KNOWLEDGE, ENGAGEMENT, AND PERCEPTIONS OF THE AMERICAN COLLEGE OF SPORTS MEDICINE GUIDELINES FOR CARDIOVASCULAR PHYSICAL ACTIVITY: A UNIVERSITY UNDERGRADUATE COMPARISON

by

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ABSTRACT

Background: The early onset of chronic disease is a major health concern facing the nation. Leading health indicators support physical activity to reduce the mortality and morbidity rates among individuals. The college years represent a time of transition and potential for improved adherence to positive health behaviors. As institutions of higher education seek to improve retention through positive health behavior, an increase in attention to physical activity is warranted.

Purpose: The purpose of this study was to evaluate the knowledge, engagement and perceptions of the American College of Sports Medicine (ACSM) guidelines for cardiovascular physical activity among university freshmen and seniors.

Methods: A cross-sectional study design was used to survey all University of Alabama undergraduate students (N=21,775). A 26-question electronic survey was used to collect data.

Results: A total of 877 surveys were returned representing a four percent (4.0%) response rate. The mean knowledge scores were 4.26 (out of possible 8.0). Students engaged in moderate intensity physical activity on less (M=3.73) days per week than recommended by the ACSM. For vigorous intensity physical activity students reported engagement on more (M=4.06) days per week than recommended by the ACSM.

Knowledge of physical activity guidelines was a significant predictor of engagement in vigorous intensity physical activity for both freshmen (n=216, p=.040) and seniors (n=211, p=.016). Significant differences (p=.047) by year in school were found with respect to walking activity where freshman walked more often than seniors. Age (p=.012), race (p<.001) and year in school

(P=.047) were all significant with respect to moderate intensity physical activity. Males engaged in more vigorous intensity physical activity than females (p=.003). When examining physical among classes, freshman students reported significant differences in engagement to vigorous intensity physical activity based on the constructs of perceived self-efficacy (p<.001) and perceived barriers (p=.006). Seniors reported significant differences in engagement to vigorous intensity physical activity based on perceived benefits (p=.002) and perceived severity (p=.019).

Discussion: University freshman and seniors vary in reasons for engagement in physical activity. While knowledge is not synonymous with engagement it does have an impact on a student's overall decision and understanding of the health benefits of physical activity.

DEDICATION

This dissertation is dedicated to my wife, Dr. Melanie Tucker (supermom!) and my children: Meredith, Zach, Ryan, Max, Quin, Sophie, and Liam. You are my constant source of inspiration.

LIST OF ABBREVIATIONS

ACHA	American College Health Association
ACSM	American College of Sports Medicine
AHA	American Heart Association
BRFSS	Behavioral Risk Factor Surveillance System
CHD	Coronary Heart Disease
CDC	Center for Disease Control and Prevention
EBBS	Exercise Benefits and Barriers Scale
EFM	Enterprise Feedback Management
ESES	Exercise Self-Efficacy Scale
GLM	General Linear Model
HBM	Health Belief Model
HINTS	Health Information Trends Survey
HRC	Housing and Residential Communities
IPAQ	International Physical Activity Questionnaire
METS	Metabolic Equivalents
NCES	National Center for Education Statistics
NCHA	National College Health Assessment
NCHRBS	National College Health Risk Behavior Survey
NCPPA	National Coalition for Promoting Physical Activity
NHANES	National Health and Nutrition Examination Survey

NIH	National Institute of Health
NSSE	National Survey of Student Engagement
PASW	Predictive Analysis Software
PCPFS	President's Council on Physical Fitness and Sport
SPSS	Statistical Package for Social Sciences
TPB	Theory of Planned Behavior
UREC	University Recreation
USDA	United States Department of Agriculture
USDHHS	United States Department of Health and Human Services
YRBSS	Youth Risk Behavior Surveillance System

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CHAPTER 1

INTRODUCTION

Chronic disease is the leading cause of death and disability in the United States, with cardiovascular disease, cancer, stroke and diabetes accounting for the majority of the health burden (CDC, 2009). As an urgent health priority, primary prevention strategies have been thrust into the public eye and have shown to be more effective than secondary and tertiary care (Pronk, Peek & Goldstein, 2004). While these chronic diseases are not curable, they are preventable. Research studies have shown that moderate physical activity may eliminate 250,000 premature deaths annually from coronary heart disease, colon cancer, and type 2 diabetes mellitus (Booth, Gordon, Carlson, & Hamilton, 2000; Haskell, Lee, Pate, Powell, Blair, Franklin et al., 2007; Pate, Pratt, Blair, Haskell, Macera, Bouchard et al., 1995). In addition, positive health results have been associated with physical activity engagement and the reduction of obesity, anxiety, as well as, depression (Kesaniemi, Danforth, Jensen, Kopleman, Lefebvre, & Reeder 2001). Despite its clear benefits, physical activity, remains underutilized and inefficiently completed; as one-quarter of U.S. adults are not physically active during their leisure time and over half do not meet the American College of Sports Medicine (ACSM) guidelines for physical activity (Ramsey, Ussery-Hall, Garcia, McDonald, Easton, Kambon et al., 2005).

The landmark *Healthy People 2010* (USDHHS, 2000) was a document developed to identify a wide range of U.S. health priorities and objectives which includes specific and measurable outcomes for increasing the overall health and well-being of U.S. citizens. The

Healthy People 2010 document centers on two over-arching goals: 1) to increase the quality of years of healthy life; and 2) to eliminate health disparities. Within this document, physical activity plays a central role, and is noted as a leading health indicator, in the prevention of multiple chronic diseases which include: coronary heart disease (CHD), obesity, hypertension, arthritis, osteoporosis, lower back pain, and some forms of cancer (USDHHS, 2000). Morrow, Krezewinski-Malone, Jackson, Bungum, and FitzGerald (2004) specifically stated that the knowledge and adoption of healthy physical activity behaviors was crucial in meeting the goals of *Healthy People 2010*; therefore, linking knowledge with effective strategies could help move individuals to healthier physical activity behaviors.

Prevention strategies are designed to affect behavior change and one factor essential to influencing this change is to increase the individual's knowledge of the physical activity recommendations put in place by health care providers and organizations (Vega, Sallis, Patterson, Rupp, Atkins, & Nader, 1987). Bethel, Klein, and Peck (2001) reported that education includes knowledge of and encouragement toward the engagement of good health habits (e.g., healthy eating, physical activity) and provide guidance on avoiding risky behaviors (e.g., smoking, alcohol use, and drunk driving, etc.). Studies (Bennett, Wolin, Puleo, Masse, & Athienza, 2009; Morrow et al., 2004) have identified a need for improved knowledge of physical activity guidelines in order to increase engagement. Providing education to individuals on the guidelines for physical activity is a tool used to alleviate sedentary behavior; however, this mode of education has been confusing and often misunderstood, which has contributed to less-than-desirable levels of physical activity compliance (Morrow et al., 2004).

In 2007, the American College of Sports Medicine (ACSM) updated its guidelines for physical activity and improved health, with the hope that it would become less confusing and

provide motivation for regular physical activity adoption (Haskell et al., 2007). In the most recent update to the guidelines, specific efforts were made to focus on disseminating physical activity information to public health agencies, health professionals, special populations, communities, educators, individuals, and families (Pate et al., 1995). Accordingly, the ACSM report encourages individuals to make modest changes in their physical activity in order to reap increased health benefits. The ACSM recent updates (Haskell et al., 2007) further documented the dose-response relationships between physical activity and the risk of cardiovascular disease and premature morality in men, women, and ethnically diverse participants. In conjunction with the national focus to decrease chronic diseases, the ACSM guidelines echoed the benefits of participating in regular physical activity and further described specific frequency (days per week), duration (minutes per session), and intensity (moderate and vigorous) requirements for physical activity (Atterhog, Jonsson, & Samuelsson, 1979; Kesaniemi, Danforth, Jensen, Kopelman, Lefebvre, & Reeder, 2001; Manson, Greenland, & LaCroix., 2002). While encouraging regular physical activity as a prevention strategy for chronic disease is widely published; it has also been noted to offer health promotion benefits in regard to increased feelings of well-being and enhanced performance of work, recreational, and sports activities (Atterhog et al. 1979; Kesaniemi et al., 2001; Manson et al., 2002).

A partnering instrument to *Healthy People 2010* is the *Healthy Campus 2010* document (ACHA, 2000). *Healthy Campus 2010* establishes the national college and university health objectives and serves as a basis for developing plans to improve overall student health. The *Healthy Campus 2010* document is a campus-driven initiative and provides a template for meeting goals and objectives for colleges and universities (Grizzell, 2009). Specific indices and measures for physical activity are included in the *Healthy Campus 2010* document. Healthy

Campus 2010 duly recognizes that the lack of physical activity in society is equally demonstrated among college and university students (ACHA, 2000).

University Students

The college years represent a time of individual exploration and discovery and serves as the final years of formal structure for education. This is a time when "independent living is being developed and health awareness might also be heightened" (Frost, 1992, p.317; Sparling & Snow, 2002). A student's transition to college is a period of adjustment into an environment that can be characterized by change, ambiguity, and acclamation across a number of life domains (Gall, Evans, & Bellerose, 2000; Lafreniere, Ledgerwood, & Docherty, 1997; Terenzini, Rendon, Upcraft, Millar, Allison, Gregg et al., 1994).

University students have specific time constraints related to academic schedules and have considerable discretionary time where choices influence their level of physical activity (Buckworth & Nigg, 2004; Keating, Guan, Pinero, & Bridges, 2005). While students have available time, data from the CDC's National Youth Risk Behavior Survey (YRBS, 2007) reports that only one in three U.S. high school students (grades 9-12) meet the recommended levels for moderate-intensity physical activity. Further challenging the efforts to healthy physical activity, many university students found a decrease in opportunities to engage in organized sports activities (Sallis, 1996; Nelson, Gortmaker, Subramanian, & Wechsler, 2007). Conversely, there has been a recent boom in the construction of on-campus, recreation and fitness facilities, as well as an increase in services and programs; therefore, increasing the opportunities for habitual physical activity (Keating et al., 2005; Leslie, Fotheringham, Veitch, & Owen, 2000; Leslie, Sparling, & Owen, 2001). Despite these expanded opportunities, more than half (54.1%) of college students do not meet ACSM guidelines. (ACHA, NCHA-II, 2008;

Suminski, Petosa, Utter, & Zhang, 2002). Keating et al. (2005) found that college students concentrate their physical activities predominately during the weekday period which provides additional challenges to meeting the ACSM guidelines for frequency of physical activity.

More than 14.5 million students are currently enrolled in colleges and universities across the United States (Keating et al., 2005) and the estimated growth is projected to increase to 17.1 to 18.2 million students by 2010 (Gerald & Husser, 2000). With this new growth, universities are increasing their on-campus resources (e.g. recreational facilities, wellness programs, activity courses) to impact physical activity among college students; however, with the large percentage (42.2%-54.1%) of college students who remain inactive, this proves that resources are not being fully utilized (ACHA, 2008; Suminski et al., 2002). Therefore, university health educators and fitness experts, along with student's access to on-campus exercise facilities, have the unique opportunity to advance physical activity knowledge and engagement without additional cost to these institutions (Leslie et al., 2001; Leslie et al., 2000). The effectiveness of these physical activity programs could be enhanced if promotion efforts were sensitive to gaining a better understanding of the characteristics of the student population including: the relationship among physical activity determinants, student ethnicity, and physical activity patterns (Chepyator-Thompson, 1994). The identification of specific factors that influence health behaviors among college students warrants further attention (Von Ah, Ebert, Ngamvitroj, Park, & Kang, 2003). With respect to these university students, freshmen and seniors present a clear distinction in relation to their experiences and matriculation process (Kuh, 2001; Pascarella & Terenzini, 1991; Pascarella & Terenzini, 2005).

The National Survey of Student Engagement (NSSE) utilized first-year and senior student responses to a series of engagement questions across a wide variety of experiences within and

outside the classroom. The variations in student experiences, based on their time in a campus setting, were captured by sampling these students at two points in their academic careers; which seeks to paint a fair picture of an overall collegiate experience (NSSE, 2009). As a key determinant of student engagement, the first-year student (freshman) involvement and satisfaction in physical activity is a strong predictor of academic retention (Kuh, 2001). Buckworth and Nigg (2004) noted that student behaviors such as studying, sitting at a computer and other more sedentary activities increased as they neared graduation and participating in physical activity may take more effort; thus, leading to a decrease in their activity. Additionally, the senior student's pattern of physical activity engagement was shown to be associated with the development of a lifetime appreciation and engagement in physical activity (Calfas, Sallis, Lovato, & Campbell, 2000). Fish and Nies (1994) and Sparling and Snow (2002) have shown that physical activity behavior, once established in college, creates a pattern of continued physical activity over longer periods of time. Therefore, these newly established patterns of physical activity have a profound impact and influence on long-term health (Sparling & Snow, 2002).

Purpose

The purpose of this study was to evaluate the knowledge and engagement of the ACSM guidelines for cardiovascular physical activity among university freshmen and seniors. Research conducted on the topic of knowledge of the ACSM guidelines was relatively sparse (Bennett et al., 2009; Morrow et al., 2004). However, the study of health knowledge, in order to predict physical activity engagement and the maintenance of moderate and vigorous physical activity, is worthy of better understanding (Sallis & Hovell, 1990). Meischke, Sellers, Robbins, Goff, Daya, Meshack et al., (2000) noted that physical activity knowledge was related to perceived risk of

poor health. Therefore, accurate knowledge of the national physical activity recommendations may be an important first step in establishing and/or increasing physical activity among the U.S. population (Bennett et al., 2009). With respect to university students, little research has been conducted that examines a student's knowledge of the physical activity guidelines. This research study determined the difference in knowledge and engagement in physical activity between university freshmen and senior students. As physical inactivity presents an on-going public health challenge, college health educators and practitioners are better positioned to tailor programs and services to students given a better understanding of their knowledge and engagement levels of physical activity.

Research Questions

Using theory is an essential component of any valid research study (Rothman, 2004). The integration of the Health Belief Model (HBM) examined the perceptions of university students in regard to their engagement in physical activity. As a value-expectancy model, the HBM (Rosenstock, 1974) is an individual health behavior model based on the belief that an individual's intention is independent of the overt action of others (DeBarr, 2004). Therefore, this study was developed using the framework of the HBM (Rosenstock, 1974; Rosenstock, 1990), which, by design, focuses on an individual's belief and perception of a specific health behavior. Buckworth, Wallace, Kirby, and Sherman (2000); Keating et al. (2005); and, Sullum, Clark, and King (2000), found that student perceptions regarding the benefits, barriers, and self-efficacy to physical activity are significant predictors of engagement and knowledge of physical activity. The remaining constructs (perceived susceptibility, perceived severity, and cues to action) from the HBM were used, in conjunction with individual demographic data (age, class status, residence status, gender, greek affiliation, and race), to determine their association with physical

activity (Ali & Haddad, 2004; Fitzpatrick, Reddy, Lonmel, Fisher, Speer, Stephens et. al., 2008; Juniper, Oman, Hamm, & Kerby, 2004; Koch, 2002).

This investigation sought to answer the following research questions:

Research Question #1**:** *Is there a difference in the mean knowledge scores of freshman and senior students for cardiovascular physical activity?*

Research Question #2**:** *Is there a difference in engagement of freshman and senior students for cardiovascular physical activity?*

Research Question #3**:** *Do year in school and perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?*

Research Question #4: *What are the individual characteristics of freshman and senior university students with respect to knowledge of the American College of Sports Medicine guidelines for cardiovascular physical activity?*

Research Question #5**:** *What are the individual characteristics of freshman and senior university students with respect to engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?*

Research Question #6**:** *Do year in school, knowledge, and perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?*

Research Question #7**:** *Do individual characteristics of freshman and senior university students and their perceptions of physical activity as measured by the constructs of the Health Belief Model relate with knowledge of the American College of Sports Medicine guidelines for cardiovascular physical activity?*

Research Question #8**:** *Do individual characteristics of freshman and senior university students and their perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?*

Limitations

Limitations exist within all research (Thomas, Nelson, & Silverman, 2005) and several factors influenced the results of this research study of knowledge, engagement, and perceptions surrounding physical activity.

1. The study sample was comprised of University of Alabama undergraduate students. Therefore, the data collected cannot be generalized to other universities or institutional settings.

2. Survey response rates may not adequately reflect the population that was measured. All undergraduate students were invited to participate in the survey, however, their willingness to actually take part and complete the survey varied.

3. The self-report survey instrument was potentially biased as to the accuracy and level of physical activity among undergraduate students. Respondents may have answered the questions in a way they thought the researcher would like for them to answer or in a way that made them look more physically active or healthy (Shih & Fan, 2008). However, Howard (1994) and Razavi (2001) assert that self-report is generally a suitable research study method with practical and conceptual advantages for the study of human characteristics, and may even be superior to other approaches.

4. The study employed a cross-sectional study design and measured one point in time in order to produce descriptive and inferential data. Therefore, physical activity changes over time

were not assessed, and estimates of how quickly university students might respond to future physical activity interventions were not inferred.

Delimitations

The inferential portion of the study was delimited to comparing freshman and senior college students at a large southeastern state institution. These classifications allowed for a comparison of the largest variance in years in college and their collegiate experience, while maintaining an emphasis on the undergraduate student experience. Study comparisons and generalizations beyond these classifications of students and within other institutional settings should occur with caution and awareness of limitations. .

The study was further delimited to surveying students by way of electronic mail (e-mail) and not by any other methods of measurement such as, pencil-and-paper. As all students at the University of Alabama were recipients of e-mail addresses during their enrollment, this may or may not have proved to be a significant challenge to the collection of responses.

Significance of the Study

Physical activity as a strong correlate of physical, emotional, and social well-being was extensively documented in multiple research studies (Atterhog et al., 1979; Haskell et al., 2007; Kesaniemi et al., 2001; Manson et al., 2002; Pate et al., 1995) and national reports (ACSM, 1998; AHA/ACSM, 2007; DHHS, 1996; DHHS, 2000; NIH, 1996). As with other populations, physical inactivity and health behavior is a major concern for university students, health educators, and researchers. Keating et al. (2005) identified that there was a significant lack of attention to college students' physical activity behaviors. The significance of this research was that the findings could contribute to the better understanding of knowledge and engagement of physical activity among university students. While knowledge alone may not effect overall

health behavior change (Parcel & Baranowski, 1981; Rudd & Glanz, 1990), it is critical to sound health–related decision-making (Salis & Hovell, 1990).

The addition of knowledge, related to physical activity, can be a strong tool for the health educator. Knowledge of physical activity recommendations can be used to empower individuals to be physically active as opposed to simply advising an individual on which exercise to complete for physical health (Salis, Simmons-Morton, Stone, Corbin, Epstein, Faucette et al., 1992, p. s249). As for the health educator, it is important to be able to determine if an individual has adequate knowledge of the physical activity guidelines for application or is merely aware of physical activity guidelines. The results from health behavior research show that awareness may not adequately address or mediate meaningful change in physical activity behavior (Hayes, Holliday, Wade, Trawick, Hodge, Caplan et al., 2009).

Determining the level of physical activity behavior among university freshmen and seniors will provide further significance for this research study. The increasingly sedentary lifestyle of Americans (CDC, BRFSS, 2007) is reflected by over half of the population not meeting the ACSM guidelines for physical activity. Furthermore, university students fare worse by exceeding this national average with 54.1% not meeting the ACSM guidelines for physical activity (ACHA, NCHA-II, 2008). A particular interest of this research study is determining the difference, if any, that university freshman and seniors exhibit in their knowledge and engagement in cardiovascular physical activity. These results could provide the health educator a rich opportunity to develop programs and interventions for improved adherence to physical activity among a population that can develop a strong sense of "brand awareness" (Wong, Huhman, Heitzler, Asbury, Bretthauer-Mueller, & McCarthy, 2004).

Definition of Terms

General Study Terms

Duration: The length of time for a given bout of exercise or physical activity. (Bouchard & Shepherd, 1994).

Exercise: A type of physical activity that is planned, structured, and consists of repetitive body movement done to improve or maintain one or more components of physical fitness. (Winter & Fowler, 2009)

Frequency: How often a person is physically active. (Bouchard & Shepherd, 1994; Winter & Fowler, 2009)

Freshmen: Those students currently enrolled at The University of Alabama with between 0-30 credit hours as determined by the Office of the Registrar (UA, 2008).

Intensity: Refers to how hard a body works during physical activity. Intensity of an activity is generally measured by direct relationship with heart rate or metabolic equivalents (METs) (Bouchard & Shepherd, 1994; Winter & Fowler, 2009).

Metabolic Equivalents (METs): The ratio of work metabolic rate to standard resting metabolic rate. Resting energy expenditure is considered 1 MET. Therefore, a 3 MET activity (equivalent to walking the dog or bowling) would require an energy expenditure at a level equal to three times resting (Bouchard & Shepherd, 1994; Winter & Fowler, 2009).

Moderate Physical Activity: Those physical activities that are defined by 3-6 metabolic equivalents (METS) to measure intensity of a particular physical activity (ACSM, 2009; Winter & Fowler, 2009)

Physical Activity: Any bodily movement produced by the contraction of skeletal muscles that result in a substantial increase over resting energy expenditure (Casperson, Powell, & Christenson, 1985; Winter & Fowler, 2009)

Physical Fitness: The ability to perform daily tasks without feeling fatigued or exhausted, with energy left over for enjoying leisure-time activities and meeting emergency demands. Physical fitness has four parts: 1) cardiovascular fitness reflects the condition of the heart and lungs; 2) muscular fitness means the strength and endurance of the muscles; 3) flexibility as the ability joints freely and without pain; and 4) body composition as the makeup of the body in terms of lean mass and fat mass (Casperson, Powell, & Christenson, 1985).

Seniors: Those students currently enrolled at The University of Alabama with 90 or more credit hours as determined by the Office of the Registrar (UA, 2008).

University Students (also used interchangeably with the term college students) Students enrolled in a four-year institution of higher education.

Vigorous Physical Activity: Those physical activities that are defined by greater than 6 metabolic equivalents (METS) to measure intensity of a particular physical activity (ACSM, 2009; Winter & Fowler, 2009).

Health Belief Model Definitions

Cues to Action: A construct that refers to strategies or reminders that assist an individual in becoming ready to adopt a new innovation (Hochbaum, 1958; Rosenstock, 1974).

Health Belief Model: A behavior change model designed to predict health behavior (Hochbaum, 1958; Rosenstock, 1974).

Perceived Barriers: A construct that refers to the belief of an individual that if they take steps to adopt a new innovation they could experience negative consequences (Hochbaum, 1958; Rosenstock, 1974).

Perceived Benefits: A construct that refers to the belief of an individual that if they take steps to adopt a new innovation they will receive a benefit (Hochbaum, 1958; Rosenstock, 1974).

Perceived Severity: A construct that refers to the personal belief that if the individual were affected by a system change then it would disrupt their daily routine (Hochbaum, 1958; Rosenstock, 1974).

Perceived Susceptibility: A construct which refers to the personal belief that the individual could be affected by a new innovation, idea, or system change. (Hochbaum, 1958; Rosenstock, 1974).

Self-Efficacy: A construct that refers to the personal belief of an individual that they have the ability to adopt a new innovation (Bandura, 1977; Rosenstock, Stretcher, & Becker, 1988).

Assumptions

Thomas et al. (2005) identified that there are certain fundamental assertions in every research study and if they did not exist then the research study could not be completed. It is assumed that certain conditions exist and that the research questions may be answered.

1. It is assumed that the HBM will adequately describe the physical activity of freshmen and seniors.
2. It is assumed that the research survey instrument will adequately capture the data needed to determine the physical activity knowledge, engagement and perceptions of freshmen and seniors.

3. It is assumed that the survey respondents will be able to read and understand the survey.
4. It is assumed that the database provided by the UA registrar will be a complete database and all UA freshmen and seniors' email addresses are correct.

CHAPTER 2

LITERATURE REVIEW

Purpose

The purpose of this study is to evaluate the knowledge, engagement, and perceptions of the American College of Sports Medicine (ACSM) guidelines for cardiovascular physical activity among university freshmen and seniors. This chapter focuses on 1) discussing the ACSM guidelines; 2) describing the knowledge of ACSM guidelines; 3) identifying and discussing the levels of physical activity among college students; 4) identifying national calls to action for cardiovascular activity and 5) identifying and discussing the Health Belief Model (HBM) as it applies to cardiovascular activity and additional research areas.

American College Sports Medicine Guidelines (ACSM)

The ACSM is an international organization of health and exercise science specialists with the mission to promote and integrate scientific research, education, and practical applications of sports medicine and exercise science to maintain and enhance physical performance, fitness, health, and quality of life for all people around the globe (ACSM, 2009). Established in 1954, the ACSM has a history of collaborating with federal organizations to provide sports medicine guidance to health professionals, communities, and individuals.

The 1970s

The original ACSM *Guidelines for Graded Exercise Testing and Prescription* was published in 1975 as a practical resource to health and fitness and clinical exercise professionals and had a major influence on the fields of exercise science and rehabilitation (ACSM, 1975).

This guideline established the recommended frequency (3-5 days per week), intensity (70-90% Heart Rate Reserve) and duration (20-45 minutes) of cardiovascular activity that is required to improve and maintain good physical health (Blair, LaMonte, & Nichaman, 2004). In order to give further credence to the physical activity recommendations, the ACSM, partnered with the Center for Disease Control and Prevention (CDC) and the American Heart Association (AHA) and published a position stand supporting the 1975 guidelines for the quantity and quality of exercise (Pollock, Gaesser, Butcher, Després, Dishman, Franklin, & Ewing-Garber, 1998).

The 1990s

The last decade of the 20th Century represented an important physical activity shift away from structured and regimented performance-related fitness toward new guidelines that focused on individual health-related outcomes. The 1990 ACSM position stand recognized that significant health benefits could be attained through regular physical activity performed more frequently and for longer duration, but at lower intensities than earlier prescribed (ACSM, 1990; Pate et al., 1998). The significance of this recommendation was the distinction made between exercise and physical activity; while introducing the notion that leading an active and fit way of life, not limited to sports and vigorous exercise, could provide important health benefits.

The next major development came in 1995 when the ACSM partnered with the CDC and published public health recommendations for physical activity. This report offered specific recommendations emphasizing that individuals need to participate in at least 30 minutes of

moderate physical activity every day. The ACSM/CDC suggested a dose of physical activity (≥ 30 minutes) that would be likely achievable by the largest portion of the population and was supported by evidence suggesting it being efficacious in disease risk prevention (Pate et al., 1995). These recommendations served as a basis for the 1996 *Surgeon General's Report on Physical Activity and Exercise* (Pate et al., 1995; United States Department of Health and Human Services, 1996).

The 2000s

In 2007, the ACSM renewed their emphasis and sought to improve the guidelines for moderate and vigorous-intensity physical activity for healthy adults age 18 to 65 years. These clarifications from the 1995 guidelines were largely related to intensity, duration, and frequency of exercise (Haskell et al., 2007). These recommendations called for moderate-intensity aerobic physical activity for a minimum of 30 minutes on five days each week or vigorous-intensity activity on at least three days each week (Haskell et al, 2007).

The 2007 ACSM guidelines clarified the physical activity term "frequency" and moved from the general terms of "most days of the week" to the more specific language of "five days a week". The simplified definition offered individuals a clearer understanding of the combined effect of both moderate and vigorous intensity activity choices. The recognition of shorter bouts of activity for cumulative effect was more completely articulated in the 2007 guidelines and suggested that individuals could complete 10 minute periods of activity, over segments throughout the day. Further clarifications included specific statements endorsing physical activity efforts performed as part of one's daily routine. The updated recommendation recognized the benefits to individuals who can incorporate both the lifestyles components of daily activities such as gardening, housework or job activities performed in bouts of 10 minutes

or more within the minimum recommended levels for moderate and vigorous intensity physical activity (Haskell, 2007).

Also, the guidelines specifically acknowledge that adherence to physical activity above the minimum recommendations can lead to additional health benefit and gives credence to the dose-response effect; meaning the more physical activity you complete, the more benefit you receive (Haskell et al, 2007; Lee, Sesso, & Paffenberger, 2000; Lee & Skerrett, 2001). Table 1 shows the changing recommendations for physical activity from 1975-2007.

The updated ACSM guidelines have also improved the understanding of general physical activities in regard to the term intensity. Intensity is defined as the amount of effort a person expends completing a physical activity and is measured in metabolic equivalents (METS). One MET is defined as the energy expenditure for sitting quietly; two METS is equivalent to standing while washing dishes. METS serve as useful method to describe the intensity of a variety of physical activities, particularly when compared to more laboratory-dependent measures such as maximal oxygen consumption, oxygen consumption reserve, heart rate reserve, and maximal heart rate (ACSM Guidelines, 2009; Blair et al., 2004). Moderate physical activity generally corresponds to 3.0-6.0 MET,S while vigorous physical activity is about 6.1-11.0 METS. A listing of moderate to vigorous physical activities, with corresponding METS, is seen in Table 2.

Other Recommendations

While the ACSM statements are seen as a definitive authority in physical activity recommendations, they are not the only organization producing guidelines to the general population (Bennett et al., 2009). In 2005, the USDHHS and the United States Department of Agriculture (USDA) jointly recommend individuals perform 30 minutes of moderate-intensity physical activity, above usual

Table 1

ACSM Guidelines 1975-2007

Year	Activity		
Cardio Fitness	*Frequency* d/wk	Duration min/d	Intensity %HRR[1]
1975	3-5	20-45	70-90
1980	3-5	15-60	50-85
1991	3-5	15-60	40-85
1995	3-5	20-60	40-85
2000	7	≥20	40-85
2007	5	30	Moderate
	3	20	Vigorous

[1] *HRR: heart rate recovery.*

Adapted from "The Evolution of Physical Activity Recommendations: How Much is Enough," by S.N. Blair, M.J, LaMonte and M.Z. Nichaman, 2004, *American Journal of Clinical Nutrition*, 79, 913S-20S.

