significant because of a relationship previously shown between stress and participation in physical activity (89). In an investigation of 82 community-residing women exercising independently (89), those who reported a higher frequency of stressful events (i.e. making deadlines, making important decisions, and having too many responsibilities) participated in less exercise, and had lower self-efficacy for being physically active. Additionally, women who reported high perceived stress, exercised fewer days per week, experienced less satisfaction (enjoyment) with exercise, and had lower self-efficacy for exercise.

These findings speak to the complexity of the interactions between determinants of physical activity. High levels of stress (peer-pressure, body image, and academic demands) specifically in women have been linked to lower self-efficacy for exercise and lower satisfaction/enjoyment with exercise (89). Conversely, physical activity has been shown to have positive effects on stress reduction (33). This suggests an association between stress, enjoyment, self-efficacy and physical activity behaviors. When changes in stress alter one's determinate (enjoyment and/or self-efficacy), this in turn can affect changes in physical activity behavior.

5.5 ALTERNATE DEPENDENT VARIABLES

5.5.1 Total Physical Activity Excluding Minutes of Walking

Due to the elevated total minutes of physical activity reported, it was thought that excluding minutes of physical activity from the total minutes might provide insight into the relation between the predictor variables and physical activity. However, the stepwise regression model for males remained the same, including enjoyment as the lone predictor variable of physical activity. This model explained 20% of the variance in total minutes of physical activity excluding walking minutes. For females, the regression model was reduced to include only extrinsic motivation, explaining 15% of the variance in total minutes of physical activity excluding walking minutes. Unfortunately the regression models from physical activity excluding walking minutes did not explain significantly more variance than total minutes of physical activity. These findings suggest that the elevated minutes of moderate activity as a result of walking may not have influenced the primary results of this investigation. This method

of calculating physical activity should be explored further in future studies that explore determinants of physical activity behaviors.

5.5.2 RPE-Minutes

When RPE-minutes served as the dependent variable, enjoyment was the lone predictor of RPE-minutes for males, explaining 29% of the variance in RPE-minutes. For females, extrinsic motivation, body image, and enjoyment combined to explain 39% of the variance in RPE-minutes. While RPE-minutes provide a unique representation of intensity levels rather than total minutes, the prediction models did not provide significantly different results from the standard outcomes of the 7D-PAR. It has been suggested that the inclusion of RPE may increase the accuracy of traditional physical activity surveillance methods (83). Further studies of physical activity determinants should consider the RPE-minute or other methods that incorporate intensity measures into a model.

5.6 STRENGTHS

It was felt that the present investigation demonstrated several strengths:

1. Few studies exclusively examine freshmen/sophomore students which can allow investigators to focus on the transition into college life. This is important because of the shifts in parental guidance, changes in leisure time, and new social influences that are considered unique to a university setting.

2. In the present investigation, error associated with the investigator-administered questionnaires was reduced by the principal investigator who administered the questionnaire exclusively by himself.
3. The previously validated standardized questionnaires made results comparable to similar investigations. These included: 1) Stanford Seven-Day Physical Activity Recall (7D-PAR) (76); 2) Exercise Self-Efficacy Scale (52); 3) Social Support for Exercise Scale (74); 4) Situational Motivation Scale (SIMS) (35); 5) Physical Activity Enjoyment Scale (PACES) (44); and 6) Contour Drawing Rating Scale (97).
4. The inclusion RPE-minutes and physical activity minus walking as dependent variables, offered alternative models, and showed significant correlations between determinants and physical activity.

5.7 LIMITATIONS

The following are considered limitations to the present investigation:

1. This investigation employed a cross-sectional design. This did not allow for causality to be determined among identified determinants and physical activity behavior. A longitudinal investigation would allow investigators to more effectively track physical activity patterns and determinants over time.
2. This investigation relied on a self-report physical activity questionnaire. Research suggests that a self-report bias can exist because participants tend to under estimate activities or behaviors that are considered negative, and overestimate more favorable/positive behaviors (30). This is especially true in an “organizational” setting such as work place, or in the

present university/community setting. It is hypothesized that reporting bias increases when participants believe that superiors (i.e. teachers/administration) may see the results of an investigation (30). More objective measures such as accelerometery or doubly-labeled water may have provided a more accurate representation of weekly physical activity and a measure of energy expenditure (kcals), allowing concurrent validity to be explored.

3. Perceived barriers (lack of interest, external obstacles, lack of time, embarrassment, psychological problems, and health barriers) were not measured in this investigation. This may be a limitation because these factors have been shown to help explain the variance in physical activity in young adults (27). Additionally, lack of time (increased academic workload) and transitions to the college environment (making friends, decreased participation in organized sports) have been shown to influence participation in physical activity among college students (47).
4. A lack of significance between most predictor variables and physical activity may be explained by statistical power. There was an uneven distribution of male and female subjects, specifically in the males sample (n=35). Insufficient statistical power for the male sample may have contributed to the non-significant findings.
5. The apparently healthy sample population used in this investigation presented with normal to above normal, blood pressure, body composition, and estimated fitness levels (Table 1). They were more fit and reported higher physical activity levels than the national averages (19, 31). As with most investigations involving volunteer subjects and the topics of health and physical activity, there may be a self-selection bias for more active individuals to participate in a study involving questions of this nature.

6. As demonstrated by the results, the interactions between the determinants of physical activity are complex. It is not possible, nor appropriate or effective to assess all possible known psychosocial determinants in one investigation. This presents a limitation to investigations of this nature. The 5 core predictor variables were chosen for their continued associations with physical activity in other populations (children, adolescence, adults, and older adults). However there may be unknown interactions between particular variables that could/could not explain physical activity behaviors in this population.
7. This investigation was limited to psychosocial determinants and did not investigate other types of determinants (i.e. demographic, biological, environmental, etc…) for development of a model. There is new evidence that suggests individual and community level environmental factors such as availability of recreation facilities, access to facilities, and neighborhood safety can help to explain variance in physical activity (99). Popkin et al., suggest that physical, social, and built environments are among the most modifiable determinants of physical activity (64). Additionally, researchers have explored the potential relation between genetics and physical activity, with inconclusive results (10, 51, 62). Therefore, it is important to consider additional determinants in future research.
8. The sample population was recruited from the University of Pittsburgh, an urban campus with abundant walking opportunities, recreation facilities, and intramural activities. These findings may not generalize to students in other geographical locations or those attending 2-year and community colleges.

