The Effectiveness of a Health Communication Campaign in Increasing Awareness of the 2008 Physical Activity Guidelines for Americans Among College Students Living in Residence Halls

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To the Graduate Council:

I am submitting herewith a thesis written by Virginia Marie Frederick entitled "The Effectiveness of a Health Communication Campaign in Increasing Awareness of the 2008 Physical Activity Guidelines for Americans Among College Students Living in Residence Halls." I have examined the final electronic copy of this thesis for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Master of Science, with a major in Kinesiology.

Eugene C. Fitzhugh, Major Professor

We have read this thesis and recommend its acceptance:

Accepted for the Council:

Dixie L. Thompson

Vice Provost and Dean of the Graduate School

(Original signatures are on file with official student records.)
The Effectiveness of a Health Communication Campaign in Increasing Awareness of the 2008 Physical Activity Guidelines for Americans Among College Students Living in Residence Halls

A Thesis Presented
For the Master of Science Degree
The University of Tennessee, Knoxville

Virginia Marie Frederick
May 2012
DEDICATION

I would like to dedicate this thesis to my parents, Larry and Carolyn Frederick. The two of you are the best role models a daughter could ask for. I am very appreciative of the values you have instilled in me throughout my life. You have taught how valuable it is to work hard in everything I do and that nothing worth having is easily obtained. You have taught me the true meaning of unconditional love and I know that no matter what happens in my life, I will always have your love and support. You have taught me how to live compassionately and care for others because a smile and “hello” may be just what is needed to brighten someone’s day. You have always taught me that my life has been full of blessings and to remain appreciative of them. Finally, you have taught me the true meaning of strength. During the past couple of years we have all been faced with extremely tough battles and through your faith, willpower and love for each other and our family, we have made it through unscathed. I love you both more than words can express and I am forever grateful to have you as my parents.
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ABSTRACT
The college years are an important time for young adults to learn and implement healthy lifestyle behaviors, such as physical activity (PA). In order to develop these habits, college students should be made aware of public health recommendations, such as the 2008 Physical Activity Guidelines for Americans (PAG). However, no studies have examined the level of awareness of these guidelines among college students. PURPOSE: To determine the level of awareness of the 2008 PAG in college students and study the effectiveness of a PA health communication campaign (HCC) designed to increase awareness. METHODS: This study utilized a quasi-experimental, two-group design. Residents living in four residence halls (N = 2136), two control and two experimental, were eligible to participate. At baseline (August 2011), 407 residents responded to an online questionnaire with 144 completing a follow-up survey. A PAG awareness score was created ranging from 0 to 6 based upon correct survey responses. Between survey administrations, the experimental residence halls were exposed to an eight-week PA HCC consisting of posters, flyers and informational e-mails. Repeated Measures ANOVA was used to analyze the change in awareness score from pre- to post-intervention in both groups. RESULTS: The average awareness score for the 407 respondents completing the baseline survey was 2.5. Among the 144 participants that completed both surveys, the overall awareness score was 2.46 (SD 1.23) with no differences by demographics. Following the campaign, both the control and experimental groups showed increases in awareness scores of 0.2 and 0.45, however the differences between groups were not significant (p = 0.348). CONCLUSION: Overall awareness of the guidelines was low in this population, supporting the need for education of the PAG. In order to be effective, a HCC may be appropriate as part of a larger PA health promotion intervention.
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CHAPTER 1

Introduction

During the past two decades, those in the field of public health have come to realize the importance of physical activity and the role it plays in maintaining proper health. Due to this realization, various organizations have released evidence-based recommendations on the amount of physical activity needed for an individual to acquire health benefits.\textsuperscript{1-3} These recommendations are meant to encourage Americans to begin integrating adequate amounts of physical activity into their everyday lives, leading to the promotion of health and prevention of disease. In 1995, the Centers for Disease Control and Prevention along with the American College of Sports Medicine released physical activity guidelines that recommended American adults participate in at least thirty minutes of moderate-intensity aerobic activity on most, preferably all days of the week.\textsuperscript{1} More than a decade later, in 2007, the American College of Sports Medicine teamed up with the American Heart Association to release an update to the 1995 recommendations.\textsuperscript{2} These guidelines were released with the intention of clarifying the frequency, duration and intensity at which adults needed to exercise to gain health benefits. The updated recommendation included moderate-intensity exercise for thirty minutes a day, five or more days per week, or vigorous-intensity exercise for at least twenty minutes on three or more days per week and a new component recommending activities that maintain or increase muscular strength and endurance a minimum of two days each week.\textsuperscript{2} More recently, the United States Department of Health and Human Services released the \textit{2008 Physical Activity Guidelines for Americans}.\textsuperscript{4} These guidelines are the first to address the need for physical activity across all stages of life and state that for health benefits, adults should accumulate the equivalent of at least
150 minutes of moderate-intensity aerobic physical activity per week and engage in muscle-
strengthening exercise at least two days per week.\textsuperscript{4}

Since the release of the 1995 recommendations, only two studies have been conducted to
directly determine the extent to which knowledge of these guidelines has disseminated
throughout the United States.\textsuperscript{5,6} Results of these studies conducted in 2009 and 2010, with focus
on the 1995 guidelines, indicate that only between 25\% and 33\% of Americans could accurately
identify the frequency and duration of recommended moderate-intensity physical activity.\textsuperscript{5,6}

Knowing that so few are aware of the recommendations, it is not surprising that a 2010
study revealed that only 32.6\% of Americans were actually accumulating enough physical
activity to meet the 1995 recommendations.\textsuperscript{7} While this same 2010 study showed that 43.5\% of
Americans currently meet the aerobic portion of the 2008 guidelines, when the muscle-
strengthening recommendation from the \textit{2008 Physical Activity Guidelines for Americans} is
added, the percentage of the population meeting both the aerobic and strength guidelines falls
drastically to 18.2\%.\textsuperscript{7} The difference in the proportion of individuals meeting the 1995 public
health recommendations for physical activity and those from 2008 is surprising given the fact
that the \textit{2008 Physical Activity Guidelines for Americans} are much more lenient than the 1995
recommendations in that they do not require the activity to be accumulated over a certain number
of days or in a certain amount of time per day. To date, there have been no studies assessing the
awareness of the \textit{2008 Physical Activity Guidelines for Americans} in the U.S. population.

One population in particular that has difficulty meeting public health recommendations
for physical activity is young adults ages 18-24, the age range of typical college students.\textsuperscript{8} Data
from 2005 show that 30-50\% of college students do not accumulate enough physical activity to
see any health benefits or meet any of the public health recommendations.\textsuperscript{8} Furthermore, in 2010
it was discovered that only 26.1% of college students accumulate enough physical activity to meet both the aerobic and muscle-strengthening portions of the 2008 recommendations. These numbers are troubling due to the fact that leading a physically active lifestyle during one’s college years can have a plethora of benefits both immediately and later in life, including prevention of weight gain\textsuperscript{10,11}, maintenance of health\textsuperscript{12}, stress reduction\textsuperscript{13,14} and the initiation of habitual physical activity that is likely to carry over into adulthood.\textsuperscript{15} In fact, it is during the transition from adolescence to early adulthood where the risk of development and maintenance of obesity increases.\textsuperscript{16} This period also marks the time when the probability of engaging in physical activity often declines as adolescents grow out of youth sports and become responsible for finding other opportunities for physical activity.\textsuperscript{17}

While the period of transition into adulthood represents increased risk of obesity and sedentary habits, it is also the time when lifetime physical activity habits are formed.\textsuperscript{18,19} Research suggests that greater emphasis should be put on promoting physical activity through specific interventions targeting this population.\textsuperscript{15,17} The literature has indicated that the physical activity patterns developed during the college years correlate closely to those seen in adulthood.\textsuperscript{15} For example, in a survey of recent college graduates, Sparling shows that 84.7% of people who identified themselves as “regular exercisers” during college were as active or more active 10-15 years after graduating.\textsuperscript{15} Even more telling, the same study revealed that 81.3% of those who considered themselves “non-exercisers” throughout their college years reported the same or lower amounts of physical activity late in life.\textsuperscript{15} For these reasons, Healthy People 2020 has identified postsecondary educational institutions as prime settings to promote a lifestyle that involves regular physical activity.\textsuperscript{20}
To understand how to increase physical activity in this population, the Transtheoretical Model of Behavior Change (TTM) can be used.\textsuperscript{21} The TTM is a framework used to evaluate how individuals move through behavior change for better health. The five stages of the model include (1) Precontemplation, (2) Contemplation, (3) Preparation, (4) Action and (5) Maintenance.\textsuperscript{21} Individuals that do not accumulate any physical activity or do not perform enough to meet recommendations are considered to be in the Precontemplation and Contemplation stages of change. In order to move from stage to stage, individuals often undergo processes of change.\textsuperscript{21} For example, individuals in the Precontemplation stage may benefit from interventions including “Consciousness Raising,” which includes increasing awareness about the causes, consequences and cures for a particular health behavior. These interventions can include educating individuals through exposure to health communication campaigns.\textsuperscript{21} Self-reevaluation is also important to people in the Precontemplation stage as well as those in the Contemplation stage.\textsuperscript{21}

In order to increase the awareness of the 2008 Physical Activity Guidelines for Americans, a health communication campaign may be appropriate.\textsuperscript{5,6,9-11,13,15,17,19,22-39} Those in the Precontemplation and Contemplation stages will benefit greatly from a media campaign focused on awareness and could use the information learned to move closer to the Action and Maintenance stages. Previous studies suggest that campaign messaging could possibly increase the chances that college students will begin performing recommended physical activity and that cues such as posters and signs may promote behavior change and encourage people to be more active.\textsuperscript{34,35,40} The idea of campaign location on the college campus has also been considered in previous studies.\textsuperscript{41-44} Most of these researchers have chosen to use on-campus residence halls as an outlet for health communication campaigns.\textsuperscript{41-44} Existing research also recommends the inclusion of media such as the Internet in physical activity promotion as it is considered the most
common avenue used by college students to retrieve health-related information.\textsuperscript{40} Furthermore, these researchers recommend that future campaigns should include a coordinated, consistent campaign message, which would include e-mail reminders to individuals as cues to be more active.\textsuperscript{34,35,40}

Statement of the Problem

This study will assess the level of awareness of the 2008 Physical Activity Guidelines for Americans in a sample of college students living in residence halls, as well as the effectiveness of a health communication campaign designed to increase awareness of these guidelines. In addition, this study will also examine the impact of increased awareness on levels of physical activity in this population. The following research questions will be the focus of the study.

Research Questions

1. What is the level of awareness of the 2008 Physical Activity Guidelines for Americans in a sample of college students living in residence halls?
2. Does a physical activity health communication campaign effectively increase awareness of the 2008 Physical Activity Guidelines for Americans?
3. Does increased awareness correspond to increased volumes of physical activity?

Significance of the Study

This study will be the first to examine the level of awareness of the 2008 Physical Activity Guidelines for Americans in college students and to determine whether a health communication campaign is effective in increasing awareness of these guidelines. It will also be
the only study to examine the relationship between an increased awareness and resulting levels of physical activity.

**Definition of Terms**

1. **Residence Hall**: synonymous with dormitory, is “a building, as at a college containing rooms and facilities for residents.”

2. **Health Communication Campaign**: “use of mass media on a health topic, typically involving television, radio, newspaper, magazines and other channels to convey health information or to provide motivation for health actions.”

3. **Obesogenic**: “the sum of influences that the surroundings, opportunities, or conditions of life have on promoting obesity in individuals or populations.”

**Delimitations**

The study population is limited to college students living in one of four residence halls on the campus of the University of Tennessee, Knoxville. The study population is limited further by the fact that only those individuals who respond to an e-mail invitation to participate in the online survey will be included in analysis.

**Limitations**

The current study has two main limitations. Results and findings of this research should be used with caution, as the following limitations are present:

1. The use of a quasi-experimental, pre/post group design prohibits randomization.

2. Physical activity was measured by a self-report questionnaire and therefore is subject to recall bias.
CHAPTER 2

Review of Literature

Rates of overweight and obesity in the U.S. have steadily increased over the past 35 years, and currently 68% of U.S. adults have a body weight that puts them at risk for developing a host of chronic diseases.\textsuperscript{48} One specific age group at risk for unhealthy weight gain is young adults between the ages of 18-24.\textsuperscript{49} Currently, 31.3% of college students are at risk for health issues due to their body weight.\textsuperscript{49} Evidence indicates that as part of a healthy lifestyle, adequate amounts of physical activity can help this population achieve and maintain a healthy body weight.\textsuperscript{50} The amount of physical activity that is recommended to achieve health benefits including a reduction in risk for various diseases has been described in detail as part of the 2008 \textit{Physical Activity Guidelines for Americans}.\textsuperscript{4} It has been determined that a majority of Americans in this age group fail to meet these recommendations and even less are aware of previous publications concerning how much physical activity is necessary.\textsuperscript{5,7} Through the implementation of a physical activity health communication campaign on a college campus, it may be possible to increase awareness of the volume of physical activity that is recommended and perhaps the proportion of this population meeting these guidelines.

This review of literature will focus on the following topics for all adults with emphasis placed on young adults between the ages of 18 and 24: 1) Health benefits of physical activity, 2) Public health recommendations for physical activity and 3) Health communications regarding physical activity.
Health Benefits of Physical Activity

Results of the most recent compilation of research regarding the health benefits of physical activity indicate that compared to less active individuals, those that are more active have lower rates of all-cause mortality, coronary heart disease, hypertension, type 2 diabetes, stroke, metabolic syndrome, colon cancer, breast cancer and depression. Regular physical activity is also associated with a healthier body mass and body composition, both of which aid in the prevention of several chronic diseases. Participation in aerobic physical activity results in an increase in cardiorespiratory fitness which has favorable effects on several biomarkers for cardiovascular disease and type 2 diabetes while engaging in strength-training increases muscle mass, muscle strength and muscle quality as well as bone mineral density.

While all of these benefits are important, one of the prominent effects of regular physical activity is weight control. According to Tsai, the cost of overweight and obesity in the United States for 2011 was $113 billion. Thus, the economic cost of physical inactivity and its role in the overweight and obesity epidemic is astounding. It is thought that increasing levels of physical activity among adults could greatly reduce this economic burden.

For the population of interest in this study, young adults ages 18-24, leading a physically active lifestyle can be even more advantageous. A plethora of literature exists concerning the prominent weight gain as a result of poor diet and a decrease in physical activity levels that accompany the transition out of high school and into postsecondary education. Approximately 70% of college students gain weight from the beginning of their freshman year to the end of their sophomore year and the average extent of this weight gain is roughly seven to nine pounds. Data indicate that these changes in weight are accompanied by increases in body mass index and body composition, or percent body fat. Compared to the
proportion of these study populations that do not see a change in body weight, or see a decrease, those that gain weight are significantly less physically active and report a decline in volume of physical activity over the study period.\textsuperscript{10,27,28,31,32} Therefore, achieving and maintaining a physically active lifestyle may help to prevent weight gain during this transitional period that is highly regarded as obesogenic.