Table 2

Metabolic Equivalent Values for Moderate and Vigorous Physical Activity

Physical Activity	Total METS
Moderate	*Moderate*
Walking (3.0 mph)	3.0
Walking at a brisk pace (4 mph)	5.0
Cleaning, heavy-washing windows, car	3.0
Sweeping floors or carpet, vacuuming	3.0
Mowing lawn	5.5
Badminton-recreational	4.5
Basketball – shooting a round	4.5
Bicycling – light effort (10-12 mph)	6.0
Dancing –ballroom slow	3.0
Dancing – ballroom fast	4.5
Golf – walking pulling clubs	4.3
Sailing boat, wind surfing	3.0
Swimming leisurely	6.0
Table tennis	4.0
Tennis doubles	5.0
Volleyball – competitive	4.0
Vigorous	*Vigorous*
Walking at very, very brisk pace (4.5 mph)	6.3
Walking/hiking at moderate pace	7.0
Hiking at steep grades	7.5
Jogging at 5 mph	8.0
Jogging at 6 mph	10.0
Running at 7 mph	11.5
Shoveling sand, coal, etc.	7.0
Carrying heavy loads	7.5
Basketball game	8.0
Bicycling (12-14 mph)	8.0
Bicycling (14-16 mph)	10.0
Skiing cross country (2.5 mph)	7.0
Skiing cross country (5.0-7.0 mph)	9.0
Soccer – casual	7.0
Soccer – competitive	10.0
Swimming – moderate	8.0
Swimming – hard	11.0
Tennis singles	8.0
Volleyball –competitive	8.0

Adapted from "ACSMs Guidelines for Exercise Testing and Prescription," by American College of Sports Medicine, 2009, p 4. Eighth Edition. Lippincott, Williams, & Wilkins. Baltimore, MD.

activity on most days of the week (USDHHS & USDA, 2005). In 2002, the Institute of Medicine (IOM) addressed unhealthy weight gain in Americans and made recommendations calling for the duration of physical activity to increase to 60 minutes on at least 5 days per week (Bennett et al., 2009; Blair et al., 2004; IOM, 2002).

Knowledge of ACSM Guidelines

Based on recent research (Bennett et al., 2009; Morrow, 2004; Ramsey et al., 2005) and the *ACSM's Guidelines for Exercise Testing and Prescription,* evidence reflects that sedentary behavior is a significant public health risk. Bennett et al. (2009) found that almost 25% of American adults are not physically active during leisure; while Ramsey et al. (2005) found that only 49% of Americans meet the ACSM guidelines. Given the low percentage of adults engaging in physical activity, it is quiet plausible that these guidelines are not generally adhered to and may not be well-known (Morrow, 2004).

Knowledge alone appears to be insufficient in changing health behavior; however, it is a required component (Parcel & Baranowski, 1981; Rudd & Glanz, 1990). Rudd and Glanz (1990, p. 115) stated that health information is "…critical to sound health-related decisions." While Sallis and Hovell (1990) indicated that health and exercise knowledge was indeed predictive of moderate physical activity; knowledge also predicted continued participation of moderate and vigorous physical activity. Sallis, Simmons-Morton, Stone, Corbin, Epstein, Faucette et al. (1992, p. s249) stated, "…knowledge about health effects of physical activity are not important but knowledge of how to be active may be a significant influence…"

Knowledge has also been linked to perceived health risk (Meischke et al., 2000). Hayes et al. (2009) found a significant number of college students reporting a level of knowledge or awareness of health and disease and the relationship between eating habits, health and disease.

Given the importance of knowledge and engagement in physical activity, it is essential to determine an individual's knowledge of the guidelines and types of physical activity that result in health benefits (Morrow, 2004). The importance of knowing the guidelines for physical activity has a direct bearing on a health educator's ability to plan, market, create media and information campaigns, and develop programs for physical activity interventions (USDHHS, 1996, 2000).

Morrow et al. (2004) researched the knowledge of physical activity ACSM-CDC guidelines among American adults to determine if knowledge alone was sufficient to achieve health benefits. Although the research revealed that participants had knowledge about how to be physically active for health benefits, there exists a strong opportunity to further educate individuals on the differences in "lifestyle" physical activities (e.g. household cleaning, mowing the lawn) and traditional physical activities (e.g. running/jogging, dancing). A lack of knowledge of what constitutes lifestyle physical activity was borne out as subjects appeared less aware of daily physical activities rather than traditional physical activities (Morrow et al., 2004).

Morrow et al. (2004) cautioned that although the ACSM guidelines have been widely disseminated and are known by adults, there has not been significant improvement in the percentage of adults engaging in physical activity for health benefit. Morrow noted that many individuals had sufficient levels of knowledge in areas of frequency, duration, and intensity. However, Casperson, Christenson and Pollard (1985) findings are contrary noting that less awareness in the minimum number of days, number of minutes and level of intensity for physical activity. Bennett et al. (2009) further corroborates Casperson, Christenson and Pollard by citing that only one third of American adults can accurately identify the ACSM recommendations and have limited knowledge of the national physical activity recommendations. Table 3 shows the comparative results of these three article.

Table 3

Comparison of Knowledge of Physical Activity Guidelines

Study	Guideline 1: Min. # of days per week for traditional physical activity	Guideline 2: Minutes exercise period should last	Guideline 3: Exercise Intensity
Casperson, Christenson and Pollard (1986)	39.3%	22.7%	33.8%
Morrow, Krezewinski-Malone, Jackson, Bungum and FitzGerald (2004)	70.4%	47.1%	64.2%

Adapted from American Adults Knowledge of Exercise Recommendations, 2004, *Research Quarterly for Exercise and Sport*, 7, (3) 231.

The lack of awareness and knowledge of ACSM guidelines may indicate that the guidelines remain confusing and misunderstood to the point of misapplication. The recommendations, throughout updates and editorial modifications, have retained their primary purpose to provide a clear, concise, public health message to encourage increased participation in physical activity by a largely US sedentary population (Haskell et al., 2007). Evidence suggests that the interpretation of the recommendations have been inconsistent (Keating et al., 2005) which leads to diverging ideas surrounding physical activity. Many individuals hold to the belief that they can only gain improved health through vigorous physical activity; while others believe that daily lifestyle activities, regardless of intensity, are sufficient for health promoting benefits (Porter Novelli, 2003).

In some cases, the ACSM guidelines have inadvertently created their own confusion through interim recommendation changes that are clearly in conflict with earlier recommendations (ACSM Position Stand, 1998; Saris, Blair, & van Baak, 2003; USDHHS, 2000). During the 1990s, in an effort to streamline and simplify recommendations, the introduction of moderate intensity physical activity in smaller bouts of time (8-10 minute intervals) was formulated in an effort to make guidelines more realistically attainable (Dubbert, 2002). In the midst of these attempts, guidelines have emerged that reveal different physical activity requirements for adults and youth. For example, Sallis and Patrick (1994), report guidelines from the International Consensus on Physical Activity Guidelines which recommend three or more 20-minute sessions of moderate to vigorous activity each week for adolescences.. This is primarily in line with the Healthy People 2010 recommendations for adolescent physical activity (USDHHS, 2000). Still other ambitious groups and associations have called for 60 minutes of physical activity a day (Cavill, Biddle, & Sallis, 2001).

Many Americans are overwhelmed and intimidated by the vast array of physical activity recommendations (Keating et al., 2005) and many are not aware of the nuances of these recommendations (Bennett et al., 2009) which can lead to a decrease in motivation and self-efficacy. A need for further research is recommended to determine if the ACSM updates of 2007 and the 2008 USDHHS (ACSM, 2009) Physical Activity Recommendations are indeed more accurately known (Bennett et al., 2009). Though subtle in difference, these interpretations and recommendations may create a confusing landscape for individuals seeking to define which type and level of physical activity is appropriate for their own health.

The University Student

A Time of Change

College students represent a viable population for study and review of physical activity. The changes and transitions that occur during the typical years of matriculation provide an environment that can be characterized by change, ambiguity, and adjustment across a number of life domains (Gall et al., 2000; Lafreniere et al., 1997; Terenzini et al., 1994). During the first year of college the process of change and disruption from the high school years is often accelerated when stable environments are modified and students experience a loss of security and sense of control.

Unfortunately, physical activity levels during this period of transition from high school to college often reflect patterns already established. Many transitioning high school students exhibit sedentary behavior prior to their arrival on campus. Recent data from the CDC (National Youth Risk Behavior Survey, 2007) indicate that only 34.7% of United States high school students (grades 9-12) met the recommended levels for moderate-intensity physical activity. Among these high school students, 43.7% of males and only 25.6% of females met the recommendation

of 60 minutes per day of moderate intensity physical activity on 5 or more days. With respect to race, 37.0% of white high school students met the recommendation while only 31.1% and 30.2% of African-American and Hispanic students, respectively, met the recommendation.

Among freshmen college students, the pre-existing physical inactivity trends are coupled with changes in wellness patterns, which are often academic, social, physical, emotional, and even cultural in nature (Bray & Born, 2004). This period of change is often marked by an increased opportunity for decision-making with use of discretionary time. This new sense of freedom is analyzed within the context of access (or the work needed to obtain the activity) and motivation (the reinforcing value of the activity); (Buckworth & Nigg, 2004). The transition to college also marks a decreased opportunity to participate in organized sporting activities (Sallis, 1996). The competitive nature of intercollegiate athletics can reduce opportunities for many students participate in more vigorous physical activity outlets and can serve to negatively influence overall physical activity (Nelson et al., 2007).

Higher education institutions are excellent laboratories to directly affect health behavior change by improving physical activity among students (Leslie, Sparling, & Owen, 2001). Specific change strategies available on college campuses include: 1) policies on the use of student fitness and recreation facilities, 2) intramural sports program promotions and access, 3) promotion of opportunities to engage in physical activity, 4) changing physical education course requirements to better educate students regarding physical activity; and 5) the provision of extra health and fitness services that use online health and fitness appraisals to improve physical activity adherence (Keating et al., 2005).

Prevalence of Physical Activity

Prevalence of physical activity among college students is not higher than the general population (USDHHS, 2000). To further challenge this notion, research suggests that a rapid reduction in physical activity occurs between the ages of 18-24 (Stephens, Jacobs, & White, 1985) while a substantial proportion of college students are leading a sedentary lifestyle (Pinto & Marcus, 1995). Therefore, the potential for creating opportunities for lifetime informed consumerism for physical activity is strong among this population.

Strategic social marketing campaigns for youth and physical activity such as the CDC "VERB Campaign" is a successful example of this concept of branding a health behavior such as physical activity (Wong, Huhman, Heitzler, Asbury, Bretthauer-Mueller, McCarthy et al.; CDC, 2004). Physical activity behavior, once established in college, has been shown to create patterns for adherence for long periods of time (Fish & Nies, 1994; Sparling & Snow, 2002). These newly established patterns have a profound impact and influence on long-term health (Sparling & Snow, 2002). Furthermore, efficiency can be obtained from improved physical activity among college students.

Physical Activity Programs

More than 14.5 million students are currently enrolled in colleges and universities (Keating et al., 2005) and a projected growth from 17.1 to 18.2 students by 2010 is expected (Gerald & Husser, NCES, 2000). Colleges and universities have resources (recreational facilities, wellness programs, activity courses) to impact physical activity among college students; however, the large percentage of these students who remain inactive shows that resources are not being fully utilized (Suminski et al., 2002). Program effectiveness could be enhanced if promotion efforts were sensitive to understanding the important characteristics of the

student population including the relationship among physical activity determinants, student ethnicity, and physical activity patterns (Chepyator-Thompson, 1994). The identification of factors that influence health behaviors among college students warrants further attention (Von Ah et al., 2003). Professionally trained health and fitness experts, along with access to university exercise facilities can facilitate physical activity knowledge and engagement without a significant amount of additional cost to these institutions (Leslie et al., 2000; Leslie et al., 2001).

Measurement of Physical Activity

The measurement of college student overall levels of physical activity has produced a degree of variance based on different studies and standards. Recent nationwide data among all adults showed that approximately 50.5% do not meet ACSM guidelines for moderate and/or vigorous physical activity (CDC, BRFSS, 2007). Data shows that 54.1% of college students do not meet these same guidelines (ACHA NCHA-II, 2008). Additionally, information from the *National College Health Risk Behavior Survey (NCHRBS)* found that 36% of college students did not participate in adequate amounts of physical activity (Collins et al., 1995); while other studies found higher percentages of college students (approximately between 40%-50%) who were not physically active (Leslie, Owen, Salmon, Bauman, Sallis, & Lo, 1999; Leslie et al., 2000; Pinto & Marcus, 1995; Stone, Strikwerda-Brown, & Gregg, 2002; Wallace et al., 2000).

In contrast to trends of adult physical activity, these various studies and the dates of their research suggest that an alarming trend toward decreased physical activity is emerging. Dinger (1999) specifically evaluated the ACSM recommendations for physical activity and found that almost 50% of college students failed to meet these recommendations.

Year of Education

Freshmen and seniors are of particular research interest given their respective points in matriculation. Freshmen provide a strong baseline of information since their relatively new status to the university. Conversely, seniors represent the results of time on campus and the collective inculcation of knowledge and experience unique to their collegiate environment (NSSE, 2009). The *National Survey of Student Engagement (NSSE),* measures first-year and senior students' engagement in empirically derived good educational practices and what they gain from their college experience (Kuh, 2001). Research supports the observation that experiences of lower-division and upper-division students are quite different at most colleges and that what happens in upper-level courses in a student's major is especially distinctive. Such variations are captured by sampling students at two points in their academic careers in order to paint a fair picture of an overall collegiate experience (NSSE, 2009). Deliberately sampling students at different levels also helped adjust for the fact that "survivors" have generally had more successful experiences than dropouts at any given institution (Kuh, 2001).

Senior-level college students' physical activity patterns warrant particular attention from health and physical activity professionals due to their ability to affect students' future physical activity patterns after graduation (Keating et al., 2005). Data and research on overall physical activity and changes in physical activity over time remain a concern. Absent longitudinal studies measuring physical activity change and corresponding determinants resulting in such change over college matriculation and the understanding of the influence of higher education on increasing physical college students' physical activity levels remains very limited (Keating et al., 2005).

Physical Activity Determinants

Present research on college students and physical activity emphasizes the activities that college students engage in most (Keating et al., 2005). In general, college students tend to get involved in physical activity that they already have some perceived or real level of competency (Keating et al. 2005). This predisposition toward certain types of physical activity does not appear to be solely based on a lack of awareness of other options, but rather familiarity. Data from the ACHA-National Collegiate Research Assessment shows that 60.8% of college students have received information on the topic of physical activity from their college or university. In addition, 55.5% of college students expressed an interest in obtaining information on the specific topic of physical activity (ACHA, NCHA-II, 2008).

Research of physical activity patterns is essential to identify individuals in immediate need of interventions and can be highly predictive of those students more likely to be sedentary post-college (Keating et al., 2005). The effects of college students' engagement in physical activity have been shown to have positive effects on adult physical activity level (Calfas, Sallis, Lovato, & Campbell, 1994). Sparling and Snow (2002), found that 84.7% of students who regularly exercised as college students were still physically active 5-10 years later. Unfortunately, the same trend for physical inactivity exists, with 81.3% of physically inactive college students maintaining this sedentary lifestyle.

The measurement and understanding of physical activity correlates are essential to any attempts to change health behavior. Many research studies aimed at college students and their levels of engagement in physical activity looked at personal, social, cognitive, and environmental factors (Calfas, Sallis, Nichols, Sarkin, Johnson, Caparosa et al., 2000; Salis, 1990; Wallace et al., 2000).

Personal Factors

Personal factors generally examined age, gender, ethnicity, year in university, physical activity history, and health status (Nahas, Goldfine, & Collins, 2003). Although age groupings for studies vary, age in general, has an impact on student's physical activity (Keating et al., 2005). Students aged younger than 30 years were more likely to engage in more vigorous activities than those over 30 (Leslie et al., 1999). Research also determined that a decrease in vigorous physical activity resulted in the decline of total physical activity over time (Keating et al., 2005)

The research of gender differences, in physical activity, found conflicting results. Certain studies noted no gender differences within the college student population (Behrens & Dinger, 2003; Calfas et al., 1994; Pinto & Marcus, 1995; Stock, Wille, & Krämer, 2001) while opposing studies reported that male students participate in more vigorous physical activities than their female counterparts (Leslie et al., 2000; Leslie et al., 2000; Huang et al., 2003). Types of physical activity did differ among gender, with men preferring weight lifting and team sports; whereas, women were more engaged in aerobics, dance and yoga (Douglas, Collins, Warren, Kahn, Gold, Clayton et al., 1997; Leslie et al., 1999; Pinto & Marcus, 1995). The gender differences and levels of physical activity appear to dissipate as the student ages (Sparling & Snow, 2002).

Race and ethnicity studies on physical activity differences among college students are rare. Of the studies completed (Ainsworth, Berry, Schnyder, & Vickers, 1992; Fennell, 1997; Kelley, & Kelley, 1994;; Suminski et al., 2002) they focused on minority students and physical activity. Fennell (1997) reported than one third of African American students did not participate in any sports activities and 54.1% did not take part in any strengthening exercise in the past 7

days. Among multiple ethnic groups, Asian and African American students were the least active when compared to Hispanic and white students (Suminski et al., 2002).

Although several studies (Calfas et al., 1994; Pinto & Marcus, 1995; Dunn & Wang, 2003) suggested no significant change in physical activity by year in college, at least one study (Huang et al., 2003) found that students reported less physical activity over time. This data provides some basis that physical activity specialists within higher education institutions have not effectively promoted physical activity on campus, nor fostered students to remain physically active (Keating et al., 2005). Longitudinal studies on the effects of the college years on students' levels of physical activity are necessary for a better understanding (Keating et al., 2005).

Social Factors

Social factors related to physical activity include support from family and friends. This support has shown to be a significant contributor to physical activity among both male and female students (Braithwaite, McDaniel, & Reed, 2003; Buckworth, 2001; Leslie et al., 1999; Wallace et al., 2000). Female students appear to derive greater support from family members (Braithwaite et al., 2003; Buckworth, 2001; Leslie et al; 1999; Wallace & Buckworth, 2003) while male students' support is more evident from peers and friends (Wallace et al., 2000).

Burke et al. (2005) recognized the importance of social contexts in meeting ACSM guidelines among college students. When students participated in physical activity contexts involving interaction with others outside a structured class setting, they reported the highest levels of meeting and maintaining ACSM-prescribed guidelines. These percentages of adherence increased significantly when additional physical activity contexts such as structured group classes, alone in an exercise setting and completely alone were included This finding

keeps with previous research that has shown that the most preferred physical activity context for university students is with others outside of a structured class (Burke, Carron, & Eys, 2005).

Cognitive Factors

Cognitive factors in research studies look at such variables as self-efficacy (one's perception of their ability to complete a task or behavior), perceived enjoyment of physical activity, and self-motivation (Keating et al., 2005). As with other populations, the construct of self-efficacy has shown to be a variable of critical interest among college students (Wallace et al., 2000). Of no surprise, high self-efficacy usually resulted in increased participation in physical activity (Sullum et al., 2000). Of even greater importance is the role that self-efficacy has had on female college student's physical activity behavior changes (Wallace & Buckworth, 2003; Wallace et al, 2000). Personal enjoyment played a significant role in the reasons college students participate in physical activity (Braithwaite et al., 2003; Huddleston, Mertesdorf, & Araki, 2002; Yoh, 2001) or enroll in elective physical activity courses (Hildebrand & Johnson, 2001; Leenders, Sherman, & Ward, 2003; Savage, 1998).

The research of self-motivation toward physical activity was minimal; however, both male and female students appear drawn to physical activity for "looking good" or physical appearance reasons (Keating et al., 2005). The definition of looking good was different for males, with muscular gain as the desired outcome, while female students' interest in weight loss was a key motivator (Leslie et al., 1999; Lowry, Galuska, Fulton, Wechsler, Kann, & Collins, 2000). A surprising finding was that students did not identify being healthy as a primary reason for physical activity participation (Keating et al. 2005). Student's age, level of maturity, and a lack of concern for personal health problems may contribute to this indifference; however, this

may be suggestive of college students' lack of knowledge of physical activity and understanding of the need for physical education (Keating et al., 2005).

Environmental Factors

Environmental factors represent variables such as facilities, public transportation systems, climate, and campus safety (Leslie et al., 2001; Nahas et al., 2003; Spence & Lee, 2003; Wallace et al., 2000; Yoh, 2001). Although this area of research on relationships to physical activity is sparse, living arrangements appear to have an influence on physical activity among college students. Behrens and Dinger, (2003) found that college students tend to exercise more during the week days and less on the weekend. Dinger (1999) specifically noted students living in fraternity and sorority housing tended to participate in significantly more vigorous physical activity or organized intramural sports opportunities than those not living in such housing. It is further noted that many of these greek organizations were organized at least in part to compete in intramural sports, thereby increasing total levels of physical activity. Although there is little research linking location of residence (on-campus vs. off-campus) to significant differences in physical activity (Brevard & Ricketts, 1996) it can be reasonably assumed that such access to campus fitness and recreation facilities are attractive and potentially inviting sites for physical activity for students (Buckworth, 2001; Leslie et al., 2001; Sparling and Snow, 2002).

Call to Action

More than ten years ago, multiple landmark publications brought considerable attention to the health-related benefits of regular physical activity and established criteria for improving fitness levels (NIH, 1996; Pate et al., 1995; USDHHS, 1996). The goals of these reports were to clarify for individuals and health professionals the amounts and intensities of physical activity needed to improve health and to decrease rates of disease morbidity and mortality (NIH, 1996;

Pate, 1995 and USDHHS, 1996). Physical activity is an inexpensive and viable means to promote and sustain good health. Yet, for many college students physical activity is an aspect of their life that remains elusive and difficult to understand. The call to action for physical activity has been spotlighted in numerous national arenas, specifically: 1) American College of Sports Medicine and The Center for Disease Control and Prevention; 2) Department of Health and Human Services Surgeon General Report; 3) Healthy People 2010 and 4) Healthy Campus 2010.

American College of Sports Medicine and the Center for Disease Control and Prevention

In the mid-1990s, a group of experts were brought together by the CDC and ACSM to review and discuss current physical activity research in order to develop a health message to be dispersed to the general public regarding their own physical activity. The goal of this project was to change our sedentary society into an active one. Therefore, in 1995, the ACSM and CDC issued a report recommending that every adult should participate in 30 minutes or more of moderate physical activity, preferably on a daily basis (Pate, 1995).

In order to succeed in the lofty goal of changing a sedentary society, the report focused on disseminating their message through the following six channels: public health agencies, health professionals, special populations, communities, educators, and individuals and families (Pate, 1995).

Public Health Agencies

The ACSM-CDC report called for more support for physical activity in the public health arena. Much acknowledgement was given to CDC, ACSM, the President's Council on Physical Fitness and Sport, and the American Heart Association for their past and current work on promoting physical activity; however, new partners were encouraged to heed the call. The report identified several potential partners and all but called them by name. Several identified

organizations were the state and local governments, parks and recreation associations, departments of transportation and environmental groups (Haskell et al., 2007; Pate et al., 1995).

Health Professionals

The ACSM-CDC report encouraged physicians and health care workers to routinely counsel and encourage their patients to begin and maintain regular physical activity. Not only did the report encourage counseling of the physician's patients, but also called for increased physical activity and improved physical health of the physician. The rationale of the latter recommendation is that improved physical health of the physician could lead to increased credibility of the physician and buy-in from the patient (Pate et al., 1995; Pollock et al., 1998).

Special Populations

The ACSM-CDC report encouraged public health educators to target their education and interventions to special populations such as ones with disabilities, health disparities, low socioeconomic status, and the elderly. The report encouraged educators and researchers to use community-based participatory research to identify their topic and target intervention (Kroll, Kehn, Ho, & Groah, 2007)

Communities

The ACSM-CDC report (1995) encouraged the use of schools, worksite, and medical communities as places to encourage and promote physical activity. These sites were chosen because they offer a means to reach the most people in a single setting. The implementation of organized programs in these community settings is one way to encourage life-long physical activity changes to many individuals (Fitzpatrick, Reddy, Lonmel, Fisher, Speer, Stephens et al., 2008).

Educators

The ACSM-CDC report (1995) calls educators specifically to deliver physical activity and health education to students at every opportunity. Tailored physical activity and health education curricula should be provided to students of all ages in a fun and interactive format in a variety of locations; school and in the community (Sparling & Owen, 2001).

Individuals and Families

The ACSM-CDC report (1995) encouraged individuals to make modest changes in their physical activity in order to reap increased health benefits. Parents are encouraged to participate in their own physical activity programs and encourage and support their children with their own physical activity interests (Braithwaite et al., 2003; Buckworth, 2001; Leslie et al; 1999; Wallace & Buckworth, 2003).

Department of Health and Human Services Surgeon General's Report

In 1994, Donna E. Shalala, then Surgeon General, commissioned the first Surgeon General's report on physical activity and health (USDHHS, 1996). The impetus for this report grew out of the agreement from health educators, epidemiologists, and health professionals that physical activity need not be vigorous in order to be beneficial to health. In addition, they all agreed that the health benefits from physical activity seem to increase with additional activities and the focus should be on the amount of activity rather than the intensity. Therefore, the first Surgeon General's report was created. The major goal of this project was to summarize the literature in regard to physical activity and assess the impact it has on an individual's physical health and the prevention of diseases. The eight major conclusions derived from the report are:

- All people, regardless of age and gender, benefit from physical activity
- Moderate amounts of physical activity can lead to significant health benefits

- Greater amounts of physical activity can led to additional health benefits
- Premature mortality can be reduced by regular physical activity
- More than 60% of American adult are not physically active on a regular basis; 25% of American adults are not active at all
- American youths age 12-21 do not participate in regular vigorous activity
- Participation in high school physical education classes has declined from 42% to 25% (between 1991 and 1995)
- Physical activity research is minimal; however, research has been successful

(ACSM, 1995; Pate et al., 1995)

Healthy People 2010

Healthy People 2010 (USDHHS, 2000) are a comprehensive set of disease prevention and health promotion objectives designed to increase the health outcomes between the years 2000 and 2010. Created by scientists both inside and outside of the government, it identifies a wide range of public health priorities and specific, measurable objectives. The organization of the *Healthy People 2010* objectives centers on two over-arching goals: 1) to increase the quality of years of healthy life; and 2) to eliminate health disparities. Physical activity is listed as one of the key 10 Leading Health Indicators and has been linked with the following focus areas in Table 4. The inclusion of physical activity from the Surgeon General Report, placed emphasis on moving from a simple interpretation of vigorous-intensity physical activity to a broad range of health enhancing activities (USDHSS, 2000).

Table 4

Health Indicators and Focus Areas: Healthy People 2010

Focus Area	Physical Activity
Access to Quality Health Care Services	X
Arthritis, Osteoporosis, and Chronic Back Conditions	X
Cancer Chronic Kidney Disease	X
Chronic Kidney Disease	X
Diabetes	X
Disability and Secondary Conditions	X
Educational and Community Based Programs	X
Environment Health	
Family Planning	
Food Safety	
Health Communication	X
Heart Disease and Stroke	X
HIV	
Immunization and Infectious Diseases	
Injury and Violence Prevention	
Maternal, Infant and Child Health	X
Medical Product Safety	
Mental Health and Mental Disorders	
Nutrition and Overweight	X
Occupational Safety and Health	
Oral Health	
Physical Activity and Fitness	X
Public Health Infrastructure	X
Respiratory Disease	X
Sexually Transmitted Disease	
Substance Abuse	
Tobacco Use	
Vision and Hearing	

Adapted from *Healthy People 2010 (2nd Edition)*, 2000, U.S. Department of Health & Human Services. U.S. Government Printing Office, Washington, DC.

The *Healthy People 2010* objective's 22-2 and 22-3 speak directly to ACSM recommendations for physical activity. They are:

22-2: *Increase the proportion of adults who engage regularly, preferably daily, in moderate physical activity for at least 30 minutes per day*.

22-3: *Increase the proportion of adults who engage in vigorous physical activity that promotes the development and maintenance of cardio respiratory fitness 3 or more days per week for 20 or more minutes per occasion*.

Healthy Campus 2010

The Healthy Campus 2010 document establishes national college health objectives and serves as a basis for developing plans to improve student health. It was established on the momentum and concepts of the Healthy People 2010 program and was developed using data gathered from the National College Health Assessment in 2000 (ACHA, 2006) which focused on more specific observation of the traditional college-aged (18-25) student. The Healthy Campus 2010 document serves as a campus-driven initiative for meeting goals and objectives created uniquely by each college and university (ACHA, 2006). This rationale for creating the Healthy Campus 2010 document was in part due to 26% of people in the United States completing at least four years of college and likely to receive services from a college health program. Of these individuals, approximately 25% will continue to graduate-level studies; thus, providing a rich opportunity for physical activity education and intervention. The Healthy Campus 2010 leading health indicators are in tandem with the 10 leading health indicators incorporated into the Healthy People 2010 program. Physical activity is equally addressed in each document and the goals for objectives 22-2 and 22-3 are as follows:

Objective 22-2/3: *Increase the proportion of college students who engage in physical activity at least three days per week that includes moderate physical activity for at least 30 minutes or vigorous physical activity for 20 or more minutes per occasion*.

National Organizations

In a letter dated, March 13, 2009 (ACSM, 2009), more than 30 national organizations strongly urged President Barack Obama to make physical fitness a priority in the national health care agenda. On October 21, 2009, over 40 national organizations wrote to congress strongly supporting the Physical Activity Guidelines for Americans Act of 2009 (ACSM, 2009). This act requires the Secretary of Health and Human Services to publish updated guidelines and reports at least every five years based the latest scientific evidence. This reinvigorated call to action identified the multitude of positive effects of physical activity and how ultimately these effects can decrease long-term health care costs. This recent and renewed call-to-action encouraged President Obama to include the Surgeon General, National Institutes of Health, and the Center for Disease Control and Prevention in earmarking monies specifically to increase the research and education toward physical activity and the health education for the prevention of chronic disease.

Health Belief Model

Social Theorist Kurt Lewin (1951, p.169) queries, "Is there nothing more practical than a good theory?" Rothman (2004) expands upon this question with the need for theorists and practitioners to treat theory as a dynamic entity which needs constant rigor of inquiry, application test, and refinement. Theory plays a profound role in the discipline and science of health education. Babbie (2003) defines theory as, "A systematic explanation for the observations that relate to a particular aspect of life" (p.12). In contrast, models are best defined

"as a subclass of theory" (McKenzie & Seltzer, 2003, p.138). While theories are organized around ideas, concepts, and constructs, models are representative of theories and acts as vehicles for the application of theories (McKenzie & Seltzer, 2003, p.139.