5.8 APPLICATION OF FINDINGS

The logical progression of this data would include the use of these correlates as target variables (determinants) for future behavior interventions that aim to improve physical activity behaviors in undergraduate college students. Improved physical activity behaviors that reflect superior intervention strategies could lead to development of a standardized approach to programming. Long term, this could have direct application in surroundings within higher education. An example of this is the University of Pittsburgh Freshman Seminar (FP 0003) Course. This course is used to integrate incoming freshman to college life and where a health promotion program may be most beneficial to students.

Theoretically based interventions designed to alter physical activity habits have had little success achieving long-term behavior change in college students (14). Results of this investigation may be considered when developing new ideas for alternate intervention models. The strength of enjoyment (the strongest predictor of physical activity in this investigation for both males and females) may suggest that helping students find activities that they enjoy is an important factor for improving physical activity adoption. A successful intervention in the university setting could focus on introducing a wide variety of activities ranging from sport-like games, outdoor recreation, to structured fitness activities, with the goal of finding fun and new activities students might not have previously experienced. Some individuals may prefer individual activities while others may prefer group or team-like activities. Promoting social interaction such as scheduled group bike rides or walks on campus, ties in the concept of social support. Additionally, exercising with others has been shown to add accountability and adherence to a physical activity program (17, 50, 91).

The identification of stage of change via the Transtheoretical Model of Behavior Change (66) may be used to match students together with similar abilities during the execution of such activities. This may increase self-efficacy through personal accomplishment or mastery and vicarious experience (i.e. when a model that is similar to the individual accomplishes a specific behavior or task) (7). Incorporating the identification of stage membership to determine group pairings during these programs may be used to increase specificity and effectiveness of interventions designed to increase physical activity behaviors.

These topics and ideas might be incorporated into a first year program at the University of Pittsburgh. This may be during freshmen orientation week or the University of Pittsburgh Residence Hall Mentor Program (designed to connect freshmen students with faculty outside the classroom). These types of programs differ from course-based programs because they are provided to all students including those who would not eagerly register for an activity-based course. Applying knowledge concerning identified determinants of physical activity in this atypical approach may help to expose students to new activities. Furthermore, this could help them to develop healthy habits by increasing physical activity adoption and maintenance during this critical transition into young adulthood.

The University of Pittsburgh also offers a student centered wellness program called Healthy U, which provides opportunities and resources to help students improve physical, emotional, intellectual, social, occupational, environmental, and spiritual well-being (University of Pittsburgh, 2012). This special program could provide a platform to disseminate educational and behavioral tools to the students, who would benefit most from such findings. The information gathered from this investigation might be particularly useful for program developers

at the University of Pittsburgh because the sample population was selected from the university student body.

5.9 RECOMMENDATIONS FOR FUTURE RESEARCH

There are several recommendations for future research one should note when considering results of this investigation:

1. The present investigation targeted first and second year college students because it was thought that students are most affected by social and environmental changes of university life during this time. In a study of Spanish University students, physically active females were older than inactive females (68). It was felt that older students might have more time to adjust to university experience and develop time management skills, allowing for more free time for physical activity (68). Future research should investigate differences between psychosocial determinates of physical activity in students throughout all 4 years of schooling. A longitudinal tracking of physical activity and assessment of psychosocial determinants of physical activity from the first to last year of college might also be of interest, and aid in the development of age/class specific physical activity intervention strategies.
2. Traditional interventions using determinants of physical activity often focus on physical activity as a primary outcome to determine the successfulness of an intervention (8). Baranowski et al., recommends focusing on interventions that change mediators of physical activity rather than physical activity alone (8). Additionally, physical activity interventions may be more effective with a better understanding of the effect interventions have on determinants (8). Investigating the effect of a classroom based, freshmen orientation,

mentoring program, or wellness program on determinates of physical activity in first year college students is warranted.

3. Due to the additive nature of determinants of physical activity, psychosocial, environmental, and biological factors should be examined in combination to provide the most comprehensive understanding of determinants of physical activity.
4. Previous investigations have demonstrated that internet and cell phone-based intervention strategies improve physical activity participation and maintenance (39, 102). Results from the present investigation indicate that students appear to use multiple forms of technology (cell phone, computer, etc.) daily. Technology has the potential to become a primary mode of communication between participants and an interventionist. This would provide daily access to students for the delivery of intervention materials and encouragement.
5. To confirm results from the present investigation, similar investigations should explore the relation between psychosocial determinants of physical activity and objectively measured physical activity. For example, the combination of a triaxial accelerometer and a daily physical activity diary might eliminate the self-report bias associated with physical activity recalls and provide a more cost effective approach for epidemiologic research of this nature.
6. Exercise enjoyment was significantly correlated to hard, and very hard physical activity for males, and moderate and very hard physical activity for females. Understanding how enjoyment and mood change within a bout of physical activity may provide a better understanding of this relationship. This might also help to explain physical activity trends and adherence to physical activity programs.

5.10 CONCLUSION

The primary aim of this investigation was to explore the relationship between self-report physical activity and modifiable psychosocial determinants. The dependent variable (physical activity) was expressed as; 1) total minutes of physical activity; 2) minutes of physical activity minus walking; and 3) RPE-minutes. Additionally, the independent predictors were represented by total scores for all variables proposed, as well as subscales for social support and motivation.

It was hypothesized that higher levels of exercise self-efficacy, social support for exercise, motivation, exercise enjoyment and positive body image would be associated with higher levels of physical activity. For males, motivation was hypothesized to be a more important predictor of physical activity when compared to females. Following analyses, all possible combinations of independent and dependent variables, (enjoyment, identified regulation, and amotivation) were significantly correlated to physical activity for males. The best prediction model for males included enjoyment, which explained 20% of the variance in total minutes of physical activity excluding walking minutes.