In addition to weight gain which can often induce stress itself, college students are presented with myriad other situations that affect psychological well-being such as exams, public speaking, forging new interpersonal relationships and the transition from living in the home environment to being independent for the first time.\textsuperscript{52} Physical activity can have a desirable impact on symptoms of depression and help with stress-reduction during these periods of increased anxiety.\textsuperscript{53-55} Specifically, college students who engage in physical activity reduce their odds of reporting suicidal behavior, feelings of hopelessness and depression, all of which lead to an increase in psychological well-being during what can be a psychologically taxing period.\textsuperscript{13,14,56,57}

Perhaps the most important benefit of leading a physically active lifestyle in college is the fact that these habits tend to predict physical activity habits later in life.\textsuperscript{15-19,25,26} For example, Sparling et al. conducted a survey of college alumni and reported that 84.7\% of those that were “regular exercisers” during college had maintained or increased their level of physical activity at the 15-year follow-up survey.\textsuperscript{15} Even more telling, 81.3\% of those who indicated that they were “nonexercisers” in college were the same or less active 15 years after graduating.\textsuperscript{15} Furthermore, significant correlations have been found between college physical activity levels and those seen during middle-age.\textsuperscript{26} This research supports a statement by Leslie et al. that, “young adulthood is a potential preventive window in which lifelong physical activity habits may be positively
influenced.” Several other authors agree that the transition to young adulthood is the opportune time to promote physical activity as this represents the time at which preferences regarding physical activity or inactivity take hold.\textsuperscript{17,18,25,26}

For each of these reasons, it is important for adults of all ages to make physical activity a priority. Engaging in adequate amounts of exercise is perhaps the most cost-effective way to decrease one’s risk for certain chronic diseases. It can also provide unique benefits to young adults during a time in life that is very crucial in many ways.

**Public Health Recommendations for Physical Activity**

*The History of Public Health Recommendations for Physical Activity*

The first public health recommendation for physical activity was developed by the American Heart Association (AHA) in 1972.\textsuperscript{58} While previous research had demonstrated that physically active adults had a lower risk of cardiovascular complications\textsuperscript{59}, these guidelines were the first to specify the type, intensity, duration and frequency of exercise that would increase physical fitness in previously sedentary individuals. The recommendations state that fitness can be improved by performing exercises that “produce sustained increases in metabolic, cardiovascular and respiratory functions.”\textsuperscript{58} These exercises should be performed at least three times per week but preferably every day, at an intensity and duration that exceed the mild demands of every-day activities but fall short of causing prolonged or excess fatigue.\textsuperscript{58} The intended purpose of these guidelines was for use in a clinical setting to aid physicians in testing and prescribing exercise for sedentary individuals with and without contraindications to physical activity. The sequel to this handbook, *Exercise Testing and Training of Individuals with Heart*
Disease or at High Risk for its development: A Handbook for Physicians, was released in 1975 and gave more attention to the prescription of exercise to increase fitness in cardiac patients.\(^60\)

By the late 1970’s it was apparent that more and more individuals were seeking information on physical activity and more specifically the quantity and quality of exercise necessary to improve physical fitness.\(^{61}\) This increased interest prompted the release of guidelines from the American College of Sports Medicine (ACSM) in 1978.\(^{61}\) These evidence-based recommendations expanded on the previous AHA guidelines by stating that continuous rhythmic, aerobic activity should occur on three-to-five days per week at an intensity equal to 60-90 percent of maximum heart rate reserve (or 50-85 percent of VO\(_2\) max).\(^{61}\) The duration of training recommended was 15 to 60 minutes of continuous aerobic activity per session, with the specific amount of time dependent on the intensity chosen. For the non-athletic adult, lower to moderate intensity activity was recommended for a longer duration as opposed to a shorter duration of high intensity activity.\(^{61}\) The recommendations also included a minimal threshold of activity, stating that training “less than two days per week at less than 50 percent of VO\(_2\) max for less than 10 minutes per day is inadequate for developing and maintaining fitness.”\(^{61}\)

The 1978 guidelines remained the primary source of exercise prescription information for quite some time before the ACSM revised them in 1990 to focus more on the developing public health issue of overweight and obesity. Throughout the late 1970’s and early 1980’s, daily life became increasingly sedentary as technological advances negated the need for physical activity associated with normal tasks such as walking for transportation, taking the stairs or active leisure-time habits.\(^{62,63}\) This trend toward a sedentary society began taking a toll, manifesting itself as an increase in the prevalence of overweight and obesity. Data from the National Health and Nutrition Examination Surveys show that between the years of 1976-1980 and 1988-1994,
the prevalence of overweight in the United States increased from 46% to 54.4% and that of obesity from 14.5% to 22.5%. Researchers and clinicians began seeing the link between sedentary lifestyle habits and disease risk due to lack of sufficient physical activity. Thus, in their 1990 position stand, the ACSM explained the clear difference between physical activity for health benefits and physical activity for fitness.

The overall recommendation for developing and maintaining cardiorespiratory fitness was retained from the 1978 guidelines (20 to 60 minutes of moderate-intensity aerobic activity on three-to-five days per week). The addition of a resistance training component that suggested one set of eight-to-twelve repetitions of eight-to-ten exercises on at least two days per week was included to help individuals develop and maintain fat-free weight and satisfy the need for a more well-rounded program. At this time, the ACSM also introduced the concept that lower levels of physical activity than those described above may help to reduce the risk of certain diseases, thus improving health. Furthermore, the ACSM also aimed to convey the importance of physical activity for weight control in that the closer one comes to meeting the recommendations, the more likely they are to reach and maintain a healthy weight. Above all, however, these guidelines stressed the significance of creating a physical activity habit that results in a permanent lifestyle change so that individuals will be able to remain physically active throughout their lifetime.

As research in the field of physical activity epidemiology flourished, and obesity rates continued to increase, more evidence became available for the specific amounts and types of exercise required for health promotion and disease prevention. With the goal of presenting a clear and concise message regarding physical activity, the Centers for Disease Control and Prevention (CDC) along with the ACSM consolidated the overwhelming amount of literature
concerning the benefits of physical activity. In their 1995 recommendation, these organizations explained that, “every U.S. adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week.”

In the process of creating this recommendation, public health officials were concerned that earlier guidelines gave the impression that one can only see benefits from performing high-intensity activities with which many individuals were and still are uncomfortable. It was thought that the idea of health benefits from vigorous activity only led people to remain sedentary and therefore contributed to the rise in overweight and obesity. The inclusion of the term “moderate-intensity” in the 1995 recommendation support the notion that health benefits can be gained from engaging in exercise that is less than vigorous and that even light activity was better than none at all. This was also the first time recommendations emphasized the concept of a dose-response relationship between physical activity and health benefits as the recommendations stated that these benefits accrue in proportion to the amount of physical activity performed. Another unique aspect of this publication was that it included a call to action targeting public health agencies, health professionals, special populations, communities, educators, individuals and families to help begin changing the sedentary nature of society. Without action to promote physical activity as part of a healthy lifestyle, the risk of obesity would continue to increase leading to the development of a plethora of other medical complications.

Many of these sentiments were mirrored in the 1996 Surgeon General’s Report on Physical Activity and Health. This document helped to bring the importance of physical activity to the forefront of governmental public health objectives. Previous reports had dealt with issues such as nutrition, the use of seatbelts and tobacco use, but the timing of this report was both appropriate and essential as rates of overweight and obesity along with sedentary lifestyle
habits continued to increase in the U.S. population. As stated in the introduction to the report, levels of physical activity in Americans were low at the time and people needed to be made aware that some physical activity is always better than none at all. A summary of the recommendations included that “all people over the age of two years should accumulate at least 30 minutes of endurance-type physical activity, of at least moderate intensity, on most-preferably all-days of the week;” that resistance training should be performed at least twice per week with one-or-two sets, each between eight and twelve repetitions, of eight-to-ten exercises that use the major muscle groups; and that additional health benefits can be achieved by performing a greater amount of moderate-intensity activity or by substituting vigorous-intensity activity. Overall, the intent of this publication was to promote the greatest benefit for the greatest number of people, hence the transition from exercise for physical fitness, like earlier recommendations, to a focus of disease prevention through increasing physical activity.

Two years later the ACSM released their 1998 position stand, which built upon the 1990 publication by including more evidence and information from continuing research. The basis of the guidelines for cardiovascular fitness remained similar with one small change. The range of intensity was widened to include lower values that still contributed to health benefits. They addressed the fact that lower levels of physical activity than those prescribed for fitness still have the ability to reduce chronic degenerative disease risk and improve metabolic fitness, or the state of one’s metabolic systems that predict the risk of diabetes and cardiovascular disease. In this report, recommendations for exercise and physical activity for health and fitness were presented on a dose-response continuum with benefits increasing in direct proportion to volume of physical activity performed. This dose-response continuum was especially evident in those choosing to
move from sedentary habits to minimal levels of physical activity, a scenario that would apply to most of the U.S. population.

Along with research on the dose-response concept, these recommendations were the first to incorporate evidence of the benefits of flexibility and include a prescription for flexibility training. On two-to-three days per week, adults should include a stretching regimen that addresses all major muscle/tendon groups using static, ballistic or proprioceptive neuromuscular facilitation techniques for four repetitions of 10-30 seconds each. The addition of this prescription helped to portray the need for a well-rounded exercise program.

Until 2002, clinicians and others involved in the prescription of exercise were familiar with the recommendation of at least 30 minutes of moderate-intensity physical activity on most days of the week. However, the Institutes of Medicine released physical activity recommendations as part of their 2002 Dietary Reference Intakes publication, which stated that based on literature from doubly-labeled water experiments, 60 minutes of moderate-intensity physical activity is needed on four-to-seven days per week. Throughout the general public, confusion ensued, as it now seemed as if one must perform double the amount of exercise to see the same benefits as before. Researchers in the field of exercise science however, noted that these recommendations are for the “prevention of un-healthful weight gain” and that there were a few flaws within the foundation of these guidelines. As described by Blair in 2004, these recommendations understate the benefits of 30 minutes of physical activity per day, stating that this amount is inadequate. The author also describes how the dismissal of 30 minutes per day is not fully supported by experimental evidence, that the recommendations include misclassified exercise intensities and finally, how the data provided does not support the author’s own conclusions. As previously stated, the volume of physical activity prescribed in this
recommendation is targeted at weight loss and not health benefits which occur at a much lower threshold of activity.

With the confusion about recommended amounts of exercise still looming in the public, the AHA and ACSM teamed up in 2007 to release an update on the 1995 public health recommendations for physical activity developed by the CDC and ACSM. While the amount of recommended physical activity stayed somewhat consistent, the goal of this report was to clarify any ambiguities put forth by the previous recommendation or other recommendations published since 1995. In the new 2007 document, the frequency of moderate-intensity activity recommended was specified as five days per week instead of the more relaxed phrase, “most, preferably all days per week.”

Furthermore, as research relating moderate- and vigorous-intensity activity had become more abundant, vigorous-intensity activity was explicitly incorporated into the recommendation by stating that as an alternative to 30 minutes of moderate-intensity activity on five days per week, 20 minutes of vigorous-intensity activity on at least three days per week is sufficient to meet recommendations. Also, for the first time, it was stated that, “combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation.”

In previous publications, it had been stated that it was acceptable to accumulate 30 minutes of activity over the course of a day instead of having to complete all 30 minutes at one time. However, the minimum length of time per bout was never established. To remedy this, experts with the AHA and ACSM stated that the minimum length of short exercise bouts is 10 minutes. Activity performed for fewer than 10 minutes at a time, while better than no activity at all, does not produce the same cardiovascular and metabolic responses that are associated with improvements in health. Along the same lines, clarification was given to the fact that physical
activity levels above and beyond the minimum recommended provide even greater health benefits.\(^2\) This concept had been mentioned in the 1995 recommendations as part of the dose-response concept but was now explicitly stated.

Finally, while the 1995 guidelines made mention of the importance of muscle-strengthening activity, the 2007 report made specific declarations based on sound evidence that necessitated the inclusion of the specific recommendation. The amount and type of such activity had been stated in previous guidelines but was now part of the core recommendation for physical activity and health.\(^2\)

*Current Physical Activity Recommendations*

As can be seen, the prescription of physical activity to achieve health benefits has evolved over many decades and been addressed by many organizations. The United States Department of Health and Human Services has touched on physical activity in each edition of their *Dietary Guidelines for Americans* since 1995. However, by the year 2008, the body of literature showing the benefits of physical activity as part of a healthy lifestyle was substantial and experts from a variety of organizations, including the CDC, decided to create a separate recommendation focusing specifically on physical activity. The *2008 Physical Activity Guidelines for Americans*\(^4\) represent a comprehensive report of the benefits of physical activity, the recommended amount of physical activity to achieve those benefits and important information about beginning and maintaining a physically active lifestyle. The aim of releasing these public health recommendations for physical activity is to place physical activity at the same level of importance as dietary habits. These physical activity guidelines, like the Dietary Guidelines for Americans, are backed by the government, supported by rigorous scientific
evidence and will be reviewed and updated periodically. The release of such recommendations will show the importance of being physically active as part of a healthy lifestyle.

While previous recommendations have only mentioned the difference between health-enhancing physical activity and performance related fitness, these guidelines are the first to divide the two and explicitly state that the current recommendations only focus on health-enhancing physical activity. The information contained in this report describes the many reasons individuals should be active, including but not limited to acquiring health benefits, having fun, improving one’s appearance, opportunities for socializing, and feeling more energized, and that individuals should be active for any and all reasons that may be important to them. This is also the first set of recommendations to include guidelines across the lifespan by emphasizing different, important aspects for each of three age groups: children and adolescents ages 6 to 17, adults ages 18 to 64 and older adults ages 65+. The guidelines also have a special section of “Additional Considerations for Some Adults,” such as those with disabilities or chronic conditions and pregnant or postpartum women.

For adults, the guidelines focus on four main recommendations:

- All adults should avoid inactivity. Some physical activity is better than none, and adults who participate in any amount of physical activity gain some health benefits.
- For substantial health benefits, adults should do at least 150 minutes (2 hours and 30 minutes) a week of moderate-intensity, or 75 minutes (1 hour and 15 minutes) a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity aerobic activity. Aerobic activity should be performed in episodes of at least 10 minutes, and preferably, it should be spread throughout the week.
• For additional and more extensive health benefits, adults should increase their aerobic physical activity to 300 minutes (5 hours) a week of moderate-intensity, or 150 minutes a week of vigorous-intensity aerobic physical activity, or an equivalent combination of moderate- and vigorous-intensity activity. Additional health benefits are gained by engaging in physical activity beyond this amount.