The Health Belief Model (HBM) is the most commonly used theory in health education and health promotion (Glanz, Rimer, & Lewis, 2002; National Cancer Institute, 2003). The widely used conceptual framework was developed in the early 1950's for the United States Public Health Service to explain individual's lack of participation in a program to detect and prevent tuberculosis (Hochbaum, 1958; Rosenstock, 1960, 1974). In the mid-1970's the model expanded to study an individual's response to symptoms (Kirscht, 1974) and behaviors in their illness and adherence to medical regimens (Becker, 1974).

Kurt Lewin was among the first to bring together the concepts of decision making and psychological conflict. Constructs from the HBM were derived from Lewin's field theory (Lewin, 1951) and hypothesized that an individual's behavior depends on two variables: the outcome of the behavior change will have value to the individual, and the individual believes that their behavior change will result in the identified outcome (Diederich, 2003).

The HBMl has been categorized as a value-expectancy theory. Value-expectancy theories were originally created in order to explain and predict an individual's attitudes toward the adoption of a new behavior. The value-expectancy constructs slowly evolved and were redesigned to provide a focus on the adoption of health behaviors rather than behaviors in general (Champion & Skinner, 2008).

Champion and Skinner (2008) discussed that the HBM consists of six main constructs that influence an individual's decision to act upon a certain behavior change. These constructs, as shown in Table 5, include perceived susceptibility, perceived severity, perceived benefits,

Table 5

Health Belief Model Constructs

Construct	Definition
Perceived susceptibility	Ones belief about the chances of getting a condition
Perceived severity	Ones belief about how serious the condition would be if acquired
Perceived benefits	Ones belief about the benefits they would receive they took action
Perceived barriers	One's belief about the barriers they would encounter if they took action
Cues to action	Strategy to motivate action
Self-efficacy	Ones confidence in their ability to act

Adapted from *Health Behavior and Health Education: Theory, Research and Practice*, by Glanz et al. 2008, San Francisco: Jossey-Bass.

perceived barriers, cues to action, and perceived self-efficacy. The combined constructs of perceived susceptibility and severity toward a specific illness or health condition, in tandem with the review of benefits and the corresponding barriers, creates an opportunity for action or inaction toward behavior change (Hochbaum, 1958; Rosenstock, 1960, 1974; Rosenstock, Strecher, & Becker, 1988). Each of these constructs is explained below.

Health Belief Model Constructs

Perceived Susceptibility

Perceived susceptibility references an individual's belief relating to how likely they are of contracting an illness or condition. With respect to physical activity one might rate the likelihood of poor health (coronary heart disease, higher blood pressure, and osteoporosis) as opposed to beginning a program of physical activity (Hochbaum, 1958; Rosenstock, 1960, 1974).

Kofahi and Haddad (2005) examined the pervasive health risks of smoking and lung cancer among college students and used the HBM as a guide for the research. Kofahi and Haddad (2005) found the perceived susceptibility rating low in predicting change, while perceived severity was high for the consequences of contracting lung cancer. The highest potential for behavior change came with the recognition of the benefits of stopping smoking while the assessment of barriers as a predictor of change was low.

Perceived Severity

Perceived severity or seriousness is an individual's view of the consequences of contracting an illness or if left untreated. These evaluations may be both medically reviewed (death, disability, pain) as well as social (effects on employment, family, relationships). Failure to engage in physical activity behaviors may be gauged on what certain health diseases (coronary

heart disease, higher blood pressure, obesity) may belie in consequences toward an individual and his or her social networks (Hochbaum, 1958; Rosenstock, 1960, 1974).

Graham (2002) employed the constructs of the HBM when researching breast self examinations in African American women. Graham found that perceived seriousness of breast cancer, benefits of breast self examination, and health motivation were predictive of positive behavior change.

Perceived susceptibility / perceived severity and physical activity

In regard to physical activity, there is mixed evidence of a relationship between perceived severity of disease and physical activity or adherence to structured exercise programs (Godin et al. 1994; Lynch et al., 1992; Mirotznik, Feldman, & Stein, 1995; Oldridge & Streiner. 1990; Robertson & Keller, 1992). The same lack of association was also found with the construct of perceived susceptibility to disease and adherence to structured physical activity programs (Lynch et al., 1992; Mirotznik et al., 1995; Oldridge & Streiner, 1990).

Perceived Benefits

Perceived benefits look at the overall advantages to adoption of a particular behavior for a particular health outcome. Specific to physical activity these benefits may be intrinsic (weight loss, lowered blood cholesterol, lowered blood pressure, feel or look better) or extrinsic (more attractive to others, making a sports team, promotion). Benefits in moving toward behavior change must ultimately be viewed as acting upon and reducing the combined threat of perceived illness susceptibility and severity (Hochbaum, 1958; Rosenstock, 1960, 1974).

McIntosh and Kubena (1996) used the HBM and its application to research fat reduction and the modification of an individual's cholesterol intake. The data showed that changing

people's beliefs regarding the perceived benefits of dietary change, relative to the costs of making the specific changes, had the greatest effects on dietary changes.

Perceived Barriers

Any negative aspects toward adoption of a particular health action are considered a perceived barrier (Champion & Skinner, 2008). Physical activity barriers may include health conditions that keep individuals from being active; such as: too costly, too little time, dislike for physical activity, considered unsafe, too painful, and no desire to engage (Fitzpatrick et al., 2008, Al-Ali & Haddad, 2004). The cognitive consideration of perceived barriers and benefits create a form of cost-benefit analysis for individuals. Thus the combined levels of perceived threat (susceptibility and severity) to provide the impetus or force to act while the perception of benefits (minus barriers) provides a preferred course of action (Rosenstock, 1974).

In the study conducted by Turner, Hunt, DiBrezzo, and Jones (2004) researchers found that increasing the influences of perceived severity, perceived susceptibility, perceived benefits, self-efficacy and cues to action while reducing perceived barriers to participation in osteoporosis prevention and education program were instrumental in behavior change.

Perceived benefits / perceived barriers and physical activity

Several studies found no association between physical activity and the constructs of perceived benefits (Hoffstetter et al., 1991; Mirotznik, Feldman, & Stein 1995; Oldridge & Streiner, 1990; Taggart & Connor, 1995). The same lack of association was found with the construct of perceived barriers (Desmond et al. 1993, Godin, Desharnais, Valois, Lepage, Jobin, & Bradet, 1994; Neuberger, Kasal, Smith, Hassanein, & DeViney, 1994; Oldridge & Streiner, 1990; Taggart & Connor, 1995). Ali and Twibell (1995) and Neuberger et al. (1994) found perceived benefits were consistently and positively associated with adult physical activity.

Lynch, Birk, Weaver, Gohara, Leighton, and Repka et al (1992) and Robertson and Keller (1992) found a positive association between perceived benefits and adherence to structured physical activity programs. Negative associations toward physical activity were found in studies of the construct of perceived barriers (Ali & Twibell, 1995; Dishman & Steinhardt, 1990; Godin et al., 1994; Hoffstetter et al., 1991; Horne, 1994). Perceived barriers and a negative association with adherence to structured physical activities were also realized in several studies (Howze, Smith, & DiGillo, 1989; Mirotznik et al., 1996; Robertson & Keller, 1992). These seemingly contradictory findings and studies notwithstanding, the cumulative body of evidence supports conclusions and expectations of both benefits and barriers as associated with physical activity adherence among adults (USDHHS, 1996, p.215).

Following the Surgeon General's Report, selected studies, using the HBM with physical activity, highlighted the strengths of associations with constructs of the model. Koch (2002) studied the relationship of African American women with type-2 diabetes mellitus and determined significant differences between those who exercised and those who did not, with respect to perceived benefits and barriers to physical activity.

Al-Ali and Haddad (2004) studied patients who had suffered myocardial infarction and revealed high scores on perceived severity and low scores on perceived barriers to exercise. In addition the research reflected significant correlations between exercise participation and health belief variables and socio-demographics, such as age, annual income, level of education, and the role of the physicians' recommendations.

The relationship between constructs of the HBM and African-American college women (Juniper, Oman, Hamm, & Kerby, 2004) were examined, with perceived barriers significantly

higher and perceived severity, cues to action and self-efficacy significantly lower in the non physically-active group compared to those who were engaged in physical activity.

Girvan and Reese, (1990) measured the effects of the HBM on future physical education teachers and their exercise behaviors finding perceived barriers such as time constraints, family, job responsibilities, and weather kept most teachers from aerobic activity. While Fitzpatrick et al. (2008) evaluated a community-based physical activity intervention for senior citizens and determined that physical activity significantly reduced the barrier of perceiving physical activity as unsafe and also lends credence to the gain in knowledge and awareness that accompanied engagement in this study.

Cues to Action

Cues to action are factors that may move an individual to some increased likelihood of behavior change (Champion and Skinner, 2008). These cues may be very subtle and individually noted. They also may be more environmental and broad such as media messages and campaigns. With physical activity cues it may be noting others engaged in physical activity or a broad advertisement for a local fun run event. The inherent difficult in measuring the effects of cues to action as triggering mechanisms make them very difficult to study in surveys and research (Champion & Skinner, 2008). .

Wdowik, Kendall, Harris, and Auld (2001) conducted a research study to assess diabetes self management among college students using the HBM. Their findings were that cues to action, self-efficacy, and perceived threat were the strongest determinants toward compliance to diabetes management.

Cues to action and physical activity

Cues to action have been theorized to influence health behaviors; however, few studies have examined these constructs explicitly. Juniper et al. (2004), noted in the research of physical activity among African American women, that cues to action were low among individuals who did not participate in regular physical activity. These cues became higher as the individual participated in more physical activity. In support of this research, Chou and Wister (2005) found cues to action to be a pivotal theoretical construct when used to increase physical activity among the elderly.

Perceived Self-Efficacy

Much emphasis in updated HBM reviews has been placed on the construct of perceived self-efficacy. Self-efficacy is defined as "the conviction that one can successfully execute the behavior required to produce an outcome" (Bandura, 1997). Rosenstock, Strecher, and Becker (1988) suggested the additional construct of perceived self-efficacy to the HBM. The significance of one's perception of competence to overcome barriers and to take action is noted in the literature towards initiation and maintenance of behavioral change (Bandura, 1997). Self-efficacy in adoption and continued adherence in physical activity would involve the perception that one could continue to engage despite the potential barriers that confront on an on-going commitment.

Mediating variables that are involved in the HBM process are demographic, socio-psychological, and structural (Figure 1). These factors will have varying levels of indirect influence on behavior change. An example of the interplay of socio-demographic influence in the HBM is the level of educational attainment affecting other constructs such as perceived susceptibility, perceived severity, benefits, and barriers (Glanz, Rimer, & Viswanath, 2008).

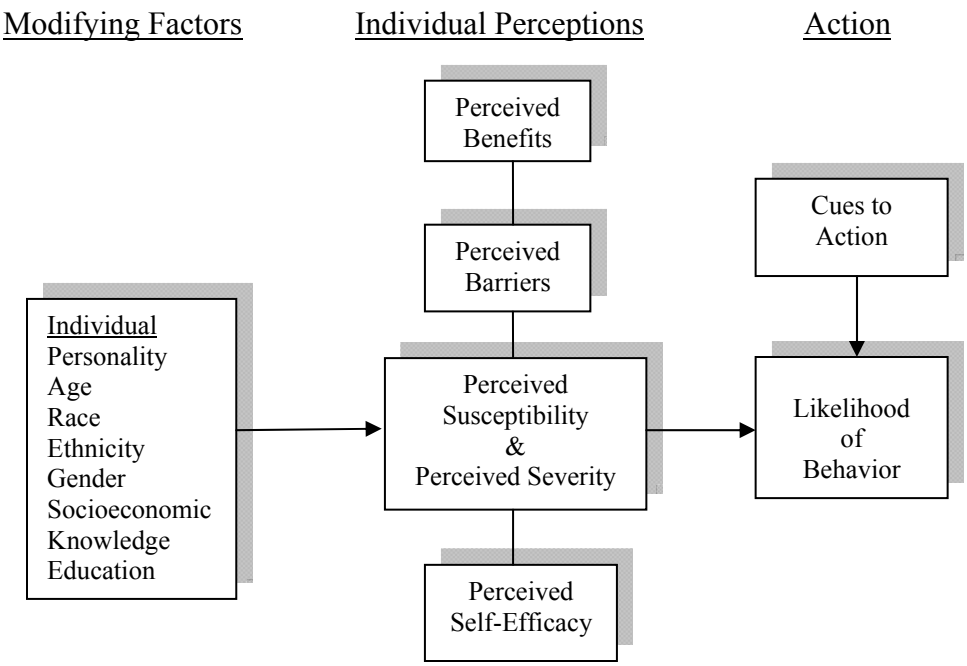

Figure 1. Health Belief Model

Adapted from The Health Belief Model and HIV risk behavior change. In R.J. DiClemente and J.L. Petersen (Eds). Preventing AIDS: Theories and methods of behavioral interventions (pp.5-24). New York: Plenum Press.

The research conducted by Downing-Matibag and Geisinger, (2009) assessed college students and their participation and perception of risky sexual behavior. Their results showed that college student's perceived susceptibility to sexually transmitted infections is low and is accompanied by misinformation regarding sexual activity. The research found that situational circumstances; such as, spontaneity have a significant effect on a student's self-efficacy.

Perceived self-efficacy and physical activity

Studies of physical activity and the utilization of the constructs of the HBM have offered mixed results as to factors of that influence physical activity. Of these constructs, self-efficacy has been consistently associated with physical activity (Courneya & McAuley, 1994; Desmond, Price, Lock, Smith, & Stewart, 1993; Hoffstetter, Hovell, Macera, Sallis, Spry, & Barrington, 1991; Yordy & Lent, 1993). These positive associations were also found with adherence to structured physical activity programs (DuCharme & Brawley, 1995; Duncan & McAuley, 1993; McAuley, Lox, & Duncan, 1993; Poag-DuCharme & Brawley, 1993; Robertson & Keller, 1992).

Among varying subgroups, self-efficacy showed the strongest and most consistent association with physical activity (USDHHS, 1996). Self-efficacy has been positively related to physical activity among men, women, younger adults, older adults (Sallis, Hovell, Hofstetter, Faucher, Elder, Blanchard et al., 1989), Latinos (Hovell, Sallis, Hofstetter, Barrington, Hackley, Elder et al. 1991) and persons with injuries or disabilities (Hoffstetter et al., 1991). This generalizability of self-efficacy is recognized in studies of college students and alumni (Calfas et al., 1994; Courneya & McAuley, 1994; Yordy & Lent, 1993).

Further extension of the strength of the construct of self-efficacy and physical activity across subgroups is noted with employed women (Marcus, Pinto, Simkin, Audrain, & Taylor, 1994), participants in structured exercise programs (Duncan & McAuley, 1993; McAuley, Lox,

& Duncan, 1993; Poag-DuCharme & Brawley, 1993), and people with coronary heart disease (Robertson & Keller, 1992).

Physical Activity and Other Theories

Other behavior change theories have been utilized in the research of physical activity. Doshi, Patrick, Sallis, and Calfas, (2003) conducted analysis of web sites with theory-based physical activity interventions and determined the most utilized contained elements from the HBM, followed by Theory of Planned Behavior (Ajzen, 1985, 1988), Transtheoretical Model (Prochaska & DiClemente, 1982, 1984), and Social Cognitive Theory (Bandura, 1986).

Theory of Planned Behavior

The Theory of Planned Behavior (TPB) is one of the most widely recognized and employed theories in behavior change studies (Godin & Kok, 1996). The Theory of Planned Behavior was developed by Icek Ajzen in 1985 and was derived from the Theory of Reasoned Action, which was proposed by Martin Fishbein and Icek Ajzen (1975). According to the theory, people's behavior is driven by three major factors: a favorable or unfavorable attitude toward the behavior, beliefs that significant individuals will approve or disapprove the intended behavior (subjective norm), and perception of behavioral control (Ajzen, 2008).

Application of the Theory of Planned Behavior and physical activity include the study of African American and Caucasian college students (Blanchard, Fisher, Sparling, Nehl, Rhodes, Courneya et al., 2008) finding differences existing between ethnicities with respect to intention to engage in physical activity and behavioral control of physical activity.

Transtheortical Model

The transtheoretical model is also known by the name "stages of change model" which seeks to explain or predict a person's success or failure in achieving a proposed behavior change (Green et al. 1999). In this model, change is a process where individual's move through a series of six stages. Green et al. (1999) describe the stages as:

1. Precontemplation is defined as when an individual has no plans to change within the next 6 months.
2. Contemplation is defined as when an individual has chosen to make a behavior change within the next 6 months.
3. Preparation is defined as when an individual is going to take action to make a behavior change within the immediate future, usually within the month.
4. Action is defined as when an individual had made the identified behavior change within the past 6 months.
5. Maintenance is defined as when an individual participated in the changed behavior for 6 months to 5 years. The main objective of this stage is to not relapse into old behaviors.
6. Termination is defined as when an individual has made the behavior change and has no chance of relapse and has complete self-efficacy.

Pinto and Marcus (1995) researched stages of change and college students' physical activity using the Transtheoretical Model and found gender and year in school unrelated to stage of exercise adoption.

Social Ecology Model

There are several adaptations of the Social Ecology Model; however, the version that is described is the CDC adaptation. The CDC developed the Social-Ecology Model to help

practitioners understand behavior in order to create effective prevention programs. The Social Ecology Model focuses on the study of people within an environment and the influences they have on one another (Dahlberg & Krug, 2002). The model contains four levels:

1. Individual — Identifies biological and personal history factors that could lead to participating in a certain behavior.
2. Relationship — Includes factors that increase risk because of relationships with peers, intimate partners and family members.
3. Community — Explores the various settings — e.g., schools, workplaces and neighborhoods — where social relationships occur.
4. Societal —Examines the broad societal factors — e.g., social and cultural norms, and/or health, economic, educational and social policies — that help to maintain economic or social equalities between groups in society (Dahlberg & Krug, 2002).

The Social Ecology Model (McLeroy, Bibeau, Steckler, & Glanz, 1988) has also been examined in the context of physical activity within broader environmental factors (Henderson, 2000; Spence & Lee, 2003). Spence and Lee (2003) determined perceived good access to public transport and recreational facilities, presence of bike lanes, and good aesthetics were among factors positively associated with being physically active.

Social Cognitive Theory

Social Cognitive Theory (Bandura, 1986) describes learning in terms of the interrelationship between behavior, environmental factors, and personal factors. According to Social Cognitive Theory, the learner acquires knowledge as his or her environment converges with personal characteristics and personal experience.

McAuley, Courneya, Rudolph, and Lox (1994) researched middle-aged individual's adherence to physical activity using social cognitive theory. Intervention programs designed to maximize information pertaining to participants' capabilities had a reasonable effect on reducing attrition in middle-aged males and females and self-efficacy was a significant predictor of exercise frequency over time (McAuley et al., 1994).

Conclusion

While physical activity research reflects many theoretical foundations, the studies in the literature suggest a richness regarding the constructs of the HBM creating strong potential for measurement of the many influential factors with respect to physical activity. The addition of the construct of self-efficacy, also contained in the Social Cognitive Theory (Bandura, 1986) and Theory of Planned Behavior (Fishbein & Ajzen, 1975; Ajzen & Fishbein, 1980), along with evidence of positive health behavior change with barriers and benefits, provides a worthwhile theory for further evaluation of physical activity.

With respect to the unique population of college and university students, the HBM is a particularly useful model for application given the primary focus at the individual level. Unlike its' theory counterparts such as the social ecological model, social cognitive theory, and theory of planned behavior that look from the environmental or interpersonal level, HBM is based in factors of influence very much mediated in the individual domain. Nowhere is individual expression and process of growth and maturation more evidence than in the years of college matriculation. Frost (1992, p.317) states "college represents the last formal structure for education" and is the time when "independent living is being developed and health awareness might also be heightened". College is a time of maturation, independence, and growth and students are very impressionable; thus this period of college is an ideal time for instilling healthy

lifestyle behaviors and knowledge of risk of risk for developing chronic disease (McMahan et al., 2007). College students present a fresh and robust population with great potential for influence using the HBM to describe physical activity among this cohort.

CHAPTER 3

METHODS

The purpose of this study was to evaluate the knowledge and engagement of the ACSM guidelines for cardiovascular physical activity among university freshmen and seniors. This chapter focused on: 1) Design; 2) Survey Sampling; 3) Survey Measurement; 4) Survey Administration; 5) Data Collection, and 6) Plan for Analysis.

Design

Quantitative

A cross-sectional study design was used in this quantitative research study to collect data on university undergraduates. According to Thomas, Nelson, and Silverman (2005), a cross-sectional study is the most frequently used study design to explain the relationship between physical activity and health outcomes. A cross-sectional study looks at an individual's behavior at a single point in time. Merrill, Lindsay, Shields, and Stoddard (2007) reviewed the types of research and statistical methods in health education journals from 1994 to 2003 and found that the most common types of research were cross-sectional studies. This movement toward increasing the use of cross-sectional studies represents a greater emphasis on completing needs assessments in health education research. Merrill et al. (2007) found that the disadvantages of cross-sectional studies include the inability to establish causality, potential for recall bias, and group size differentiation, while advantages of cross-sectional study design were their relative ease of use and reduced cost.

Survey Sampling

This investigation surveyed all undergraduate (freshman, sophomore, junior, and senior) students currently enrolled at the University of Alabama in the spring of 2010. The justification for including all students in the survey was to increase the overall response rate of those eligible undergraduate students. From this larger sample population, the survey of all undergraduate students allowed for better understanding and determination of the effects of matriculation and campus experience, discrete by year in school, on knowledge, engagement, and perceptions of physical activity. Several studies (Calfas et al., 1994; Dunn &Wang, 2003; Pinto & Marcus, 1995) found little association with changes in level of physical activity by year in school. Huang et al., (2003) reported less physical activity over time. For the purpose of this data analysis and to address the specific inferential research questions of this study, freshman and senior student responses were analyzed. These freshman and senior student classifications represent the widest variance among the undergraduate student population and offered the best insight to the effect of the undergraduate student experience.

As a key determinant of student engagement, the first-year student (freshman) involvement and satisfaction in physical activity was a strong predictor of academic retention (Kuh, 2001). Buckworth and Nigg (2004) noted that student behaviors such as studying, sitting at a computer, and other more sedentary activities increase as they near graduation and participating in physical activity may take more effort; thus, leading to a decrease in their activity. Additionally, the senior student's pattern of physical activity engagement has shown to be associated with the development of a lifetime appreciation and engagement in physical activity (Calfas, Sallis, Lovato, & Campbell, 2000). Fish and Nies, (1994) and Sparling and Snow, (2002) identified that physical activity behavior, once established in college, created a

pattern of continued physical activity over longer periods of time. Therefore, these newly established patterns of physical activity have a profound impact and influence on long-term health.

After receiving the Institutional Review Board Approval (see Appendix A), the study subjects were contacted through email from addresses obtained from the University of Alabama Registrar's office. Upon enrollment at the University of Alabama all students were assigned an email address with the domain bama.ua.edu or crimson.ua.edu. These email addresses are the official communication of the University of Alabama and are required to be maintained. Therefore, these email addresses were considered the most thorough and currently available for communication at the University of Alabama.

Classification of students was determined by the registrars' office based on credit hours they have completed. The University of Alabama recognizes students as freshmen status based on 30 credit hours or less attained, sophomore status based on 31-60 credit hours attained, junior status as 61-90 credit hours attained, and students as senior status at 91 credit hours or more attained (U.A., 2008). Establishing each student's classification served as the first step in determining the study participants.

Following approval of the project by The University of Alabama's Institutional Review Board, the survey was distributed to all undergraduate students currently enrolled at the University of Alabama. At the beginning of the spring 2010 semester, in an effort to reach a target response rate of 20% (approximate n=4716) of the undergraduate population, eligible students were preliminarily notified via a pre-notification email which briefly described the study and encouraged students to participate (see Appendix B). Pre-notification procedures were shown to increase the overall response rates as shown in Porter and Umbach's (2006) research

which was completed by surveying similar student populations. Previous studies that used pre-notification notices found that they increased their response rate by 7.7% - 28.5% above response rates when not using such notices (Essex, Welsch, Fletcher, & Crew, 2004; Fox, Crask, & Kim, 1988; Yammarino, Skinner, & Childers, 1991; Yu & Cooper, 1983).

Pilot Testing

Pilot testing established face validity and readability of the survey, (Desmond et al., 1990; McMahan et al., 2007) and allowed for a test run of the survey distribution and collection system. Fink (2003) recommended pilot testing of 10 or more subjects to allow the researcher better feedback on instructions and understanding of the questions. The pilot test allowed students to take the identical and actual survey under the same electronic methods and assisted in determining functionality of this method of survey distribution. Prior to the survey being sent to the entire study population, the instrument was pilot tested with 15 current students recruited through the student government association (SGA).

The Student Government Association (SGA) Vice President for External Affairs (see Appendix C, letter of support) announce the pilot testing project to the officers of the SGA and collected the email addresses of 15 students that volunteered to participate in the pilot testing portion of this study. The volunteer's addresses were added to a separate database and were sent the same consent letter and survey that was sent to the full undergraduate population for completion. After the completion of the pilot survey the students were immediately directed to an additional ten question survey (Iraossi, 2006) and asked to answer questions about the initial survey. These questions assessed the readability, ease of completion, and length of the study (see Appendix D, pilot test questions).

Inclusion and Exclusion Criteria

The inclusionary and exclusionary criteria used for this investigation is described below:

Inclusion-An undergraduate student currently enrolled at the University of Alabama based on credit hours as defined by the University Registrar.

Exclusion-A student not enrolled at the University of Alabama or a student currently defined as a graduate student by the Office of the Registrar of the University of Alabama.

As of October 2009, (U.A. Registrar, 2009) approximately 7854 freshmen, 4896 sophomores, 5081 juniors, and 5757 senior students (*N = 23,588)* were enrolled at the University of Alabama. The target response rate was 20% or approximately 4716 students. The recently completed, spring 2008, National Survey of Student Engagement (NSSE) at the University of Alabama reported a response rate among first-year and senior students at 20% and 23%, respectively. Email surveys of college students have experienced similar response rates (Porter & Umbach, 2006). Porter and Umbach (2006) further determined that larger, public institutions tended to see less overall student engagement which correlated with lower survey responses. Maglione and Hayman (2009) surveyed low-income college students and their physical activity levels and received a 23% response rate. A recent study of international university students of four countries realized a 90% response rate to a survey of correlates of physical activity (Seo, Torabi, Jiang, Fernandez-Rojas, & Park, 2009).

Incentives

No incentives were provided for participation in this study. Several studies (Porter & Umbach, 2006; Porter & Whitcomb, 2003; Shih & Fan, 2008) report on the differences in response rates for paper and email surveys and found, with respect to incentives, little effect on response rates realized. However, Porter, Whitcomb and Weitzer (2005) identified that response

rates tended to increase as the burden of the survey completion decreases. Employing email surveys within populations where accesses to computers are prevalent was a viable method to increasing survey response (Porter et al., 2005). Universities tend to have a more technology-friendly student body and are less intimidated by electronic communication (Porter & Umbach, 2006).

Survey Measurement

The survey instrument for this study was used to measure the physical activity knowledge, engagement, and perceptions of university undergraduate students (see Appendix E). After a review of the leading physical activity questionnaires, four were chosen to develop the survey questions for this research study. The following questionnaires for measurement of knowledge and engagement were: The Health Information Trends Survey (HINTS), The National Coalition for Promoting Physical Activity Questionnaire (NCPPA), American College Health Association- National College Health Assessment-II Survey (ACHA-NCHAII), and the International Physical Activity Questionnaire (IPAQ). Survey questions with references, reliability, validity, and level of alterations (if any) from their original source is included in Appendix F.

The survey questions (see Appendix E, question 18, items, a-mm) used to measure the constructs of the HBM were taken from four established questionnaires. These questions were taken from the Juniper et al. (2004) survey of physical fitness status and perceptions of exercise; the Exercise Benefits/Barriers Scale (EBBS); the Exercise Self-Efficacy Scale (ESES); and a survey developed by Tergerson and King (2002) to measure perceptions and involvement in physical activity.

Knowledge Questions

The Health Information Trends Survey (HINTS).

The HINTS (2007) instrument was developed by the National Cancer Institute (NCI) investigators and HINTS stakeholders completing a survey to identify important constructs to be assessed in the HINTS 2007 instrument. The constructs, of the 189 item survey, fell into the following categories: health communication; cancer communication; cancer knowledge, cognitions, and affect; cancer screening/cancer-specific knowledge and cognitions; and cancer-related lifestyle behaviors/cancer contexts. Two physical activity knowledge questions (see Appendix E, questions #1 and #2) from the 2007 HINTS were used in the current research study. These two questions are fill-in-the blank and ask about the knowledge of the frequency and duration of moderate physical activity. There are no validity and reliability data for the two HINTS questions. These knowledge questions are not used as a scale; therefore, do not lend themselves well to the traditional methods of reliability testing. Since the HINTS is a cross-sectional survey, a test-retest reliability cannot be conducted (Richard Moser, NIH/NCI, personal communication, September 14, 2009).

The National Coalition for Promoting Physical Activity Questionnaire (NCPPA).

The NCPPA survey, developed by Morrow et al. (2004) is a sixty-two item, phone survey consisting of seven total subscales: Health risks perception subscale (6 items); Health risks perceptions and physical activity (10 items), Knowledge of physical activity (25 items), Knowledge of the Surgeon General Report (5 items), Individual engagement (7 items), and Demographic question (9 items). Six knowledge questions from the NCPPA survey were used in the research questionnaire. Two of these knowledge questions (see Appendix E, #3 and #4) are fill-in-the-blank and four questions (see Appendix E, #5-#8) were answered by marking true or

false. The Kuder-Richardson internal consistency reliability from the previous study is .59 and is considered a moderate value.

Engagement Questions

American College Health Association- National College Health Assessment-II Survey (ACHA-NCHA II).

The ACHA-NCHA II (2008) is a national research survey developed in 2000 and modified in 2008 by the American College Health Association in order to describe health issues on American college campuses. The ACHA-NCHA II is a 65-item survey that includes ten subscales that measure: Health, Health Education and Safety (7 items); Alcohol, Tobacco, and Drugs (11 items); Sex Behavior and Contraception (7 items); Weight, Nutrition, and Exercise (4 items); Mental Health (8 items); Physical Health (7 items); Impediments to Academic Performance (1 item); and Demographic Characteristics (20 items). This survey employed two questions from the ACHA-NCHA II survey which measured physical activity engagement within the past seven days. With both questions, the survey respondents chose from 0-7 days in response to the number of days they participated in moderate physical activity (see Appendix E, question #9) and vigorous physical activity (see Appendix E, question #10). The Cronbach alpha was .79 for question #9 and .70 for question #10.