For females, social support and body image were expected to have stronger influences on young female physical activity patterns when compared to their young male counterparts. For females, self-efficacy, enjoyment, total motivation, intrinsic motivation, identified regulation, external regulation, support from friends, and body image were each significantly correlated to physical activity. The model that best predicted total minutes of physical activity was the combination of enjoyment, extrinsic motivation, support from friends, and body image. When combined, this explained 43% of the variance in total minutes of physical activity.

Results from this investigation would support the use of constructs derived from theoretical models including: 1) enjoyment and motivation (Self Determination Theory) (28);

and 2) self-efficacy and social support (Social Cognitive Theory) (7), because of their significant association with physical activity in this investigation. The psychosocial variables targeted in this investigation were explored because of their continued association to physical activity in other populations, and for their ability to be modified. It is important to note that the identified determinates from this investigation are but a few of the complex psychosocial, environmental, and demographic determinants of physical activity behavior. The above mentioned determinants continue to be important factors in explaining physical activity in young adult college students aged 18-20. This investigation has identified gender specific trends in determinants of physical activity for the young adult college population. This is an important step to explaining physical activity behaviors in a population that is at risk for sedentary behaviors.

APPENDIX A

EXPANDED LIST OF DETERMINANTS OF ADULT PHYSICAL ACTIVITY

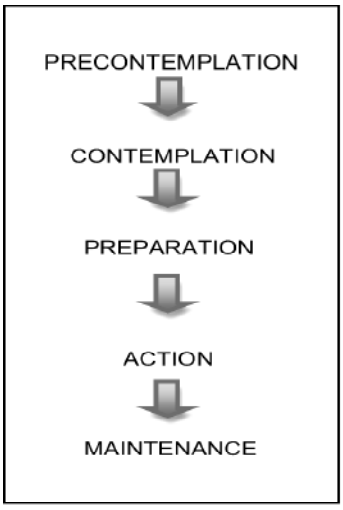
Demographic and biological factors	Social and cultural factors	Physical activity characteristics
Age	Class size	Intensity
Blue-collar occupation	Exercise models	Perceived effort
Childless	Group cohesion	
Education	Past family influences	Psychological, cognitive, and emotional factors
Gender (male)	Physician influence	Attitudes
Hereditary	Social isolation	Barriers to exercise
High risk for heart disease	Social support from friends/ peers*	Control over exercise
Income/socioeconomic status	Social support from spouse/ family*	Enjoyment of exercise*
Injury history	Social support from staff/ Instructor	Expect benefits
Marital status (married)		Health locus of control
Overweight/obesity	Physical environment factors	Intention to exercise
Race/ethnicity	Access to facilities: actual	Knowledge of health and exercise
Behavioral attributes and skills	Access to facilities: perceived	Lack of time
Activity history during childhood	Adequate lighting	Mood disturbance
Activity history during adulthood	Climate/season	Normative beliefs
Alcohol	Cost of programs	Perceived health or fitness
Contemporary exercise program	Disruption in routine	Personality variables
Dietary habits (quality)	Enjoyable scenery	Poor body image*
Past exercise program	Frequently observe others exercising	Psychological health
Processes of change	Heavy traffic	Self-efficacy*
School sports	Home equipment	Self-motivation*
Skills for coping with barriers	High Crime rates in the region	Self-schemata for exercise
Smoking	Hilly terrain	Stage of change
Sports media use	Neighborhood safety	Stress
Type A behavior pattern		Susceptibility to illness
		Value of exercise outcomes

* Modifiable determinants selected for this investigation (Trost et al., 2002)

APPENDIX B

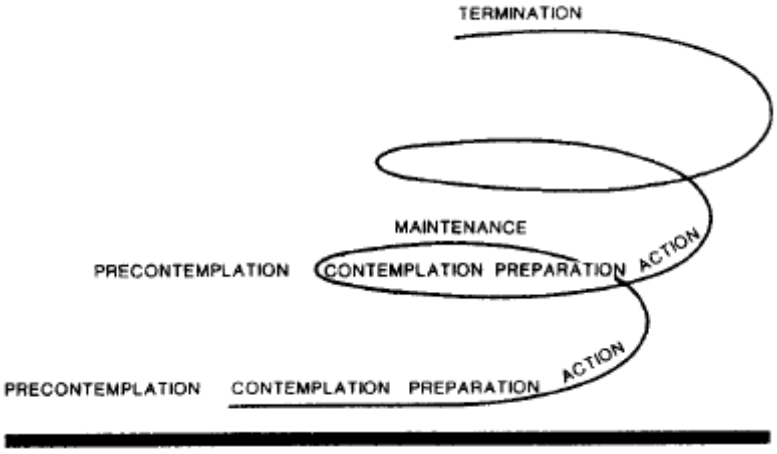
STAGES OF CHANGE MODELS

Original Stages of Change Model



(Prochaska and Diclemente, 1983)

A Spiral Model of the Stages of Change

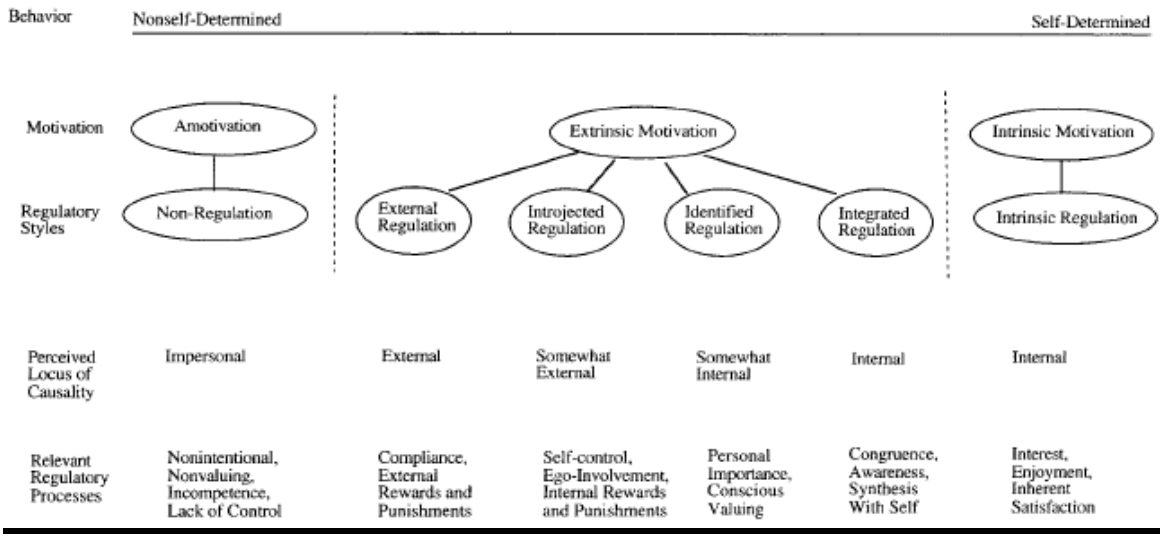


(Prochaska et al., 1992)