• Adults should also do muscle-strengthening activities that are moderate or high intensity and involve all major muscle groups on 2 or more days a week, as these activities provide additional health benefits.

The reason for the shift away from recommending 30 minutes of exercise on five days per week is the fact that no evidence exists to support the idea that this pattern of exercise is more beneficial than performing for example, 50 minutes of exercise on five days per week or various other combinations of frequency and duration. The benefits of physical activity are more closely related to the total volume of activity performed rather than a precise frequency or duration. However, one caveat addressed in this recommendation is the fact that some evidence exists to support the notion that activity spread out over at least three days is more beneficial than performing all of one’s weekly physical activity in one or two days.4

The experts go on to explain that the “benefits” referred to in the prescription include a decreased risk of premature death, coronary heart disease, stroke, hypertension, type 2 diabetes and depression.4 The “additional” benefits that can be gained from performing more than the minimum recommended include a decreased risk of colon and breast cancer along with prevention of unhealthy weight gain. Also, in order to limit confusion, the relationship between moderate- and vigorous-intensity aerobic activity is described in that one minute of moderate-intensity activity is equivalent to two minutes of vigorous-intensity activity.4
A muscle-strengthening recommendation is given in the statement that one set of eight-to-twelve repetitions should be performed using the major muscle groups: legs, hips, back, chest, abdomen, shoulders and arms. The inclusion of such exercises will help to improve bone strength and muscular fitness.

In terms of meeting these guidelines, individuals can fall into one of four categories based on the number of minutes of moderate-intensity aerobic activity they perform each week: inactive (no activity beyond baseline activities of daily living), low (some activity above baseline but less than 150 minutes), medium (150 minutes to 300 minutes per week) or high (above 300 minutes per week). Individuals in the ‘inactive’ or ‘low’ categories should aim to gradually increase the amount of physical activity they perform by choosing activities that they enjoy. Those that are active in the ‘medium’ range should set goals to increase their volume of physical activity to around 300 minutes per week. Finally, those that are ‘highly active’ should be sure to maintain their current level of physical activity and incorporate a variety of activities to avoid boredom and possible overuse injuries.

With explicit guidelines, appropriate definitions and thorough explanations, this set of recommendations is by far the most user-friendly and most likely to be understood by the general public. The authors set out to create a publication that was straightforward and clear while maintaining consistency with proven scientific evidence. The final sections of the publication are geared toward the promotion of physical activity and ways to increase knowledge of its benefits. Those interested in becoming part of the effort to increase physical activity in their community also have resources as a tool-kit, online blog, FAQs page and more are available for the *2008 Physical Activity Guidelines for Americans*. 
Proportion of the Population Meeting Physical Activity Recommendations

While extensive research on the benefits of physical activity has been conducted and the results compiled into explicit reports as mentioned above, levels of physical activity among the U.S. population have been and remain insufficient. Self-report data collected in 1990 as part of the Health Promotion and Disease Prevention Supplement of the National Health Interview Survey revealed that the prevalence of U.S. adults who met the 1995 CDC/ACSM recommendation was only 32%.\textsuperscript{69} Of this sample, the prevalence of adequate levels of physical activity among those between the ages of 18 and 24 was slightly higher at 37%.\textsuperscript{69} Since the release of that publication, the proportion of Americans meeting newer recommendations has decreased\textsuperscript{7}.

A recent study indicates that 43.5% of U.S. adults met the aerobic portion of the 2008 \textit{Physical Activity Guidelines for Americans} and 21.9% met the muscle-strengthening portion of this recommendation.\textsuperscript{7} However, when combined, only 18.2% of participants were performing adequate aerobic and muscle-strengthening exercise to meet both parts of the 2008 guidelines.\textsuperscript{7} Among the population of interest, young adults (ages 18-24), these percentages increase to 52.4%, 29.3% and 26.1%.\textsuperscript{7} Even though activity levels among this age group are higher than those in the general population, roughly 74% of young adults are not acquiring enough physical activity to achieve health benefits.\textsuperscript{7,9} The lack of sufficient physical activity is not unique to current college students but has been a trend for over a decade. Research from 2000-2009 indicates that approximately 67% of college students were insufficiently active based on the 1995 CDC/ACSM recommendations.\textsuperscript{49,70,71} Such low levels of physical activity have been linked with a high prevalence of overweight and obesity in this population.\textsuperscript{11,24} Furthermore, results of a
meta-analysis of college students’ physical activity behaviors indicate that higher education currently does not encourage students to become physically active.\textsuperscript{8}

Because the college years are a transitional period in life, levels of physical activity often decline as certain complex patterns of and motivations for physical activity emerge. For example, research indicates that younger college students tend to be more active than older students.\textsuperscript{10,13,17,19,25,29,32,36,72} Younger students also report engaging in a greater amount of vigorous-intensity activity in the past 12 months and report having exercised at their current activity level for a longer period of time than their senior counterparts.\textsuperscript{36} Reed et al. suggest that these differences in physical activity level could be due to the fact that many freshman and sophomore students live on campus, in close proximity to exercise facilities, whereas juniors and seniors tend to live off-campus and therefore have less access to such amenities.\textsuperscript{72}

While college students of all ages report that their reasons for engaging in exercise include achieving and maintaining positive health and avoiding ill health, they also report that regularly engaging in exercise is difficult.\textsuperscript{73,74} Strong et al. attribute this feeling to a lack of self-regulation and time management skills due to the fact that students reported difficulty engaging in regular exercise as a perceived barrier in spite of having ample free time, high exercise self-efficacy and a desire to exercise more.\textsuperscript{73} It is clear that the factors involved in distinguishing physical activity patterns in this population are extremely complex and must be clarified before promotional efforts will be successful in increasing physical activity.\textsuperscript{75}

\textit{Awareness of Physical Activity Recommendations}

The evident lack of sufficient physical activity in the U.S. population and college-aged adults may be attributable to many things, including a lack of awareness of public health recommendations for physical activity. The first study to look at the level of awareness of
physical activity recommendations was published in 1986 and focused on the 1978 ACSM publication. Researchers conducted their analyses using data from the 1985 National Health Interview Survey and found that only 5.1% of respondents were able to correctly answer three questions concerning the minimum frequency, duration and intensity of activity needed to strengthen the heart and lungs. However, due to the specificity of the response choices considered acceptable, researchers performed a second analysis using a more relaxed definition of correct answers to include responses that implied more than the minimum recommendations. This analysis revealed that 63.7% of the study population was aware of physical activity levels, including and beyond the minimum that lead to increases in cardiovascular fitness.

Although various physical activity recommendations were released after 1978, there were no studies seeking to determine the extent to which these publications were recognized by the general population until 1999. Three years after the release of Physical Activity and Health: A Report of the U.S. Surgeon General, a nation-wide random digit dial telephone survey was conducted, asking respondents to indicate whether or not they had heard of this report. Only one-third of participants answered ‘yes’ to this question, but when prompted to point out which of several chronic health conditions (i.e. cardiovascular disease, hypertension, depression, osteoporosis, stroke, etc.) were linked to sedentary lifestyle habits, 70% of respondents were able to correctly identify cardiovascular-related diseases and depression. When looking at the data for those ages 18-24, only 16% were aware of the 1996 publication and this group also exhibited the lowest mean knowledge score (7.12 out of 12) of health benefits of physical activity. From these results it is clear that at this point, most individuals were aware of the major health concerns associated with physical inactivity. However, without knowing the volume of physical
activity necessary to avoid these health issues, approximately 62.1% of Americans remained insufficiently active. Following this report, researchers delved deeper into uncovering how aware Americans actually were about recommendations for physical activity. Three separate studies involved survey questions asking participants to identify the exact frequency and duration of moderate-intensity activity recommended in the 1995 CDC/ACSM guidelines.\textsuperscript{5,6,22} While all three publications aimed to identify the level of awareness of the same set of guidelines, the questions used to ascertain this information were vastly different, thus leading to very different results. In 2004, Morrow et al. used a nation-wide random telephone survey in which respondents answered six open-ended and “true or false” items regarding the recommended frequency, duration, intensity and overall volume of physical activity.\textsuperscript{22} On average, each of these six questions was answered correctly by 68.3\% of participants.\textsuperscript{22} Furthermore, individuals in this study were also presented with 14 different activities and were asked to indicate which provided a health benefit. Results show that on average, questions considering traditional physical activities, such as walking or biking, were answered correctly 94.1\% of the time while those asking about lifestyle physical activities like household cleaning, raking leaves and moving furniture were answered correctly only 70.6\% of the time.\textsuperscript{22} The responses to these additional questions were encouraging in that members of the general public seem to at least be aware of the types of activities that provide health benefits.

Continuing to look at awareness of the 1995 recommendation from CDC/ACSM, a 2009 study chose to ask open-ended questions about the frequency and duration of physical activity needed to meet these guidelines.\textsuperscript{6} While 57\% of respondents were able to correctly identify the recommended frequency and 86\% the correct duration, only 33\% of the sample was able to recall
both portions of the recommendation. Due to the fact that the 1995 recommendation is somewhat vague in its description of the frequency of activity that is recommended (i.e. “most, preferably all days of the week”), an “alternative” definition was also analyzed. Now, including reported frequencies of four or more days per week, 47% of the sample indicated the correct recommendation. Furthermore, because the 1995 recommendations could also be met by performing a lesser volume of vigorous-intensity activity, Bennett et al. performed a third analysis that included a “vigorous” definition of twenty minutes or more of activity on three or more days per week. When this definition was included, the proportion of individuals considered ‘aware’ of recommendations increased to 80%. While these results are promising, authors caution the use of these additional definitions because the analyses were run on the assumption that those were the thoughts of the respondents, when in reality, they could represent answers that are completely incorrect.

Most recently, Moore et al. analyzed data from the 2003-2005 HealthStyles surveys, which included a multiple choice question asking, “what is the minimum amount of moderate-intensity physical activity the government recommends for health benefits.” Only 25.6% of all respondents, and 25.8% of those between the ages of 18 and 24, chose the correct answer of “30 minutes on five or more days per week.” Surprisingly, this answer was the second most common behind the incorrect response of “20 minutes on five or more days per week.” While this volume of activity does come close to representing an adequate amount of vigorous-intensity activity, the question asked specifically targets moderate-intensity. The authors state that the reason most respondents chose this answer could stem from residual thoughts that only vigorous-intensity physical activity is beneficial. This notion is obviously incorrect and detrimental due to
the fact that those believing moderate- or low-intensity activity fail to provide health benefits are not likely to incorporate such activities into their daily lives.\textsuperscript{5}

Because the health-enhancing benefits of physical activity are not unique to Americans, it is no surprise that other countries have also developed physical activity guidelines and are interested in how well these recommendations are known.\textsuperscript{78-80} In 2000, Bauman et al. used the stage of the 5\textsuperscript{th} International Olympic Committee World Congress on Sport Science in Sydney, Australia to conduct a paper survey analyzing the awareness of both \textit{Physical Activity and Health: A Report of the U.S. Surgeon General}, and Australia’s counterpart, \textit{Active Australia}.\textsuperscript{78} Results of the four-question Likert scale survey indicate that only 43.1\% of those in attendance had actually heard of \textit{Active Australia} and 33.6\% were aware of \textit{Physical Activity and Health: A Report of the U.S. Surgeon General}.\textsuperscript{78} With somewhat similar findings, Spence et al. conducted a telephone survey of Canadians asking whether or not they had heard of \textit{Canada’s Physical Activity Guide (CPAG)}.\textsuperscript{79} Only 20.7\% of the sample reported hearing of the guidelines.\textsuperscript{79}

Later, a 2007 study used a telephone survey to determine the proportion of individuals who could recall \textit{CPAG} unprompted and those that could recognize it when asked specifically about the publication.\textsuperscript{80} Shockingly, only 3.9\% gave the correct answer of ‘\textit{CPAG}’ when asked if they had heard of any physical activity guidelines.\textsuperscript{80} Those that answered ‘no’ to the first question were asked if they had heard of any of several public health recommendations in the past 12 months (i.e. \textit{CPAG, Healthy Living Strategy, Canada’s Food Guide}, etc.). Of these individuals, 37.3\% responded that they had indeed heard of \textit{CPAG}\textsuperscript{80}. However, the awareness of those between the ages of 18-24 was much lower with only 14.6\% indicating they had heard of the \textit{CPAG}.\textsuperscript{80}
In light of these results it can be seen that the United States is not alone in its battle to provide citizens with relevant information on the volume of physical activity necessary to achieve health benefits. Public health professionals across the globe share the momentous task of educating individuals on the importance of physical activity as part of a healthy lifestyle.

Although the most recent recommendations were released almost four years ago, there is currently no literature regarding the level of awareness of the 2008 Physical Activity Guidelines for Americans among adults. More specifically, no studies addressing awareness of recommendations have been conducted that target young adults on college campuses. From research that is currently available, it can be hypothesized that the level of awareness of these most recent guidelines in college students is low. Finding ways to increase awareness is an important first step on the road to increasing levels of physical activity.

Health Communication Campaigns

Overview of Health Communication Campaigns

The use of media health communication campaigns by various organizations is often seen when goals involve changing or reinforcing health behaviors. These campaigns can take many forms and use a variety of outlets such as television, radio, Internet, billboards or smaller signage and allow public health promotion specialists and researchers to reach a large number of people relatively easily. In the past, this type of health promotion has been used with much success to provide information addressing issues such as smoking, alcohol use, oral health, heart disease prevention, seat belt use, sexual behaviors, mammography and other cancer screenings.

Several researchers have looked at the effects of health communication campaigns on physical activity behaviors. In an overview of physical activity interventions using health
communication strategies, Marcus et al. reported that mass media campaigns such as Australia’s Heart Week, resulted in large increases in awareness of campaign messages and slight increases in physical activity. Furthermore, smaller community-based interventions analyzed in the review showed increases in physical fitness and adherence to physical activity recommendations. These findings are echoed by Marshall et al, who indicate that mass media campaigns tend to increase recall of campaign messages and have small impacts on behavior change while print- and telephone-based projects mainly show modest behavior change.

While many health communication campaigns have resulted in positive behavior change, they are not without limitations. Those in the field understand that just providing individuals with the information necessary to lead a healthier lifestyle may not be the “magic bullet” to induce change. The main reason behind this limitation is explained by the dependency theory which holds that when presented with information regarding health behaviors, individuals will respond to that information differently based on a variety of factors. For example, campaigns targeting smoking behavior may have different effects on individuals based upon smoking status, gender, age, ethnicity or socioeconomic status.