International Physical Activity Questionnaire (IPAQ).

The short-form IPAQ (2002) is a seven item questionnaire used to evaluate an individual's engagement in physical activity. The entire IPAQ survey was used in the current research study survey (questions #11-#17). The IPAQ focused on frequency (days per week) and duration (length of time) of physical activity participation within the past seven days.

Dinger, Behren and Han (2006) reported the Cronbach alpha coefficients of .71-.89 for the seven items, indicating moderate to high level of reliability.

Perception Questions

The HBM was used to develop the perception questions of the survey instrument and consisted of 39 total questions (see Appendix E, question 18; items a-mm).

Juniper Scale (Perceived susceptibility and perceived severity).

Juniper et al. (2004), developed their 29-item research tool in order to evaluate fitness status and exercise perception among African American female college students. The current survey utilized 6 questions (see Appendix E, question 18, items a-f) for perceived susceptibility and 8 questions (items g-n) for perceived severity. The original four-point scale for responses was used. These responses were: Strongly Agree, Agree, Disagree, and Strongly Disagree. The Cronbach alpha for these questions ranged from .92 (item a-f) to .86 (items g-n).

The Exercise Benefits/Barriers Scale (Perceived benefits and barriers).

The Exercise Benefits/Barriers Scale, developed by Sechrist, Walker, and Pender (1987) is a 43-item tool used to determine the benefits and barriers to physical activity. In this research study 10 original items were used (see Appendix E, question 18, items o-x). The four-point scale for responses included: Strongly Agree, Agree, Disagree, and Strongly Disagree. The Cronbach alpha for these questions ranged from .886 (barrier questions p, r, s, u, and w), to .954 (benefits questions o, q, t, v, and x).

The Exercise Self-Efficacy Scale (Perceived Self-Efficacy).

The Exercise Self-Efficacy Scale developed by Kroll, Kehn, Ho and Groah (2007) is a ten item tool that uses a four point scale for responses: Strongly Agree, Agree, Disagree, and Strongly Disagree. The ESES was used in its' entirety to measure the confidence in one's ability

to engage in a physical activity (see Appendix E, question #18, items y-hh). The Cronbach alpha for these questions was .927.

Tergerson and King Scale (Perceived Cues to Action).

Cues to action were measured using a tool developed by Tergerson and King (2002), which consists of three subscales: cues to action (12 items), perceived benefits (12 items) and barriers (12 items). This 49-item (including background and demographic questions) tool used a seven-point scale for responses is: Strongly Disagree, Somewhat Disagree, Disagree, Neutral, Agree, Somewhat Agree, and Strongly Agree. Five items (see Appendix E, question #18; items ii-mm) from the Tergerson and King scale were used in the current survey. A Cronbach alpha for these questions was .803.

Survey Administration

After receiving IRB approval, an excel spreadsheet containing email addresses with tabs for each of the four classifications of students was received from The University of Alabama Registrar office. Prior to the formal administration of the survey, a pre-notification email was sent to all students using The University of Alabama Registrar-supplied databases. This pre-notification letter (see Appendix E) was designed to generate awareness of the soon-to-be released survey. Information directing students to monitor their campus-wide email in the coming days was contained in the pre-notification letter.

The pre notification email was launched on January 6th, 2010. Six days after the email of the pre-notification on January 12th, 2010, a consent letter (see Appendix G) and survey (see Appendix E) were sent via email, through the Vovici survey system, to all undergraduate students who were currently enrolled at the University of Alabama. The Vovici system, formerly known as Perseus, is an online survey tool used to conduct and analyze web-based surveys in a

secure environment (Vovici, 2009). Vovici is an Enterprise Feedback Management (EFM) system that is used throughout health research (Aranda & Law, 2007; Buse, 2008; Desai, O'Hara & White, 2007).

The spring 2010 undergraduate students at The University of Alabama were sent an email (*N=21,775*) from a survey-specific established email account. This account was established with assistance from The University of Alabama Office of Information Technology. The account address that students received was from University Recreation (UREC) Research and the subject line in all emails was entitled UA Undergraduate Survey. The account lessened the potential for SPAM-mail to be misdirected to e-address junk inboxes (Shih & Fan, 2007).

The email contained information about the survey, consistent with IRB consent letter requirements, along with a link to the survey website. The website shared details of the survey and directed the students to participate in the survey. Based on prior pilot testing during the late fall of 2009, completion of the survey took between 10-15 minutes. If an email was returned as undeliverable, further attempts were continued through subsequent emails requesting the students' participation in the survey.

In total, 5 reminder emails for access to the survey were performed. The second sending of the survey occurred on January 19th, 2010. On January 22nd, 2010, after noting lower-than-desired response rates, a modification to the protocol was submitted to the IRB requesting authorization for enhanced recruitment efforts: These efforts included:

- Local student newspaper ads with notice of survey link
- Housing and Residential Communities direct communication to residence hall students with notice of link and request to complete the survey through dedicated listserv and email announcements

- University Recreation departmental website link to survey
- Selected classroom instructors notification and request to mention to students of the survey and link
- Placement on campus-wide, MyBama portal, under student tab to notify students of the survey link.

IRB approval of the modification was obtained on January 25th, 2010 (see Appendix H). On January, 26th, 2010, Housing and Residential Communities (HRC) distributed the email with notification of the survey link to approximately 7150 students who reside in on-campus, University owned and operated facilities. Additionally, HRC sent a listserv announcement of the survey and link to those students who subscribed to departmental service. The survey was re-sent on January 26th, 2010 to all undergraduates as well. The survey link was included on the UREC website as well through within the MyBama campus information website with invitation to take the survey. An advertisement within the *Crimson White* student newspaper was also created and ran on January 28th and 29th, 2010.

The survey was re-sent on February 1st, and February, 4th, 2010. The survey and Vovici system ability to receive and process surveys were closed on February 11th, 2010. The study flow chart is located in Appendix I.

The email-based method of survey distribution, has become increasingly popular and utilized across many fields including health and medicine (Hollowell, Patel, Bales, & Gerber, 2000; Jones & Pitt, 1999; Kim, Hollowell, Patel, Bales, Clayman & Gerber, 2000), management (Donahue & Fox, 2000), market research (Metha & Sivadas, 1995; Ranchhod & Zhou, 2001; Smee & Brenna, 2000), policy research (Enticott, 2002), education (Fraze, Hardin, Brashshears, Smith, & Lockaby, 2002), and telecommunication (Shermis & Lombard, 1999). Shih and Fan

(2008) found that although email surveys tend to have a lower response rate than traditional mail surveys (as much as 20% less); those differences were negligible among college student populations. Advantages of an email survey distribution method included shorter response time, considerably lower costs (38% less), (Schleyer & Forrest, 2000), capable of reaching a large sample of respondents, and improved knowledge of whether an email was delivered to a correct address (Shih & Fan, 2008).

Data Collection

The Vovici system was used to collect and analyze the study survey in a secure environment (Vovici, 2008). Upon completion of the survey, the Vovici system automatically downloaded the data into the Predictive Analysis SoftWare, formerly known as SPSS, (PASW, Version 17.0) data file. This data was stored on a secured server that will backed-up on a daily basis. The survey data was kept in a password protected database.

Plan for Analysis

The plan for analysis section discusses how the study data was managed and analyzed.

Preparing the Data for Analysis

The data was reviewed for outliers and checked for accuracy. An outlier was defined as an observation that is distant from the other data and was considered a possible data error. As outliers were found, the entire record was examined for potential, additional errors such as incomplete responses. These outliers were removed from the database as an error was determined. The frequencies were identified in order to help determine legitimate data. A frequency refers to the number of times an event occurs during a study (Daniel, 2004).

Descriptive Statistics

Descriptive statistics were used to organize and summarize the data in order to easily determine what information they contained and describe what the data showed (Daniel, 2004). Descriptive statistics were used to determine frequencies, counts, and proportions which described the respondents' individual demographic characteristics (age, gender, race, greek-letter affiliation, campus residence status, and hometown zip code) and assisted in determining the outcome variables.

Inferential Statistics

For means of this investigation an alpha level of .05 was used. The alpha level was not calculated, it was chosen by the researcher and in the social sciences, an alpha level of .05 is generally considered acceptable (Le, 2009). The alpha level was established to reduce the potential for a Type 1 error. For the purposes of this research a Type 1 error was reporting that there was a difference in university freshman and seniors with respect to their knowledge, engagement and perceptions of ACSM guidelines and physical activity when in actuality there was no difference. With the established .05 alpha there is a 95% confidence that the findings reflected no Type 1 error.

Inferential statistics were applied to the following research questions:

Research Question #1

Is there a difference in the mean knowledge scores of freshman and senior students for cardiovascular physical activity?

The dependent variable was knowledge of ACSM guidelines for cardiovascular physical activity (continuous variable). The independent Variable was year in school (freshman vs. senior; categorical variable). The statistical analysis was a two-sample independent t-test for comparison

of mean scores. If the samples measured were non-normal in distribution, then a Mann-Whitney U test was performed. The rationale for this statistical analysis was knowledge of ACSM guidelines as the dependent variable and continuous in nature based on responses to knowledge questions and year in school as a single independent categorical variable with two levels (freshman and senior). The two–sample independent t-test measurement examined the difference in means, therefore these mean scores for freshman and senior students was best suited for this analysis.

This research question was tested by using the information obtained in questions #1 - #8 of the survey (see Appendix E). Knowledge was determined by scoring correct responses with a "1" and incorrect responses with a "0". A total score of between 0-8 was calculated across the 8 questions determining the level of knowledge among the students surveyed. Question #1 of the survey was scored correctly for a response of 5 days per week. All other responses were scored incorrect. Although responses higher (6 or 7 days per week) might appear to be correct, Bennett (2009), determined that such inaccurate knowledge of guidelines higher than actually necessary for health benefit often produced a sense of inability to comply and reduced motivation towards physical activity.

Question #2 of the survey was scored correctly for responses of 30 minutes. All other responses were scored incorrect. Question #3 of the survey was scored correctly for a response of 3 days per week. All other responses were scored incorrect. Question #4 of the survey was scored correctly for a response of 20 minutes per day. All other responses were scored incorrect. Question #5 of the survey was scored correctly for an answer of "false." Responses that state "true" were scored as incorrect. Question #6 of the survey was scored correctly for an answer of "false." Responses that state "true" were scored as incorrect. Question #7 of the survey was

scored correct for an answer of "true." Responses that state "false" were scored as incorrect. Question #8 of the survey was scored correct for an answer of "true." Responses that state "false" were scored as incorrect.

The designation of year in school was established by the university registrar designation based on students credit hours attained to date. Students with 0-30 credit hours were defined as freshman while students with 91 or more credit hours were defined as seniors.

Research Question #2

Is there a difference in engagement of freshman and senior students for cardiovascular physical activity?

The dependent variable was engagement in cardiovascular physical activity (continuous variable). This variable was reviewed with respect to both moderate and vigorous intensity physical activity. The independent variable was year in school (freshman vs. senior; categorical variable). The statistical analysis was a two-sample independent t-test. If the samples measured were non-normal in distribution then a Mann-Whitney U test was performed. The rationale for this statistical analysis was that engagement in moderate and vigorous intensity physical activity was the dependent variable and continuous in nature, and year in school was a single independent categorical variable with two levels (freshman and senior). The cumulative engagement responses (days per week) were attained and t-tests were conducted to compare freshmen and seniors based on a normal distribution and the measurement of means. The two–sample independent t-test measurement examined the difference in means, therefore these mean days per week for freshman and senior student engagement was best suited for this analysis.

Research question #2 was tested using the information obtained in survey questions #11, #13 and #15 (see Appendix E.) Survey questions #11, #13, and #15, based on the IPAQ

questions for engagement in vigorous, moderate, and walking physical activity, further determined the nature and level of engagement. All responses to these questions were coded and analyzed based on number of days per week of engagement.

Question #17 was reported for descriptive purposes only and to denote differences between university freshman and seniors. The IPAQ (2002) question regarding sitting (sedentary) behavior was an additional indicator variable of time spent in sedentary activity and was not included as part of any summary score of physical activity. To-date there was little data on sedentary (sitting) behaviors and no well-accepted thresholds for data presented as categorical levels (Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire ([IPAQ] – Short and Long Forms-November, 2005).

Research Question #3

Do year in school and perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

The dependent variable was engagement in physical activity (continuous variable) of both moderate and vigorous intensity. The independent variables were the constructs of the HBM (Benefits, Barriers, Perceived Susceptibility, Perceived Severity, Self-Efficacy, and Cues to Action) and year in school (freshman and senior; categorical variables). The statistical analysis was multiple linear regression.

Engagement (moderate and vigorous) in physical activity was a continuous variable based on responses to the engagement questions (see Appendix E, questions #11 and #13) from the survey.

Research Question #3 was tested using the responses to questions of perceptions to physical activity obtained in the survey (see Appendix E, question 18, items a-mm). The six constructs of the HBM were recorded and scored as continuous independent variables. The HBM construct questions were scored based on either four-point (perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and perceived self efficacy) or seven-point (cues to action) scales. Four-point scales were scored between 0-3 for strongly disagree to strongly agree responses for all constructs except perceived barriers where the scoring was reversed. The seven-point scale was scored between 0-6 for strongly disagree to strongly agree for the construct of cues to action. Each construct score was weighted and computed based on the response score (0-3 or 0-6) for each question divided by the number of questions. The mean scores for each construct were then determined.

A multiple linear regression was the preferred method when the multiple response outcome data were continuous. This approach permitted the response-specific information about physical activity outcomes to be included in a single regression analysis, at the same time adjusting for the correlation between responses. A multiple linear regression was used to determine the level of engagement in physical activity (moderate and vigorous) with respect to the perceptions from the constructs of the HBM between freshman and senior university students.

This process of weighting the constructs (mean scored derived from the total construct scores divided by the number of construct questions) of the HBM prevented one variable from dominating others, based on varying scales and number of questions. The significant levels remained unchanged in this process and basic descriptive statistics utilized the original scoring of

the perception sections. Within the regression analysis, the standard beta coefficient and standard error were utilized.

A multiple linear regression was recognized given the dependent variable of engagement as continuous and the independent variables were continuous. Initially this regression examined bivariate correlations, and as more predictors were placed into the model the structure of the regression was examined and aspects of multiple co-linearity were reviewed. A step-wise regression was performed to better predict perception influences on the model.

Research Question #4

What are the individual characteristics of freshman and senior university students with respect to knowledge of the American College of Sports Medicine guidelines for cardiovascular physical activity?

The dependent variable was the mean knowledge scores of ACSM guidelines for cardiovascular physical activity (continuous variable) for freshman and senior students. This was derived from the survey questions #1-#8 (see Appendix E).The independent variables were demographic characteristics (year in school, age, gender, race, greek affiliation, and campus residence status; continuous and categorical variables). This data was obtained from survey questions #19-#24 (see Appendix E). The statistical analysis utilized to test research question #4 was a general linear model (GLM) using a univaraite analysis. The statistical test of a GLM was used to relate the individual demographic characteristics of freshman and senior university students' to knowledge of ACSM guidelines for cardiovascular physical activity.

The mix of continuous and categorical independent variables with a continuous dependent variable was best analyzed using this statistical analysis. This approach permitted the response-specific information about physical activity knowledge to be included in a single

regression analysis, at the same time adjusting for the correlation between responses. The purpose of this regression was to examine the variables that were significant in the bivariate correlation analysis and enter them into a regression model to see what combinations of variables, including interaction of variables were significant. The benefit was obtaining and predicting variables rather than determining only relationships between variables and to observe the combinations of variables.

Research Question #5

What are the individual characteristics of freshman and senior university students with respect to engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

The dependent variable was the level of engagement of ACSM guidelines for cardiovascular physical activity (moderate and vigorous intensity; continuous variables). This was derived from the survey questions #11 and #13 (see Appendix E).The independent variables were the demographic characteristics (year in school, age, gender, race, greek affiliation, and campus residence status; continuous and categorical variables). This information was obtained from survey questions #19-#24 (see Appendix E). The statistical analysis utilized to test research question #4 was a general linear model (GLM) using a univariate analysis. The statistical test of a GLM was used to relate the individual demographic characteristics of freshman and senior university students' with moderate and vigorous intensity engagement in cardiovascular physical activity.

The mix of continuous and categorical independent variables with a continuous dependent variable was best analyzed using this statistical analysis. This approach permitted the response-specific information about engagement in moderate and vigorous intensity physical

activity to be included in a single regression analysis, at the same time adjusting for the correlation between responses. The purpose of this regression was to examine the variables that were significant in the bivariate correlation analysis and enter them into a regression model to see what combinations of variables, including interaction of variables were significant. The benefit was obtaining and predicting variables rather than determining only relationships between variables and to observe the combinations of variables.

Research Question #6

Do year in school, knowledge, and perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

The dependent variable was the level of engagement of ACSM guidelines for cardiovascular physical activity (moderate and vigorous intensity; continuous variables). This was derived from the survey questions #11 and #13 (see Appendix E).The independent variables were the mean knowledge scores and mean scores for 6 HBM constructs (continuous variables). This information was obtained from survey questions #1-8 and #18, items a-mm. (see Appendix E). The statistical analysis utilized to test research question #6 was multiple linear regression. The statistical test of a multiple linear regression was used to relate the influence of knowledge of ACSM guidelines and influences of the HBM of freshman and senior university students with moderate and vigorous intensity engagement in cardiovascular physical activity.

Multiple linear regression was the preferred method when the multiple response outcome data were continuous. This approach permitted the response-specific information about physical activity outcomes to be included in a single regression analysis, at the same time adjusting for the correlation between responses. Multiple linear regression was used to determine the level of

engagement in physical activity (moderate and vigorous) with respect to the perceptions from the constructs of the HBM between freshman and senior university students.

Multiple linear regression was recognized given the dependent variable of engagement as continuous and the independent variables as also continuous. Initially this regression examined bivariate correlations. As more predictors were placed into the model the structure of the regression was examined and aspects of multiple co-linearity were reviewed. As necessary to better predict knowledge and perception influences on the model, step-wise regression was also performed.

Research Question #7

Do individual characteristics of freshman and senior university students and their perceptions of physical activity as measured by the constructs of the Health Belief Model relate with knowledge of the American College of Sports Medicine guidelines for cardiovascular physical activity?

The dependent variable was the mean knowledge scores of ACSM guidelines for cardiovascular physical activity (continuous variable) for freshman and senior students. This was derived from the survey questions #1-#8 (see Appendix E).The independent variables were the individual demographic characteristics and mean scores for the 6 HBM constructs (categorical and continuous variables) for freshman and senior students. This information was obtained from survey questions #18, items a-mm and #19-#24. (see Appendix E). The statistical analysis utilized to test research question #7 was multiple linear regression. The statistical test of a multiple linear regression was used to relate the influence of individual demographic characteristics and influences of the HBM constructs of freshman and senior university students' on knowledge of ACSM guidelines for cardiovascular physical activity.

Multiple linear regression was recognized given the dependent variable of knowledge of ACSM guidelines as continuous and the independent variables as continuous and categorical. Initially this regression examined bivariate correlations. As more predictors were placed into the model the structure of the regression was examined and aspects of multiple co-linearity were reviewed. As necessary to better predict knowledge and perception influences on the model, step-wise regression was also performed.

Research Question #8

Do individual characteristics of freshman and senior university students and their perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

The dependent variable was the level of engagement of ACSM guidelines for cardiovascular physical activity (moderate and vigorous intensity; continuous variables). This was derived from the survey questions #11 and #13 (see Appendix E).The independent variables were the individual demographic characteristics and mean scores for the 6 HBM constructs (categorical and continuous variables) for freshman and senior students. This information was obtained from survey questions #18, items a-mm and #19-#24. (see Appendix E). The statistical analysis utilized to test research question #8 was multiple linear regression. The statistical test of a multiple linear regression was used to relate the influence of individual demographic characteristics and influences of the HBM constructs of freshman and senior university students' on knowledge of ACSM guidelines for cardiovascular physical activity.

Multiple linear regression was recognized given the dependent variable of engagement in moderate and vigorous intensity physical activity as continuous and the independent variable as

categorical and continuous. Initially this regression examined bivariate correlations. As more predictors were placed into the model the structure of the regression was examined and aspects of multiple co-linearity were reviewed. As necessary to better predict engagement, individual demographic characteristics and perception influences on the model, step-wise regression was also performed.

As a concluding question in the survey, question #26 gave student respondents the opportunity to express comments and/or concerns about physical activity specific to The University of Alabama campus. The survey and subsequent analysis determined the unique differences between university freshman and senior students with respect to knowledge, engagement and perceptions toward cardiovascular physical activity. This information provides assistance to health educators and campus-based practitioners of physical activity and fitness facilities in tailoring programs and services that best meet the needs of this population.

CHAPTER 4

RESULTS

Purpose

The purpose of this study was to evaluate the knowledge, engagement, and perceptions of the ACSM guidelines for cardiovascular physical activity among university freshmen and seniors. The results of the data analysis are reported in three sections: 1) Overview of the study population, 2) inferential statistical analysis, and 3) result summary.

Overview

Prior to the launch of the survey, pilot-testing with sophomore and junior classification students was conducted using the e-mail and data collection system for the full survey. A total of 15 students were identified and 12 participated in the pilot test. This portion of the research provided valuable information on the content validity of the instrument as well as the accuracy of the data collection process of the Vovici system. The students were able to evaluate their understanding of the questions and the readability of the overall instrument. The average length of time to complete the survey among this group was between 10 and 12 minutes. No problems were found with the data collection process; therefore, no revisions were made to the survey.

The study commenced on January 12, 2010 with undergraduate students (freshman, sophomore, junior, and senior classifications) receiving the first of a total of 5 e-mail announcements and invitations to participate in the survey. The initial distribution of e-mails consisted of 21,775 student e-mail addresses. Within this distribution 5,452 (25.0%) were

classified as a freshman, 5,171 (23.7%) as a sophomore, 5,007 (22.9%) as a junior, and 6,145 (28.2%) as a senior. Ten e-mail addresses were returned as undeliverable and remained in the database for follow-up attempts to respond. The survey closed on February 10, 2010 with a total of 877 completed surveys which represented a 4.0% overall response rate. The classification-specific response rates and percentages of the total surveys sent were 216 (4.0 %) for freshman, 201 (3.9%) for sophomores, 204 (4.0%) for juniors, and 211 (3.4 %) for seniors.

A total of 66 surveys (7.5%) were removed from the analysis due to the age question not being answered or the respondent identified themselves as less than 18 years or over 25 years of age. These respondents were removed in order to align the sample with the traditional 18-25 year old undergraduate population (Hermon & Davis, 2004) which represents 95% of current undergraduate students (UA, 2008).

If a student chose not to answer a particular question, except for age, their data was used in the final analysis; therefore, the total responses for some questions varied.

Descriptive Statistics

Individual Demographic Characteristics

Individual demographic characteristics are shown in Table 6. Six questions from the survey (see Appendix D) identified a student's year in school (Freshman, Sophomore, Junior, or Senior; question 19), age (question 20), gender (question 21), race (African American, White, Hispanic, Asian, or Other; question 22), greek affiliation status (Yes or No; question 23), and local living status (Off Campus or On Campus; question 24). Two additional questions regarding zip code of permanent hometown address (question 25) and an open-ended request for comments or concerns about physical activity on campus (question 26) were included in the survey for future research purposes.

Table 6

Individual Demographic Characteristics of Student Respondents

Demographics		Frequency	%
Gender	Male	282	34.8
N=810	Female	528	65.2
Age	18 years	146	18.0
N=811	19 years	228	28.1
M=19.92	20 years	179	22.1
SD=1.533	21 years	139	17.1
	22 years	74	9.1
	23 years	20	2.5
	24 years	16	2.0
	25 years	9	1.1
Race	African American	71	8.8
N=804	White	690	85.8
	Other	43	5.3
Greek	Yes	194	23.9
N=811	No	617	76.1
Living	Off-Campus	339	42.0
N=808	On-Campus	469	58.0

Female students (65.2%) responded at higher rates than the male students (34.8%). This difference is higher than the most current UA Factbook (2008-2009) information which reflects the undergraduate enrollment figures totaling 52.7% for female students and 47.3% for male students.

The mean age of the students who completed the survey was 19.92 (*SD*=1.53) years. This age was consistent with The University of Alabama student undergraduate population data which depicts over 95% of the students fall within the ages of 18-25.

The racial breakdown among the students who completed the survey were as follows: 85.8% White, 8.8% African-American, and 5.3% other racial identifications. By comparison, The University of Alabama's most recent Factbook (2008-2009) report shows 83.6% White, 11.2% African-American, and 3.7% other racial identifications.

Of the respondents, almost one quarter (23.9%), identified themselves as belonging to a greek organization. The data from UA Factbook (2008-2009) reflects similar overall greek involvement with 27.0% of the undergraduate students registered in these social organizations.

The living status among survey respondents indicates that 58.0% reside on-campus; however, the UA Factbook (2008-2009) reflects that 29.8% of undergraduates live on-campus. This higher percentage of student respondents is reflective of the significant recruitment efforts conducted through the housing department.

Knowledge Questions

Eight questions from the survey (see Appendix D; questions 1-8) analyzed student's knowledge of the ACSM guidelines (see Table 7). The mean scores were derived from the current number of responses to these questions. The overall mean score for knowledge was 4.26 (*SD*=1.23) correct responses out of a possible 8 correct responses.

Table7

Knowledge Score Correct Response Frequencies

Correct Responses	Frequency	%
0	0	0.0
1	5	0.6
2	54	6.7
3	167	20.6
4	237	29.2
5	218	26.9
6	104	12.8
7	26	3.2
8	0	0.0
Total	811	100.0

Note: Correct responses ranged from 0-8.

With respect to ACSM guidelines for frequency of physical activity (see Appendix D; question 1), student responses displayed inaccurate knowledge with only 33.4% answering correctly. Of all the incorrect responses, the majority (49.7%) believed that the recommended frequency to be less than the actual ACSM guidelines. When asked the recommend duration of daily physical activity, more correct responses (45.7%) were observed; however, of all incorrect responses, the majority (36.4%) reported amounts lower than the ACSM guidelines.

When asked about the minimum number of days of physical activity per week for health benefit, almost half the students (46.8%) answered correctly. Only 12.8% of students correctly answered the minimum duration of daily physical activity for health benefit. Of the incorrect responses, 79.1% of the students answered higher than the ACSM guidelines. The students' responses were largely correct (74.0% and 96%, respectively) to knowledge of the need for vigorous and moderate intensity physical activity. The majority of the correct responses (80.3%) identified the appropriate frequency and duration of moderate intensity physical activity. The question most often answered incorrectly (65.1%) was the knowledge that incremental sessions of physical activity can produce health benefits equal to longer bouts of physical activity.

The knowledge scores were compared to individual demographic characteristics. Table 8 depicts the mean scores with respect to age, year in school, race, gender, greek affiliation, and living status. Based on an ANOVA, only gender with female scores ($M=4.49$, $SD=1.20$) were significantly higher than male scores ($M=3.83$, $SD=1.18$) (F (1,808)$=55.44$; $p<.001$).

Table 8

Demographics and Knowledge Scores

Variable: Knowledge Score *M*=4.26 *SD*=1.23		*N*	*M*	*SD*	*p*
Age in years	*18*	146	4.34	1.14	
N=811	*19*	228	4.18	1.28	
	20	179	4.30	1.31	
	21	139	4.36	1.18	.507
	22	74	4.08	1.08	
	23	20	4.00	1.21	
	24	16	4.56	1.67	
	25	9	4.44	1.01	
Race	White	690	4.27	1.25	
N=811	African-American	78	4.19	1.12	.863
	Other	43	4.26	1.21	
Year in School	Freshmen	255	4.21	1.20	
N=311	Sophomores	192	4.26	1.29	.691
	Juniors	188	4.35	1.29	
	Seniors	176	4.26	1.17	
Gender	Male	282	3.83	1.18	.001*
	Females	528	4.49	1.20	
Greek Affiliation	Greek	194	4.30	1.30	
N=811	Non-Greek	617	4.25	1.21	.604
Living Status	On-Campus	469	4.25	1.19	
N=808	Off-Campus	339	4.29	1.29	.660

Note. * $p<.001$, Correct responses range from 0-8, N=Number of responses, M=Mean number of correct responses, SD=Standard deviation, P=Significance.

Engagement Questions

ACHA

Two questions in the survey (see Appendix D; questions 9 and 10) were taken from the American College Health Association (ACHA) National College Health Assessment (ACHA, 2008) and were used to determine engagement (number of days over the past 7 days). The mean number of days reported for moderate intensity physical activity was 3.35 (*SD*=2.01) while the mean number of days for vigorous intensity physical activity was 2.61 (*SD*=1.98). Tables 9 and 10 show the frequency of engagement (number of days per week) in which students participate in moderate and vigorous physical activity.

Students' engagement in moderate and vigorous intensity physical activity and individual demographic characteristics were examined. Tables 9 and 10 show that only race was significant in number of days per week of engagement. White students engaged in moderate intensity physical activity on 3.42 (*SD*=2.01*)* days per week while African-American students engaged on 2.79 (*SD*=2.02*)* days per week (*p*=.034). For vigorous intensity physical activity, White students engaged 2.67 (*SD*=1.99) days per week while African-American students engaged 1.96 (*SD*=1.91) days per week (*p*=.009).

IPAQ

The survey questions (see Appendix D; questions 11 and 13) from the International Physical Activity Questionnaire (IPAQ, 2002) addressed levels of engagement for both moderate and vigorous intensity physical activity. The frequency of engagement in moderate and vigorous intensity physical activity is shown in Tables 11 and 12, respectively. Students engaged in moderate intensity physical activity on average 3.73 (*SD*=2.14) days per week and vigorous intensity physical activity on 4.06 (*SD*=3.76) days per week.