APPENDIX C

THE SELF-DETERMINATION CONTINUUM

The Self-Determination Continuum Showing Types of Motivation With Their Regulatory Styles, Loci of Causality, and Corresponding Processes



(Ryan and Deci, 2000)

APPENDIX D

HOUSTON N-EX PREDICTION MODEL

Equation for estimating $VO2_{max}$

(VO2max = 50.513 + 1.589(PA-R) – 0.289(age) - 0.552(%fat) + 5.863(gender)

VO_{2max} ml · kg^{-1} · min^{-1} = _____ _____
Classification

50.513 + (1.589 x _____)
physical activity rating, 0 to 7*

- (0.289 x _____)
age

- (0.552 x _____)
%fat

+ (5.863 x _____)
gender**

*Pick a physical activity rating that best fits your typical habits:

I. Does not participate regularly in programmed recreation sport or physical activity:
   0 points: Avoids walking or exertion (e.g., always uses elevator, drives whenever possible instead of walking)
   1 point: Walks for pleasure, routinely uses stairs, occasionally exercises sufficiently to cause heavy breathing or perspiration.

II. Participates regularly in recreation or work requiring modest physical activity, such as golf, horseback riding, calisthenics, gymnastics, table tennis, bowling, weight lifting, or yard work.
   2 points: 10 to 60 minutes per week.
   3 points: Over 1 hour per week.

III. Participates regularly in heavy physical exercise (such as running or jogging, swimming, cycling, rowing, skipping rope, running in place) or engages in vigorous aerobic-type activity (such as tennis, basketball, or handball).
   4 points: Runs less than 1 mile per week or spends less than 30 minutes per week in comparable physical activity.
   5 points: Runs 1 to 5 miles per week or spends 20 to 60 minutes per week in comparable physical activity.
   6 points: Runs 5 to 10 miles per week or spends 1 to 3 hours per week in comparable physical activity.
   7 points: Runs over 10 miles per week or spends over 3 hours per week in comparable physical activity.

**gender= 0 for female, 1 for male (Jackson et al., 1990)

APPENDIX E

PHYSICAL ACTIVITY RECALL ITEMS

Now we would like to know about your physical activity during the past 7 days. But first, let me ask you about your sleep habits.

1. On the average, how many hours did you sleep each night during the last five weekday nights (Sunday-Thursday)? _____hours

2. On the average, how many hours did you sleep each night last Friday and Saturday nights? _____hours

Now I am going to ask you about your physical activity during the past 7 days, that is, the last 5 weekdays, and last weekend, Saturday and Sunday. We are not going to talk about light activities such as slow walking, light housework, or unstrenuous sports such as bowling, archery, or softball. Please look at this list which shows some examples of what we consider moderate, hard, and very hard activities. (Interviewer hand subject card of example activities and allow time for the subject to read it over.) People engage in many other types of activities, and if you are not sure where one of your activities fits, please ask me about it.

3. First, let's consider moderate activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these moderate activities or others like them? Please tell me to the nearest half hour. _____hours

4. Last Saturday and Sunday, how many hours did you spend on moderate activities and what did you do? (Probe: Can you think of any other sports, job, or household activities that would fit into this category?) _____hours

5. Now, let's look at hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these hard activities or others like them? Please tell me to the nearest half hour. _____hours

6. Last Saturday and Sunday, how many hours did you spend on hard activities and what did you do? (Probe: Can you think of any other sports, job, or household activities that would fit into this category?) _____hours

7. Now, let's look at very hard activities. What activities did you do and how many total hours did you spend during the last 5 weekdays doing these very hard activities or others like them? Please tell me to the nearest half hour. _____hours

8. Last Saturday and Sunday, how many hours did you spend on very hard activities and what did you do? (Probe: Can you think of any other sports, job, or household activities that would fit into this category?) _____hours

9. Compared with your physical activity over the past 3 months, was last week's physical activity more, less, or about the same?

__ 1. More
__ 2. Less
__ 3. About the same

Interviewer: Please list below any activities reported by the subject which you don't know how to classify. Flag this record for review and completion.

Activity (brief description)	**Hours: workday**	**Hours: weekend day**
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

EXAMPLES OF ACTIVITIES IN EACH CATEGORY

Moderate activity

Occupational tasks: 1) delivering mail or patrolling on foot; 2) house painting; and 3) truck driving (making deliveries, lifting and carrying light objects).

Household activities: 1) raking the lawn; 2) sweeping and mopping; 3) mowing the lawn with a power mower; and 4) cleaning windows.

Sports activities (actual playing time): 1) volleyball; 2) Ping-Pong; 3) brisk walking for pleasure or to work (4.83 km/hour (3 miles/hour) or 20 minutes/km (mile)); 4) golf, walking and pulling or carrying clubs; and 5) calisthenic exercises.

Hard activity

Occupational tasks: 1) heavy carpentry; and 2) construction work, doing physical labor.

Household tasks: 1) scrubbing floors.

Sports activities (actual playing time): 1) tennis doubles; and 2) disco, square, or folk dancing.

Very hard activity

Occupational tasks: 1) very hard physical labor, digging or chopping with heavy tools; and 2) carrying heavy loads such as bricks or lumber.

Sports activities (actual playing time): 1) jogging or swimming; 2) singles tennis; 3) racquetball; and 4) soccer.