Keeping these limitations in mind, it is also noted that campaigns do have the ability to increase awareness of health issues, which is often seen as the first step towards behavior change. Therefore, while immediate adoption of positive health practices may not be observed following a health communication campaign, increase in awareness is a longer-lasting effect and may lead to eventual behavior change.

Perhaps the best time to introduce information regarding positive health behaviors is the period during young adulthood when lifestyle habits are beginning to take shape. By providing adequate information on the benefits and dangers of various behaviors, young adults
will have a greater foundation of knowledge upon which decisions regarding health practices can be made.

*Health Communication Campaigns on College Campuses*

Because college students spend a majority of their time on campus, institutes of higher education are prime settings for the promotion of healthy lifestyle habits. Topics of previous college health communication campaigns include alcohol and drug use, adequate sleep, safe sex practices, personal health and physical activity. Researchers choosing to implement health communication campaigns on college campuses have used a variety of methods to convey information.

In order to tackle the issue of dangerous binge drinking, both Glider et al. and Stewart et al. chose to post advertisements in the school newspaper, host non-alcohol social events and even use the concept of social norms to educate students about the dangers of excessive alcohol consumption. Along with the advertisements mentioned, both of these studies, along with White et al. also placed campaign materials in campus residence halls. Each of these health communication campaigns resulted in positive changes in students’ habits and was considered successful.

To date, the only health communication studies conducted on college campuses concerning physical activity have involved a single dispersal of printed information about the benefits of physical activity and ways to increase exercise self-efficacy while maintaining a physically active lifestyle. However, neither of these studies assessed the awareness of physical activity recommendations in their study populations, which could prove to be a vital part of physical activity promotion in this population.
According to the Transtheoretical Model of Behavior Change, the acquisition of information regarding the benefits of a particular behavior change is an inaugural step in the process of undergoing behavior change. If students are not aware of the recommendation, they are less likely to perform enough physical activity to meet such guidelines. Also, once they become aware of how much physical activity is necessary, it may aid in their transition through the early stages of behavior change. For example, those in the Precontemplation stage may benefit from becoming more aware of the benefits of physical activity, while another individual in the Contemplation or Action stage may benefit from knowing how much activity is required for achieving health benefits. For these reasons, several authors have indicated a need for health communication campaigns on college campuses that focus on physical activity. Appropriate campaigns should include the use of multiple modes to present information such as printed materials and media such as the Internet as it is the avenue most commonly used by this population to retrieve health-related information.

Summary

In conclusion, the benefits of accumulating recommended amounts of physical activity for adults of all ages are numerous. Specifically, young adults stand to gain the most benefit from establishing sound physical activity habits, as these are likely to carry over into adulthood. Current physical activity recommendations advise that these individuals accumulate the equivalent of 150 minutes of moderate-intensity aerobic physical activity per week and engage in muscle-strengthening activity at least two days per week to achieve health benefits. Currently, the extent to which college-aged individuals are aware of these recommendations is unknown and without this knowledge, many young adults are falling short of accumulating sufficient
volumes of physical activity. Therefore, effective methods of increasing awareness of physical activity recommendations in this population should be discovered.
CHAPTER 3

Methods

Introduction

The primary purposes of this research were to determine the level of awareness of the 2008 Physical Activity Guidelines among dorm-living college students, to determine the effectiveness of a physical activity health communication campaign in increasing awareness of these guidelines, and finally to determine whether or not increased awareness leads to an increase in levels of physical activity. In order to achieve these objectives, a quasi-experimental, pre/posttest, two-group design was utilized. Data were collected using an on-line survey that was administered in the fall of 2011, which measured awareness of the guidelines and level of physical activity.

Subjects

College students (at least 18 years of age) living in one of four residence halls on the campus of the University of Tennessee-Knoxville during the fall semester of 2011 were recruited for this study. Data collected from University Housing Administration indicated that there were 2136 possible participants living in the selected residence halls. Residents in control dorms comprised 53.7% of the possible study population with residents of the experimental halls accounting for the other 46.3%. Gender distribution was extremely similar between the two conditions, as the control group was comprised of 55.3% females and 44.7% males while the experimental group was 50.9% females and 49.1% males.
Study Location

Four on-campus residence halls were selected for inclusion in this study based on location and gender distribution. Massey Hall and Clement Hall are co-ed halls and were chosen as control halls while Reese Hall and Humes Hall, which are all male and all female, respectively, were selected as experimental halls. In the control halls, one side of the building is specifically for male residents while the other side houses the female residents. These halls were chosen based on the fact that these groups allowed the most comparable gender distributions among any of the on-campus residence halls, while still maintaining enough distance in between to minimize contamination, as the two experimental residence halls are located across campus from the control halls. This option was chosen due to the fact that having control and experimental residence halls in the same vicinity would increase the chances of students in control halls being exposed to the health communication campaign while visiting friends in the experimental halls.

Study Protocol

In order to determine the level of awareness of the 2008 Physical Activity Guidelines for Americans in this sample, an online questionnaire was used (see Appendix A). Participants were directed to the survey via an e-mail sent to their campus e-mail account (see Appendix B). The survey took approximately 10 minutes to complete and included questions regarding the 2008 Physical Activity Guidelines for Americans, physical activity behavior and demographic information. It was created using SPSS mrInterview Dimensionnet software and hosted by the University of Tennessee’s Office of Information Technology. Upon completion of the survey, respondents were given a chance to provide their university e-mail address to be entered in a
drawing to win a $50 Visa gift card. Participants were also asked for permission to be re-
contacted to complete a follow-up survey.

The survey was conducted during a two-week period in September 2011. After this two-
week period, an eight-week physical activity health communication campaign began in the
experimental residence halls. The health communication campaign included posters advertising
the 2008 Physical Activity Guidelines for Americans hung on each hall of each floor in the two
experimental halls. The posters were rotated once per week in order to keep students’ interest.
Every other week (weeks 1, 3, 5 and 7), students in the experimental residence halls received an
informational e-mail concerning the guidelines. Additionally, students in the experimental group
received flyers in their residence hall mailboxes every other week. At the conclusion of the
eighth week, all communication materials were removed from the experimental residence halls
and respondents of the baseline survey who gave permission to be re-contacted were sent a series
of three e-mails with a hyperlink to the online follow-up survey. At the conclusion of the survey,
participants were given the opportunity to provide their university e-mail address and be entered
in a drawing for a chance to win a $50 Visa gift card. Follow-up surveys were collected for a
period of two weeks.

**Study Measures**

The primary dependent measures assessed in this research were 1) awareness of the 2008
Physical Activity Guidelines for Americans, 2) level of physical activity, and 3) change in
awareness score. The independent factor in this study was exposure to the physical activity
health communication campaign.
Dependent Measures

Awareness: The main dependent measure in this study is awareness of the 2008 Physical Activity Guidelines for Americans. This variable was measured using six single-response multiple-choice questions on the on-line survey: minimum number of minutes of moderate-intensity physical activity recommended to achieve health benefits, minimum number of minutes of vigorous-intensity physical activity recommended to achieve health benefits, minimum number of minutes of moderate-intensity physical activity recommended to achieve weight loss, minimum number of minutes of vigorous-intensity physical activity recommended to achieve weight loss, minimum number of days per week muscle-strengthening is recommended and the ability to combine moderate- and vigorous-intensity physical activity to meet recommendations. Each of the first five questions had four possible answer choices that varied in number of minutes and respondents were to choose whichever answer they felt was correct. The final question had two possible answers, true or false. For each correct response, participants scored one point for a possible range of scores from 0 to six with six indicating the highest level of awareness. An aerobic score was also calculated for each participant based upon responses to the first five questions in the survey. This score was calculated by giving one point per correct answer, with a possible range of scores from 0 to 5.

There are limitations to using multiple choice questions when conducting survey research, such as measurement error and position bias.\textsuperscript{102,103} Measurement error may occur because of the opportunity to guess the correct answer among a limited set of answer choices, which makes it difficult to discern the extent to which individuals really understand or are aware of the material.\textsuperscript{102} Position bias may also be present in that a respondent’s answer choice in multiple-choice questions depends on the position of the answer in relation to the alternatives.\textsuperscript{103}
Therefore, data obtained from questionnaires using multiple-choice questions must be interpreted with these limitations in mind.

**Minutes of Physical Activity:** The second dependent measure of the study was reported as total minutes of aerobic physical activity performed over the past week and total MET-minutes of activity performed over the past week using the International Physical Activity Questionnaire. This questionnaire has established validity and reliability in the targeted population with an interclass correlation coefficient between 0.71 – 0.89. Participants indicated the number of days over the past week they participated in vigorous-intensity and moderate-intensity physical activity, walking and sitting. Respondents were then asked the average amount of time on each of those days they spent performing activity at the specified intensity. The value for total minutes of aerobic activity performed over the past week was calculated using the following equation:

\[
\text{Total minutes} = [(\text{moderate days}\times\text{moderate minutes}) + (\text{vigorous days}\times2\text{(vigorous minutes)}) + (\text{walking days}\times\text{walking minutes})]
\]

According to the *2008 Physical Activity Guidelines for Americans*, each minute of vigorous-intensity activity counts as two minutes of moderate-intensity activity, and this is the reason for doubling the average number of vigorous-intensity physical activity minutes reported. Based on this calculation, respondents’ activity levels were also classified into one of four categories: inactive (0 total minutes), low (1-149 total minutes), moderate (150-300 total minutes) and high (300+ total minutes).

**MET-Minutes of Physical Activity:** A total MET-minutes per week score was calculated for each participant using the IPAQ scoring protocol, which involves multiplying the frequency of each intensity by the average amount of time spent on activity of that intensity, and then by the appropriate metabolic equivalent value (4.0 for moderate-intensity, 8.0 for vigorous-intensity...
and 3.3 for walking). The MET-minute values for each of the intensities were then summed to represent total MET-minutes performed over the past week.

Independent Measures

Exposure: The main independent measure in this study was exposure to the physical activity health communication campaign. Only those participants in the experimental residence halls were exposed to the health communication campaign. Those in the control residence halls were not exposed to any part of the campaign.

Demographic Measures: The demographic survey questions used in this study were derived from the Behavioral Risk Factor Surveillance System (BRFSS) and included questions regarding age, gender, race/ethnicity, weight, height, employment status and household income. All demographic information was self-reported by survey respondents. Age was reported in years. Gender was categorized and coded into two groups: 1=males, 2=females.

Race/ethnicity was measured using two questions: “Are you Hispanic or Latino?” and “Which one or more of the following would you say is your race?” Hispanic or Latino status was measured by a Yes/No question and race was categorized into six groups: white, black or African-American, Asian, Native Hawaiian or Pacific Islander, American Indian or Alaska Native and Self-identify/Multiracial. Weight was reported in pounds and height in feet and inches. These values were converted into metric units and used in the following formula to determine Body Mass Index.

\[ \text{BMI} = \frac{\text{weight (kg)}}{\text{height (m})^2} \]

Responses for employment status included no, yes (full-time) and yes (part-time). Household income was measured using a question that asked “what is your annual household income from all sources at your permanent household?” Respondents were asked to classify their parents’ (or
guardians’) annual household income into one of nine groups: “Less than $9,999,” “between $10,000 and $14,999,” “between $15,000 and $19,999,” “between $20,000 and $24,999,” “between $25,000 and $34,999,” “between $35,000 and $49,999,” “between $50,000 and $74,999,” “$75,000 or more,” and “Don’t know.”

**Physical Activity Facility Utilization:** Respondents were asked to indicate any and all facilities they had used to perform physical activity within the past two weeks. Possible responses included: Tennessee Recreation Center for Students (TREC), intramural fields, TREC outdoor pool, handball courts, tennis courts, Tom Black track, the sports bubble, sand volleyball court, the Student Aquatic Center, Health, Physical Education and Recreation gyms or racquetball courts, residence hall workout facility, Knoxville Greenway System, campus running routes and other.

**Academic Measures:** Academic level was assessed with the question “What is your academic level?” Possible responses included: freshman, sophomore, junior, senior and graduate student. Students indicating graduate status were excluded from analysis and those in the Junior and Senior categories were combined to form the Upperclassman Category. Respondents were also asked if they had declared an academic major and had the choice of answering Yes or No. Those responding “Yes” were prompted to provide the academic college in which their major is housed. Responses included: Agricultural Sciences and Natural Resources, Architecture and Design, Arts and Sciences, Business Administration, Communication and Information, Education, Health and Human Sciences, Engineering, Law, Nursing, Social Work, Space Institute, and Veterinary Medicine.
Respondents were asked to report their current grade point average with possible responses including: below 1.5, 1.51-1.75, 1.76-2.0, 2.1-2.25, 2.26-2.5, 2.51-3.0, 3.1-3.25, 3.26-3.50, 3.51-3.75, 3.76-4.0 and no established GPA at the University of Tennessee.

**Athletic Participation:** Current and previous participation in athletics was assessed using four questions: “Are you a varsity athlete at the University of Tennessee?”; “Have you participated in or do you plan to participate in club sports at the University of Tennessee?”; “Have you participated in or do you plan to participate in intramural sports at the University of Tennessee?”; and “Did you participate in varsity athletics in high school?” Possible responses to all four questions were yes or no.

**Statistical Analysis**

Several statistical methods were used to analyze the data collected in this study and answer the research questions. To answer research question 1, descriptive statistics corresponding to awareness score were analyzed. Research question 2 was answered using a one-way repeated measures ANOVA to determine if there were significant differences in the means of each group’s awareness score across time. To answer research question 3, a change score was calculated to relate changes in awareness score and changes in total minutes of aerobic physical activity so that a correlation could be analyzed. For all other measures, t-tests were used to analyze continuous measures and Chi-square analyses were used to analyze categorical measures. All statistical analyses were performed using SPSS 19.0 software with significance set at $p \leq 0.05$.109
CHAPTER 4

Manuscript

ABSTRACT

Objective and Participants: To determine the level of awareness of the 2008 Physical Activity Guidelines for Americans (PAG) among college students living in residence halls. Methods: Respondents (n = 407) completed an online questionnaire asking them to identify the six main aspects of the PAG. For each correct response, individuals received one point (scores ranged from 0-6). An aerobic awareness score was also created using participant responses to the five aerobic-based questions (range 0-5). Demographic information and past-week physical activity (PA) were also reported. Results: Overall awareness was very low and did not differ by any demographic variable. The average awareness score was 2.5. Most students are aware that moderate- and vigorous-intensity PA are beneficial and of muscle-strengthening recommendations. However, less than one-third were aware of the volume of PA recommended to achieve health benefits. Conclusions: Efforts should be made to increase awareness of PA recommendations in this population.