Table 9

Demographics and Moderate Intensity Physical Activity (American College Health Association)

Variable: Moderate PA (Days Per week) *M*=3.35 *SD*=2.01		*N*	*M*	*SD*	*p*
Age in years	18	146	3.47	2.02	
N=810	19	228	3.33	1.96	
	20	179	3.13	2.05	
	21	138	3.46	2.03	
	22	74	3.32	2.14	.484
	23	20	3.85	1.78	
	24	16	3.25	1.48	
	25	9	4.33	1.87	
Race	White	689	3.42	2.01	
N=810	AA	78	2.79	2.02	.034*
	Other	43	3.33	1.78	
Year in School	Freshmen	255	3.29	1.96	
N=810	Sophomores	192	3.22	2.02	.325
	Juniors	187	3.34	2.04	
	Seniors	176	3.59	2.03	
Gender	Male	282	3.34	2.06	
N=809	Females	527	3.35	1.98	.962
Greek Affiliation	Greek	194	3.45	2.03	
N=810	Non-Greek	616	3.32	2.00	.425
Living Status	On-Campus	469	3.40	2.06	
N=807	Off-Campus	338	3.28	1.94	.434

Note. *$p<.05$, Range from 0-7 days,

Table 10

Demographics and Vigorous Intensity Physical Activity (American College Health Association)

Variable: Vigorous PA (Days Per week) *M*=2.61 *SD*=1.98		*N*	*M*	*SD*	*p*
Age in years	18	146	2.56	2.15	
N=809	19	227	2.66	2.00	
	20	179	2.45	1.90	
	21	138	2.67	1.94	
	22	74	2.58	1.94	.666
	23	20	3.35	2.08	
	24	16	2.50	1.54	
	25	9	3.11	2.02	
Race	White	688	2.67	1.99	
N=809	AA	78	1.96	1.91	.009*
	Other	43	3.81	1.79	
Year in School	Freshmen	254	2.53	2.02	
N=809	Sophomores	192	2.54	1.97	.325
	Juniors	188	2.64	1.98	
	Seniors	175	2.77	1.94	
Gender	Male	280	2.77	1.98	
N=808	Females	528	2.52	1.98	.095
Greek Affiliation	Greek	194	2.75	2.03	
N=809	Non-Greek	615	2.56	1.97	.246
Living Status	On-Campus	467	2.64	2.04	
N=806	Off-Campus	339	2.58	1.90	.434

Note. $^{*}p<.01$. Range from 0-7 days.

Table 11

Engagement in Moderate Intensity Physical Activity Frequencies (International Physical Assessment Questionnaire)

M=3.73 days per week
SD=2.14

Days of Week	Frequency	%
0	75	9.3
1	60	7.4
2	100	12.4
3	146	18.1
4	110	13.6
5	144	17.8
6	64	7.9
7	94	11.6
Don't Know/Not Sure	14	1.7
Total	807	100.0

Note: Response ranges from 0-7 days, shaded area represents recommended ACSM frequency.

Table 12

Engagement in Vigorous Intensity Physical Activity Frequencies (International Physical Activity Questionnaire)

M=4.06 days per week
SD= 3.76

Days of Week	Frequency	%
0	159	19.6
1	105	13.0
2	132	16.3
3	136	16.8
4	108	13.3
5	88	10.9
6	50	6.2
7	32	4.0
Total	810	100.0

Note: Response ranges from 0-7 days, shaded area represents recommended ACSM frequency.

Table 13 shows the relationship between the individual demographic characteristics and engagement in moderate intensity physical activity. The engagement differences, based on race, were significant ($p<.001$) where White students participated in 3.86 ($SD=2.13$) days per week while their African-American counterparts engaged on 2.91 ($SD=2.05$) days per week. Living status ($p=.044$) was significant in that students who lived on-campus engaged in moderate intensity physical activity on average 3.87 ($SD=2.17$) days per week, while those students who lived off-campus participated 3.56 ($SD=2.08$) days per week.

Table 14 shows the relationship between individual demographic characteristics and engagement in vigorous intensity physical activity. Race proved significant ($p<.001$) with White students reporting vigorous physical activity on 4.26 ($SD=3.78$) days per week compared to African-American students reporting 2.38 ($SD=3.25$) days per week. Gender also was significant ($p=.003$) with male students engaging in 4.59 ($SD=3.82$) days per week while females engaged in 3.77 ($SD=3.70$) days per week.

A survey question (see Appendix D; question 14) shown in Table 15 denotes the duration of engagement in moderate intensity physical activity with respect to individual demographic characteristics. The average number of minutes of engagement per day was 54.44 ($SD=48.25$). Year in school was significant ($p=.047$) where freshmen students engaged for the longest length of time per day with 61.01 minutes ($SD=51.43$) per day compared to junior students ($M=48.89$, $SD=46.27$) with the least number of minutes per day. Age was significant ($p=.012$) with 24 year old students engaging for the longest length of time per day at 72.87 minutes ($SD=56.06$). Race was significant ($p=.001$) with African-American students reporting 63.55 minutes ($SD=60.74$) per day compared to White students 52.04 minutes ($SD=45.32$) per day.

Table 13

Demographics and Moderate Intensity Physical Activity (IPAQ)

Variable: Moderate PA (Days Per week) *M*=3.73 *SD*=2.14		*N*	*M*	*SD*	*p*
Age in years	18	145	3.83	2.18	
N=807	19	226	3.81	2.10	
	20	179	3.82	2.20	
	21	139	3.56	2.02	
	22	73	3.36	2.29	.614
	23	20	3.85	2.13	
	24	16	3.44	1.82	
	25	9	4.44	2.29	
Race	White	686	3.86	2.13	
N=807	AA	78	2.91	2.05	.001**
	Other	43	3.16	1.98	
Year in School	Freshmen	255	3.69	2.13	
N=807	Sophomores	192	3.80	2.21	.960
	Juniors	187	3.70	2.11	
	Seniors	176	3.75	2.12	
Gender	Male	280	3.60	2.18	
N=806	Females	526	3.79	2.11	614
Greek Affiliation	Greek	194	3.81	2.07	
N=807	Non-Greek	613	3.71	2.16	.541
Living Status	On-Campus	465	3.40	2.17	
N=807	Off-Campus	339	3.28	2.08	.044*

Note. * $p<.05$, ** $p<.001$, response ranges from 0-7 days.

Table 14

Demographics and Vigorous Intensity Physical Activity (IPAQ)

Variable: Vigorous PA (Days Per week) *M*=4.06 *SD*=3.76		*N*	*M*	*SD*	*p*
Age in years	18	146	3.90	3.88	
N=810	19	227	4.11	3.80	
	20	179	3.69	3.62	
	21	139	4.39	3.71	
	22	74	3.88	3.73	.285
	23	20	4.70	3.85	
	24	16	4.31	3.49	
	25	9	6.78	4.17	
Race	White	689	4.26	3.78	
N=810	AA	78	2.38	3.25	.001**
	Other	43	3.86	3.62	
Year in School	Freshmen	254	3.91	3.77	
N=810	Sophomores	192	3.88	3.74	.515
	Juniors	188	4.12	3.80	
	Seniors	176	4.39	3.72	
Gender	Male	281	4.59	3.82	
N=809	Females	528	3.77	3.70	.003*
Greek Affiliation	Greek	194	4.43	3.94	
N=810	Non-Greek	616	3.94	3.69	.114
Living Status	On-Campus	468	4.13	3.81	
N=807	Off-Campus	339	3.97	3.69	.434

Note. * $p<.01$, ** $p<.001$, response ranges from 0-7 days.

Table 15

Demographics and Duration of Moderate Intensity Physical Activity (IPAQ)

Variable: Duration of Moderate Physical Activity (Minutes per day) *M*=54.44 *SD*=48.25		*N*	*M*	*SD*	*p*
Age in years	18	146	61.70	50.68	
N=811	19	228	58.06	53.32	
	20	179	52.07	46.93	
	21	139	47.42	34.42	
	22	74	42.30	44.13	.012*
	23	20	68.50	57.88	
	24	16	72.87	56.06	
	25	9	36.67	47.50	
Race	White	690	52.04	45.32	
N=811	AA	78	63.55	60.74	.001**
	Other	43	76.42	60.91	
Year in School	Freshmen	255	61.01	51.43	
N=811	Sophomores	192	53.98	48.80	.047*
	Juniors	188	48.89	46.27	
	Seniors	176	51.36	44.10	
Gender	Male	282	58.36	52.27	
N=810	Females	528	52.40	45.92	.094
Greek Affiliation	Greek	194	51.15	39.97	
N=811	Non-Greek	617	55.48	50.57	.276
Living Status	On-Campus	469	56.70	50.50	
N=808	Off-Campus	339	51.63	44.96	.141

Note. * $p<.05$, ** $p<.001$, responses reported in minutes per day.

The duration of engagement in vigorous intensity physical activity (see Appendix D; question 12) with respect to individual demographic characteristics is shown in Table 16. The average number of minutes of engagement per day was 54.75 (*SD*=50.40). Significance with respect to gender (*p*<.001*)* was reflected where male students reported 67.24 minutes (*SD*=54.62) per day compared to female students reporting 48.15 minutes (*SD*=46.73) per day.

Walking activity (see Appendix D; question 15) of 10 minutes or greater, at a single time within the past week, was reported in Table 17. The age of the students (*p*=.001*)* reflected significance with 18 year olds walking the most days with 5.80 (*SD*=1.47) days per week and 24 year olds walking the least days with 4.56 days (*SD*=2.56) per week. With respect to race (*p*<.001*)*, White students walked at least 10 minutes at a time on 5.39 (*SD*=1.86) days per week while African-American students walked on 4.06 (*SD*=2.29) days per week. The year in school reflects a significant difference (*p*<.001*)* with freshman walking the most with 5.76 (*SD*=1.58) days per week and juniors the least with 4.95 (*SD*=2.06) days per week. Living status was significant (*p*<.001*)* as more on-campus students reported walking on 5.47 (*SD*=1.86) days per week compared to students who reside off-campus walking 4.95 *(SD*=2.01) days per week.

Health Belief Model Questions

The six constructs of the HBM were examined through multiple questions (see Appendix D; question 18, items a-mm) designed to assess the strength of each construct with respect to perceptions toward physical activity. The frequency of responses to the 39 questions examining the constructs of the HBM will be discussed.

Table 16

Demographics and Duration of Vigorous Intensity Physical Activity (IPAQ)

Variable: Duration of Vigorous Physical Activity (Minutes per day) *M*=54.75 *SD*=50.40		*N*	*M*	*SD*	*p*
Age in years	18	146	48.69	47.82	
N=811	19	228	61.54	54.04	
	20	179	50.45	48.17	
	21	139	52.06	48.31	
	22	74	53.32	51.04	.092
	23	20	74.25	60.74	
	24	16	56.56	34.81	
	25	9	73.33	47.69	
Race	White	690	54.01	67.75	
N=811	AA	78	54.94	46.63	.302
	Other	43	66.28	68.94	
Year in School	Freshmen	255	53.87	45.89	
N=811	Sophomores	192	55.05	54.93	.967
	Juniors	188	54.23	52.16	
	Seniors	176	56.26	49.95	
Gender	Male	282	67.24	54.62	
N=810	Females	528	48.15	46.73	.001*
Greek Affiliation	Greek	194	50.73	43.88	
N=811	Non-Greek	617	56.02	52.25	.203
Living Status	On-Campus	469	54.17	48.45	
N=808	Off-Campus	339	55.64	53.12	.683

Note. * $p<.001$, responses reported in minutes per day.

Table 17

Demographics and Walking Activity (IPAQ)

Variable: Walking at least 10 minutes at a time (Days Per week) *M*=5.25 *SD*=1.94		*N*	*M*	*SD*	*p*
Age in years	18	145	5.80	1.47	
N=809	19	227	5.45	1.83	
	20	179	5.08	2.02	
	21	139	4.88	2.15	
	22	74	5.05	2.05	.001*
	23	20	4.70	1.72	
	24	16	4.56	2.52	
	25	9	4.67	2.50	
Race	White	688	5.39	1.86	
N=809	AA	78	4.06	2.29	.001*
	Other	43	5.26	1.84	
Year in School	Freshmen	253	5.76	1.58	
N=809	Sophomores	192	5.07	2.01	.001*
	Juniors	188	4.95	2.06	
	Seniors	176	5.05	2.06	
Gender	Male	281	5.15	2.12	
N=808	Females	527	5.31	1.83	.244
Greek Affiliation	Greek	194	5.26	1.84	
N=809	Non-Greek	615	5.25	1.97	.938
Living Status	On-Campus	467	5.47	1.86	
N=806	Off-Campus	339	4.95	2.01	.001*

Note. * p<.001, responses range from 0-7 days.

The perceived susceptibility questions (see Appendix D; question 18, items a-f) sought to gauge the student's perception to the threat of a health risk. When asked to compare themselves to their peers, the students' scores were low, depicting a lack of perceived susceptibility. On average, 75.3% of the students disagreed or strongly disagreed with these perceptions. Table 18 depicts these responses.

The perceived severity questions (see Appendix D; question 18, items g-n) revealed more concern toward the threat of physical inactivity and such health risks as becoming overweight or incurring heart or health problems. Additional concerns were noted with becoming lazy, feeling bad, or not being able to do the things they would like. Approximately 3 out of 4 (74.2%) students agreed or strongly agreed with these consequences from a lack of physical activity. Table 18 depicts these responses.

Perceived benefits of physical activity questions (see Appendix D; question 18, items o, q, t, v, and x) reflected 87.5% of student responses agreeing or strongly agreeing with benefits of physical activity which included longer life span, stress reduction, social contact with others, improved self-image, and mental alertness. Table 19 depicts these responses.

The perceived barriers toward physical activity (see Appendix D; question 18, items p, r, s, u, and w) were low among students where 72.3% of the responses disagreed or strongly disagreed with statements reflecting barriers, such as, lack or time, convenience of facilities, embarrassment, or lack of family support or encouragement. More than half of the students (53.3%) agreed or strongly agreed that physical activity involved hard work. Table 19 depicts these responses.

The construct of perceived self-efficacy was measured through 10 items (see Appendix D; question 18, items y-hh) in the survey. The majority (87.5%) of student responses agreed or

Table 18

Perceived Susceptibility and Perceived Severity Constructs

Question	SA	A	D	SD
a. I am more physically active than others my age and sex.	16.1%	46.2%	31.6%	6.1%
b. I am more likely than others my age and sex to become overweight.	4.1	22.7	41.0	32.2
c. I am more likely than others my age and sex to become out of shape.	5.2	27.3	46.2	21.2
d. I am more likely than others my age and sex to have heart problems.	5.2	16.3	54.5	24.0
e. I am more likely than others my age and sex to have health problems.	4.4	15.2	54.4	26.1
f. I am more likely than others my age and sex to die earlier than normal	2.3	10.7	56.8	30.3
g. If I am not physically active, I will become overweight.	22.8	40.2	30.0	7.1
h. If I am not physically active, I will get out of shape.	40.0	52.7	5.3	2.0
i. Physical inactivity will cause me to have heart problems.	14.8	42.9	34.9	7.4
j. Physical inactivity will cause me to have health problems.	17.8	51.1	25.3	5.7
k. Being physically inactive makes me feel lazy.	52.4	42.3	4.0	1.2
l. Being physically inactive makes me feel bad.	42.3	42.9	12.6	2.2
m. If I were not physically active, I would not be able to do a lot of things.	25.6	47.2	23.8	3.4
n. If I were not physically active, I would die earlier than normal.	17.1	49.9	27.7	5.4

Note. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree.

Table 19

Perceived Benefits and Perceived Barriers Constructs

Question	SA	A	D	SD
a. Exercise decreases feelings of stress and tension for me (survey item o)	51.9%	41.4%	5.2%	1.5%
b. Exercising takes too much of my time. (survey item p)	5.7	25.6	56.8	11.9
c. Exercise lets me have contact with friends and persons I enjoy.(survey item q)	14.8	51.6	28.7	4.9
d. I am too embarrassed to exercise. (survey item r)	3.5	12.8	44.9	38.8
e. Exercise facilities do not have convenient schedules for me. (survey item s)	3.7	11.1	54.7	30.6
f. I will live longer if I exercise. (survey item t)	33.2	59.5	6.7	.5
g. My family members do not encourage me to exercise. (survey u)	5.1	18.0	50.2	26.7
h. Exercising increases my mental alertness. (survey item v)	31.3	57.9	10.1	.7
i. Exercise is hard work for me. (survey item w)	9.0	44.3	40.7	6.0
j. Exercise improves the way my body looks. (survey item x)	43.1	52.6	3.9	.5

Note. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree

strongly agreed with statements relating to their ability to overcome physical activity barriers, establish and maintain physical activity goals, persistence in engagement in physical activity, motivation to restart after stopping exercising despite fatigue or depression, and lack of access to facilities or trainers. Table 20 depicts these responses.

The Cues to action responses (see Appendix D; question 18, items, ii-mm) reflected 71.9% of students somewhat to strongly agreeing with statements of motivation towards physical activity ranging from observation of seasonal clothing, looking in the mirror, health benefit reminders to seeing pictures in print media. The observation of actual exercise on TV encouraged 50% of students toward engagement in physical activity. Table 21 depicts these responses.

Summary analysis of the frequency of responses to the 39 questions support an affiliation towards the 6 constructs of the HBM. The Undergraduate students perceived a high level of self-efficacy toward physical activity and see benefits to physical activity much more so than barriers. Their motivation to action toward physical activity is mixed with the strongest association to looking at one's self in a mirror and being reminded of the health benefits of physical activity.

Of the six HBM constructs, the mean scores (based on the association with each construct, higher the mean score, the higher the association) from high to low based on percent of maximum possible score were, Perceived Benefits (73.3%), Perceived Self-Efficacy (72%), Cues to Action (70.6%), Perceived Severity (66.6%), Perceived Barriers (63.0%), Perceived Susceptibility (37.3%).

Table 20

Perceived Self-Efficacy Construct

Question	SA	A	D	SD
a. I can overcome barriers and challenges with regard to physical activity and exercise if I try hard enough. (survey item y)	38.3%	56.9%	4.5%	.4%
b. I can find means and ways to be physically active and exercise. (survey item z)	39.6	58.3	1.9	.2
c. I can accomplish the physical activity goals that I set. (survey item aa)	32.6	59.9	6.9	.6
d. When I am confronted with a barrier to physical activity or exercise, I can find several solutions to overcome this barrier. (survey item bb)	22.7	63.6	13.5	.3
e. I can be physically active and exercise even when I am tired. (survey cc)	17.3	51.5	28.2	3.0
f. I can be physically active and exercise even when I am depressed. (survey dd)	21.9	54.0	20.9	3.3
g. I can be physically active or exercise even without the support of my family and friends. (survey ee)	30.4	57.8	10.5	1.4
h. I can be physically active or exercise even without the help of a therapist or trainer. (survey ff)	46.8	49.3	3.1	.8
i. I can motivate myself to start being physically active or exercising again after I've stopped for a while. (survey gg)	32.1	59.6	9.5	.8
j. I can be physically active or exercise even if I had no access to a gym, exercise training, or rehabilitation facility. (survey item hh)	28.8	54.2	14.2	2.8

Note. SA=Strongly Agree; A=Agree; D=Disagree; SD=Strongly Disagree

Table 21

Cues to Action Construct

Question	SA	A	SwA	N	SwD	D	SD
a. Seeing spring/summer clothes that you would like to buy. (survey item ii)	26.7%	23.0%	17.2%	16.0%	2.6%	6.9%	7.5%
b. Looking at myself in the mirror. (survey item jj)	46.8	28.8	14.5	5.3	1.0	2.4	1.2
c. Being reminded of health benefits of physical activity. (survey item kk)	24.4	36.9	24.3	9.7	2.1	1.5	1.1
d. Seeing pictures of physically fit people in magazines or on TV. (survey item ll)	27.6	22.8	17.1	15.0	6.2	6.4	4.8
e. Watching exercise on TV. (survey item mm) .	14.6	16.5	18.2	22.1	9.9	10.9	7.8

Note. SA=Strongly Agree; A=Agree; SwA=Somewhat Agree; N=Neutral; SwD=Somewhat Disagree; D=Disagree; SD=Strongly Disagree

Perceived Susceptibility

Table 22 examines the comparison between perceived susceptibility and individual demographic characteristics. Only year in school was found significant (*p=.023)* with sophomore students rating their susceptibility to health problems from a lack of physical activity the highest (*M*=1.20, *SD*=.545) and freshman (*M*=1.05, *SD*=.462) students the lowest.

Perceived Severity

Table 23 examines the comparison between perceived severity and the individual demographic characteristics. Race (*p*=.021*)* and gender (*p*=.048) were found significant. The White student scores reflected a higher (*M*=2.02, *SD*=.505) level of perceived severity of health problems from a lack of physical activity than African-American (*M*=1.90, *SD*=.515) students. The female students rated their perceived severity of health problems from a lack of physical activity higher (M=2.02, *SD*=.509) than male students (*M*=1.95, *SD*=.498).

Perceived Benefits

Table 24 examines the comparison between perceived benefits and individual demographic characteristics. No significant differences among students were found with this construct. The lowest score associated with this construct was among 22 year olds (*M*=2.12, *SD*=.468) while the highest score was among 24 year olds (*M*=2.38, *SD*=.403).

Perceived Barriers

Table 25 examines the comparison between perceived barriers and the individual demographic characteristics. No significant differences were found among students with this construct. The lowest score associated with this construct was among African-American students (*M*=1.84, *SD*=.587), while the highest score was among 23 year olds (*M*=2.06, *SD*=.430).

Table 22

Demographics and Perceived Susceptibility

Variable: Perceived Susceptibility (Mean Score range 0-3) *M*=1.12 *SD*=.496		*N*	*M*	*SD*	*p*
Age in years	18	145	1.09	.472	
N=786	19	219	1.06	4.83	
	20	172	1.15	.508	
	21	134	1.13	.466	
	22	72	1.22	.575	.138
	23	19	1.09	.439	
	24	16	1.36	.521	
	25	9	1.19	.637	
Race	White	676	1.11	.477	
N=786	AA	71	1.18	.624	.452
	Other	39	1.17	.549	
Year in School	Freshmen	249	1.05	.462	
N=786	Sophomores	183	1.20	.545	.023*
	Juniors	180	1.13	.512	
	Seniors	174	1.13	.460	
Gender	Male	269	1.10	.500	
N=785	Females	516	1.13	.493	.355
Greek Affiliation	Greek	189	1.09	.448	
N=786	Non-Greek	615	1.13	.509	.316
Living Status	On-Campus	453	1.09	.489	
N=783	Off-Campus	330	1.16	.506	.089

Note. * $p<.05$.

Table 23

Demographics and Perceived Severity

Variable: Perceived Severity (Mean Score range 0-3) *M*=2.00 *SD*=.506		*N*	*M*	*SD*	*p*
Age in years	18	141	1.98	.455	
N=771	19	214	1.93	.512	
	20	170	2.05	.518	
	21	133	2.01	.521	
	22	71	2.01	.505	.060
	23	20	2.10	.453	
	24	14	2.35	.543	
	25	8	1.93	.508	
Race	White	660	2.02	.505	
N=771	AA	71	1.90	.515	.021*
	Other	40	1.84	.462	
Year in School	Freshmen	244	1.96	.484	
N=771	Sophomores	179	2.00	.538	.428
	Juniors	180	2.01	.520	
	Seniors	168	2.04	.485	
Gender	Male	266	1.95	.498	
N=770	Females	504	2.02	.509	.048*
Greek Affiliation	Greek	181	2.04	.500	
N=771	Non-Greek	590	1.99	.507	.242
Living Status	On-Campus	448	1.97	.496	
N=768	Off-Campus	320	2.04	.515	.089

Note. * $p<.05$.

Table 24

Demographics and Perceived Benefits

Variable: Perceived Benefits (Mean Score range 0-3) *M*=2.20 *SD*=.448		*N*	*M*	*SD*	*p*
Age in years	18	143	2.16	.435	
N=789	19	217	2.23	.434	
	20	177	2.18	.478	
	21	137	2.22	.434	
	22	71	2.12	.468	.244
	23	20	2.33	.401	
	24	15	2.38	.403	
	25	9	2.26	.538	
Race	White	675	2.21	.435	
N=789	AA	73	2.20	.521	.452
	Other	41	2.12	.515	
Year in School	Freshmen	247	2.21	.421	
N=789	Sophomores	186	2.19	.467	.830
	Juniors	183	2.18	.471	
	Seniors	173	2.22	.442	
Gender	Male	272	2.18	.444	
N=788	Females	516	2.21	.451	.373
Greek Affiliation	Greek	185	2.24	.431	
N=789	Non-Greek	604	2.19	.453	.167
Living Status	On-Campus	455	2.21	.455	
N=786	Off-Campus	331	2.20	.439	.785

Table 25

Demographics and Perceived Barriers

Variable:		*N*	*M*	*SD*	*p*
Perceived Barriers (Mean Score range 0-3) *M*=1.89 *SD*=.489					
Age in years	18	146	1.93	.483	
N=794	19	221	1.92	.488	
	20	175	1.86	.529	
	21	134	1.91	.418	
	22	73	1.80	.534	.402
	23	20	2.06	.430	
	24	16	1.78	.481	
	25	9	1.93	.519	
Race	White	679	1.90	.474	
N=794	AA	73	1.84	.587	.641
	Other	42	1.89	.545	
Year in School	Freshmen	251	1.92	.509	
N=794	Sophomores	188	1.86	.523	.478
	Juniors	182	1.86	.468	
	Seniors	173	1.90	.440	
Gender	Male	272	1.91	.450	
N=793	Females	521	1.88	.509	.309
Greek Affiliation	Greek	190	1.95	.447	
N=794	Non-Greek	604	1.87	.500	.059

Perceived Self-Efficacy

Table 26 examines the comparison between perceived self-efficacy and individual demographic characteristics. The individual demographic characteristic of gender was found to be significant (p=.007). Male students perceived greater self-efficacy towards physical activity (M=2.23, SD=.438) than female students (M=2.13, SD=.465). The lowest level of perceived self-efficacy towards physical activity was found among 25 year olds (M=2.05, SD=.891) while the highest level of perceived self-efficacy was among 24 year olds (M=2.29, SD=.428).

Cues to Action

Table 27 examines the comparison between cues to action and the individual demographic characteristics. Three individual demographic characteristics were significantly different among these students. With respect to age, 18 year old students (p=.017) scored higher (M=4.53, SD=1.16) on cues to action as influencing physical activity than their 25 year old counterparts (M=3.37, SD=.569). Gender (p<.001*)* reflected that female students (M=4.57, SD=1.07) were affected by cues to action toward physical activity more than male students (M=3.62, SD=1.11). The greek affiliated students (p<.001*)* responded more (M=4.55, SD=1.02) to cues to action toward physical activity than non-greek affiliated students (M=4.14, SD=1.20). The lowest score found with the construct of cues to action toward physical activity was among 25 year old students (M=3.37, SD=.569), while the highest score associated with this construct was realized with female students (M=4.57, SD=1.07).

Table 26

Demographics and Perceived Self-Efficacy

Variable: Perceived Self Efficacy (Mean Score range 0-3) *M*=2.16 *SD*=.391		*N*	*M*	*SD*	*p*
Age in years	18	140	2.18	.436	
N=761	19	208	2.19	.438	
	20	170	2.14	.469	
	21	131	2.16	.422	
	22	68	2.11	.502	.732
	23	20	2.21	.587	
	24	16	2.29	.428	
	25	9	2.05	.891	
Race	White	658	2.16	.453	
N=761	AA	64	2.19	.508	.824
	Other	39	2.13	.451	
Year in School	Freshmen	240	2.21	.441	
N=761	Sophomores	177	2.16	.481	.180
	Juniors	176	2.11	.438	
	Seniors	168	2.16	.473	
Gender	Male	264	2.23	.438	
N=760	Females	496	2.13	.465	.007*
Greek Affiliation	Greek	177	2.16	.454	
N=761	Non-Greek	584	2.16	.459	.995
Living Status	On-Campus	436	2.19	.447	
N=758	Off-Campus	322	2.14	.473	.133

Note. * $p < .01$.

Table 27

Demographics and Cues to Action

Variable: Cues to Action (Mean Score range 0-6) *M*=4.24 *SD*=1.17		*N*	*M*	*SD*	*p*
Age in years	18	146	4.52	1.16	
N=802	19	222	4.23	1.29	
	20	178	4.20	1.23	
	21	137	4.20	.93	
	22	74	4.00	1.15	.017*
	23	20	4.09	1.06	
	24	16	4.36	.84	
	25	9	3.37	.56	
Race	White	682	4.26	1.17	
N=802	AA	78	4.22	1.25	.824
	Other	42	3.87	1.06	
Year in School	Freshmen	253	4.40	1.27	
N=802	Sophomores	189	4.17	1.26	.054
	Juniors	184	4.21	1.05	
	Seniors	176	4.12	1.02	
Gender	Male	277	3.62	1.11	
N=801	Females	524	4.57	1.07	.001**
Greek Affiliation	Greek	190	4.55	1.02	
N=802	Non-Greek	612	4.14	1.20	.001**
Living Status	On-Campus	461	4.23	1.24	
N=799	Off-Campus	338	4.25	1.07	.776

Note. * $p<.05$. ** $p<.001$.

Reliability of HBM Questions

Reliability for the questions from the HBM was determined. For perceived self-efficacy the standardized Cronbach alpha was .982, for perceived susceptibility the standardized Cronbach alpha was .699, for perceived severity the standardized Cronbach alpha was .817, for cues to action the standardized Cronbach alpha was .791, for perceived barriers the standardized Cronbach alpha was .639, and for perceived benefits the standardized Cronbach alpha as .554.

Inferential Statistical Analysis

The eight research questions were examined based on the freshman and senior population with respect to knowledge, engagement, and perceptions to cardiovascular physical activity.

Research Question #1

Is there a difference in the mean knowledge scores of freshman and senior students for cardiovascular physical activity?

Using the survey responses to the 8 knowledge questions regarding ACSM guidelines (see Appendix D; questions 1-8), ANOVA revealed no significant differences (p=.645) with senior mean scores of 4.26 (SD=1.17) compared to freshman mean scores of 4.21 (SD=1.20).

Research Question #2

Is there a difference in engagement of freshman and senior students for cardiovascular physical activity?

Using the survey responses to the IPAQ question for moderate physical activity (see Appendix D; question 13), ANOVA testing showed no significant difference (p=.960) between freshman and senior students. Freshmen engaged in moderate physical activity 3.69 (SD=2.13) days per week, while seniors participated on 3.75 (SD=2.12) days per week.

Using the survey responses to the IPAQ question for vigorous physical activity (see Appendix D; question 11) the ANOVA showed no significant difference (p=.515) with freshman students engaged on 3.91 days (SD=3.77) per week compared to 4.39 days (SD=*3.72)* per week for senior students.