(Sallis et al., 1985)

APPENDIX F

PHYSICAL ACTIVITY EXAMPLES

Please think about ***moderate*** intensity activities like the following:

Sports/Recreational Activities:	Brisk walking (3-4 mph or 15-20 min mile) Golf- walking and pulling/carrying clubs Calisthenic exercise or weight lifting Softball, volleyball, horseback riding
At home:	Raking the lawn Weeding and cultivating in the garden Housework such as mopping, cleaning windows, and sweeping Mowing the lawn with a walking mower
At work:	Delivering mail or patrolling on foot House painting Making deliveries, lifting and carrying light objects

Please think about ***hard*** intensity activities like the following:

Sports/Recreational Activities:	Walking or hiking at 4.5 to 5.5 mph (11-14 min mile) Doubles tennis Lap swimming (slow pace) Square, folk, or fast dancing
At home:	Scrubbing the floors Digging in the garden Stair climbing (moderate pace)
At work:	Heavy carpentry, construction work- doing physical labor

Please think about ***very hard*** intensity activities like the following:

Sports/Recreational Activities:	Running (10 min miles or less) or swimming (fast pace) Singles tennis Backpacking (hilly country or rough trails) Rope jumping Soccer, basketball
At home:	Lifting and carrying heavy loads (more than 50 pounds) Digging ditches
At work:	Chopping wood

APPENDIX G

EXERCISE SELF-EFFICACY SCALE

Exercise Self-Efficacy Scale

(Marcus et al., 1992)

Directions*: Select the response that best indicates how confident you are that you could be physically active in each of the following situations.*

How confident are you that you can be physically active in each of the following situations?	Not at all Confident	Slightly Confident	Moderately Confident	Very Confident	Extremely Confident
1. When I am tired	**1**	**2**	**3**	**4**	**5**
2. When I am in a bad mood.	**1**	**2**	**3**	**4**	**5**
3. When I feel I don't have time	**1**	**2**	**3**	**4**	**5**
4. When I am on vacation	**1**	**2**	**3**	**4**	**5**
5. When it is raining or snowing	**1**	**2**	**3**	**4**	**5**

APPENDIX H

SOCIAL SUPPORT FOR EXERCISE SCALE

Family and Friend Social Support for Exercise Scales

(Sallis et al., 1987)

Directions: Please rate the frequency with which both family and friends have done or said was is described in the items during the previous 3 months. Values range from 1(none) to 5 (very often).

Friends *(friends, acquaintances, or co-workers)*					
1. Exercised with me	**1**	**2**	**3**	**4**	**5**
2. Offered to exercise with me	**1**	**2**	**3**	**4**	**5**
3. Gave me helpful reminders to exercise	**1**	**2**	**3**	**4**	**5**
4. Gave me encouragement to stick with my exercise program	**1**	**2**	**3**	**4**	**5**
5. Changed their schedule so we could exercise together	**1**	**2**	**3**	**4**	**5**

Family *(members of the household)*					
1. Exercised with me	**1**	**2**	**3**	**4**	**5**
2. Gave me encouragement to stick with my exercise program	**1**	**2**	**3**	**4**	**5**
3. Changed their schedule so we could exercise together	**1**	**2**	**3**	**4**	**5**
4. Offered to exercise with me	**1**	**2**	**3**	**4**	**5**
5. Gave me helpful reminders to exercise	**1**	**2**	**3**	**4**	**5**
6. Planned for exercise on recreational outings	**1**	**2**	**3**	**4**	**5**
7. Discussed exercise with me	**1**	**2**	**3**	**4**	**5**
8. Talked about how much they like to exercise	**1**	**2**	**3**	**4**	**5**
9. Helped me for ideas on how they can get more exercise	**1**	**2**	**3**	**4**	**5**
10. Asked me for ideas on how they can get more exercise	**1**	**2**	**3**	**4**	**5**
11. Took over chores so I had more time to exercise					

	1	**2**	**3**	**4**	**5**
12. Made positive comments about my physical appearance	**1**	**2**	**3**	**4**	**5**
13. Got angry at me for exercising	**1**	**2**	**3**	**4**	**5**
14. Criticized me or made fun of me for exercising	**1**	**2**	**3**	**4**	**5**
15. Gave me rewards for exercising	**1**	**2**	**3**	**4**	**5**

APPENDIX I

SITUATIONAL MOTIVATION SCALE (SIMS)

The Situational Motivation Scale (SIMS)

(Guay and Vallerand, 2000)

Directions: Read each item carefully. Using the scale below, please circle the number that best describes the reason why you are currently engaged in this activity. Answer each item according to the following scale: 1: *corresponds not all*; 2: *corresponds a very little*; 3: *corresponds a little*; 4:*corresponds moderately*; 5: *corresponds enough*; 6: *corresponds a lot*; 7: *corresponds exactly*.

Why are you currently engaged in this activity?							
1. Because I think that this activity is interesting	**1**	**2**	**3**	**4**	**5**	**6**	**7**
2. Because I am doing it for my own good	**1**	**2**	**3**	**4**	**5**	**6**	**7**
3. Because I am supposed to do it	**1**	**2**	**3**	**4**	**5**	**6**	**7**
4. There may be good reasons to do this activity, but personally I don't see any	**1**	**2**	**3**	**4**	**5**	**6**	**7**
5. Because I think that this activity is pleasant	**1**	**2**	**3**	**4**	**5**	**6**	**7**
6. Because I think that this activity is good for me	**1**	**2**	**3**	**4**	**5**	**6**	**7**
7. Because it is something that I have to do	**1**	**2**	**3**	**4**	**5**	**6**	**7**
8. I do this activity but I am not sure if it is worth it	**1**	**2**	**3**	**4**	**5**	**6**	**7**
9. Because this activity is fun	**1**	**2**	**3**	**4**	**5**	**6**	**7**
10. By personal decision	**1**	**2**	**3**	**4**	**5**	**6**	**7**
11. Because I don't have any choice	**1**	**2**	**3**	**4**	**5**	**6**	**7**
12. I don't know; I don't see what this activity brings me	**1**	**2**	**3**	**4**	**5**	**6**	**7**
13. Because I feel good when doing this activity	**1**	**2**	**3**	**4**	**5**	**6**	**7**
14. Because I believe that this activity is important for me	**1**	**2**	**3**	**4**	**5**	**6**	**7**
15. Because I feel that I have to do it	**1**	**2**	**3**	**4**	**5**	**6**	**7**
16. I do this activity, but I am not sure it is a good thing to pursue it	**1**	**2**	**3**	**4**	**5**	**6**	**7**