INTRODUCTION

During the past several decades, various organizations have released public health recommendations stating the amount of physical activity (PA) necessary to preserve health. Research indicates that the level of awareness of such recommendations has been quite low in the general population and specifically among college-aged individuals. In 2010, Moore et al, found that awareness of the 1995 Centers for Disease Control and Prevention (CDC) and American College of Sports Medicine (ACSM) recommendations for PA was lacking in college-
age individuals as only 25.8% of 18-24 year olds in the sample could identify the correct PA recommendation.\textsuperscript{5}

The amount of PA recommended has been most recently described in detail as part of the 2008 Physical Activity Guidelines for Americans.\textsuperscript{4} These guidelines state that in order to achieve health benefits, adults should accumulate the equivalent of 150 minutes of moderate-intensity PA each week and engage in muscle-strengthening exercises at least two days per week.\textsuperscript{4} For even more substantial health benefits, including weight loss, individuals should aim to accumulate the equivalent of 300 minutes of moderate-intensity PA per week. While these are the most current evidence-based recommendations for PA, no studies have been conducted to determine the level of awareness of these guidelines in the college-age population.

While it may not lead to immediate health behavior change, the acquisition of information regarding the benefits of a behavior change is a crucial part of the behavior change process.\textsuperscript{21} Thus, college-aged students who are not aware of PA recommendations and the benefits of adequate PA, may be less likely to engage in enough PA to meet such recommendations.\textsuperscript{21} Research indicates that one’s level of physical activity during adulthood is highly correlated with physical activity during the college years and that individuals who are inactive during these years are more likely to remain sedentary as adults.\textsuperscript{15} Thus, increasing awareness of recommendations and encouraging college-age students to become and remain physically active can have life-long benefits. Furthermore, the university may be the last setting in which these individuals receive health-related information such as physical activity recommendations and healthy eating habits before they enter the workforce.\textsuperscript{93}

Therefore, the purpose of conducting this study was to determine the level of awareness of the 2008 Physical Activity Guidelines for Americans among college students living in
residence halls. The results of such an investigation will help researchers understand the extent to which college students are aware of physical activity as part of a healthy lifestyle. This knowledge will inform health promotion professionals on college campuses about the need to invest resources in campaigns to increase awareness of PA guidelines.

METHODS

Participants
Students living in four residence halls at a large Southeastern university were invited to participate in the study during the fall semester of 2011. The residence halls were chosen based on qualities necessary for a related longitudinal study. During the first week of September 2011, an e-mail was sent to all students living in the four residence halls (N = 2136) explaining the study and containing a web address, which was linked to the online questionnaire. Students who accessed the site containing the online questionnaire indicated informed consent by clicking “I agree” on the introductory page containing the study information. In total, 407 participants completed the online questionnaire during the first two weeks of the fall semester for a response rate of 19.1%.

Procedure
Approval for the study was obtained from the University of Tennessee Institutional Review Board. Participants were informed via e-mail that information obtained from the questionnaire was confidential. Residence hall directors sent the recruitment e-mail containing information about the study and a hyperlink to the online questionnaire. This questionnaire was created using SPSS mrInterview Dimensionnet and hosted through the University of Tennessee server101. The web-based questionnaire remained open for two weeks following the initial
recruitment e-mail, and took approximately 10 minutes to complete. To increase participation, three participants were selected at random to receive a $50 gift card.

**Measures**

*Participant Characteristics*

Respondents self-reported demographic information on age, gender (male or female), race (coded into white or non-white), height (in feet/inches), weight (in pounds), academic level (freshman, sophomore, junior or senior), declared academic major (yes or no), and employment status (employed or unemployed) using questions from the Behavioral Risk Factor Surveillance System (BRFSS). Self-reported height and weight were used to calculate body mass index (BMI) as kilograms per squared meter (kg·m⁻²). Respondents were categorized according to BMI values; values <25.0 were *normal*, values between 25.0 and 29.99 were *overweight* and values > 30 were classified as *obese*.

Physical activity was assessed using the short form International Physical Activity Questionnaire, which has been validated in this population with an interclass correlation coefficient of 0.71-0.89. Respondents were asked to report the frequency (in days) and duration (in average number of minutes on each of those days) of moderate- and vigorous-intensity activity as well as walking and sedentary time.

Reported physical activity was converted into total minutes of moderate-intensity physical activity per week in order to classify individuals according to the 2008 Physical Activity Guidelines for Americans categories: *inactive* (0 minutes), *low* (1-149 minutes), *moderate* (150-299 minutes) and *high* (300+ minutes). Reported minutes of physical activity are moderate-intensity equivalents (i.e. one minute of vigorous-intensity activity is equal to two minutes of moderate-intensity activity).
Awareness of the 2008 Physical Activity Guidelines for Americans

Awareness of the 2008 Physical Activity Guidelines for Americans was the main dependent variable and was assessed using six multiple choice, single-response questions. The questions are as follows, with correct answers in bold:

- **Aerobic 1:** What is the minimum length of time (in minutes) one needs to perform moderate-intensity physical activity (i.e. walking, bicycling, shooting hoops) throughout a typical week to achieve health benefits? **150 minutes**
- **Aerobic 2:** What is the minimum length of time (in minutes) one needs to perform vigorous-intensity physical activity (i.e. running, swimming laps, playing a game of basketball) throughout a typical week to achieve health benefits? **75 minutes**
- **Aerobic 3:** What is the minimum length of time (in minutes) one needs to perform moderate-intensity physical activity (i.e. walking, bicycling, shooting hoops) throughout a typical week to achieve additional health benefits, including weight loss? **300 minutes**
- **Aerobic 4:** What is the minimum length of time (in minutes) one needs to perform vigorous-intensity physical activity (i.e. running, swimming laps, playing a game of basketball) throughout a typical week to achieve additional health benefits, including weight loss? **150 minutes**
- **Aerobic 5:** A combination of moderate- and vigorous-intensity physical activity is appropriate to meet current recommendations. **True**
- **Muscle-Strengthening:** What is the minimum number of days per week one should perform muscle-strengthening activities (i.e. weight training, calisthenics) involving all major muscle groups? **2 days**
For each correct response, participants scored one point for a possible range of awareness scores from 0 to 6. An aerobic awareness score was also calculated for each participant based upon responses to the first five questions in the questionnaire. This score was calculated by giving one point per correct answer, with a possible range of scores from 0 to 5.

Analyses
Student’s $t$ tests and ANOVAs were used to examine differences in awareness and aerobic awareness score by various demographic variables (gender, race, academic level, BMI category and physical activity category). Simultaneous multiple regression was used to determine the association of age, gender, race, academic class, BMI and PA category on awareness score and aerobic score. All variables were entered into the model at the same time. Data were analyzed using SPSS 19.0 and level of significance was set at $p < 0.05$.109

RESULTS
Questionnaire data was obtained for 407 students (19.1% response rate). This response rate is not uncommon for web-based surveys.110 Descriptive information for the individuals that completed the survey can be seen in Table 1. Respondents were mostly white (78.9%) and more than half were female (68.8%). The average age of participants was 18.5 years and 75.2% were college freshmen. A majority of the students were unemployed (78.7%). The average BMI for the sample was 23.5 and 73.7% of individuals had a normal BMI value. A high percentage of respondents (88.9%) reported participating in the enough physical activity to meet the minimum recommendation of the 2008 Physical Activity Guidelines for Americans.
Table 1. Demographic Characteristics of Study Participants (n = 407)

<table>
<thead>
<tr>
<th>Gender</th>
<th>%</th>
<th>(n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>68.8</td>
<td>(280)</td>
</tr>
<tr>
<td>Male</td>
<td>31.2</td>
<td>(127)</td>
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</table>

<table>
<thead>
<tr>
<th>Class</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Freshman</td>
<td>75.2</td>
<td>(306)</td>
</tr>
<tr>
<td>Sophomore</td>
<td>15.7</td>
<td>(64)</td>
</tr>
<tr>
<td>Junior</td>
<td>4.7</td>
<td>(19)</td>
</tr>
<tr>
<td>Senior</td>
<td>4.4</td>
<td>(18)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Race</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>78.9</td>
<td>(321)</td>
</tr>
<tr>
<td>Non-White</td>
<td>21.1</td>
<td>(86)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>BMI Category</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Normal</td>
<td>73.7</td>
<td>(300)</td>
</tr>
<tr>
<td>Overweight</td>
<td>17.4</td>
<td>(71)</td>
</tr>
<tr>
<td>Obese</td>
<td>8.8</td>
<td>(36)</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>PA Categories</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Inactive (0)</td>
<td>3.4</td>
<td>(14)</td>
</tr>
<tr>
<td>Low (1-149)</td>
<td>7.6</td>
<td>(31)</td>
</tr>
<tr>
<td>Moderate (150-299)</td>
<td>14.0</td>
<td>(57)</td>
</tr>
<tr>
<td>High (300+)</td>
<td>74.9</td>
<td>(305)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Mean (SD)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>18.5</td>
<td>(1.0)</td>
</tr>
<tr>
<td>BMI (kg·m⁻²)</td>
<td>23.5</td>
<td>(4.5)</td>
</tr>
<tr>
<td>Awareness Score*</td>
<td>2.5</td>
<td>(1.2)</td>
</tr>
<tr>
<td>Aerobic Score**</td>
<td>2.0</td>
<td>(1.0)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Median IQR</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>PA Minutes</td>
<td>520.0</td>
<td>295.0–900.0</td>
</tr>
</tbody>
</table>

*Range 0-6; includes all six awareness questions
**Range 0-5; excludes muscle-strengthening question
*Moderate-Equivalent minutes (i.e. each vigorous minute counts as two moderate minutes)

The average awareness score for those responding to the questionnaire was 2.5 ± 1.2 and the average aerobic score was 2.0 ± 1.0. There were no differences in awareness score or aerobic awareness score based on any of the demographic variables (See Table 2). However, based on results of the multiple regression, physical activity category was the best predictor of awareness score (p = 0.013), but was not a significant predictor of aerobic score (p = 0.056). (See Table 3).
Table 2. Awareness and Aerobic Awareness Scores by Demographic Measures (n = 407)

<table>
<thead>
<tr>
<th></th>
<th>Mean Awareness Score</th>
<th>p</th>
<th>Mean Aerobic Score</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>2.6</td>
<td>0.229</td>
<td>2.0</td>
<td>0.823</td>
</tr>
<tr>
<td>Male</td>
<td>2.4</td>
<td></td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td><strong>Class</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>2.5</td>
<td>0.469</td>
<td>2.0</td>
<td>0.797</td>
</tr>
<tr>
<td>Sophomore</td>
<td>2.5</td>
<td></td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td>Junior</td>
<td>2.8</td>
<td></td>
<td>2.2</td>
<td></td>
</tr>
<tr>
<td>Senior</td>
<td>2.8</td>
<td></td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>2.5</td>
<td>0.934</td>
<td>2.0</td>
<td>0.880</td>
</tr>
<tr>
<td>Non-White</td>
<td>2.5</td>
<td></td>
<td>2.0</td>
<td></td>
</tr>
<tr>
<td><strong>BMI Category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>2.5</td>
<td>0.575</td>
<td>2.0</td>
<td>0.593</td>
</tr>
<tr>
<td>Overweight</td>
<td>2.6</td>
<td></td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Obese</td>
<td>2.3</td>
<td></td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td><strong>PA Categories (minutes/wk)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactive (0)</td>
<td>2.0</td>
<td>0.138</td>
<td>1.6</td>
<td>0.217</td>
</tr>
<tr>
<td>Low (1-149)</td>
<td>2.2</td>
<td></td>
<td>1.8</td>
<td></td>
</tr>
<tr>
<td>Moderate (150-299)</td>
<td>2.6</td>
<td></td>
<td>1.9</td>
<td></td>
</tr>
<tr>
<td>High (300+)</td>
<td>2.6</td>
<td></td>
<td>2.1</td>
<td></td>
</tr>
</tbody>
</table>

Table 3. Sociodemographic Predictors of Awareness Score (n = 407)

<table>
<thead>
<tr>
<th></th>
<th>Awareness Score</th>
<th></th>
<th>Aerobic Score</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>SE B</td>
<td>B</td>
<td>SE B</td>
</tr>
<tr>
<td>Age</td>
<td>0.131</td>
<td>0.134</td>
<td>0.041</td>
<td>0.117</td>
</tr>
<tr>
<td>Gender</td>
<td>0.212</td>
<td>0.128</td>
<td>0.013</td>
<td>0.111</td>
</tr>
<tr>
<td>Race</td>
<td>0.014</td>
<td>0.143</td>
<td>0.009</td>
<td>0.125</td>
</tr>
<tr>
<td>Class</td>
<td>0.000</td>
<td>0.170</td>
<td>0.042</td>
<td>0.148</td>
</tr>
<tr>
<td>BMI</td>
<td>-0.015</td>
<td>0.013</td>
<td>-0.012</td>
<td>0.011</td>
</tr>
<tr>
<td>PA Category</td>
<td>0.169*</td>
<td>0.076</td>
<td>0.148*</td>
<td>0.066</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>B</th>
<th>SE B</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>1.809</td>
<td>1.162</td>
</tr>
<tr>
<td>R^2</td>
<td>0.026</td>
<td>0.017</td>
</tr>
</tbody>
</table>

* p < 0.050

Only two (0.05%) of the respondents correctly answered all six awareness questions while five (1.2%) were able to accurately answer all of the questions pertaining to the aerobic guidelines. Ninety-two percent of respondents correctly answered Aerobic Question 5, concerning the combination of moderate- and vigorous-intensity activity, while the percentages
of correct answers for the other aerobic questions varied between 25.3% and 29.2% (See Figure 1). Approximately half (50.6%) of the sample knew the recommended frequency of muscle-strengthening activities.

**Figure 1.** Awareness of the 2008 Physical Activity Guidelines for Americans Among College Students Living in Residence Halls ($N = 407$).