With respect to the IPAQ survey question for walking activity (see Appendix D; question 15), the ANOVA revealed freshman students (M=5.76, SD=1.58) walked significantly more days than seniors (M=5.05, SD=2.06). The ANOVA model showed (F (3,805) = 8.813; p<.001). Further independent sample t-tests revealed significance between freshmen and senior students (t (42) = 2.59, p=.010).

Research Question #3

Do year in school and perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

Moderate Intensity Physical Activity (Freshmen)

From bivariate analysis significance of the HBM constructs were perceived susceptibility (p=.012), perceived severity (p=.012), perceived benefits (p=.005), perceived barriers (p=.003), perceived self-efficacy (p=.002). The regression analysis from the ANOVA revealed significant differences (p=.015) between the constructs of the HBM and freshmen students in regard to engagement in moderate intensity physical activity. However, cues to action was not significant (p=.359). Regression modeling was then utilized with the enter method conducted and determined no specific HBM construct significance. With respect to the model, 7.2% of the variance in freshman engagement in moderate physical activity was explained by the constructs

of the HBM. A stepwise regression analysis was also performed. In Table 28, correlations for freshman moderate physical activity and the HBM constructs are shown.

The ANOVA showed significance at (p=.004). As constructs were placed into the model, self-efficacy significantly related with freshman engagement in moderate physical activity (β=.196, t (215) = 2.934, p=.004). Self-efficacy also explained a significant proportion of the variance in engagement in moderate physical activity among freshman (R^2=.038, F (1,215) = 8.606, p=.004).

Table 28

Correlates of the HBM Constructs and Moderate Physical Activity: Freshmen

Constructs	Moderate PA	Susceptibility	Severity	Benefits	Barriers	Self-Efficacy	Cues to Action
Susceptibility	-.154	1.000	.069	-.220	-.470	-.302	.003
Severity	.153	.069	1.000	.444	.019	.319	.274
Benefits	.174	-.220	.444	1.000	.442	.637	.377
Barriers	.187	-.470	.019	.442	1.000	.455	.151
Self-Efficacy	.196	-.302	.319	.637	.455	1.000	.209
Cues to Action	.025	.003	.274	.377	.151	.209	1.000

Moderate Intensity Physical Activity (Seniors)

Regression analysis revealed significant differences (p=.009) between the constructs of the HBM and senior students with engagement in moderate intensity physical activity. Regression modeling was used to examine the relationship with perceived severity, which was significant (p=.007). With respect to the model, 10.7% of the variance in senior student engagement, in moderate physical activity was explained by the constructs of the HBM. A stepwise method regression analysis was then performed. In Table 29, correlations for senior, moderate physical activity and the HBM constructs are shown and the ANOVA showed significance (p<.001).

As the constructs were placed into the model, perceived severity (β=.303 t (155) = 3.950, $p<.001$) was significantly related with senior student engagement in moderate physical activity. This construct of the HBM explained a significant proportion of the variance in engagement in moderate physical activity among senior students (R^2=.092, F (1, 155) = 15.604, P<.001). No other constructs were significant.

Table 29

Correlates of the HBM Constructs and Moderate Physical Activity: Seniors

Constructs	Moderate PA	Susceptibility	Severity	Benefits	Barriers	Self-Efficacy	Cues to Action
Susceptibility	.330	1.000	.016	.106	.000	.002	.244
Severity	.000	.016	1.000	.000	.042	.000	.002
Benefits	.004	.106	.000	1.000	.000	.000	.000
Barriers	.029	.000	.042	.000	1.000	.000	.113
Self-Efficacy	.005	.002	.000	.000	.000	1.000	.033
Cues to Action	.105	.255	.002	.000	.113	.033	1.000

Vigorous Intensity Physical Activity (Freshmen)

Regression analysis from ANOVA revealed significant differences ($p<.001$) between the constructs of the HBM and freshman students with engagement in vigorous intensity physical activity. Regression modeling with the enter method was used and determined that the constructs of perceived barriers ($p=.021$) and self-efficacy ($p=.014$) were significant. With respect to the model, 15.6% of the variance in freshman student engagement in vigorous physical activity was explained by the constructs of the HBM.

A stepwise method regression analysis was then performed and the ANOVA showed significance ($p<.001$). In Table 30, correlations for freshmen vigorous physical activity and the HBM constructs are shown. As constructs were placed into the model, self-efficacy ($\beta=.255$, $t(218) = 3.617$, $p<.001$) and perceived barriers ($\beta=.198$, $t(218) = 2.799$, $p=.006$) were found as significant in correlates of freshman student engagement in vigorous physical activity. These two constructs of the HBM explained a significant proportion of the variance in engagement in moderate physical activity among senior students, $R^2=.151$, $F(2, 216) = 19.172$, $p<.001$. No other constructs were significant.

Table 30

Correlates of the HBM Constructs and Vigorous Physical Activity: Freshmen

Constructs	Vigorous PA	Susceptibility	Severity	Benefits	Barriers	Self-Efficacy	Cues to Action
Susceptibility	-.200	1.000	.061	-.219	-.475	-.314	.021
Severity	.142	.061	1.000	.448	.023	.321	.272
Benefits	.273	-.219	.448	1.000	.441	.631	.379
Barriers	.315	-.475	.023	.441	1.000	.460	.141
Self-Efficacy	.346	-.314	.321	.631	.460	1.000	.190
Cues to Action	.069	.021	.272	.379	.141	.190	1.000

Vigorous Intensity Physical Activity (Seniors)

Regression analysis from ANOVA revealed significant differences ($p<.001$) between the constructs of the HBM and senior students with engagement in vigorous intensity physical activity. The bivariate significance of the 6 constructs were perceived susceptibility ($p=.276$), perceived severity ($p<.001$), perceived benefits ($p<.001$), perceived barriers ($p=.001$), and perceived self-efficacy ($p<.001$). Perceived susceptibility ($p=.276$) and cues to action ($p=.440$) were not significant. Regression modeling using the enter method determined the construct of perceived severity ($p=.017$) was significant. With respect to the model, 18.7% of the variance in senior student engagement in vigorous physical activity was explained.

A stepwise method regression analysis was significant ($p<.001$). In Table 31, correlations for senior vigorous physical activity and the HBM constructs are shown. As constructs were placed into the model, perceived benefits ($\beta=.269$, $t(156) = 3.205$, $p=.002$) and perceived severity ($\beta=.198$ $t(156) = 2.365$, $p=.019$) were found significant for senior student engagement in vigorous physical activity. These two constructs of the HBM explained a significant proportion of the variance in engagement in moderate physical activity among senior students ($R^2=.162$, $F(1, 156) = 14.897$, $p<.001$).

Table 31

Correlates of the HBM Constructs and Vigorous Physical Activity: Seniors

Constructs	Vigorous PA	Susceptibility	Severity	Benefits	Barriers	Self-Efficacy	Cues to Action
Susceptibility	-.048	1.000	.165	-.103	-.273	-.227	.054
Severity	.326	.165	1.000	.475	.135	.422	.236
Benefits	.363	-.103	.475	1.000	.495	.652	.315
Barriers	.245	-.273	.135	.495	1.000	.506	.096
Self-Efficacy	.323	-.227	.422	.652	.506	1.000	.148
Cues to Action	.020	.054	.236	.315	.096	.148	1.000

Research Question #4

What are the individual characteristics of freshman and senior university students with respect to knowledge of the American College of Sports Medicine guidelines for cardiovascular physical activity?

Table 32 depicts the mean scores with respect to age, year in school, race, gender, greek affiliation, and living status of freshmen. Based on the ANOVA, gender with female scores (M=4.38, SD=1.18) was higher than male scores (M=3.81, SD=1.14) and was significant (F (1,253) = 13.082; p<.001).

The demographic characteristics of race and gender, while controlling for age, were further analyzed using univariate analysis from GLM to determine freshman individual demographic characteristics as predictors of knowledge of ACSM guidelines for cardiovascular physical activity. None of the demographic characteristics independent or with interaction were found significant in the model. With respect to the individual characteristics of freshman and knowledge of ACSM guidelines for cardiovascular physical activity, 8.0% of the variance in knowledge scores of these students was explained by the individual demographic characteristics of race and gender.

Table 32

Freshmen Demographics and Knowledge Scores

Variable: Knowledge Score *M*=4.21 *SD*=1.20		*N*	*M*	*SD*	*p*
Age in years	18	136	4.34	1.14	
N=255	19	116	4.09	1.23	
	20	3	3.00	1.73	.054
	21				
	22				
	23				
	24				
	25				
Race	White	225	4.16	1.30	
N=255	AA	19	4.58	1.30	.162
	Other	11	4.64	.92	
Gender	Male	78	3.81	1.14	
N=255	Females	177	4.38	1.18	.001*
Greek Affiliation	Greek	71	4.17	1.35	
N=255	Non-Greek	184	4.22	1.14	.749
Living Status	On-Campus	240	4.23	1.19	
N=253	Off-Campus	13	3.85	1.40	.264

Note. * $p < .01$. Correct responses range from 0-8.

Table 33 examines the mean scores with respect to age, year in school, race, gender, greek affiliation, and living status of seniors. Based on the ANOVA, gender where female scores (M=4.48, SD=1.11) were higher than male scores (M=3.86, SD=1.16), was significant (F (1,174) = 12.117; p=.001).

From the ANOVA in Table 33, the demographic characteristics of race and gender, while controlling for age, were further analyzed using univariate analysis from GLM to determine senior student's individual demographic characteristics as predictors of knowledge of ACSM guidelines for cardiovascular physical activity. None of the demographic characteristics, independent or with interaction were found significant in the model. With respect to the individual characteristics of freshman students and knowledge of ACSM guidelines for cardiovascular physical activity, 8.4% of the variance in knowledge scores of these students was explained by the individual demographic characteristics of race and gender.

Table 33

Senior Demographics and Knowledge Scores

Variable: Knowledge Score *M*=4.26 *SD*=1.17		*N*	*M*	*SD*	*p*
Age in years	18				
N=176	19				
	20	6	4.17	1.16	. 373
	21	72	4.38	1.14	
	22	64	4.09	1.06	
	23	16	4.06	1.23	
	24	12	4.83	1.74	
	25	6	4.17	.98	
Race	White	144	4.23	1.20	
N=176	AA	17	4.18	.72	.371
	Other	15	4.67	1.23	
Gender	Male	64	3.86	1.16	
N=175	Females	111	4.48	1.11	.001*
Greek Affiliation	Greek	31	4.16	1.00	
N=176	Non-Greek	145	4.28	1.20	.602
Living Status	On-Campus	43	4.30	1.19	
N=253	Off-Campus	133	4.25	1.12	.793

Note. * p<.01, Correct responses range from 0-8.

Research Question #5

What are the individual characteristics of freshman and senior university students with respect to engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

Moderate Intensity Physical Activity (Freshmen)

Table 34 shows the relationship of the individual demographic characteristics with freshman student engagement in moderate intensity physical activity. The ANOVA revealed no significant differences among these individual demographic characteristics.

Further analysis using the univariate analysis from GLM was employed to determine if certain individual characteristics were related with engagement in moderate intensity physical activity. Given the sample size limitations, only race and gender, while controlling for age, were utilized in the model. None of the demographic characteristics independent or with interaction were found significant in the model. The individual characteristics of freshman students and engagement in moderate intensity physical activity, 1.2% of the variance of model students was explained by race and gender.

Moderate Intensity Physical Activity (Seniors)

Table 35 shows the relationship of the individual demographic characteristics with senior student engagement in moderate vigorous intensity physical activity. Through ANOVA for moderate intensity physical activity, race was significant ($F\ (2,172) = 4.236,\ p = .016$).

Further analysis was conducted for the univariate analysis from GLM to determine certain individual characteristics as predictors of engagement in moderate intensity physical activity. Only race and gender, while controlling for age, were utilized in the model given sample size limitations necessary to adequately measure all interactions.

Table 34

Engagement in Moderate Intensity Physical Activity (Freshmen)

Variable: Engagement in Moderate Intensity Physical Activity *M*=3.69 (Days per week) *SD*=2.13		*N*	*M*	*SD*	*p*
Age in years	18	135	3.72	2.18	
N=252	19	114	3.71	2.07	
	20	3	2.00	1.00	. 384
	21				
	22				
	23				
	24				
	25				
Race	White	222	3.42	2.16	
N=252	AA	19	3.75	1.89	.441
	Other	11	3.00	1.89	
Gender	Male	76	3.47	2.29	
N=252	Females	176	3.79	2.05	.281
Greek Affiliation	Greek	71	3.59	2.07	
N=252	Non-Greek	181	3.73	2.15	.632
Living Status	On-Campus	237	3.74	2.13	
N=250	Off-Campus	13	3.31	1.93	.478

Table 35

Engagement in Moderate Intensity Physical Activity (Seniors)

Variable: Engagement in Moderate Intensity Physical Activity *M*=3.75 (Days per week) *SD*=2.12		*N*	*M*	*SD*	*p*
Age in years	18				
N=175	19				
	20	6	4.00	3.09	. 516
	21	72	3.74	1.95	
	22	63	3.51	2.26	
	23	16	4.19	2.22	
	24	12	3.67	1.77	
	25	6	5.17	1.94	
Race	White	143	3.97	2.11	
N=175	AA	17	2.71	1.96	.016*
	Other	15	2.87	1.92	
Gender	Male	64	3.56	2.15	
N=174	Females	110	3.83	2.09	.428
Greek Affiliation	Greek	31	3.84	2.29	
N=175	Non-Greek	144	3.73	2.09	.795
Living Status	On-Campus	42	3.93	2.10	
N=175	Off-Campus	133	3.69	2.13	.530

Note. * $p<.05$, Days Range from 0-7.

Among senior students, race (F (2, 173) = 4.898; p=.009) was found significant. With respect to the individual characteristics of senior students and engagement in moderate intensity physical activity, 6.9% of the variance of the model is explained by race and gender.

Vigorous Intensity Physical Activity (Freshman)

Table 36 shows the relationship of the various individual demographic characteristics with engagement in vigorous intensity physical activity among freshmen. Through ANOVA no significant differences were found within these individual demographic characteristics and freshmen.

Further analysis using the univariate analysis from GLM was employed to determine certain individual characteristics as predictors of engagement in vigorous intensity physical activity. Only race and gender, while controlling for age, were utilized in the model to adequately measure all interactions. No significant interactions were found among the individual demographic characteristics for freshman engagement in vigorous intensity physical activity. With respect to the individual characteristics of freshman students and engagement in vigorous intensity physical activity, 2.2% of the variance of the model is explained by the individual demographic characteristics of race and gender.

Vigorous Intensity Physical Activity (Seniors)

Table 37 shows the relationship of the various individual demographic characteristics with engagement in vigorous intensity physical activity among seniors. Through ANOVA gender was found significant (F (1,175) = 4.962, p=.027).

Further analysis using the univariate analysis from GLM was employed to determine if certain individual characteristics were related with engagement in vigorous intensity

Table 36

Engagement in Vigorous Intensity Physical Activity (Freshmen)

Variable: Engagement in Vigorous Intensity Physical Activity *M*=3.91 (Days per week) *SD*=3.77		*N*	*M*	*SD*	*p*
Age in years	18	136	3.79	3.85	
N=254	19	115	4.10	3.71	
	20	3	1.33	.57	. 402
	21				
	22				
	23				
	24				
	25				
Race	White	224	4.04	3.79	
N=254	AA	19	3.37	3.98	.175
	Other	11	2.00	2.23	
Gender	Male	77	3.97	3.95	
N=254	Females	177	3.88	3.70	.849
Greek Affiliation	Greek	71	4.39	3.94	
N=254	Non-Greek	183	3.72	3.69	.199
Living Status	On-Campus	239	4.02	3.80	
N=252	Off-Campus	13	2.23	2.97	.097

Table 37

Engagement in Vigorous Intensity Physical Activity (Seniors)

Variable: Engagement in Vigorous Intensity Physical Activity *M*=4.39 (Days per week) *SD*=3.72		*N*	*M*	*SD*	*p*
Age in years	18				
N=176	19				
	20	6	3.17	2.63	. 144
	21	72	4.47	3.73	
	22	64	3.86	3.70	
	23	16	5.06	3.97	
	24	12	4.67	3.62	
	25	6	7.00	2.96	
Race	White	144	4.78	3.76	
N=176	AA	17	1.88	2.59	.057
	Other	15	3.53	3.27	
Gender	Male	64	5.22	3.81	
N=175	Females	111	3.93	3.61	.027*
Greek Affiliation	Greek	31	4.23	3.92	
N=176	Non-Greek	145	4.43	3.69	.785
Living Status	On-Campus	43	4.38	3.73	
N=176	Off-Campus	133	4.44	3.73	.920

Note. * p<.05, Days Range from 0-7.

physical activity. Given the sample size limitations, only race and gender, while controlling for age, were utilized in the model. Among senior students, race was significant (F (2, 174) = 5.029; p=.008). With regard to the individual characteristics of senior students and engagement in vigorous intensity physical activity, 11.5% of the variance of the model was explained by the individual demographic characteristics for race and gender.

Research Question #6

Do year in school, knowledge, and perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

Moderate Intensity Physical Activity (Freshman)

Regression analysis from ANOVA revealed significant differences (p=.021) between the constructs of the HBM and knowledge of ACSM guidelines among freshmen students engagement in moderate intensity physical activity. Regression modeling was then used with the enter method and determined no specific HBM construct or knowledge significance. With respect to the model, 7.5% of the variance in freshman engagement in moderate physical activity was explained by the constructs of the HBM and knowledge of ACSM guidelines. A stepwise regression analysis was performed and ANOVA was significnat (p=.004). As constructs were placed into the model, self-efficacy was significant in relating freshman engagement in moderate physical activity (β=.196, t (215) = 2.934, p=.004). Self-efficacy also explained a significant proportion of the variance in engagement in moderate physical activity among freshman (R^2=.038, F (1,215) =8.606, p=.004). No other constructs were significant.

Moderate Intensity Physical Activity (Seniors)

Regression analysis from ANOVA revealed significant differences (p=.012) between the constructs of the HBM, knowledge of ACSM guidelines, and senior students with engagement in moderate intensity physical activity. Regression modeling was then used with the enter method and determined that the construct of perceived severity was significant (p=.010). With respect to the model, .11.2% of the variance in senior student engagement in moderate physical activity was explained by the constructs of the HBM and knowledge of ACSM guidelines. A stepwise method regression analysis was then performed and once again, ANOVA was significant (p<.001). As constructs were placed into the model, perceived severity (β=.303, t (155) = 3.950, p<.001) was significant in relating with senior student engagement in moderate physical activity. This construct of the HBM explained a significant proportion of the variance in engagement in moderate physical activity among senior students (R^2=.092, F (1, 155) = 15.604, p<.001). No other constructs were significant.

Vigorous Intensity Physical Activity (Freshmen)

Regression analysis from ANOVA revealed significant differences (p<.001) between the constructs of the HBM, knowledge of ACSM guidelines, and freshman students with engagement in vigorous intensity physical activity. Regression modeling was used with the enter method and the constructs of perceived barriers (p=.017) and self- efficacy (p=.018) were significant. With respect to the model, 16.5% of the variance in freshman student engagement in vigorous physical activity was explained by the constructs of the HBM and knowledge of ACSM guidelines. A stepwise method regression analysis was then performed. Once again, the ANOVA was significant (p<.001). As constructs were placed into the model, self-efficacy (β=.255, t (218) = 3.617, p<.001) and perceived barriers (β=.198, t (218) = 2.799, p=.006) were

again significant in relating with freshman student engagement in vigorous physical activity. These two constructs of the HBM explained a significant proportion of the variance in engagement in moderate physical activity among senior students (R^2=.151, F (1, 216) = 19.172, p<.001). No other constructs were significant.

Vigorous Intensity Physical Activity (Seniors)

Regression analysis from ANOVA revealed significant differences (p<.001) between the constructs of the HBM, knowledge of ACSM guidelines, and senior students with engagement in vigorous intensity physical activity. Regression modeling was then used with the enter method and determined the construct of perceived severity (p=.009) was significant. With respect to the model, 21.6% of the variance in senior student engagement in vigorous physical activity was explained by the constructs of the HBM and knowledge of ACSM guidelines. A stepwise method regression analysis was then performed and once again, the ANOVA was significant (p<.001). As constructs were placed into the model, perceived benefits (β=.251, t (156) = 3.032, p=.003), perceived severity, (β=.221 t (156) = 2.666, p=.009), and knowledge of ACSM guidelines (β =-.181, t (156) = -2.473, p=.015) were significantly related with senior student engagement in vigorous physical activity. These two constructs of the HBM and knowledge of ACSM guidelines explained a significant proportion of the variance in engagement among senior students (R^2=.194, F (3,156) = 12.300, P<.001). No other constructs were significant.

Research Question #7

Do individual characteristics of freshman and senior university students and their perceptions of physical activity as measured by the constructs of the Health Belief Model relate with knowledge of the American College of Sports Medicine guidelines for cardiovascular physical activity?

Freshmen Analysis

Regression analysis from ANOVA revealed significant differences (p=.005) between freshmen students' individual demographic characteristics and the constructs of the HBM with knowledge of ACSM guidelines for physical activity. Regression modeling was then used with the enter method and determined that gender was significant (p<.001). With respect to the model, 11.9% of the variance in freshman knowledge of ACSM guidelines for cardiovascular physical activity was explained by the individual demographic characteristics and the constructs of the HBM. A stepwise regression analysis was performed and once again, the ANOVA was significant (p<.001). As individual demographic characteristics and the HBM constructs were placed into the model, gender (β=.330, t (217) = 4.458, p<.001) and cues to action (β=-.183, t (217) = -2.468, p=.014) were significant. These characteristics and constructs explained a significant proportion of the variance in knowledge of ACSM guidelines for cardiovascular physical activity among freshman (R^2=.085, F (1,217) =10.021, p<.001). No other individual characteristics or constructs were significant.

Senior Analysis

Regression analysis from ANOVA revealed no significant differences (p=.129) between senior student's individual demographic characteristics and the constructs of the HBM with knowledge of ACSM guidelines for physical activity. Regression modeling was then used with

the enter method and determined that gender as significant (p=.005). With respect to the model, 10.4% of the variance in senior's knowledge of ACSM guidelines for cardiovascular physical activity was explained by the individual demographic characteristics and the constructs of the HBM. A stepwise regression analysis was performed and the ANOVA was significant (p=.001). As individual demographic characteristics and the HBM constructs were placed into the model, gender (β=.268, t (155) = 3.4.52, p=.001) was significant. This individual demographic characteristic explained a significant proportion of the variance in knowledge of ACSM guidelines for cardiovascular physical activity among senior students (R^2=.072, F (1,155) =11.913, p=<.001). No other individual characteristics or constructs were significant.

Research Question #8

Do individual characteristics of freshman and senior university students and their perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

Moderate Intensity Physical Activity (Freshmen)

Regression analysis from ANOVA revealed no significant differences (p=.087) between freshmen student's individual demographic characteristics and the constructs of the HBM with engagement in moderate intensity physical activity. Regression modeling was then used with the enter method and determined variables were significant. With respect to the model, 8.2% of the variance in freshman engagement in moderate intensity physical activity was explained by the individual demographic characteristics and the constructs of the HBM. A stepwise regression analysis was also performed. The ANOVA was significant (p=.006). As individual demographic characteristics and the HBM constructs were placed into the model, the construct, perceived self-

efficacy (β=-.188, t (214) = 2.801, p=.006) was significant. This construct explained a significant amount of the variance in engagement in moderate intensity physical activity among freshmen (R^2=.036, F (1,214) = 7.844, p=.006). No other constructs were significant.

Moderate Intensity Physical Activity (Seniors)

Regression analysis from ANOVA revealed significant differences (p=.033) between senior student's individual demographic characteristics and the constructs of the HBM with engagement in moderate intensity physical activity. Regression modeling was used with the enter method and determined perceived severity (p=.009) was significant. With respect to the model, 13.3% of the variance in senior student's engagement in moderate intensity physical activity was explained by the individual demographic characteristics and the constructs of the HBM. A stepwise regression analysis was also performed. The ANOVA was significant (p<.001). As individual demographic characteristics and the HBM constructs were placed into the model, perceived severity (β=-.307, t (154) = 3.986, p<.001) was significant. This construct explained a significant amount of the variance in engagement in moderate intensity physical activity among seniors (R^2=.094, F (1,154) = 15.885, p<.001). No other constructs were significant.

Vigorous Intensity Physical Activity (Freshmen)

Regression analysis from ANOVA revealed significant differences (p<.001) between freshmen student's individual demographic characteristics and the constructs of the HBM with engagement in vigorous intensity physical activity. Regression modeling was used with the enter method and determined perceived barriers (p=.027) and perceived self-efficacy (p=.009) were significant. With respect to the model, 17.4% of the variance in freshman engagement in moderate intensity physical activity was explained by the individual demographic characteristics and the constructs of the HBM. A stepwise regression analysis was also performed and the

ANOVA was significant (p<.001). As individual demographic characteristics and the HBM constructs were placed into the model, perceived self-efficacy (β=-..253, t (216) = 3.559, p<.001) and perceived barriers (β=.197, t (217) = 2.775, p=.006) were significant. These constructs explained a significant amount of the variance in engagement in moderate intensity physical activity among freshmen (R^2=.148, F (2,216) = 18.657, p=.001). No other constructs were significant.

Vigorous Intensity Physical Activity (Seniors)

Regression analysis from ANOVA revealed significant differences (p<.001) between senior student's individual demographic characteristics and the constructs of the HBM with engagement in vigorous intensity physical activity. Regression modeling was then used with the enter method and determined that perceived severity (p=.009) was significant. With respect to the model, 21.1% of the variance in senior students' engagement in vigorous intensity physical activity was explained by the individual demographic characteristics and the constructs of the HBM. A stepwise regression analysis was also performed. The ANOVA was significant (p<.001). As individual demographic characteristics and the HBM constructs were placed into the model, perceived benefits (β= .235, t (155) = 2.797, p=.006), perceived severity (β=-.222, t (155) = 2.659, p=.009), and the individual demographic characteristic of gender (β= -.172, t (155) = -2.315, p=.022) were significant. These constructs explained a significant amount of the variance in engagement in moderate intensity physical activity among seniors (R^2=.190, F (3,155) = 11.883, p<.001)

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Results Summary

While knowledge of ACSM guideline mean score differences among freshman and senior students were relatively small, gender among both classifications of students and cues to action revealed significant differences in levels of knowledge. Knowledge was also a significant variable in predicting senior students' engagement in vigorous physical activity.

Freshman and senior students varied with perceptions to many of the constructs of the HBM as well as with individual demographic characteristics with respect to both moderate and vigorous intensity cardiovascular physical activity. In general, freshman students' engagement in moderate intensity physical activity was more often associated with less perceived self-efficacy and greater perceived barriers than any other construct of the HBM. With respect to vigorous intensity physical activity among freshmen, greater perceived barriers and less perceived self-efficacy were again significant predictors.

Senior students' engagement in moderate intensity physical activity was explained by greater perceived benefits and higher perceived severity. For vigorous intensity physical activity these same constructs as well as the demographic characteristic of gender (where male students engaged more often than female students) and their differences in knowledge of ACSM guidelines (where female students exhibited greater knowledge than male students) related significant differences.

Table 38 outlines the eight research questions while Table 39 summarizes the key variables showing significance in bivariate analysis from selected research questions. Table 40 summarizes the 8 inferential research questions with variables showing significance in regression analysis.

Table 38

Research Questions

Research Questions
1) Is there a difference in the mean knowledge scores of freshman and senior students for cardiovascular physical activity?
2) Is there a difference in engagement of freshman and senior students for cardiovascular physical activity?
3) Do year in school and perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?
4) What are the individual characteristics of freshman and senior university students with respect to knowledge of the American College of Sports Medicine guidelines for cardiovascular physical activity?
5) What are the individual characteristics of freshman and senior university students with respect to engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?
6) Do year in school, knowledge, and perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?
7) Do individual characteristics of freshman and senior university students and their perceptions of physical activity as measured by the constructs of the Health Belief Model relate with knowledge of the American College of Sports Medicine guidelines for cardiovascular physical activity?
8) Do individual characteristics of freshman and senior university students and their perceptions of physical activity as measured by the constructs of the Health Belief Model relate with engagement in the American College of Sports Medicine guidelines for cardiovascular physical activity?

Table 39

Bivariate Findings

Research Questions	Significant Variables			
	Moderate Intensity PA Freshmen	Vigorous Intensity PA Freshmen	Moderate Intensity PA Seniors	Vigorous Intensity PA Seniors
Question #3	Perceived Self-Efficacy (*p*=.002); Perceived Barriers (*p*=.003); Perceived Benefits (*p*=.005); Perceived Severity (*p*=.012); Perceived Susceptibility (*p*=.012)	Perceived Self-Efficacy (*p*<.001); Perceived Barriers (*p*<.001); Perceived Benefits (*p*<.001); Perceived Severity (*p*=.018); Perceived Susceptibility (*p*=.001)	Perceived Self-Efficacy (*p*=.005); Perceived Barriers (*p*=.029); Perceived Benefits (*p*=.004); Perceived Severity (*p*<.001)	Perceived Self-Efficacy (*p*<.001); Perceived Barriers (*p*=.001); Perceived Benefits (*p*<.001); Perceived Severity (*p*<.001)
Question #6	Perceived Self-Efficacy (p=.002); Perceived Barriers (*p*=.003); Perceived Benefits (*p*=.005); Perceived Severity (*p*=.012); Perceived Susceptibility (*p*=.012	Perceived Self-Efficacy (*p*<.001); Perceived Barriers (*p*<.001); Perceived Benefits (*p*<.001); Perceived Severity (*p*=.018); Perceived Susceptibility (*p*=.001); Knowledge (*p*=.040)	Perceived Self-Efficacy (*p*=.005); Perceived Barriers (*p*=.029); Perceived Benefits (*p*=.004); Perceived Severity (*p*<.001)	Perceived Self-Efficacy (*p*<.001); Perceived Barriers (*p*=.001); Perceived Benefits (*p*<.001); Perceived Severity (*p*<.001); Knowledge (*p*=.016)

Table 40

Summary of Findings

Research Questions	Significant Findings
Question #1	None
Question #2	Walking Activity: Freshmen > Seniors (p=.010)
Question #3	Moderate Intensity: Freshmen-Self-Efficacy (p=.004) Seniors-Perceived severity (p<.001) Vigorous Intensity: Freshmen: Self-Efficacy (p<.001); Perceived barriers (p=.006) Seniors: Perceived Benefits (p=.002); Perceived severity (p=.019)
Question #4	Freshmen: Gender (p=.001); Females > Males Seniors: Gender (p=.001); Females > Males
Question #5	Moderate Intensity (Seniors): Race (p=.009); Whites > AA Vigorous Intensity (Seniors): Race (p=.008); Whites > AA
Question #6	Moderate Intensity (Freshmen): Perceived Self-Efficacy (p=.004) Moderate Intensity (Seniors): Perceived Severity (p<.001) Vigorous Intensity (Freshmen): Perceived Self-Efficacy (p<.001); Perceived Barriers (p=.006) Vigorous Intensity (Seniors): Perceived Benefits (p=.003); Perceived Severity (p=.009); Knowledge (p=.015)
Question #7	Freshmen: Gender (p=.001); Females > Males; Cues to Action (p=.019) Seniors: Gender (p=.001); Females > Males
Question #8	Moderate Intensity (Freshmen): Perceived Self-Efficacy (p=.006) Moderate Intensity (Seniors): Perceived Severity (p<.001) Vigorous Intensity (Freshmen): Perceived Self-Efficacy (p<.001); Perceived Barriers (p=.006) Vigorous Intensity (Seniors): Perceived Benefits (p=.006); Perceived Severity (p=.009); Gender (p=.022); Males > Females

CHAPTER 5

DISCUSSION

The purpose of this chapter is to discuss the knowledge, engagement and perceptions of the ACSM guidelines for cardiovascular physical activity among university undergraduate students. This chapter is divided into five sections 1) Summary of findings, 2) Implications, 3) Limitations, 4) Future research, and 5) Conclusion.