APPENDIX J

Exercise Enjoyment

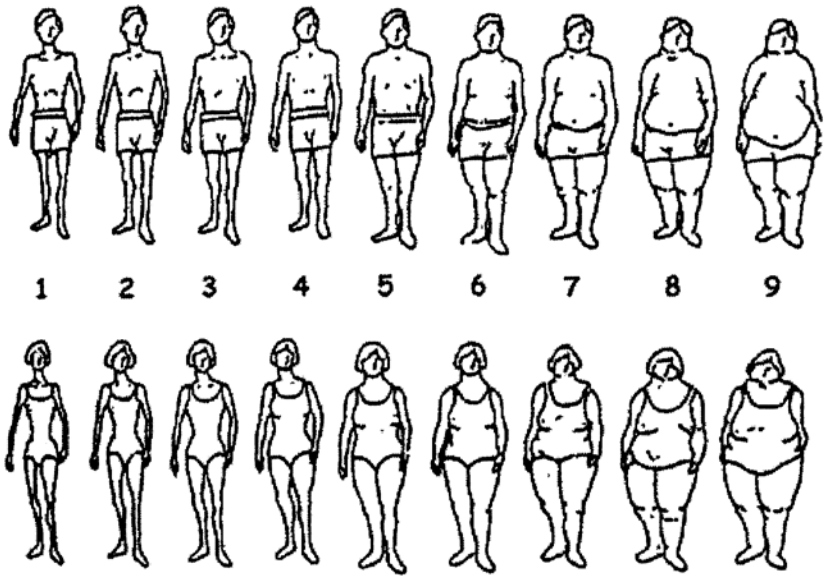
(Kendzierski and DeCarlo, 1991)

Directions: Please rate how you feel *at the moment* about the physical activity (exercise) you have been doing by circling the value for each pair of statements below

I enjoy it	1	2	3	4	5	6	7	I hate it
I feel bored	1	2	3	4	5	6	7	I feel interested
I dislike it	1	2	3	4	5	6	7	I like it
I find it pleasurable	1	2	3	4	5	6	7	I find it unpleasurable
I am very absorbed in this activity	1	2	3	4	5	6	7	I am not at all absorbed in this activity
It's no fun at all	1	2	3	4	5	6	7	It's a lot of fun
I find it energizing	1	2	3	4	5	6	7	I find it tiring
It makes me depressed	1	2	3	4	5	6	7	It makes me happy
It's very pleasant	1	2	3	4	5	6	7	It's very unpleasant
I feel good physically while doing it	1	2	3	4	5	6	7	I feel bad physically while doing it
It's very invigorating	1	2	3	4	5	6	7	It's not at all invigorating
I am very frustrated by it	1	2	3	4	5	6	7	I am not at all frustrated by it
It's very gratifying	1	2	3	4	5	6	7	It's not at all gratifying
It's very exhilarating	1	2	3	4	5	6	7	It's not at all exhilarating
It's not at all stimulating	1	2	3	4	5	6	7	It's very stimulating
It gives me a strong sense of accomplishment	1	2	3	4	5	6	7	It does not give me any sense of accomplishment
It's very refreshing	1	2	3	4	5	6	7	It's not at all refreshing
I felt as though I would rather be doing something else	1	2	3	4	5	6	7	I felt as though there was nothing else I would rather be doing

APPENDIX K

CONTOUR DRAWING RATING SCALE



Using the silhouettes above, circle the number of the appropriate figure that…

1. **Most closely matches your own**
   1 2 3 4 5 6 7 8 9

2. **You would most like to have**
   1 2 3 4 5 6 7 8 9

3. **You think most women would like to have**
   1 2 3 4 5 6 7 8 9

4. **You think most men would like to have**
   1 2 3 4 5 6 7 8 9

5. **You think most spouses/partners would like best**
   1 2 3 4 5 6 7 8 9

(Thompson and Gray, 1995)

APPENDIX L

SCALES USED TO MEASURE DETERMINANTS OF PHYSICAL ACTIVITY

Scales used to measure psychosocial determinants of physical activity

Scale	**Cronbach's α**	***Concept/Sample Questions***
Situational Motivation Scale (SIMS) (16 items) (Guay and Vallerand, 2000)	*0.85*	Assesses four subscales of motivation including: *Intrinsic motivation, Identified regulation, External regulation, & Amotivation.* Example: "Why are you currently engaging in physical activity? (Because I think this activity is interesting)"
Exercise self-efficacy Scale (5 items) (Marcus et al., 1992)	*0.76*	One's belief or confidence in their ability to perform a specific behavior. Example: "How confident are you that you can be physically active in each of the following situations? (When I am tired)"
Social Support for Exercise Scale (20 item) (Sallis, 1987)	*0.61-0.91*	Influence of family and friends on physical activity. Example: "You have been invited to walk with a family member"
Physical Activity Enjoyment Scale (PACES) (18 item) (Kendzierski and DeCarlo, 1991)		Assesses the extent to which one enjoys exercise. Example: "Please rate how you feel at the moment about the physical activity (enjoy it-hate it)"
Contour Drawing Rating Scale (2 item) (Thompson and Gray, 1995)	*0.79*	Body image assessment tool consists of nine male and nine female contour drawing in graduated sizes. Example: "Which figure best represents you body type?"

APPENDIX M

DESCRIPTIVE CHARACTERISTICS

1. Which of these categories best describes your race? Please mark only one.

- ☐ White
- ☐ African American
- ☐ Hispanic
- ☐ Asian American
- ☐ Other (specify): _____

2. Which of the following best describes your primary residence?

- ☐ On campus residence halls (dorms)
- ☐ Rent apartment
- ☐ Live with parents
- ☐ Other (specify) _____

3. Approximately how many hours per week do you work for pay (other than school)?

- ☐ Do not currently work for pay
- ☐ 1-10 hours/week
- ☐ 11-20 hours/week
- ☐ 21-30 hours/week
- ☐ 31-40 hours/week
- ☐ 41 hours or more a week

4. During a normal week, how many <u>hours a day</u> do you watch television and videos, or play computer or video games?