Note:
- **Aerobic 1:** What is the minimum length of time (in minutes) one needs to perform moderate-intensity physical activity (i.e. walking, bicycling, shooting hoops) throughout a typical week to achieve health benefits? **150 minutes**
- **Aerobic 2:** What is the minimum length of time (in minutes) one needs to perform vigorous-intensity physical activity (i.e. running, swimming laps, playing a game of basketball) throughout a typical week to achieve health benefits? **75 minutes**
- **Aerobic 3:** What is the minimum length of time (in minutes) one needs to perform moderate-intensity physical activity (i.e. walking, bicycling, shooting hoops) throughout a typical week to achieve additional health benefits, including weight loss? **300 minutes**
- **Aerobic 4:** What is the minimum length of time (in minutes) one needs to perform vigorous-intensity physical activity (i.e. running, swimming laps, playing a game of basketball) throughout a typical week to achieve additional health benefits, including weight loss? **150 minutes**
- **Aerobic 5:** A combination of moderate- and vigorous-intensity physical activity is appropriate to meet current recommendations. **True**
- **Muscle-Strengthening:** What is the minimum number of days per week one should perform muscle-strengthening activities (i.e. weight training, calisthenics) involving all major muscle groups? **2 days**
Because Aerobic Question 1 represents the main physical activity recommendation, a breakdown of incorrect answers for this question was examined and can be seen in Figure 2. Roughly 39% of respondents chose minute values that are less than the recommendation while 17.7% chose a value higher than the recommendation.

![Figure 2. Reported Answers to Minimum Amount of Moderate-Intensity Aerobic Physical Activity Recommended for Health Benefits (N = 407).](image)

**COMMENT**

Results of the online questionnaire indicate that awareness of the latest public health recommendations for physical activity is low among college students living in residence halls. Less than one-third of the individuals sampled were able to correctly identify the various volumes of aerobic activity necessary to achieve health benefits and those necessary for
additional benefits, including weight loss. The level of awareness seen here is similar to that in a sample of U.S. adults who were asked to recall the amount of physical activity recommended by the Centers for Disease Control and Prevention and the American College of Sports Medicine in their 1995 report. An additional study was conducted to determine the level of awareness of the CDC/ACSM guidelines from 1995 and the results indicated that only one-quarter of individuals between the ages of 18-24 were able to correctly identify this recommendation. While the consistency of these findings is not surprising, it should be noted that the 2008 Physical Activity Guidelines for Americans are different from the 1995 recommendations in that they do not specify the number of days per week on which individuals should be active. Instead, an overall goal of the equivalent of 150 minutes of moderate-intensity activity is recommended. Therefore, individuals should have less trouble understanding and remembering the recommendation, as it does not require recall of both frequency and duration variables.

The low level of awareness in this population did not differ by any demographic variable, unlike what has been seen in previous research. Generally, awareness of recommendations is significantly lower among males and those that do not meet the minimum guidelines for physical activity. While females in this sample did show higher awareness scores than males, the difference was not significant. However, the difference in awareness scores based on physical activity category did approach significance, making this finding similar to those of other studies. In fact, results of the multiple regression analysis indicated that physical activity category was the only significant predictor of awareness score and aerobic score, when controlling for all other variables in the model. Once again, this finding is similar to that seen in previous studies that show physical activity is associated with higher levels of correct knowledge and regularly active individuals were twice as likely to be aware of recommendations. This
may indicate that individuals who meet or exceed public health recommendations are more attentive to such guidelines. However, due to the cross-sectional nature of this investigation, the direction of such a relationship cannot be determined.

While the level of awareness concerning the recommended volumes of physical activity was quite low, a vast majority of respondents were aware of the fact that both moderate- and vigorous-intensity activity are beneficial. Furthermore, half of the individuals were aware of the recommended frequency of muscle-strengthening activity. In fact, this is the reason that the average aerobic awareness score was lower than the overall awareness score. For approximately 50% of the individuals, awareness of the muscle strengthening recommendation raised their overall awareness score. When this question was removed (to calculate the aerobic score), the average was lower. These findings in particular, may be very beneficial to health promotion specialists trying to increase awareness of physical activity recommendations in college or university settings. Due to the fact that many students are aware of these two aspects of the guidelines, valuable resources can be spared and used to promote awareness of the minutes of moderate- and vigorous-intensity physical activity that are necessary to gain health benefits and that aid in weight control.

Aerobic Question 1, concerning the minimum recommendation for achieving health benefits, was analyzed individually due to the fact that it is the minimum recommendation for health benefits and having an understanding of the minimum volume of activity recommended is extremely important for the general public. Of the individuals who did not answer Aerobic Question 1 correctly, approximately 40% chose minute values below the recommendation, while roughly 18% chose values higher than those recommended. Almost half of the respondents in this sample think that accumulating less than the equivalent of 150 minutes of moderate-intensity
activity per week is sufficient to achieve health benefits. This finding raises concern because these students may think that lower levels of physical activity will be enough to provide the protective effects of aerobic exercise, when in reality they are not. While the guidelines clearly indicate that some physical activity is better than none at all, these individuals need to be made aware that in order to achieve health benefits, they should accumulate the appropriate amount of aerobic physical activity. Conversely, the group that indicated that it is necessary to accumulate 300 minutes of moderate-intensity physical activity is also misinformed. As discussed by Bennett et al, this is not necessarily beneficial due to the fact that if individuals perceive the minimum recommendation as unachievable, motivation to accumulate physical activity may decrease.¹

In regards to the low awareness scores seen in this sample, it should be noted that these individuals were most likely not exposed to the 2008 Physical Activity Guidelines for Americans before entering college. Three-quarters of the individuals responding to the online questionnaire identified themselves as freshmen at the university, meaning that they were high school freshmen in the year 2007. Currently, 31 states have laws requiring students to take only one health education course during their four years in grades 9-12, and this is usually satisfied during the student’s first year.¹¹ Thus, the individuals that comprised a majority of this sample likely took their only required health education course before the 2008 Physical Activity Guidelines for Americans were released. Although the awareness scores were not significantly different between freshmen and individuals in higher classes, average scores were higher for students in their junior and senior year of college, who may have been exposed as part of a health/physical education class taken at the university. However, this cannot be said with certainty, as enrollment in a physical education class was not assessed. Because of the unique timing for the freshmen in
this cohort, there is a gap in knowledge of recommended amounts of physical activity. However, 79.1% of health education teachers in U.S. high schools covered material focused on how much physical activity is enough for a healthy lifestyle. Because this information is being taught as part of the physical education curriculum, future cohorts of college students will hopefully have been exposed to the newest public health recommendations for physical activity as part of their high school education and will therefore be more aware as they enter college.

Limitations
While this is the first study to examine the level of awareness of the 2008 Physical Activity Guidelines for Americans among college students living in residence halls, it is not without limitations. First, the sample size from which the conclusions of this study are drawn is a concern. However, the data are part of a longer-term study and therefore, researchers were limited in the number of students that could be contacted for participation. Future studies should go to any lengths to ensure larger sample sizes. Because participants were informed of the nature of the survey before deciding to participate, response bias is also considered a limitation. Those who are not interested in physical activity or have a negative experience with physical activity may have chosen not to participate. This idea explains the unusually high proportion of individuals who were categorized as “highly physically active” and had a favorable BMI. Also, the timing of the questionnaire was early in the semester, before students had time to adjust to class and schoolwork obligations, thus leaving more time for physical activity. These limitations should also be addressed in future research.

Conclusions
Overall, the level of awareness of the 2008 Physical Activity Guidelines for Americans is low among college students living in residence halls. While most individuals in this population
are aware of the ability to combine moderate- and vigorous-intensity physical activity to meet current recommendations, only about one-quarter are aware of the actual volume of physical activity recommended. Although awareness of the benefits of a given health behavior does not lead to immediate behavior change, increasing awareness of recommended volumes physical activity may help to minimize the decline in physical activity normally seen in this population. Preventing the decline in physical activity during the transition from adolescence to adulthood will help individuals incorporate adequate physical activity as a lifestyle habit. Future researchers should investigate the effectiveness of various strategies to increase awareness of the 2008 Physical Activity Guidelines for Americans in college students living in residence halls.


63. Ravussin E. Obesity in Britain. Rising trend may be due to 'pathoenvironment'. *British Medical Journal*. 1995;311(7019).


111. Tennessee Department of Education. Rules of the State Board of Education: Minimum Requirements for the Approval of Public Schools 2008.

APPENDIX A

Online-Questionnaire
You must be 18 years or older to participate in this survey.
Are you 18 years or older? Yes___ No___

INTRO
Thank you for taking the time to participate in this survey.

The purpose of this study is to assess awareness of the 2008 Physical Activity Guidelines in college students living on the University of Tennessee campus. Researchers are also interested in the volume of physical activity of these students. As part of the 10-minute survey, you will be asked to answer questions about the 2008 Physical Activity Guidelines as well as your current volume of physical activity. Upon completing the survey, you will be entered into a drawing for a chance to win a $50 Visa gift card. This is the first stage of a two-stage survey. You will be re-contacted at a later date to complete the second stage and upon doing so, will be entered into another drawing for a chance to win another $50 Visa gift card.

By completing and submitting this survey, you are providing your consent to participate in this study.

INTRO
1. What is your age?

PART I: Physical Activity Guidelines
The first part of this survey will have questions regarding the 2008 Physical Activity Guidelines for Americans.

Please use the following definitions to answer the questions:

**Moderate-intensity** refers to activities that take moderate physical effort and make you breathe somewhat harder than normal. Examples include walking, bicycling or shooting hoops.

**Vigorous-intensity** refers to activities that take hard physical effort and make you breathe much harder than normal. Examples include running, swimming laps or playing a game of basketball.

1. What is the minimum length of time (in minutes) one needs to perform moderate-intensity physical activity (i.e. walking, bicycling, shooting hoops) throughout a typical week to achieve a health benefit?
   a. 90 minutes
   b. 120 minutes
   c. 150 minutes
   d. 300 minutes
   e. Don’t know/unsure
2. What is the minimum length of time (in minutes) one needs to perform vigorous-intensity physical activity (i.e. running, swimming laps, playing a game of basketball) throughout a typical week to achieve a health benefit?
   a. 50 minutes
   b. 75 minutes
   c. 100 minutes
   d. 150 minutes
   e. Don’t know/unsure

3. What is the minimum length of time (in minutes) one needs to perform moderate-intensity physical activity (i.e. walking, bicycling, shooting hoops) throughout a typical week to lose weight?
   a. 150 minutes
   b. 200 minutes
   c. 250 minutes
   d. 300 minutes
   e. Don’t know/unsure

4. What is the minimum length of time (in minutes) one needs to perform vigorous-intensity physical activity (i.e. running, swimming laps, playing a game of basketball) throughout a typical week to lose weight?
   a. 150 minutes
   b. 125 minutes
   c. 100 minutes
   d. 75 minutes
   e. Don’t know/unsure

5. What is the minimum number of days per week one should perform muscle strengthening activities (i.e. weight training, yoga, calisthenics) involving all major muscle groups?
   a. 1 day per week
   b. 2 days per week
   c. 3 days per week
   d. 5 days per week
   e. Don’t know/unsure

6. A combination of moderate- and vigorous-intensity physical activity is appropriate to meet current recommendations.
   a. True
   b. False
   c. Don’t know/unsure

PART II: International Physical Activity Questionnaire
   This section of the survey is going to ask you questions about your physical activity habits over the last 7 days only. Please answer each question to the best of your ability.
Think about all the **vigorous** activities that you did in the last 7 days. **Vigorous physical activities** refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do **vigorous physical activities** like running, lap swimming or fast bicycling?
2. How much time (in minutes) did you usually spend doing **vigorous physical activities** on one of those days?

Think about all the **moderate activities** that you did in the last 7 days. **Moderate physical activities** refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do **moderate physical activities** like walking, bicycling or playing doubles tennis?
4. How much time (in minutes) did you usually spend doing **moderate physical activities** on one of those days?

Think about the time you spent **walking** in the last 7 days. This includes at work, school and at home, walking to travel from place to place (i.e. going to class), and any other walking that you might do solely for recreation, sport, exercise or leisure.

5. During the last 7 days, on how many days did you **walk** for at least 10 minutes at a time?
6. How much time (in minutes) did you usually spend **walking** on one of those days?

The last question is about the time you spent **sitting** on weekdays during the last 7 days. Include time spent at work, at home, while doing school work and during leisure time. This may include time spent sitting at a desk, visiting with friends, reading or sitting or lying down to watch television.

7. During the last 7 days, how much time (in hours) did you spend **sitting** on a weekday?

**PART III: Demographic Information**

The final section of this survey will contain questions about your demographic information. Please answer each question to the best of your ability.

1. What is your age?
2. What is your sex?
   a. Male
   b. Female
3. About how much do you weigh (in pounds) without shoes?
4. About how tall are you (in feet and inches) without shoes?
5. Are you Hispanic or Latino?
6. Which one or more of the following would you say is your race? (Check all that apply)
a. White
b. Black or African American
c. Asian
d. Native Hawaiian or Other Pacific Islander
e. American Indian or Alaskan Native
f. Self-identified (specify)

7. Which on-campus residence hall do you live in?
   a. Clement Hall
   b. Gibbs Hall
   c. Hess Hall
   d. Humes Hall
   e. Massey Hall
   f. Morrill Hall
   g. North Carrick Hall
   h. Reese Hall
   i. South Carrick Hall
   j. Volunteer Hall
   k. Laurel Apartments
   l. Apartment Residence Hall

8. What is your academic level?
   a. Freshman
   b. Sophomore
   c. Junior
   d. Senior
   e. Graduate Student

9. Have you declared an academic major at the University of Tennessee?
   a. Yes
   b. No

10. If yes, in which college or school is your major housed?
   a. Agricultural Sciences and Natural Resources
   b. Architecture and Design
   c. Arts and Sciences
   d. Business Administration
   e. Communication and Information
   f. Education, Health and Human Sciences
   g. Engineering
   h. Law
   i. Nursing
   j. Social Work
   k. Space Institute
   l. Veterinary Medicine
11. Which of the following most closely represents your current grade point average?
   a. Below 1.5
   b. 1.51-1.75
   c. 1.76-2.0
   d. 2.1-2.25
   e. 2.26-2.5
   f. 2.51-3.0
   g. 3.1-3.25
   h. 3.26-3.5
   i. 3.51-3.75
   j. 3.76-4.0
   k. No established GPA at the University of Tennessee (i.e. First-semester Freshman)

12. Please check all of the facilities that you have visited or used to perform physical activity in the past 2 weeks.
   a. Tennessee Recreation Center for Students (TRECS)
   b. Intramural Fields
   c. TRECS Pool
   d. Handball courts
   e. Tennis courts
   f. Tom Black Track
   g. Health, Physical Education and Recreation (HPER) Gyms and weight room
   h. HPER (HPER) racquetball courts
   i. Sand volleyball court
   j. Student Aquatic center
   k. Residence hall work-out room
   l. Greenway
   m. Running routes through/around campus
   n. Off campus facility (privately owned gym, YMCA, etc.)
   o. Other (specify):

13. Are you a varsity athlete at the University of Tennessee?
   a. Yes
   b. No

14. Have you participated or do you plan to participate in University of Tennessee Club Sports?
   a. Yes
   b. No

15. Have you participated or do you plan to participate in University of Tennessee Intramural Sports?
   a. Yes
   b. No

16. Did you participate in high-school athletics?
17. Are you currently employed?
   a. No
   b. Yes, less than 20 hours per week
   c. Yes, more than 20 hours per week

18. What is your annual household income from all sources at your permanent household?
   a. Less than $9,999
   b. Between $10,000 and $14,999
   c. Between $15,000 and $19,999
   d. Between $20,000 and $24,999
   e. Between $25,000 and $34,999
   f. Between $35,000 and $49,999
   g. Between $50,000 and $74,999
   h. $75,000 or more
   i. Don’t know

19. What is the zip code of your permanent household address?
APPENDIX B

Recruitment E-mail
Hello Fellow Tennessee Volunteer,

I am a graduate student at the University of Tennessee and I am conducting a research study for the Department of Kinesiology, Recreation and Sport Studies. My study involves an online survey that will take you about 10 minutes to complete. The survey will ask you a few questions about physical activity, your current level of physical activity and some demographic information. Upon completion of the survey, you will have the opportunity to submit your e-mail address to enter a drawing to win a $50 Visa gift card. If you are interested in completing the survey and entering to win a $50 Visa gift card, please follow the link below.

http://tinyurl.com/3gaspwh

In order to participate, you must be 18 years of age or older. Your name will not be included on the survey. By completing and submitting the survey, you provide your informed consent to participate. Participation is completely voluntary and there are no consequences if you choose not to participate. If you have any questions about the study, you may contact the Principal Investigator, Ginny Frederick at (865)974-8768, or the Co-Principal Investigator, Dr. Eugene Fitzhugh at (865)974-0458. If you have any questions about your rights as a participant, you may contact the Office of Research Compliance Services at the University of Tennessee at (865) 974-3466.