Summary of Findings

The purpose of this study was to evaluate the knowledge, engagement, and perceptions of the ACSM guidelines for cardiovascular physical activity among university freshmen and seniors. The students' knowledge, engagement, and perceptions of these guidelines were based on a combination of individual demographic characteristics, self-reported levels of knowledge and engagement in cardiovascular physical activity, as well as, an application of the Health Belief Model (HBM).

Individual Demographic Characteristics

The demographic profile of the study subjects was consistent with the students that are currently enrolled at The University of Alabama. While gender (higher representation of females) and living status (higher representation of on-campus students) was less representative of the campus as whole, the overall distribution of student responses was consistent by year in school, age, race, and greek affiliation status. The individual demographic characteristics of the

respondents were also consistent with the overall campus population with over 95% falling within the 18-25 year old age range.

Knowledge of ACSM Guidelines

The study subjects' knowledge of the ACSM guidelines for cardiovascular physical activity determined approximately half of the questions being answered correctly. A stricter guideline was used to determine the accuracy of responses to these questions (Morrow et al., 2004; NCI HINTS survey, 2007). Only one in three students were able to accurately identify the recommended guidelines for frequency of physical activity. These findings parallel those of other studies (Bennett et al., 2009) with respect to adult populations. From the Health Information National Trends Survey (HINTS), half of the students surveyed under reported the number of days per week of moderate physical activity required for health benefit. To the practitioner, this represents a challenge in finding effective ways to increase awareness of the recommended frequency of physical activity. Students could benefit from consistent announcements through varied marketing efforts aimed to increase their overall knowledge of the physical activity recommendations.

With respect to the duration of a physical activity session, half of the students answered the knowledge questions correctly. Of those incorrect responses, students answered with durations lower than recommended by the ACSM, signifying a belief that meeting guidelines on a daily basis required less time than the actual ACSM guidelines recommended. The incorrect knowledge of duration, combined with an inaccurate knowledge of frequency of engagement, could reflect a belief that engagement on fewer days per week with less time per day will satisfy the health requirements for physical activity.

Three out of 4 students correctly identified that they do not need to participate in vigorous intensity activities to receive health benefits. This knowledge appears to reflect an accurate understanding of the multiple ways individuals can attain health benefits through moderate intensity efforts. More fundamentally, students overwhelmingly (90.7%) understood that moderately intense bouts of physical activity can provide adequate health benefits. These findings may signal a shift of understanding and engagement in physical activity from previous findings (Leslie, et al, 1999; Keating et al., 2005) where vigorous intensity was more likely to be the preferred form of engagement. This may also reflect recognition of the role moderate intensity physical activity plays in overall health.

When students were asked to acknowledge a statement that included the actual ACSM guidelines for frequency and duration of moderate intensity physical activity, their responses were largely (80.3%) accurate. The students were able to recognize that all individuals should engage in moderate levels of physical activity and appear to find these levels to be reasonable and attainable. These findings corroborate those of Morrow et al. (2004) where respondents exhibited knowledge of how to be physical activity.

An interesting finding was the lack of knowledge of the health benefits of incremental sessions of physical activity over a given day, as compared to full and continuous engagement sessions. With two of three students failing to recognize this benefit, it seems to point to a misunderstanding of the role these types of durations of physical activity can play. This is particularly salient to previous studies finding that students engage in less physical activity upon arrival to campus and cite time restrictions as a more pervasive reason for failing to maintain adequate levels of physical activity (Bray & Born, 2004; Buckworth & Nigg, 2004; Keating et al., 2005; Nelson, 2007; Sallis, 1996). This finding may be particularly important to improving

engagement among freshmen where barriers such as, a lack of time, appear to be stronger than among seniors.

The knowledge of ACSM guidelines for cardiovascular physical activity did not vary greatly based on the demographic characteristics of the respondents. A student's knowledge was not influenced by their age, year in school, race, Greek-affiliation, or their campus residential status. Gender was the only individual demographic characteristic that showed significant differences in levels of knowledge. The female students' knowledge of ACSM guidelines for physical activity was found to be higher than that of her male counterparts. This finding was consistent with other studies (Bennett et al., 2009; Morrow et al., 2004) where female respondents more accurately answered questions regarding ACSM guidelines. An explanation for this difference may be attributable to womens' greater attention to recommendations for modifiable health behaviors (Bennett et al., 2009).

While year in school did not reflect a significant difference in knowledge, further review of the Morrow et al. (2004) findings determined that education did play a role in knowledge when comparing college and university graduates with high school-only graduates and those with less than high school education. With respect to under-estimates of the duration of physical activity for health benefit, this lack of accurate knowledge may be contributing to a belief that physical activity is too difficult, by virtue of the time required for benefit. At this point, it appears that knowledge, while not sufficient in changing behavior without other factors, plays an important role in stimulating appropriate behavior (Morrow et al., 2004). With the present research, knowledge of ACSM guidelines in a pre-collegiate time frame is important to establish consistent engagement in physical activity.

Engagement in Cardiovascular Physical Activity

The undergraduate students' engagement in cardiovascular physical activity presents a varied landscape for the health practitioner. As the research depicts, the students actual engagement varied based on the intensity of the activity. The use of two different survey questions (ACHA, 2008 & IPAQ, 2002) allowed for internal agreement on the frequency of engagement. Interestingly, the questions exposed a difference in the responses. In the ACHA questions, students reported more engagement in moderate intensity physical activity than vigorous intensity physical activity, however, the IPAQ questions showed the opposite response with student reporting higher number of days per week of vigorous activity than moderate. The responses from the IPAQ questions were contrary to Nelson et al.'s (2007) observation of a decline in vigorous intensity physical activity among college students.

It should be noted that the survey questions for engagement derived from IPAQ offered more examples of moderate and vigorous physical activity. A better understanding of the differences between the intensities, coupled with the IPAQ questions appearing after the ACHA questions, may have produced some level of learning; thus, presenting an opportunity to re-think their first response to frequencies of engagement in physical activity. Rzewnicki, Vanden Auweele and De Bourdeaudhuij (2003) reported a similar pattern of over-reporting from the IPAQ. This current research may also reflect similar difficulties found in other studies (Keating et al., 2004) with accurate measurement of overall engagement by intensity and the interpretations that researchers and students may apply to these questions.

The students in this study engaged more often in at least one day per week of moderate intensity physical activity (88.8%) than national studies (ACHA, 2008) of college student engagement (75.8%). For vigorous intensity physical activity, students in this research also

engaged more often on at least one day per week (80.4%) compared to national studies (ACHA, 2008) of college student engagement (58.6%). With respect to meeting the ACSM guidelines, study respondents' engagement in moderate intensity physical activity (37.3%) exceeded national studies (ACHA, 2008) of college student engagement (19.1%). For vigorous intensity physical activity, students in this research also reported more engagement (51.1%) compared to national studies (ACHA, 2008) of college student engagement (28.6%).

On average, the students' frequency of engagement in moderate intensity was less than the ACSM guidelines suggest (3.73 days per week compared to 5 days per week based on ACSM guidelines). With respect to individual demographic characteristics, the race of a student was a factor in the level of engagement where White students engaged in this type of physical activity more than their African-American counterparts. Suminski et al. (2002) also found this difference in engagement by race where African-American male and female college students engaged in physical activity less often than White, Asian, and Hispanic students. Additionally, Suminski et al. (2002) found that students who lived on-campus engaged in moderate physical activity more often than off-campus students. This may be attributed to the addition of sophisticated campus recreation facilities and comprehensive university programs that create a beneficial environment for physical activity.

For vigorous physical activity, students met the ACSM recommendations (4.06 days per week compared to 3 days per week based on ACSM guidelines). While year in school did not play a role in this level of engagement, race and gender were significant, where White students engaged in vigorous intensity physical activity more often than African-American students and males engaged more often than females. These findings were consistent with other research studies (Buckworth & Nigg, 2004; Nelson et al., 2007; Suminski, et al., 2002) however, contrary

to Sparling and Snow (2002) who suggested that vigorous intensity physical activity diminished among male and female students over time.

The duration of individual sessions devoted to physical activity (moderate and vigorous intensity=54 minutes) was above the minimum level as recommended by ACSM (moderate intensity=30 minutes, vigorous intensity=20 minutes). Interestingly, while African-American students reported less frequency in moderate and vigorous intensity physical activity, they did report longer bouts of activity on those days of engagement in moderate intensity physical activity. Consistent with the findings for frequency of vigorous intensity physical activity, male students engaged for longer periods of times on their days of activity than female students; a finding also supported by Nelson, et al (2007) where males tended to engage in more days of vigorous physical activity and for longer periods on those days.

This difference may be attributable to the orientation of males to more aggressive and vigorous physical activity through increased exposure and opportunities within scholastic team sports offerings. These affinities may continue during their collegiate experience. With respect to race, African-American reports of higher duration on a given day support the nature of physical activity as often being more group or team sports oriented which lends itself to longer bouts of activity within a period of time than those sessions that White students may engage that are individual in nature. While overall health benefit for each of these students (by race and gender) may be sufficient, those individuals who engage with less frequency may be at higher risk of injury given less overall acclimation to the activity when engaged for longer periods of time.

Walking activity among survey respondents represented several areas of difference. Younger (18-19 years), freshman-classification, White, and on-campus students engaged in more walking than their older (24-25 years), upperclassman, African-American, and off-campus

dwelling peers. This finding supports the role that environment plays on engagement in physical activity and the university's attempt to create a more pedestrian-friendly campus that provides alternatives to motorized vehicle transportation. Keating, et al. (2004) reported there is little research conducted on environmental factors relative to physical activity among college students.

The findings of this study contradicted the findings of Huang et al., (2003), which showed that students' overall engagement in physical activity decreases based on year in school where upperclassmen engaged less often than freshmen. The lack of significant differences in this research with respect to year in school is also supported by several other studies (Calfas et al., 1994; Dunn & Wang, 2003; Pinto & Marcus, 1995). The possibility remains that differences by simple year in school are less pronounced than differences among age, gender, race as well as perceptions toward physical activity.

Health Belief Model (HBM))

The HBM constructs (*perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy, and cues to action*) were compared to the students' knowledge and engagement in physical activity. These perceptions provided an interesting distinction based on students' year in school among other individual demographic characteristics.

With respect to student perceptions toward physical activity, the HBM construct of *perceived susceptibility* to illness or negative condition from physical inactivity when compared to their peers' revealed little overall concern. As with studies measuring this construct and adult adherence to physical activity (Lynch et al., 1992; Miroztnik et al., 1995; Oldridge & Streiner, 1990), little relationship was found. Within year in school classifications, freshman exhibited the least perceived susceptibility, which is consistent with research noting lower perceived levels of vulnerability to health issues among college students in general (Keating, 2004).

The construct of *perceived severity* reflected a difference among intensity of physical activity and year in school classifications. With respect to both moderate and vigorous intensity engagement, seniors perceived a greater threat of adverse consequences from a lack of physical activity than freshmen. Mixed evidence from previous studies (Lynch et al., 1992; Miroztnik et al., 1995; Oldridge & Streiner, 1990), note the positive relationship between this construct and adherence to structured exercise programs.

The construct of *perceived barriers* to physical activity was recognized with respect to freshmen and seniors and vigorous intensity engagement. Freshmen reported barriers as a greater impediment to this level of physical activity than seniors. This finding is supported by the research of Ali and Twibell (1995) where barriers to physical activity were significant to engagement among post-menopausal women and osteoporosis prevention. In terms of an understanding of such barriers as establishing and maintaining time for exercise, overcoming embarrassment, determining locations for physical activity, and perseverance despite a lack of social/family support, freshman appear to incur a period of adjustment and transition to these physical activity barriers while senior students have developed certain skills to allow for such activity.

The students' perceptions of *perceived benefits* varied by year in school, where seniors related this construct positively with engagement in vigorous intensity physical activity. Ali and Twilbell (1995) also recognized this positive relationship of benefits with adult physical activity. The senior students' recognition of the benefits of vigorous intensity physical activity may be further evidence of their knowledge that higher intensity efforts are important to maintaining health over time. This is particularly encouraging in light of Nelson et al. (2007) acknowledging

a decrease in vigorous intensity physical activity as students progress through their collegiate experience.

Perceived self-efficacy was related to freshmen engagement in both moderate and vigorous physical activity. Consistent with other studies (Courneya & McAuley, 1994; Hoffstetter, 1991; Yordy & Lent, 1993), self-efficacy has been positively associated with adherence to physical activity. The fact that this construct is evident with freshman further supports the developmental phase of transition and empowerment that college students seem to acquire during these years. As noted in other studies among college students (Sullum et al., 2000; Wallace et al., 2000) self-efficacy is a strong determinant of both physical activity establishment as well as maintenance of such behavior.

Cues to action did not reflect any differences in engagement among freshmen and seniors; however, this construct was related to knowledge of ACSM guidelines among freshman. This could represent an opportunity to utilize media and marketing efforts to inform freshmen of the recommended guidelines for physical activity, which may result in increase physical activity in their college years. Tergerson and King (2002) found the specific cue of exercise with a friend as a strong determinant toward participation in physical activity.

Implications

Practitioners of campus-based physical activity and fitness facilities may wish to integrate the findings from this research to aid engagement in physical activity. Given the differences in participation and perceptions to engagement among college students, tailored programs, services and facilities can have a meaningful impact on students' health.

The gender differences with respect to vigorous intensity physical activity suggest creating programs and services that typically are most popular with female students (group

exercise classes and personal training sessions) (Keating et al., 2005) and that develop an understanding and application of vigorous intensity physical activity. Male students may be better served by creating popular campus programs such as intramural and club sports offerings that accentuate significant amounts of moderate and vigorous intensity physical activity (Dinger, 1999). Ample research suggests that physical activities that are enjoyable, regardless of gender identification, are more likely to maintain consistent engagement (Braithwaite et al., 2003). Gaining student input in the decisions regarding programs and services may better ensure the important aspect of enjoyment in physical activity that may differ based on gender (Braithwaite et al., 2003).

Campus fitness professionals may wish to establish and promote fitness programs and services that include an application of both moderate and vigorous physical activities (Keating et al., 2004). The differentiation by intensity may assist in bridging the gap in engagement based on ACSM guidelines; thus, leading to a reduction in the decline of vigorous intensity physical among college students (Keating et al., 2004; Nelson et al., 2007). For example, differences in engagement by race, as this research confirms, suggest the need for emphasis in vigorous intensity programs that target African-American students. Dunn and Wang (2003) found a similar trend toward less physical activity among Asian and African-American students. At this point, an understanding of the cultural differences and ethnically popular programs within a diverse campus setting may serve as an advantage to bridging the gap in physical activity.

Students' transition and integration to college is often difficult and is usually attained in stages (Terenzini et al., 1994). The HBM suggests that perceptions, along with individual demographic characteristics, play a strong role in mediating behavior change. This research study found that college students exhibit a wide range of perceptions toward engagement in

physical activity. Therefore, the importance of self-efficacy among freshmen cannot be overstressed. The critical first 6-8 weeks of a student's first semester on campus is an essential time to communicate educational opportunities of specific activities that may aid their engagement in physical activity. As possible methods to increase knowledge and self-efficacy, campus fitness practitioners may consider such programs as: freshman welcome nights at campus recreational facilities, group exercise classes offered at the freshman residence halls, free personal training consultations, and special intramural sport leagues designed for freshman participation. These programs, among many others, can reinforce concepts of access and availability to new students as well as empowerment through specific training opportunities to allow students to learn how to use equipment, register and attend classes, become part of teams and otherwise overcome the inevitable intimidation that comes with establishing new routines.

Not surprisingly, freshman also reported higher levels of *perceived barriers* to physical activity. It may be unreasonable to expect that these barriers will disappear during the first year of college but with improved self-efficacy, through participation in activities that expose the benefits of physical activity, they may have an impact on physical activity engagement. Campus health and fitness providers should give thought to promoting programs that have a wide variety of convenient times and locations which include activities that address the multiple skill and experience levels of the student. In order to minimize the potential intimidation that accompanies engagement in unfamiliar settings, specialized training and assistance with the exercise equipment should be readily available. Also, based on the research of Tergerson and King, (2002) it is important for universities to promote events and activities where freshmen can socialize and participate in group settings with their friends.

The importance of knowledge acquisition is particularly salient to freshmen engagement. Given a general lack of concern with susceptibility to disease associated with physical inactivity, health education and activity classes may offer freshman students positive opportunities to develop knowledge of the health benefits of physical activity and the accompanying skills to maintain such behavior (Keating et al., 2005). Academic courses along with campus recreational/fitness offerings should attempt to complement one another with shared resources (facilities, equipment, and staff) to the largest extent possible.

Senior students' perceptions toward physical activity may be developed throughout their campus experience. Their recognition of the HBM constructs were different from freshmen and were evidenced by their motivation with respect to physical activity. While it cannot be stated that senior students possess a complete understanding of the potentially negative impact on health from physical inactivity, their heightened sense of perceived severity serves as an opportunity for health educators and practitioners to better promote long term adherence and lifetime appreciation for physical activity. To this end, the campus-based fitness providers should promote lifestyle activities that recognize individual physical activity, as opposed to, more group and team sport-oriented opportunities which become less available as students leave the collegiate setting.

Senior students' engagement is related to the perceptions of the benefits of physical activity. Consistent with the finding of Leslie et al. (1999), college students expressed an affinity to engagement based on looking good (for males-muscle gain and for females-weight loss or control). This desire to look good may not be considered a primary health benefit of physical activity but it can be argued that such an emphasis may serve as a catalyst to maintaining physical activity for more direct and tangible health reasons. Health educators and practitioners

may wish to promote the healthy definitions of looking good by emphasizing the key components of physical health (muscular endurance, muscular strength, cardiovascular endurance, body fat composition and flexibility). Like freshmen, the seniors' lack of perception of susceptibility contributes to a lower level of understanding of the importance of these components (Keating et al., 2004). The students at this stage of maturity and development should be considered candidates for programs and services that express individual health benefits beyond college.

Limitations

This study has important limitations that should be recognized. This section will discuss the limitations of the current research project and will be divided into three areas: 1) study design, 2) survey instrument, and 3) response rate.

Study Design

The study design is cross-sectional and represents a snapshot in time of the knowledge, engagement, and perceptions of students of this particular institution. The conclusions and findings, while germane to the campus of study, cannot be generalized to campus settings in other geographic locations, of larger or smaller sizes or different in terms of public or private affiliation. Also, care should be taken in recognizing the effect that college health and recreation facilities may have on overall engagement in physical activity. These findings may have different application in settings with more or less campus maintained and supervised facilities. This effect, based on a lack of direct research, remains unclear (Keating et al., 2004).

The study also relied on survey respondents self-report of physical activity. While unlikely to be grossly inaccurate, as with any self-reported data, students may be more or less inclined to give responses that researchers would want to receive or to report levels of

engagement or knowledge that may be greater than actual levels relevant to physical activity. Howard (1994) determined that despite this potential limitation, the benefits of this type of research of human subjects had conceptual advantages that made it an acceptable means of collecting data.

Survey Instrument

The survey instrument was designed using multiple, validated surveys attempting to accurately measure knowledge, engagement, and perceptions of physical activity. While the overall survey was not validated, the effort to use intact questions, instructions and scales, wherever possible, was undertaken. An example of this attempt occurred with the use of the short-version IPAQ (IPAQ, 2002) survey fully intact.

The questions that measured the knowledge of the ACSM guidelines were scored in a slightly different manner than the previous research (Morrow et al., 2004) on this subject. The more restrictive interpretation of certain levels of responses may have netted a lower overall correct response score; however, this research sought to gauge accurate responses where over interpretation of ACSM guidelines may be predictive of lower levels of engagement (Bennett et al., 2009). Despite attempts to explain and cite examples of moderate and vigorous physical activity, there remains the possibility for confusion and correct reporting of each of these intensities. This challenge has been found in other research efforts examining multiple levels of intensity of physical activity (Nelson et al., 2007). As certain HBM questions were utilized in partial sub-scales, reliability of these questions and Cronbach alpha levels were found to range from moderate to excellent.

Response Rate

The bias of respondents already engaging in physical activity, where individuals who did not respond are not represented in the sample (non-response bias), is a potential limitation to the accuracy of measurement of engagement for the population as a whole. While this possibility exists within this research, other studies (Craig, Cameron, Griffiths, Bauman, Tudor-Locke, & Anderson, 2009) found no significant impact on physical activity trend estimates due to differential non response rates.

The survey response rate of 4.0% was lower than anticipated; however, the large number of surveys completed assisted in creating a normal distribution that was representative of the campus of study. The nature of electronic (email) surveys may have contributed to this lower rate as some previous research indicates (Porter & Umbach, 2004). These response rates were consistent with other collegiate surveys using this method (Sax et al., 2003).

The survey was conducted at the beginning of the spring semester and may be biased by a predisposition to report engagement based on the effect of a New Year commitment and/or the increased opportunities that present at the beginning of an academic period. This threat to validity was minimized by the survey remaining open beyond the initial portion of the academic year. The engagement questions asked for past seven day activity and given the time period of the survey, certain respondents may not have been able to accurately assess and report activity so close to the beginning of a semester. Furthermore, the time period of the survey may have limited some levels of engagement given less opportunities for outdoor physical activities (weather) or limited access to indoor fitness facilities (over-crowding)

In an effort to increase the survey response rate, residence halls were targeted as a place of recruitment. While these efforts resulted in more surveys completed, the percentage of

freshman (given the required first year on campus living experience) was elevated. This also reflected a slight weighing of the data to younger-aged students. Consistent with other studies (Porter and Umbach, 2006) among college students, female responses were higher than the campus percentage as whole. Given the large overall number of surveys completed, year in school and gender differences found in the research should not be considered less significant.

Future Research

This research project established many opportunities for the expansion and emphasis of future research among college students regarding their knowledge, engagement and perceptions of physical activity. The recognition of the unique differences among the students, by virtue of the collegiate experience, offers ample evidence to review in greater depth the mediators that impact decisions to engage in physical activity. The need for improved evidence-based interventions is extremely important in the area of physical activity (Ballaw, Brownson, Haire-Joshu, Heath, & Kreuter, 2010). Such interventions may be useful to establishing guidelines for real-world practices allowing for unique differences such as those finding in college settings. As a first step in creating a more collegiate-specific research more studies are needed in campus settings. To improve external validity, a mix of private and public, large and small, region/geographically diverse, and land-grant and historically black colleges and universities need to be sites for such research.

This research found a variance in motivating factors among this unique population; therefore, a call for qualitative research may be reasonable and recommended. A better personal articulation of the perceptions that students have toward physical activity, based on their years of undergraduate study, will greatly assist health educators and practitioners alike. From such

research, truly applicable programs and services that overcome barriers, increase real benefits, and aid in self-efficacy, can be created and implemented.

Given the conspicuous absence of research on physical activity among college students, longitudinal studies observing a specific student cohort over time are recommended. A freshman class may be analyzed over time to truly determine, not only the specific changes in physical activity, knowledge, and perceptions, but also the all-important higher education concerns of effect on recruitment and retention from this behavior. Such research may reasonably extend to include the review of knowledge, engagement and perceptions of graduate students. While acknowledging the time costs of such research, true understanding of the behavior change over time could be served with this form of analysis.

The quantitative analysis of physical activity can be refined as survey instrumentation is addressed. For this research, a merger of validated surveys proved useful and convenient; however, for future research, the use of validated, intact and comprehensive surveys for knowledge, engagement and perceptions are recommended. To the researcher's knowledge and based on review, there are no fully intact surveys for physical activity that assess all six of the constructs of the HBM.

While the HBM proved a very intriguing and useful model for examining student perceptions of physical activity, a review of the literature suggests that other theories, such as the Transtheoretical Model and Theory of Planned Behavior as well as the increasingly popular application of Social Ecological Models, provide valuable research opportunities for the future. When bearing in mind the purpose of this research in examining freshmen and seniors and their similarities and distinctions, it is possible that some combination of the constructs of these models and theories may further serve research with college students and physical activity.

Lastly, the domain of college students and physical activity research should not be exclusive to health educators in academic areas. Campus fitness and recreation professionals occupy an important role as front-end providers of programs and services, as well as managing experts on the supervision and function of sophisticated campus recreation and fitness facilities. Providing these professionals with a working understanding of research (qualitative and quantitative) will empower these key stakeholders in implementing programs and designing facilities that best meet the changing needs of the college student. A strong emphasis on research from institutional and national association organizations will further the understanding of college students and physical activity.

Conclusion

The rising incidence of chronic disease is a cause for immediate action. With roughly half of the college student population not engaging in physical activity, the need for interventions and programs tailored to this market is essential. Informing college students during a time of growth and maturation within settings where knowledge acquisition is stressed offers opportunities to combat physical inactivity before poor adherence leads more directly to the premature onset of disease. Improving their knowledge of the ACSM guidelines, though not a panacea for healthy engagement, increases the student's awareness of the many alternatives that exist to initiate physical activity in tangible and realistic ways. The behavior patterns established earlier in life have more potential to remain in place through time.

College students reasons to engage (or not) are varied and unique. Beyond these reasons, college students are obviously not all the same in their knowledge, motivation and engagement in physical activity. One-size-fits-all programs, even among relatively homogenous student populations, will not meet the needs of many who need such engagement the most. As the

perceptions of physical activity among college students by year in school and other demographic characteristics present a wide landscape of information for the health educator and practitioner, so do the potential methods by which effective programs and services can be established to best address such varied populations. As researchers determine the effects of the time in college on student's knowledge, engagement and perceptions, more effective strategies for physical activity can be created and evaluated.

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APPENDIX A

IRB APPROVAL

Office for Research

Institutional Review Board for the
Protection of Human Subjects

THE UNIVERSITY OF
ALABAMA
RESEARCH

December 23, 2009

George Brown
University Recreation
Box 870373

Re: IRB#: 09-OR-363 "Knowledge, Engagement and Perceptions of the American College of Sports Medicine Guidelines for Cardiovascular Physical Activity: An Undergraduate Comparison"

Dear Mr. Brown:

The University of Alabama Institutional Review Board has granted approval for your proposed research.

Your application has been given expedited approval according to 45 CFR part 46. You have also been granted the requested waiver. Approval has been given under expedited review category 7 as outlined below:

(7) Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies

Your application will expire on December 22, 2010. If your research will continue beyond this date, complete the relevant portions of Continuing Review and Closure Form. If you wish to modify the application, complete the Modification of an Approved Protocol. Changes in this study cannot be initiated without IRB approval, except when necessary to eliminate apparent immediate hazards to participants. When the study closes, complete the appropriate portions of the Continuing Review and Closure Form.

Should you need to submit any further correspondence regarding this proposal, please include the above application number.

Good luck with your research.

Sincerely,

Carpantato T. Myles, MSM, CIM
Director & Research Compliance Officer
Office of Research Compliance
The University of Alabama

152 Rose Administration Building
Box 870117
Tuscaloosa, Alabama 35487-0117
(205) 348-5152
FAX (205) 348-8882

APPENDIX B

PRE-NOTIFICATION CARD

Coming Soon!!!!!

A survey for UA Undergraduate Students

George M. Brown, PhD Candidate,
is conducting a survey to evaluate your knowledge, engagement and perceptions.
Look for the survey in your email next week.

APPENDIX C

SGA LETTER OF SUPPORT

Student Government Association

THE UNIVERSITY OF
ALABAMA
STUDENT GOVERNMENT

October 23, 2009

George M. Brown
University Recreation
The University of Alabama
Box 870373
Tuscaloosa, AL 35487

Dear Mr. Brown,

I am pleased to offer my strong support for your research study titled "Knowledge, Engagement, and Perception of the ACSM Guidelines for Cardiovascular Activity: A University Freshman and Senior Comparison" which seeks approval from your dissertation committee and the UA Institutional Review Board. Your proposed project addresses the extremely important health component of physical activity, among The University of Alabama student population which can possibly be translated to university students across the nation.

The University of Alabama Student Government Association is happy to assist with your pilot study. I agree to recruit at least 10 students (a minimum of 5 sophomores and 5 juniors) to complete your electronic pilot survey in which they will give immediate feedback regarding its ease of use, readability and study relevance. It is my understanding that the study survey will take approximately 15 minutes to complete and the follow-up questionnaire will take an additional 10 minutes. I am very encouraged that this process is electronic so that the student volunteers may complete the survey at their leisure.

I enthusiastically support your research study and your efforts. If I can be of further assistance at any time now and in the future, please do not hesitate to contact me.

Sincerely,

James Fowler, Vice President for External Affairs
Student Government Association
The University of Alabama

231 Ferguson Center
Box 870292
Tuscaloosa, Alabama 35487-0292
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APPENDIX D

PILOT TEST SURVEY

Knowledge, Engagement and Perceptions Among University Undergraduates
Pilot Test Survey Questions

Thank you for taking the time to complete the survey. Your responses to the following questions regarding the survey and your experience taking the survey will be most helpful in ensuring that responses will assist in researching the intended aims of the study. Please take a few moments to answer these questions.