- ☐ None
- ☐ 1 hour or less
- ☐ 2 to 3 hours
- ☐ 4 to 5 hours
- ☐ 6 or more hours

5. During a normal week how many <u>hours a day</u> do you use a cell phone for texting or media (games, web, social media, music)?

- ☐ None
- ☐ 1 hour or less

- ☐ 2 to 3 hours
- ☐ 4 to 5 hours
- ☐ 6 or more hours

6. During the <u>past 30 days</u>, on how many <u>days</u> did you smoke cigarettes?

- ☐ 0 days
- ☐ 1 or 2 days
- ☐ 3 to 5 days
- ☐ 6 to 9 days
- ☐ 10 to 19 days
- ☐ 20 to 29 days
- ☐ All 30 days

7. During the <u>past 30 days</u>, on the days you smoked, <u>how many</u> cigarettes did you smoke?

- ☐ Did not smoke cigarettes during the past 30 days
- ☐ Less that 1 cigarette
- ☐ 1 cigarette per day
- ☐ 2 to 5 cigarettes per day
- ☐ 6 to 10 cigarettes per day
- ☐ 11 to 20 cigarettes per day
- ☐ more than 20 cigarettes per day

8. During the <u>past 30 days</u>, on how many <u>days</u> did you use chewing tobacco or snuff?

- ☐ 0 days
- ☐ 1 or 2 days
- ☐ 3 to 5 days
- ☐ 6 to 9 days
- ☐ 10 to 19 days
- ☐ 20 to 29 days
- ☐ All 30 days

9. During the <u>past 30 days</u>, on how many days did you have <u>at least one</u> drink of alcohol?

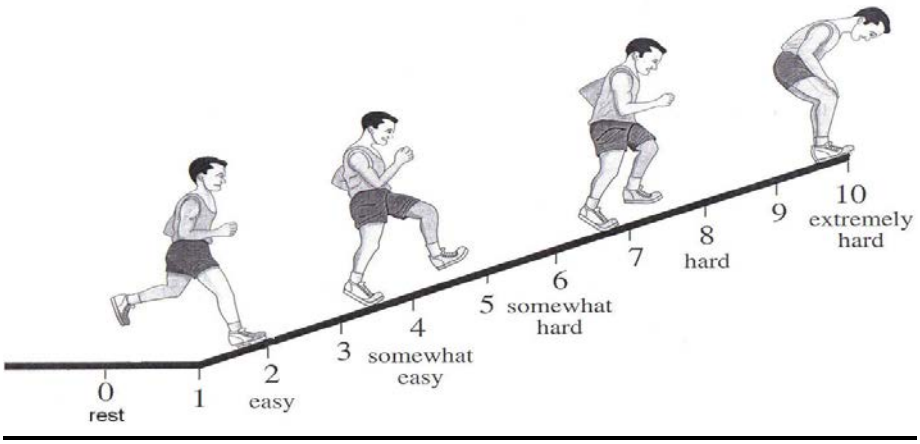
- ☐ 0 days
- ☐ 1 or 2 days
- ☐ 3 to 5 days
- ☐ 6 to 9 days
- ☐ 10 to 19 days
- ☐ 20 to 29 days
- ☐ All 30 days

10. During the <u>past 30 days</u>, how many times did you use marijuana?

- ☐ 0 days
- ☐ 1 or 2 days
- ☐ 3 to 5 days
- ☐ 6 to 9 days
- ☐ 10 to 19 days
- ☐ 20 to 29 days
- ☐ All 30 days

APPENDIX N

ADULT OMNI-WALK/RUN SCALE OF PERCEIVED EXERTION



(Robertson et al., 2004)

RPE Definition and Scale Orientation Sheet

Definition of RPE: We define exertion as the intensity of effort, strain, discomfort or fatigue that you feel during exercise.

Instructions: Please use the numbers on this scale to tell us how your body feels when you are exercising. Please look at the person at the bottom of the hill who is just starting to run *(point to the left-hand picture)*. If you feel like this person when you are exercising your rating should be the number 1. Now look at the person who is exhausted at the top of the hill *(point to the right-hand picture)*. If you feel like this person when exercising your rating should be the number 10. We will ask you to point to the number that tells how your whole body feels. There is no right or wrong answer. Use both the pictures and the words to help you select a number. Use any of the numbers to tell how you feel when you are exercising.

Ask the subject the following questions and instruct them to point to the appropriate number on the scale.

1. Rate your feelings of exertion right now.
2. Rate your feelings of exertion when you are running up a moderate hill.
3. Rate your feelings of exertion when you exercised as hard as you can remember.

APPENDIX O

INFORMED CONSENT

TITLE: Psychosocial Determinants of Physical Activity in a Sample of Undergraduate College Students

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School of Education

SOURCE OF SUPPORT: School of Education Research Grant

Why is this research being done?

The purpose of this study is to better understand the relation between self-reported physical activity and psychosocial determinants (factors) that might affect physical activity participation in a sample of undergraduate college freshman.

Who is being asked to take part in this research study?

Seventy-two male and seventy-two female college freshmen and sophomore (18-20 yrs old) will participate as subjects in this investigation. Participation will include one laboratory visit and last approximately 1 hour. You are being invited to take part in this research study because you are healthy, 18-20 years old, and do not participate in collegiate sports. You will not

be eligible to participate in this research study if you have any cardiovascular, orthopedic, or metabolic diseases that limit participation in physical activity, and/or if you are knowingly pregnant.

What procedures will be performed for research purposes?

If you decide to take part in this research study, you will be required to complete a seven page questionnaire packet, blood pressure, and body composition screenings during the single visits to the laboratory. The laboratory visit will involve answering questions about your physical activity habits, as well as assessments of blood pressure, height, weight, body composition, and waist circumference.

All procedures will take place and be administered by trained staff members from the Human Energy Research Laboratory at the Center for Exercise and Health-Fitness Research located in Trees Hall at the University of Pittsburgh.