Thank you,

Ginny Frederick  
Department of Kinesiology, Recreation and Sport Studies  
College of Education, Health and Human Sciences  
The University of Tennessee, Knoxville, TN  
Phone: (865)974-8768  
E-mail: gfreder1@utk.edu
APPENDIX C

Increasing Awareness of the 2008 Physical Activity Guidelines for Americans Among College Students Living in Residence Halls: The Effectiveness of a Health Communication Campaign
The information in this Appendix relates to the final two research questions addressed by this thesis project. These research questions are 1) is a health communication campaign effective in increasing awareness of the *2008 Physical Activity Guidelines for Americans* among college students living in residence halls, and 2) does increased awareness correspond to increased volumes of physical activity?

**METHODS**

**Participants**

Students living in four residence halls, two control and two experimental, at a large Southeastern university were invited to participate in the study during the fall semester of 2011. The residence halls were chosen based on gender distribution and location on campus. The experimental halls were located across campus from the control halls in order to minimize contamination. During the first week of September 2011, an e-mail was sent to all students living in the four residence halls (*N* = 2136) explaining the study and containing a web address, which was linked to the online questionnaire. Students who accessed the site containing the online questionnaire indicated informed consent by clicking “I agree” on the introductory page containing the study information.

Baseline questionnaire data was obtained for 396 students (18.5% response rate). Completed follow-up questionnaires were obtained from 144 students for a retention rate of 36.4% and an overall response rate of 6.7%.

**Procedure**

Approval for the study was obtained from the University of Tennessee Institutional Review Board. Participants were informed via e-mail that information obtained from the questionnaire was confidential. Residence hall directors sent the recruitment e-mail containing information about the study and a hyperlink to the online questionnaire. This questionnaire was
created using SPSS mInterview Dimensionnet and hosted through the University of Tennessee server. The web-based questionnaire remained open for two weeks following the initial recruitment e-mail, and took approximately 10 minutes to complete. Three participants were randomly selected to win a $50 Visa gift card. Before exiting the questionnaire, respondents were asked for permission to be re-contacted to complete the follow-up questionnaire.

At the end of this two-week period, the questionnaire was deactivated and the 8-week health communication campaign began in the experimental residence halls. The campaign consisted of seven sets of three informational posters communicating three main messages of the 2008 Physical Activity Guidelines for Americans. The posters were 11” x 17” and were hung in the hallways of the residence halls and were rotated each week to maintain students’ interest. Additionally, students in the experimental residence halls received informational flyers and e-mails pertaining to the guidelines every other week. The weeks in which e-mails were not sent, these students received informational flyers in their residence hall mailboxes.

At the end of the 8th week, all campaign materials were removed from the experimental residence halls and respondents of the baseline questionnaire who gave permission to be re-contacted were sent a series of three e-mails with a link to the online follow-up questionnaire. Once again, three participants were randomly selected to win a $50 gift card.

**Measures**

Respondents reported demographic information on age, gender (male or female), race (white or non-white), height, weight, academic level (freshman or upperclassman), declared academic major (yes or no), and employment status (employed or unemployed) using questions from the Behavioral Risk Factor Surveillance System (BRFSS). Self-reported height and weight were used to calculate body mass index (BMI) scores (kg/m²). Respondents were
categorized according to BMI values; values <25 were normal and values ≥ 25 were overweight/obese.

Physical activity was assessed using the short form International Physical Activity Questionnaire, which has been validated in this population with an interclass correlation coefficient of 0.71-0.89. Respondents are asked to report the frequency, in days and duration, in average number of minutes on each of those days, of vigorous- and moderate-intensity activity as well as walking and sedentary time.

Reported physical activity was translated into total minutes of moderate-intensity physical activity per week in order to classify individuals according to the 2008 Physical Activity Guidelines for Americans categories: inactive (0 minutes), low (1-149 minutes), moderate (150-299 minutes) and high (300+ minutes). Reported minutes of physical activity are moderate-intensity equivalents (i.e. one minute of vigorous-intensity activity is equal to two minutes of moderate-intensity activity).

Awareness of the 2008 Physical Activity Guidelines for Americans was the main dependent variable and was assessed using six multiple choice, single-response questions. Five of these questions asked about the aerobic portion of the guidelines while the sixth asked about the recommended frequency of muscle-strengthening activity. For each correct response, participants scored one point for a possible range of awareness scores from 0 to 6. An aerobic awareness score was also calculated for each participant based upon responses to the first five questions in the questionnaire. This score was calculated by giving one point per correct answer, with a possible range of scores from 0 to 5.

Analyses
Student’s t tests were used to examine differences in baseline awareness score by various demographic variables (gender, race, academic level, BMI category and physical activity category). Baseline and follow-up awareness scores were analyzed using one-way repeated measures analyses of variance (ANOVAs) and significant differences by group were assessed. A Spearman’s rho correlation was used to assess the relationship between changes in awareness score and changes in minutes of physical activity reported. Data was analyzed using SPSS 19.0 and level of significance was set at \( p < 0.05 \).^{109}

**RESULTS**

One-hundred forty-four individuals completed both the baseline and follow-up questionnaires. Respondents were mostly white, female and freshmen students with normal BMI and high levels of physical activity (Table 4).

At baseline, individuals in the experimental \( (n = 51) \) and control \( (n = 93) \) groups that completed both questionnaires differed significantly by race and minutes of moderate-intensity equivalent physical activity \( (p < .05) \). The average awareness score at baseline for all participants was 2.5 \( \pm \) 1.2 (Table 4). Over the course of the study, the increase in awareness score for the entire study population was significant \( (p = 0.031) \) while that for aerobic score approached significance \( (p = 0.073) \) (Table 5). At the follow-up questionnaire, respondents in the experimental group were more aware of the minimum amount of moderate-intensity physical activity recommended to achieve a health benefit than those the control group \( (p = 0.031) \).

Results of repeated measures ANOVA indicate interactions between both awareness and aerobic awareness scores and study group. Specifically, overweight/obese respondents in the experimental group had a 1.6 point increase in awareness score \( (p = 0.009) \) (Figure 3) and a 1.4 point increase in aerobic score \( (p = 0.018) \) (Figure 4).
Table 4. Demographic Characteristics of Participants that Completed Both Questionnaires (n = 144).

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Total (N=144)</th>
<th>Experimental (N=51)</th>
<th>Control (N=93)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>68.1 (98)</td>
<td>64.7 (33)</td>
<td>69.9 (65)</td>
<td>0.523</td>
</tr>
<tr>
<td><strong>Class</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>75.0 (108)</td>
<td>84.3 (43)</td>
<td>69.9 (65)</td>
<td>0.156</td>
</tr>
<tr>
<td>Upperclassman</td>
<td>25.0 (36)</td>
<td>15.7 (8)</td>
<td>30.1 (28)</td>
<td></td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>81.2 (117)</td>
<td>92.2 (47)</td>
<td>75.3 (70)</td>
<td>0.013</td>
</tr>
<tr>
<td>Non-White</td>
<td>18.8 (27)</td>
<td>7.8 (4)</td>
<td>24.7 (23)</td>
<td></td>
</tr>
<tr>
<td><strong>Declared Major</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Yes</td>
<td>72.2 (104)</td>
<td>70.6 (36)</td>
<td>73.1 (68)</td>
<td>0.746</td>
</tr>
<tr>
<td>No</td>
<td>27.8 (40)</td>
<td>29.4 (15)</td>
<td>26.9 (25)</td>
<td></td>
</tr>
<tr>
<td><strong>BMI Category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>72.9 (105)</td>
<td>80.4 (41)</td>
<td>68.8 (64)</td>
<td>0.135</td>
</tr>
<tr>
<td>Overweight/Obese</td>
<td>27.1 (39)</td>
<td>19.6 (10)</td>
<td>31.2 (29)</td>
<td></td>
</tr>
<tr>
<td><strong>PA Categories</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactive (0)</td>
<td>2.1 (3)</td>
<td>2.0 (1)</td>
<td>2.2 (2)</td>
<td>0.799</td>
</tr>
<tr>
<td>Low (1-149)</td>
<td>9.0 (13)</td>
<td>5.9 (3)</td>
<td>10.8 (10)</td>
<td></td>
</tr>
<tr>
<td>Moderate (149-299)</td>
<td>12.5 (18)</td>
<td>13.7 (7)</td>
<td>11.8 (11)</td>
<td></td>
</tr>
<tr>
<td>High (300+)</td>
<td>76.4 (110)</td>
<td>78.4 (40)</td>
<td>75.3 (70)</td>
<td></td>
</tr>
<tr>
<td><strong>Age (x ± sd)</strong></td>
<td>18.5 ± 0.9</td>
<td>18.4 ± 0.6</td>
<td>18.5 ± 1.0</td>
<td>0.298</td>
</tr>
<tr>
<td><strong>BMI (kg•m−2) (x ± sd)</strong></td>
<td>23.5 ± 4.5</td>
<td>23.0 ± 3.9</td>
<td>23.7 ± 4.8</td>
<td>0.350</td>
</tr>
<tr>
<td><strong>Awareness Score</strong></td>
<td>2.5 ± 1.2</td>
<td>2.5 ± 1.0</td>
<td>2.5 ± 1.4</td>
<td>0.930</td>
</tr>
<tr>
<td><strong>Aerobic Score</strong></td>
<td>1.9 ± 1.0</td>
<td>1.9 ± 0.9</td>
<td>2.0 ± 1.1</td>
<td>0.978</td>
</tr>
<tr>
<td><strong>PA Minutes (Median, IQR)</strong></td>
<td>609.7 (302–840)</td>
<td>723.9 (390–1020)</td>
<td>547.0 (290–730)</td>
<td>0.019</td>
</tr>
</tbody>
</table>

*Range 0-6; includes all six awareness questions
**Range 0-5; excludes muscle-strengthening question
+Moderate-Equivalent minutes (i.e. each vigorous minute counts as two moderate minutes)
Table 5. Changes in Awareness Score by Demographic Measures \((n = 144)\).

<table>
<thead>
<tr>
<th></th>
<th>Baseline</th>
<th>Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>Awareness Score</td>
<td>2.5 ± 1.2</td>
<td>2.7 ± 1.2*</td>
</tr>
<tr>
<td>Aerobic Awareness Score</td>
<td>2.0 ± 1.0</td>
<td>2.2 ± 1.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Experimental</th>
<th>Control</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>68.7%</td>
<td>2.6 ± 1.0</td>
<td>2.6 ± 1.3</td>
<td>3.1 ± 1.1</td>
<td>2.7 ± 1.3</td>
</tr>
<tr>
<td>Male</td>
<td>31.3%</td>
<td>2.6 ± 0.9</td>
<td>2.1 ± 1.4</td>
<td>2.7 ± 1.1</td>
<td>2.6 ± 1.2</td>
</tr>
<tr>
<td>Class</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freshman</td>
<td>74.7%</td>
<td>2.5 ± 1.0</td>
<td>2.4 ± 1.3</td>
<td>3.0 ± 1.1</td>
<td>2.8 ± 1.2</td>
</tr>
<tr>
<td>Upperclassman</td>
<td>25.3%</td>
<td>2.5 ± 0.8</td>
<td>2.7 ± 1.5</td>
<td>2.4 ± 1.1</td>
<td>2.4 ± 1.3</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>78.3%</td>
<td>2.4 ± 0.9</td>
<td>2.4 ± 1.3</td>
<td>3.0 ± 1.1</td>
<td>2.8 ± 1.3</td>
</tr>
<tr>
<td>Non-White</td>
<td>21.7%</td>
<td>3.0 ± 1.4</td>
<td>2.5 ± 1.5</td>
<td>2.3 ± 0.5</td>
<td>2.3 ± 0.9</td>
</tr>
<tr>
<td>BMI Category</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>72.7%</td>
<td>2.6 ± 0.9</td>
<td>2.4 ± 1.3</td>
<td>2.8 ± 1.1</td>
<td>2.7 ± 1.3</td>
</tr>
<tr>
<td>Overweight/Obese</td>
<td>27.3%</td>
<td>2.0 ± 1.1</td>
<td>2.6 ± 1.5</td>
<td>3.6 ± 0.7</td>
<td>2.6 ± 1.2*</td>
</tr>
<tr>
<td>PA Category (min/wk)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inactive (0)</td>
<td>2.1%</td>
<td>4.0 ± 0.0</td>
<td>2.0 ± 1.4</td>
<td>1.0 ± 0.0</td>
<td>3.0 ± 1.4</td>
</tr>
<tr>
<td>Low (1-149)</td>
<td>9.0%</td>
<td>2.3 ± 1.5</td>
<td>2.2 ± 1.2</td>
<td>4.0 ± 1.0</td>
<td>2.1 ± 1.0</td>
</tr>
<tr>
<td>Moderate (150-299)</td>
<td>12.5%</td>
<td>2.3 ± 0.5</td>
<td>2.4 ± 1.4</td>
<td>3.1 ± 0.9</td>
<td>2.3 ± 1.1</td>
</tr>
<tr>
<td>High (300+)</td>
<td>76.4%</td>
<td>2.5 ± 1.0</td>
<td>2.5 ± 1.4</td>
<td>2.9 ± 1.1</td>
<td>2.8 ± 1.3</td>
</tr>
</tbody>
</table>

*\(p < 0.05\)

Note: Results of Repeated Measures ANOVA

Figure 3. Change in Awareness Score by BMI Category Following Exposure to a Health Communication Campaign.