1. Did you feel comfortable answering the questions?
   Yes _____
   No _____
   Comments: _____

2. Is the wording of the survey clear?
   Yes _____
   No _____
   Comments: _____

3. Is the time reference clear to the respondents?
   Yes _____
   No _____
   Comments: _____

4. Are the answer choices compatible with your experience in this matter?
   Yes _____
   No _____
   Comments: _____

5. Did any of the items require you to think too long or hard before responding? If so, which ones?
   Yes _____
   No _____
   Comments: _____

6. Which items, if any, produce irritation, embarrassment, or confusion?
   Comments: _____

7. Is the survey too long?
   Yes _____
   No _____
   Comments; _____

Thank you again!

APPENDIX E

SURVEY

Knowledge, Engagement, and Perceptions Among University Freshmen and Seniors

Please answer the following questions.

1) How many days a week of physical activity or exercise of at least moderate intensity are recommended for the average adult to stay healthy? (e.g. walking, mowing the lawn, shooting basketball, tennis, dancing, etc.)

_____

2) On those days, how long should the average adult be physically active to stay healthy?

_____
□ Minutes
□ Hours

3) What is the minimum number of days per week you believe a person must be physically active in order to receive any health benefit?

_____

4) What is the minimum length of time (in minutes) one needs to be physically active throughout a typical day in order to achieve a health benefit?

_____

5) Vigorous levels of physical activity are necessary to provide a health benefit.

_____ True
_____ False

6) Moderate levels of physical activity do NOT provide any health benefits.

_____ True
_____ False

7) Ten minutes of physical activity three times per day provide the same health benefits as a single session of 30 minutes.

_____ True
_____ False

8) Everyone should get 30 minutes of moderate physical for a minimum of 5 days per week.

_____ True
_____ False

9) On how many of the past 7 days did you?
Do moderate intensity cardio or aerobic exercise (caused a noticeable increase in heart rate, such as a brisk walk) for at least 30 minutes?

- **0 days**
- **1 day**
- **2 days**
- **3 days**
- **4 days**
- **5 days**
- **6 days**
- **7 days**

10) On how many of the past 7 days did you?
Do vigorous intensity cardio or aerobic exercise (caused large increases in breathing or heart rate, such as jogging) for at least 20 minutes?

- **0 days**
- **1 day**
- **2 days**
- **3 days**
- **4 days**
- **5 days**
- **6 days**
- **7 days**

I am going to ask you about the time you spent being physically active in the last 7 days. Please answer the questions even if you do not consider yourself to be an active person. Think about the activities you do at school, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Now, think about all the *vigorous* activities which take *hard physical effort* that you did in the last 7 days. Vigorous activities make you breathe much harder than normal and may include heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for at least 10 minutes at a time.

11) During the *last 7 days,* on how many days did you do *vigorous* physical activities?

_____ Days per week

12) How much time did you usually spend doing *vigorous* physical activities on one of those days?
___ ___ Hours per day
___ ___ Minutes per day

Now, think about activities which *moderate physical effort* that you did in the last 7 days. Moderate physical activities make you breathe somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Again, think only about those physical activities that you did for at least 10 minutes at a time.

13) During the *last 7 days*, on how many days did you do *moderate* physical activities?

_____ Days/week

14) How much time did you usually spend doing *moderate* physical activities on one of those days?
____ ___ Hours per day
___ ___ Minutes per day

Now think about the time you spent walking in the last 7 days. This includes at school and at home, walking to travel from place to place and any other walking that you might do solely for recreation, sport, exercise, or leisure.

15) During the *last 7 days,* on how many days did you *walk* for at least 10 minutes at a time?

____ Days per week

16) How much time did you usually spend *walking* on one of those days?

___ ___ Hours per day
___ ___ Minutes per day

Now think about the time you spent sitting on week days during the last 7 days. Include time spent at work, at home, while doing course work, and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television.

17) During the last 7 days, how much time did you usually spend *sitting* on a *week day?*

___ ____ Hours per weekday
___ ____ Minutes per weekday

18) For the following questions, please state whether you agree or disagree with the following statements.

a. I am more physically active than others my age and sex.	Strongly Agree	Agree	Disagree	Strongly Disagree
b. I am more likely than others my age and sex to become overweight.	Strongly Agree	Agree	Disagree	Strongly Disagree
c. I am more likely than others my age and sex to become out of shape.	Strongly Agree	Agree	Disagree	Strongly Disagree
d. I am more likely than others my age and sex to have heart problems.	Strongly Agree	Agree	Disagree	Strongly Disagree
e. I am more likely than others my age and sex to have health problems.	Strongly Agree	Agree	Disagree	Strongly Disagree
f. I am more likely than others my age and sex to die earlier than normal.	Strongly Agree	Agree	Disagree	Strongly Disagree
g. If I am not physically active, I will become overweight.	Strongly Agree	Agree	Disagree	Strongly Disagree
h. If I am not physically active, I will get out of shape.	Strongly Agree	Agree	Disagree	Strongly Disagree
i. Physical inactivity would cause me to have heart problems.	Strongly Agree	Agree	Disagree	Strongly Disagree
j. Physical inactivity would cause me to have health problems.	Strongly Agree	Agree	Disagree	Strongly Disagree
k. Being physically inactive makes me feel lazy.	Strongly Agree	Agree	Disagree	Strongly Disagree
l. Being physically inactive makes me feel bad.	Strongly Agree	Agree	Disagree	Strongly Disagree
m. If I were not physically active, I would not be able to do a lot of things.	Strongly Agree	Agree	Disagree	Strongly Disagree
n. If I were not physically active, I would die earlier than normal.	Strongly Agree	Agree	Disagree	Strongly Disagree

Below are statements that relate to ideas about exercise. Please indicate the degree to which you agree or disagree with the statements by circling strongly agree, agree, disagree, or strongly disagree

o. Exercise decreases feeling of stress and tension for me.	Strongly Agree	Agree	Disagree	Strongly Disagree
p. Exercising takes too much of my time	Strongly Agree	Agree	Disagree	Strongly Disagree
q. Exercising lets me have contact with friends and persons I enjoy.	Strongly Agree	Agree	Disagree	Strongly Disagree
r. I am too embarrassed to exercise.	Strongly Agree	Agree	Disagree	Strongly Disagree
s. Exercise facilities do not have convenient schedules for me.	Strongly Agree	Agree	Disagree	Strongly Disagree
t. I will live longer if I exercise.	Strongly Agree	Agree	Disagree	Strongly Disagree
u. My family members do not encourage me to exercise.	Strongly Agree	Agree	Disagree	Strongly Disagree
v. Exercising increases my mental alertness	Strongly Agree	Agree	Disagree	Strongly Disagree
w. Exercise is hard work for me.	Strongly Agree	Agree	Disagree	Strongly Disagree
x. Exercise improves the way my body looks.	Strongly Agree	Agree	Disagree	Strongly Disagree
y. I can overcome barriers and challenges with regard to physical activity and exercise if I try hard enough	Strongly Agree	Agree	Disagree	Strongly Disagree
z. I can find means and ways to be physically active and exercise	Strongly Agree	Agree	Disagree	Strongly Disagree
aa. I can accomplish the physical activity and exercise goals that I set	Strongly Agree	Agree	Disagree	Strongly Disagree
bb. When I am confronted with a barrier to physical activity or exercise I can find several solutions to overcome this barrier	Strongly Agree	Agree	Disagree	Strongly Disagree
cc. I can be physically active or exercise even when I am tired	Strongly Agree	Agree	Disagree	Strongly Disagree

dd. I can be physically active or exercise even when I am feeling depressed	Strongly Agree	Agree	Disagree	Strongly Disagree
ee. I can be physically active or exercise event without the support of my family and friends	Strongly Agree	Agree	Disagree	Strongly Disagree
ff. I can be physically active or exercise even without the help of a therapist or trainer	Strongly Agree	Agree	Disagree	Strongly Disagree
gg. I can motivate myself to start being physically active or exercising again after I've stopped for a while.	Strongly Agree	Agree	Disagree	Strongly Disagree
hh. I can be physically active or exercise even if I had no access to a gym, exercise training, or rehabilitation facility	Strongly Agree	Agree	Disagree	Strongly Disagree

How strongly do you disagree or agree that each of the following is helpful in encouraging you to exercise.

ii. Seeing spring/summer clothes that you would like to buy.	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
jj. Looking at myself in the mirror	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
kk. Being reminded of the health benefits of physical activity	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
ll. Seeing pictures of physically fit people in magazines or on TV.	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree
mm. Watching exercise on TV.	Strongly Disagree	Disagree	Somewhat Disagree	Neutral	Somewhat Agree	Agree	Strongly Agree

19) What is your year in school?

- □ **Freshman**
- □ **Sophomore**
- □ **Junior**
- □ **Senior**

20) What is your age? _____

21) What is your gender?

□ **Male** □ **Female**

22) What is your race?

- □ **African American**
- □ **White**
- □ **Hispanic**
- □ **Asian**
- □ **Other (please specify)**

If you selected other, please specify

_____

23) Are you a member of a Greek organization (fraternity or sorority)?

□ **Yes** □ **No**

24) Where do you live now?

□ **Off Campus** □ **On Campus**

25) What is the zip code of your permanent (hometown) address?

_____

26) Please share any comments or concerns you have about physical activity on the UA campus.

_____

_____

_____

Thank you for taking the time to complete this survey.

APPENDIX F

SURVEY WITH CITATIONS AND JUSTIFICATIONS

Knowledge, Engagement and Perceptions among University Undergraduates

Please answer the following questions.

1) How many days a week of physical activity or exercise of at least moderate intensity are recommended for the average adult to stay healthy? (e.g. walking, mowing the lawn, shooting basketball, tennis, dancing, etc.)

_____

Scale Name / Construct or Behavior it measures: Knowledge of ACSM Guidelines for frequency of moderate physical activity.

Reference: 2007 Health Information National Trends Survey (HINTS) Question #BRQ1045

Reliability & Validity: Note from HINTS analytical staff in direct question of validity and reliability:
"These questions do not lend themselves well to traditional measures of reliability--they cannot be used as a scale so there is no measure of internal consistency, and no test-retest reliability can be conducted since HINTS is a cross-sectional survey. Face validity is high since these are knowledge questions and simply ask for information while their construct validity can be tested by looking at convergent and discriminant validity as tested by individual researchers".

A statement telling us if all of the items are included from this scale. **If they are not, please state why.**
Open ended question from a telephone survey format. Scale as appears in 2007 HINTS.

A statement telling us if you altered the original wording of the items and if so, how.
Examples of moderate physical activity were added using activities as cited from the ACSM 2009 Guidelines for Exercise Prescription.

List all the items from this scale that you are proposing to use. Use of scale as it appears in 2007 HINTS.

2) On those days, how long should the average adult be physically active to stay healthy?

_____

□ **Minutes**
□ **Hours**

Scale Name / Construct or Behavior it measures: Knowledge of ACSM Guidelines for duration of moderate physical activity.

Reference: 2007 Health Information National Trends Survey (HINTS) Question #BRQ1050.

Reliability & Validity: Note from HINTS analytical staff in direct question of validity and reliability:
"These questions do not lend themselves well to traditional measures of reliability--they cannot be used as a scale so there is no measure of internal consistency, and no test-retest reliability can be conducted since HINTS is a cross-sectional survey. Face validity is high since these are knowledge questions and simply ask for information while their construct validity can be tested by looking at convergent and discriminant validity as tested by individual researchers".

A statement telling us if all of the items are included from this scale. If they are not, please state why. Open ended question from a telephone survey format. Scale as appears in 2007 HINTS.

A statement telling us if you altered the original wording of the items and if so, how. No alteration of wording.

List all the items from this scale that you are proposing to use. Use of scale as it appears in 2007 HINTS.

3) What is the minimum number of days per week you believe a person must be physically active in order to receive any health benefit?

_____

4) What is the minimum length of time (in minutes) one needs to be physically active throughout a typical day in order to achieve a health benefit?

_____

5) Vigorous levels of physical activity are necessary to provide a health benefit.

_____ **True**
_____ **False**

6) Moderate levels of physical activity do NOT provide any health benefits.
_____ **True**
_____ **False**

7) Ten minutes of physical activity three times per day provide the same health benefits as a single session of 30 minutes.

_____ True
_____ False

8) Everyone should get 30 minutes of moderate physical for a minimum of 5 days per week.

_____ True
_____ False

Scale Name / Construct or Behavior it measures: National Coalition for Promoting Physical Activity Questionnaire (NCPPA). Interview questions (#1-#6) asked about physical activity. Knowledge of ACSM Guidelines for physical activity.

Reference: Morrow, J.R., Krezwinski-Malone, J.A., Jackson, A.W., Bungum, T.J., FitzGerald, S.J. (2004). American Adults' Knowledge of Exercise Recommendations. *Research Quarterly for Exercise and Sport*, 7(3), 231-237.

Reliability & Validity: Kuder-Richardson internal consistency reliability was .59 (moderate value). Scale demonstrates content-related validity as items reflect physical activity recommendations of the time (Morrow et al., 2004). Expert panel review conducted on questionnaire.

A statement telling us if all of the items are included from this scale. **If they are not, please state why.**
Six of the 7 interview questions for physical activity were included. The seventh question was omitted as it was not related to guidelines but sought to determine knowledge of difference between lifestyle and traditional activities.

A statement telling us if you altered the original wording of the items and if so, how. No alteration of wording was conducted with these questions.

List all the items from this scale that you are proposing to use. Questions #1-#6 from the Morrow et al. survey will be used as questions #3-8 in my proposed survey. .

9) On how many of the past 7 days did you:
Do moderate intensity cardio or aerobic exercise (caused a noticeable increase in heart rate, such as a brisk walk) for at least 30 minutes?

- □ **0 days**
- □ **1 day**
- □ **2 days**
- □ **3 days**
- □ **4 days**
- □ **5 days**
- □ **6 days**
- □ **7 days**

Scale Name / Construct or Behavior it measures: Engagement in moderate physical activity.

Reference: American College Health Association National College Health Assessment (ACHA-NCHA-II, 2008, Question #29A)

Reliability & Validity: Cronbach's alpha of .79

A statement telling us if all of the items are included from this scale. If they are not, please state why. Scale as it appears in 2008 ACHA-NCHA-II.

A statement telling us if you altered the original wording of the items and if so, how. No alteration of wording.

List all the items from this scale that you are proposing to use. Use of scale as it appears 2008 ACHA-NCHA-II.

10) On how many of the past 7 days did you:
Do vigorous intensity cardio or aerobic exercise (caused large increases in breathing or heart rate, such as jogging) for at least 20 minutes?

- □ **0 days**
- □ **1 day**
- □ **2 days**
- □ **3 days**
- □ **4 days**
- □ **5 days**
- □ **6 days**
- □ **7 days**

Scale Name / Construct or Behavior it measures: Engagement in vigorous physical activity.

Reference: American College Health Association National College Health Assessment (ACHA-NCHA-II, 2008, Question #29B)

Reliability & Validity: Cronbach's alpha of .70

A statement telling us if all of the items are included from this scale. If they are not, please state why. Scale as it appears in 2008 ACHA-NCHA-II.

A statement telling us if you altered the original wording of the items and if so, how. No alteration of wording.

List all the items from this scale that you are proposing to use. Use of scale as it appears 2008 ACHA-NCHA-II.

I am going to ask you about the time you spent being physically active in the last 7 days. Please answer the questions even if you do not consider yourself to be an active person. Think about the activities you do at school, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Now, think about all the *vigorous* activities which take *hard physical effort* that you did in the last 7 days. Vigorous activities make you breathe much harder than normal and may include heavy lifting, digging, aerobics, or fast bicycling. Think only about those physical activities that you did for at least 10 minutes at a time.

11) During the *last 7 days,* on how many days did you do *vigorous* physical activities?

_____ days/week _____ don't know/not sure

12) How much time did you usually spend doing *vigorous* physical activities on one of those days?
_____ hours/day _____ minutes/day _____ don't know/not sure

Now, think about activities which *moderate physical effort* that you did in the last 7 days. Moderate physical activities make you breathe somewhat harder than normal and may include carrying light loads, bicycling at a regular pace, or doubles tennis. Again, think only about those physical activities that you did for at least 10 minutes at a time.

13) During the *last 7 days*, on how many days did you do *moderate* physical activities?

_____ days/week _____ don't know/not sure

14) How much time did you usually spend doing *moderate* physical activities on one of those days?
_____ hours/day _____ minutes/day _____ don't know/not sure

Now think about the time you spent walking in the last 7 days. This includes at school and at home, walking to travel from place to place and any other walking that you might do solely for recreation, sport, exercise, or leisure.

15) During the *last 7 days,* on how many days did you *walk* for at least 10 minutes at a time?

____ Days per week

16) How much time did you usually spend *walking* on one of those days?

___ ___ Hours per day
___ ___ Minutes per day

Now think about the time you spent sitting on week days during the last 7 days. Include time spent at work, at home, while doing course work, and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television.

17) During the last 7 days, how much time did you usually spend *sitting* on a *week day?*

___ ____ Hours per weekday
___ ____ Minutes per weekday

Scale Name / Construct or Behavior it measures: International Physical Activity Questionnaire (IPAQ, 2002). Questions #1-#7. Engagement in physical activity.

Reference: International Consensus Group for the Development of an International Physical Activity Questionnaire. *International Physical Activity Questionnaire, 2002.* Available at: http://www.ipaq.ki.se/ipaq.htm

Dinger, M.K., Behren, T.K., Han, J.L. (2006). Validity and reliability of the International Physical Activity questionnaire for college students. *Journal of Health Education.* I37(6):337-343.

Reliability & Validity: Intraclass correlation coefficients(ICC) ranged from .71-.89 indicating moderate to high reliability. Vigorous and moderate physical activity was significantly correlated with accelerometer (ACC) steps and PED steps (ρ*:0.30-0.47,* $p<0.01$*)* and *(*ρ*:0.19-0.23,* $p>0.05$ *)*respectively (Dinger et al., 2006).

A statement telling us if all of the items are included from this scale. If they are not, please state why. All response items included in scale except for options "refused" as this was taken from a telephone survey format. .

A statement telling us if you altered the original wording of the items and if so, how. One word in each of the instruction sections was altered from "work" to "school". No alteration of the words in the questions section was performed other than response "Don't Know/Not Sure" in the scale which were excluded

List all the items from this scale that you are proposing to use. All items except for "refused" and "don't know/not sure" in response options. Questions #1-#7 in the IPAQ will be used in my proposed survey as questions #14-#20

18) For the following questions, please state whether you agree or disagree with the following statements by circling your response:

a. I am more physically active than others my age and sex.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Susceptibility
b. I am more likely than others my age and sex to become overweight.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Susceptibility
c. I am more likely than others my age and sex to become out of shape.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Susceptibility
d. I am more likely than others my age and sex to have heart problems.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Susceptibility
e. I am more likely than others my age and sex to have health problems.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Susceptibility
f. I am more likely than others my age and sex to die earlier than normal.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Susceptibility

Scale Name / Construct or Behavior it measures: Four point Scale. Health Belief Model (HBM) HBM perceived susceptibility for items a-f.

Reference: Juniper, K.C., Oman, R.F., Hamm, R.M., & Kerby, D.S. (2004). The relationship among constructs in the health belief model and the transtheoretical model among African-American college women for physical activity. *American Journal of Health Promotion, 18*(5):354-357. Item a=Question #1 from susceptibility scale. Items b-f=Adapted from questions #1-5 of severity scale.

Reliability & Validity: Item a=Cronbach Alpha .86. Items b-f=Cronbach Alpha .92

A statement telling us if all of the items are included from this scale. If they are not, please state why. Selected items to best measure the construct were included in this scale. Those omitted were more specifically geared towards African American women only.

A statement telling us if you altered the original wording of the items and if so, how. The addition of words, "my age and sex" was introduced into the survey questions.

List all the items from this scale that you are proposing to use. Selected items existing scale proposed use.

g. If I am not physically active, I will become overweight.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Severity
h. If I am not physically active, I will get out of shape.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Severity
i. Physical inactivity would cause me to have heart problems.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Severity
j. Physical inactivity would cause me to have health problems.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Severity
k. Being physically inactive makes me feel lazy.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Severity
l. Being physically inactive makes me feel bad.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Severity
m. If I were not physically active, I would not be able to do a lot of things.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Severity
n. If I were not physically active, I would die earlier than normal.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Severity

Scale Name / Construct or Behavior it measures: Four point Scale. Health Belief Model (HBM) HBM perceived severity for items g-n.

Reference: Juniper, K.C., Oman, R.F., Hamm, R.M., & Kerby, D.S. (2004). The relationship among constructs in the health belief model and the transtheoretical model among African-American college women for physical activity. *American Journal of Health Promotion, 18*(5):354-357. Item g-n=adapted from questions #1-8 of severity scale.

Reliability & Validity: Item g-n=Cronbach Alpha .92

A statement telling us if all of the items are included from this scale. If they are not, please state why. All items included from this scale..

A statement telling us if you altered the original wording of the items and if so, how. No alteration of wording was introduced into the survey questions.

List all the items from this scale that you are proposing to use. All items from existing scale are proposed..

Below are statements that relate to ideas about exercise. Please indicate the degree to which you agree or disagree with the statements by circling strongly agree, agree, disagree, or strongly disagree

o. Exercise decreases feeling of stress and tension for me.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Benefits
p. Exercising takes too much of my time	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Barriers
q. Exercise lets me have contact with friends and persons I enjoy.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Benefits
r. I am too embarrassed to exercise.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Barriers
s. Exercise facilities do not have convenient schedules for me	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Barriers
t. I will live longer if I exercise..	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Benefits

u. My family members do not encourage me to exercise..	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Barriers
v. Exercise increases my mental alertness. .	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Benefits
w. Exercise is hard work for me	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Barriers
x. Exercise improves the way my body looks.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Benefits
y. I can overcome barriers and challenges with regard to physical activity and exercise if I try hard enough.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy
z. I can find means and ways to be physically active and exercise.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy
aa. I can accomplish my physical activity and exercise goals that I set.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy
bb. When I am confronted with a barrier to physical activity or exercise I can find several solutions to overcome this barrier.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy
cc. I can be physically active or exercise even when I am tired.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy

dd. I can be physically active or exercise when I am depressed.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy
ee. I can be physically active or exercise even without the support of my family and friends.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy
ff. I can be physically active or exercise even without the help of a therapist or trainer.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy
gg. I can motivate myself to start being physically active or exercise again after I've stopped for a while.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy
hh. I can be physically active or exercise even if I had no access to a gym, exercise training, or rehabilitation facility.	Strongly Agree	Agree	Disagree	Strongly Disagree	Perceived Self-Efficacy

Scale Name / Construct or Behavior it measures: Likert scale 4-point. Health Belief Model (HBM) Exercise benefits/barriers scale (EBBS) for items o-x, and Exercise self-efficacy scale (ESES) for items y-hh:

Reference: Items f-m: Sechrist, K.R., Walker, S.N., Pender, N.J. (1987). Development and psychometric evaluation of the exercise benefits/barriers scale. *Research in Nursing & Health*, 10(6), 357-365.. Items n-q: Kroll, T., Kehn, M., Ho, P-S., Groah, S. (2007). The SCI Exercise Self-Efficacy Scale (ESES): development and psychometric properties. *International Journal of Behavioral Nutrition and Physical Activity.* 4(34):1479-1485.

Item o: EBBS question #2
Item p: EBBS question #4
Item q: EBBS question #11
Item r: EBBS question #12
Item s: EBBS question #16
Item t: EBBS question #27
Item u: EBBS question #33
Item v: EBBS question #34
Item w: EBBS question #40

Item x: EBBS question #43
Item y: ESES question #ES1
Item z: ESES question #ES2
Item aa: ESES question #ES3
Item bb: ESES question #ES4
Item cc: ESES question # ES5
Item dd: ESES question #ES6
Item ee: ESES question #ES7
Item ff: ESES question #ES8
Item gg: ESES question #ES9
Item hh: ESES question #ES10

Reliability & Validity:
Items o: .954 Cronbach Alpha
Item p: .886 Cronbach Alpha
Item q: .954 Cronbach Alpha
Item ri: .886 Cronbach Alpha
Item s: .886 Cronnbach Alpha
Item t: .954 Cronbach Alpha
Item u: .886 Cronbach Alpha
Item v: .954 Cronbach Alpha
Item w: .886 Cronbach Alpha
Item x: 954 Cronbach Alpha
Item y: 9269 Cronbach Alpha
Item z: 9269 Cronbach Alpha
Item aa: .9269 Cronbach Alpha
Item bb: .9269 Cronbach Alpha
Item cc: .9269 Crombach Alpha
Item dd: .9269 Cronbach Alpha
Item ee: .9269 Cronbach Alpha
Item ff: .9269 Cronbach Alpha
Item gg: .9269 Cronbach Alpha
Item hh: .9269 Cronbach Alpha

A statement telling us if all of the items are included from this scale. If they are not, please state why. Ten of 43 items used in EBBS. Items included best met the purposes of the intended survey audience. All items in ESES used.
A statement telling us if you altered the original wording of the items and if so, how. No alteration of original wording of questions or scales.
List all the items from this scale that you are proposing to use. All items from existing scale proposed use.

How strongly do you disagree or agree that each of the following is helpful in encouraging you to exercise. Circle your response.

ii. Seeing spring/summer clothes that you would like to buy.	SD	D	SWD	N	SWA	A	SA	Cues to Action
jj. Looking at myself in the mirror.	SD	D	SWD	N	SWA	A	SA	Cues to Action
kk. Being reminded of health benefits of physical activity.	SD	D	SWD	N	SWA	A	SA	Cues to Action
ll. Seeing pictures of physically f people in magazines or on TV	SD	D	SWD	N	SWA	A	SA	Cues to Action
mm. Watching exercise on TV.	SD	D	SWD	N	SWA	A	SA	Cues to Action

Scale Name / Construct or Behavior it measures: Likert scale 7-point. Health Belief Model (HBM) cues to action for items ii-mm.

Reference: Items r-u: Tergerson, J.I. & King, K.A. (2002). Do perceived cues, benefits, and barriers to physical activity differ between male and female adolescents? *Journal of School Health.* 72(9):374-379. . Items ii-mm:
Item ii: question #8
Item jj: question #6
Item kk: question #5
Item ll: question #11
Item mm: question # 12
Reliability & Validity:
Item ii: .803 Cronbach Alpha
Item jj: .803 Cronbach Alpha
Item kk: .803 Cronbach Alpha
Item ll 803 Cronbach Alpha
Item mm: .803 Cronbach Alpha

A statement telling us if all of the items are included from this scale. If they are not, please state why. Five of 12 items included in scale. Those included were slected based on survey respondents best understanding and relevance to the questions.
A statement telling us if you altered the original wording of the items and if so, how. No alteration of original wording of questions or scales.
List all the items from this scale that you are proposing to use. All items from existing scale proposed use..

19) What is your year in school?

- □ **Freshman**
- □ **Sophomore**
- □ **Junior**
- □ **Senior**

20) What is your age?

_____

21) What is your gender?

- □ **Male**
- □ **Female**

22) What is your race?

- □ **African American**
- □ **White**
- □ **Hispanic**
- □ **Asian**
- □ **Other (please specify)**

If you selected other, please specify

_____

23) Are you a member of a Greek organization (fraternity or sorority)?

- □ **Yes**
- □ **No**

24) Where do you live now?

- □ **Off Campus**
- □ **On Campus**

25) What is the zip code of your permanent (hometown) address?

_____

26) Please share any comments or concerns you have about physical activity on the UA campus.

_____

_____

_____

Thank you for taking the time to complete this survey.

APPENDIX G

CONSENT LETTER

THE UNIVERSITY OF ALABAMA

January 12, 2010

Dear University of Alabama Undergraduate Student,

I am George M. Brown, PhD candidate in the College of Human Environmental Sciences and the Executive Director of University Recreation. I am conducting a research study to evaluate university undergraduate students' knowledge, engagement and perceptions of cardiovascular physical activity. Your name and contact information was obtained through the University of Alabama registrar based on your classification as an undergraduate student.

This is a research study and completion of the attached survey will imply consent. This survey will take approximately **fifteen minutes** of your time and may be completed by simply clicking the following link:

http://vovici.com/wsb.dll/s/1300fg425ad

Some important information about the survey:

- *Confidentiality:* Your responses will be strictly confidential. Only summary data will be provided in the final report.
- *How this information will be used:* Results of this survey will be used to evaluate programs, services and facility operations with respect to improving the delivery of physical activity as a health benefit.
- *Incentive:* No formal incentives are offered in this study.

Your participation is completely voluntary. Your willingness or unwillingness to participate will not affect your relationship with The University of Alabama. If you have questions about the survey or the work of University Recreation, please contact George Brown at 205-348-3994. For questions or concerns about Research Participant's Rights, please contact Tanta Myles, Research Compliance Officer in the University's Office for Sponsored Programs, at 205-348-5746.

On behalf of University Recreation at The University of Alabama, thank you for taking the time to provide us with this important information.

Sincerely,

George M. Brown, Ph.D. Candidate

APPENDIX H

IRB APPROVAL FOR STUDY MODIFICATION

Office for Research

Institutional Review Board for the
Protection of Human Subjects

THE UNIVERSITY OF
ALABAMA
RESEARCH

January 22, 2010

George Brown
University Recreation
Box 870373

Re: IRB#: 09-OR-363 (Revision) "Knowledge, Engagement and Perceptions of the American College of Sports Medicine Guidelines for Cardiovascular Physical Activity: An Undergraduate Comparison"

Dear Mr. Brown:

The University of Alabama Institutional Review Board has reviewed the revision to your previously approved expedited protocol. The board has approved the change in your protocol.

Please remember that your approval period expires one year from the date of your original approval, 12/23/2009 not the date of this revision approval.

Should you need to submit any further correspondence regarding this proposal, please include the assigned IRB application number.

Good luck with your research.

Sincerely,

Carpantato T. Myles, MSM, CIM
Director & Research Compliance Officer
Office of Research Compliance
The University of Alabama

152 Rose Administration Building
Box 870117
Tuscaloosa, Alabama 35487-0117
(205) 348-5152
FAX (205) 348-8882

APPENDIX I

STUDY FLOW CHART

Task	Jan. 6	Jan. 12	Jan. 19	Jan. 25	Jan. 26	Feb. 1	Feb. 4	Feb. 11
Pre-notification cards mailed	X							
Send surveys		X	X					
IRB Modifications Approved				X				
Resend Surveys			X		X	X	X	
End of Study								X