Laboratory Visit

Screening Procedures:

1. Your resting blood pressure will be measured using a standard blood pressure cuff and stethoscope.

2. Your body height and weight will be measured using a standard physicians' scale.

3. Body composition will be assessed using a Tanita bioelectrical impedance analyzer (BIA). The BIA is a non-invasive pain-free procedure for assessing your body fat and muscle. The BIA instrument transmits a low-level electrical impulse through the body. You will remove your shoes and socks and stand on the Tanita BIA scale for approximately 10 seconds to obtain the body composition measurement. During the body composition measurement there may be a potential for the hair on your arms and legs to stand up.

4. Your waist circumference will be measured using a flexible tape measure.

Physical Activity Recall

5. Upon the competition of the preliminary screening you will complete an interview administered seven-day physical activity recall. This will measure your activity for the past seven days including hours spent in: 1) sleep; 2) light activity; 3) moderate activity; 4) hard activity; and 5) very hard activity. The physical activity interview should take no longer than 30 minutes.

Questionnaire Packet

6. A questionnaire packet will include standard scales to assess your enjoyment, social support, motivation, confidence to be physically active, as well as your perceived body image.

What are the possible risks, side effects, and discomforts of this research study?

Risks of the Study Monitors

Risks associated with study monitors (e.g. blood pressure cuff) include redness, irritation, and bruising. Subjects who wear a blood pressure cuff may encounter some infrequent chafing that will dissipate upon removal. The Tanita BIA scale may also cause the hair to stand up on your arm.

What are possible benefits from taking part in this study?

You will likely receive no direct benefit from taking part in this research study. However, you will receive information regarding your blood pressure, percent body fat, and physical activity level.

If I agree to take part in this research study, will I be told of any new risks that may be found during the course of the study?

You will be promptly notified if, during the conduct of this research study, any new information develops which may cause you to change your mind about continuing to participate.

Will my insurance provider or I be charged for the costs of any procedures performed as part of this research study?

Neither you, nor your insurance provider, will be charged for the costs of any procedures performed for the purpose of this research study.

Will I be paid if I take part in this research study?

You will be paid $20 upon completion of all procedures outlined in the laboratory visit.

Who will pay if I am injured as a result of taking part in this study?

University of Pittsburgh researchers and their associates who provide services at UPMC recognize the importance of your voluntary participation in their research studies. These individuals and their staffs will make reasonable efforts to minimize, control, and treat any injuries that may arise as a result of this research. If you believe that you are injured as a result of the research procedures being performed, please contact immediately the Principal Investigator or one of the Co-Investigators listed on the first page of this form.

Emergency medical treatment for injuries solely and directly related to your participation in this research study will be provided to you by the hospitals of the UMPC.

It is possible that the UPMC may bill your insurance provider for the costs of this emergency treatment, but none of these costs will be charged directly to you. If your research-related injury requires medical care beyond this emergency treatment, you will be responsible for

the cost of this follow-up unless otherwise specifically stated below. There is no plan for monetary compensation. You do not, however, waive any legal rights by signing this form.

Who will know about my participation in this research study?

Any information about you obtained from this research will be kept as confidential (private) as possible. All records related to your involvement in this research study will be stored in a locked file cabinet. Your identity on these records will be indicated by a case number rather than by your name, and the information linking these case numbers with your identity will be kept separate from the research records. You will not be identified by name in any publication of the research results unless you sign a separate consent form giving your permission (release).

Will this research study involve the use or disclosure of my identifiable medical information?

This research study will not involve the use or disclosure of any identifiable medical information.

Who will have access to identifiable information related to my participation in this research study?

In addition to the investigators listed on the first page of this authorization (consent) form and their research staff, the following individuals will or may have access to identifiable information related to your participation in this research study:

- Authorized representatives of the University of Pittsburgh Research Conduct and Compliance Office may review your identifiable research information for the purpose of monitoring the appropriate conduct of this research study.

- In unusual cases, the investigators may be required to release identifiable information related to your participation in this research study in response to an order from a court of law.

- Authorized people sponsoring this research study, because they need to make sure that the information collected is correct, accurate, and complete, and to determine the results of this research study.

For how long will the investigators be permitted to use and disclose identifiable information related to my participation in this research study?

The investigators may continue to use and disclose, for the purposes described above, identifiable information related to your participation in this research study for a minimum of seven years after final reporting or publication of a project.

Is my participation in this research study voluntary?

Yes! Your participation in this study is completely voluntary. You may refuse to take part in it, or you may stop participating at any time, even after signing this form. Your decision will not affect your current or future relationship with the University of Pittsburgh.

May I withdraw, at a future date, my consent for participation in this research study?

You may withdraw at any point. To do so, inform Mr. Shafer or a member of his research team during this research visit. If you withdraw from this study, we will continue to use whatever information we have collected (from either the questionnaire packet, the physical activity recall interview and/or the blood pressure, height, weight and waist measures, or body composition assessment) prior to you notifying us of your decision to withdraw.

If I agree to take part in this research study, can I be removed from the study without my consent?

It is possible that you may be removed from the research study by the researchers to protect your safety or if you are unable or unwilling to complete the research protocol.

****

VOLUNTARY CONSENT

All of the above has been explained to me and all of my questions have been answered. I understand that a copy of this consent form will be given to me and any future questions I have about this research study during the course of this study, and that such future questions will be answered by the investigators listed on the first page of this consent document at the telephone numbers given. Any questions I have about my rights as a research subject will be answered by the Human Subject Protection Advocate of the IRB Office, University of Pittsburgh (1-866-212-2668). By signing this form, I agree to participate in this research study.

_____

Participant's Name (Print)

_____ _____

Participant's Signature Date

CERTIFICATION OF INFORMED CONSENT

I certify that I have explained the nature and purpose of this research study to the above-named individual, and I have discussed the potential benefits, and possible risks associated with participation. Any questions, concerns or complaints the individual has about this study have been answered, and we will always be available to address future questions as they arise. I further certify that no research component of this protocol was begun until after this consent form was signed.

_____ _____

Printed Name of Person Obtaining Consent Role in Research Study

_____ _____

Signature of Person Obtaining Consent Date

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