Note: Results of Repeated Measures ANOVA; \(F = 8.384, p = 0.009\)
Figure 4. Change in Aerobic Awareness Score in Overweight/Obese Respondents Following Exposure to a Health Communication Campaign ($n = 39$).
Note: Results of Repeated Measures ANOVA; $F = 4.466, p = 0.018$

No significant changes in total moderate-equivalent minutes of physical activity were seen for either group. Also, there was no correlation of change in total moderate-equivalent minutes of physical activity and change in awareness or aerobic score ($\rho = -0.072, p = 0.391$).

**COMMENT**

The aims of the current study were to assess the effectiveness of a physical activity health communication campaign designed to increase awareness of the *2008 Physical Activity Guidelines for Americans*, and to determine if an increase in awareness was correlated with an increase in volume of physical activity. Results of the study show that the health communication campaign was not effective in increasing awareness of the latest public health recommendations for physical activity.
Overall awareness scores and aerobic awareness scores increased for both groups over the duration of the study by an average of 0.3 points. Based on questionnaire results, individuals in the experimental residence halls indicated having seen the physical activity campaign in their residence halls, in their mailboxes and via their campus e-mail. However, individuals in both groups recalled having seen information in other areas on campus such as the library, dining halls or the campus recreation center. This finding would explain the fact that awareness score increased in both groups. Students in the control group may also have been exposed to the guidelines through a class they were taking through the university, but because enrollment in a health/physical education course was not assessed, it cannot be said with certainty. Also, because students are allowed to enter any of the residence halls on campus, there is no guarantee that those in control group were not exposed to the health communication campaign while visiting a friend or classmate in an experimental residence hall. By seeing the posters in the hallways of the experimental residence halls, awareness among those in the control group could have increased. Finally, if any of the individuals in the control group became interested in finding out more information about physical activity, the 2008 Physical Activity Guidelines for Americans are easily accessible on the Internet. Therefore, awareness among control students would increase, not as a result of the health communication campaign, but as a result of their own interest in learning about physical activity recommendations.

Previous research indicates that the methods used in this campaign may not have saturated the exposed individuals to the threshold at which they would retain the information. For example, a study conducted at the University of Arizona used various health communication strategies to target binge drinking among students. Researchers placed advertisements in school newspapers and other publications targeted at the priority populations (fraternity and sorority
members and those living in residence halls), funded several alcohol-free social events for students, wrote mini-papers about the misconceptions of drinking on campus, hosted awareness week activities and placed ads on local TV and radio stations. The campaign proved effective at decreasing the prevalence of binge drinking among students and also lead to favorable changes in attitudes towards binge drinking. Overall, the campaign saturated the entire campus and surrounding community.

A similar campaign focused on awareness of physical activity recommendations may also be effective if the level of saturation necessary to increase awareness is met. This may involve more than just signage in residence halls and information via e-mail. A campus-wide campaign utilizing additional modes of communication such as newspaper advertisements, displays at bus stops around campus, and point of decision prompts reminding individuals of the recommendations may be more effective in increasing awareness and subsequently, volumes of physical activity.

Conversely, due to the amount of media college students are currently exposed to on a daily basis, important health-related information may be lost, or go unnoticed when added to the mix. For this reason, other avenues should be evaluated for their effectiveness in increasing awareness of health-related behaviors such as physical activity. Such avenues include programming by the residence hall assistants focusing on physical activity, why it is important and how much is recommended. Having an individual such as a resident assistant communicate the information to students in a more controlled setting, such as monthly face-to-face meetings with residents of his or her floor, may be an effective way to educate college students on physical activity and other important health behaviors.
Another possible avenue for promoting awareness of physical activity guidelines on a college campus would be to incorporate the information as part of freshman orientation or a first-year studies class. Such classes often educate students on proper time management, study habits and personal safety. Therefore, adding a component about physical activity recommendations and ways to lead a healthy lifestyle throughout the college years would be logical.

There was no correlation between changes in awareness score and changes in reported volume of physical activity. This is most likely due to the fact that the changes in awareness score were relatively small. Also, a very large proportion of respondents were highly physically active at baseline, reporting an average exceeding the equivalent of 1000 minutes of moderate-intensity physical activity per week. These levels of physical activity were quite unexpected, as Raynor et al estimate that only 22% of college students meet the 2008 Physical Activity Guidelines for Americans. It should be noted, however, that this information was based on physical activity assessed with accelerometers and that objective measurement of physical activity often results in lower volumes than self-reported data.

While the campaign as a whole was not effective, one promising result should be noted. Overweight/obese individuals who were exposed to the health communication campaign showed a significant increase in overall awareness and aerobic awareness scores, indicating an increase in knowledge of the 2008 Physical Activity Guidelines for Americans. These respondents started with awareness scores that were lower than those with normal BMI but showed a greater increase over the course of the study. This increase in awareness is important as it marks the acquisition of information which can be a vital step in the behavior change process. These individuals can use this information to make informed decisions about including physical activity as part of a healthy lifestyle and hopefully incorporate activity as part of their weight loss plan if
and when they progress to the action stage of behavior change. Furthermore, it is important that an increase in aerobic awareness was seen in these individuals, as this type of activity is very beneficial for individuals trying to lose weight.4

One way to improve the current health communication campaign aimed at increasing awareness would be to perform a needs assessment to determine exactly what aspects of awareness need to be targeted. For example, a majority of individuals in this sample were aware that moderate- and vigorous-intensity physical activity are beneficial and that muscle-strengthening activity should be performed on two days per week. Therefore, one-third of the resources used (on promoting the muscle-strengthening recommendation) could have been used to promote awareness of the volume of physical activity needed to achieve health benefits and that necessary for weight loss.

Furthermore, a needs assessment would have been appropriate to determine the proportion of individuals in each stage of behavior change. The results of such an assessment in this sample would have revealed that a majority of individuals are in the action or maintenance stages. In this case, it would still be important to increase awareness of the physical activity recommendations due to the fact that a majority of these students were first-semester freshmen. Research indicates that physical activity levels decline as students transition from high school into college and even more so as the college years progress.17,19,26 In this sample in particular, upperclassmen reported significantly less physical activity than freshmen (699 minutes per week vs 1016 minutes per week). It is crucial for college-age individuals to maintain adequate levels of physical activity due to the fact that many lifelong habits, including physical activity, are formed during these years.15,26 For example, in a survey of college alumni, Sparling et al report that roughly 85% of those who considered themselves “regular exercisers” as college students were
as active or more active at the time of the survey.\textsuperscript{15} Even more striking, 81\% of those who were non-exercisers as college students were still inactive or even less active after graduation.\textsuperscript{15} Therefore, by increasing awareness of the amount of physical activity recommended, students may be more likely to maintain adequate levels of physical activity as they move into their second, third and fourth years of college.

\textbf{Limitations}

The most influential limitation in this research study was the small sample size. Both low response and retention rates hindered the ability to see significant changes in awareness between the control and experimental groups. This also made it difficult to perform sub-group analyses based on demographic characteristics (i.e. class level, gender, race, PA category, etc.) to determine the effectiveness of the campaign on various sub-populations. Results of a power analysis reveal that the limitation of sample size could be addressed by having approximately 1,250 participants complete the study. Response bias was also a limitation in that individuals that value physical activity as part of a healthy lifestyle are more likely to respond to an online questionnaire on the topic. This is the most likely reason for the large proportion of respondents categorized as highly physically active with a normal BMI.

\textbf{Conclusions}

This health communication campaign was not effective in increasing awareness of the 2008 \textit{Physical Activity Guidelines for Americans} in the entire sample. However, promising results were seen for overweight/obese individuals. Future health communication campaigns to increase awareness of physical activity recommendations should first examine the gaps in knowledge and use this information to design a campaign that reaches individuals at all stages of
behavior change. Also, health promotion professionals at the college level should take all necessary measures to ensure the campaign messages saturate the environment to ensure adequate exposure. The development of appropriate and effective health communication and promotion campaigns may go a long way in increasing and maintaining adequate levels of physical activity among college students.
APPENDIX D

Health Communication Campaign Posters
The U.S. Department of Health and Human Services recommends that adults accumulate at least 150 minutes of moderate-intensity or 75 minutes of vigorous-intensity aerobic activity per week for health benefits.
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The U.S. Department of Health and Human Services recommends that for additional health benefits including weight loss, adults should accumulate at least 300 minutes of moderate-intensity or 150 minutes of vigorous-intensity aerobic activity per week.
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The U.S. Department of Health and Human Services recommends that adults perform muscle-strengthening exercises at least 2 days per week.

The U.S. Department of Health and Human Services recommends that adults perform muscle-strengthening exercises at least 2 days per week.
The U.S. Department of Health and Human Services recommends that adults perform **muscle-strengthening** exercises at least 2 days per week.

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**Be Active Your Way**

**Muscle Strength**

Exercising with a friend is a great way to stay motivated!

---

**Be Active Your Way**

**Muscle Strength**

Make sure to include exercises for all of the major muscle groups!

---

**Be Active Your Way**

**Muscle Strength**

You can use free weights, sandbags or your own body weight to strengthen your muscles.

---

**Be Active Your Way**

**Muscle Strength**

Be a variety of exercises to include all major muscle groups.

---

The U.S. Department of Health and Human Services recommends that adults perform **muscle-strengthening** exercises at least 2 days per week.
The U.S. Department of Health and Human Services recommends that adults perform muscle-strengthening exercises at least 2 days per week.
APPENDIX E

Health Communication Campaign Flyers
**Got 150?**

Get at least 150 minutes of moderate-intensity physical activity this week!

**Need a break? Take a walk!**

Walk for 10 minutes and count it towards your 150 for this week!

**Looking for some fun?**

Get a group of friends together and play Ultimate Frisbee, soccer or basketball. Count it towards your 75 minutes of vigorous activity for this week!

*Note: All flyers were printed on fluorescent paper*
APPENDIX F

Health Communication Campaign E-mails
E-mail #1:
SUBJECT: Did you get your 150 minutes this week?

Regular physical activity is an important part of maintaining a healthy lifestyle.

The U.S. Department of Health and Human Services recommends that adults accumulate 150 minutes of moderate- or 75 minutes of vigorous-intensity aerobic activity per week for substantial health benefits.

For additional health benefits including weight loss, adults should aim to get 300 minutes of moderate- or 150 minutes of vigorous-intensity aerobic activity per week.

In addition to aerobic exercise, it is important to perform muscle-strengthening exercises at least 2 days per week.

To find out more information about these recommendations, including descriptions of different activities, what activities can count towards your weekly goal and ideas for incorporating more physical activity into your day, visit the Physical Activity for Everyone website below!

http://www.cdc.gov/physicalactivity/everyone/guidelines/adults.html

E-mail #2:
SUBJECT: The Benefits of Physical Activity

The benefits of physical activity are endless! Making exercise a part of your regular routine can have a drastic effect on many aspects of your health.

Research indicates that young adulthood is a crucial time for making the decision to incorporate physical activity into your daily life.

As a college student, we face a tremendous amount of stress. Everything from academics to finances and our social lives can leave us feeling overworked and anxiety-ridden. Physical activity has been proven to reduce the feelings of stress and other depressive symptoms.

This is also an important point in life because those that choose to make exercise a priority at this time are more likely to keep being physically active into adulthood and later in life.

Even though some of the benefits may not seem important right now, being physically active as an adult is associated with decreased risks of certain health issues like heart disease, diabetes, stroke and even cancer!

Check out the following website for ways that physical activity can enhance your health and your life!
E-mail #3:
SUBJECT: Finding Fun Ways to Stay Active
Exercise isn't everyone's favorite thing to do. For some of us, we don't really like it at all! However, knowing the benefits of maintaining a physically active lifestyle, it's important that we accumulate enough physical activity to meet public health recommendations.

The 2008 Physical Activity Guidelines for Americans indicate that adults should accumulate at least 150 minutes of moderate-intensity physical activity each week or 75 minutes of vigorous-intensity activity per week, or an equivalent combination of both to achieve health benefits such as reduced risk of heart disease and high cholesterol. For even more health benefits including weight loss, the recommendations goes up to 300 minutes of moderate and 150 minutes of vigorous-intensity activity per week, or an equivalent combination of the two.

So, you may be thinking, what's the difference in moderate and vigorous activities and how do I know which intensity I'm working at? The list below indicates popular activities that are considered moderate and some that are considered vigorous. If activities you like to do aren't on the list, think of a listed activity that is similar in intensity and see whether it is moderate or vigorous, your selected activity will be the same as that one!

**Moderate-Intensity Activities**
- Walking
- Leisurely Cycling
- Leisurely Swimming
- Doubles Tennis
- Shooting a Basketball (for at least 10 minutes)
- Golfing
- Skateboarding
- Softball or Baseball
- Kickball

**Vigorous-Intensity Activities**
- Jogging or Running
- Fast Cycling
- Weight Lifting
- Playing a game of Basketball
- Flag/Touch Football
- Ultimate Frisbee
- Lacrosse
- Rugby
- Racquetball
- Soccer
- Singles Tennis
- Lap Swimming

Find an activity you enjoy from the list above or one you already do. See if you can meet the minimum recommendations of 150 minutes of moderate-intensity activity, 75 minutes of vigorous-intensity, or an equivalent combination of both!

HAVE FUN AND STAY ACTIVE!
VITA

Virginia (Ginny) Marie Frederick was born on January 24, 1988 in Decatur, Georgia. Ginny grew up in Snellville, Georgia where she graduated from Shiloh High School in 2006. From there, she went on to play volleyball for Kennesaw State University from 2006-2010, while pursuing a Bachelor of Science degree in Exercise and Health Science with a minor in Chemistry. While at Kennesaw State, Ginny was involved in research and leadership with the Exercise and Health Science Major’s Club as well as the Student-Athlete Advisory Committee. After graduating from KSU, she enrolled at The University of Tennessee and accepted a position as a Graduate Teaching Associate teaching volleyball, weight training, and exercise and weight control classes. This research is part of the pursuit of her Master’s Degree in Exercise Physiology with a minor in Epidemiology. Ginny’s career goal is to work at the state or federal level researching and promoting physical activity.