HIGH SCHOOL PHYSICAL EDUCATION AND SPORT PARTICIPATION: IMPACT ON YOUNG ADULT PHYSICAL ACTIVITY BEHAVIORS

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by

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The undersigned, appointed by the dean of the Graduate School, have examined the dissertation entitled:

HIGH SCHOOL PHYSICAL EDUCATION AND HIGH SCHOOL SPORT: IMPACT ON YOUNG ADULT PHYSICAL ACTIVITY BEHAVIORS

Presented by Catherine Elizabeth Peterson

A candidate for the degree of doctor of philosophy,

And hereby certify that, in their opinion, it is worthy of acceptance.

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Dedication

The work of my higher education degrees is dedicated to my family. My Mom, my Dad, my sister, and two brothers have always supported my efforts in more ways than any typical family would and then some. This work is dedicated in a very special way to my son, Isaac, who has literally been with me every single day of my journey through three degrees in higher education. Isaac, if we have made it through these journeys together, then we are stronger together, and because you have felt the sacrifice and yet supported my time, efforts, and work ethic over the past 11 years, I will be working harder than ever to love you every second from this day forward in gratitude for the gifts you have given me and the sacrifices you have endured. To my husband, Derrick, who despite marrying me with the hopes of having a medical doctor for a wife, supported me as I wound my way down the path to becoming a Dr., of philosophy. Derrick, your loving and 'tough love' support and encouragement throughout my educational endeavors are more valuable to me than any amount of money, or number of gifts. My parents, John and Mary Ann Young, and my siblings, Rebecca, J.P. and Daniel, have been in my life on a daily or weekly basis, supporting me in every way from the first college classes I took in the summer of 2001 through the last days of my doctoral enrollment. The final efforts of this degree are dedicated to a family of whom two members started their doctoral degrees at MU many years ago, P. Noble and Barbara Young. In a very unique way your lives, shared with me through friendship, family, conversation, travel, photographs, laughs, and writing sessions have inspired me on a daily basis to be a better person, a better friend, and a more compassionate citizen of the world. Thank you, I love you all.

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HIGH SCHOOL PHYSICAL EDUCATION AND SPORT PARTICIPATION: IMPACT ON YOUNG ADULT PHYSICAL ACTIVITY BEHAVIORS

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Abstract

The link between High School Physical Education and High School Sport participation and subsequent young adult physical activity habits was explored in this study. There is evidence that activity behaviors track from adolescence to adulthood and these programs have high participation rates, yes very few studies have evaluated their potential for long-term public health impact. A survey was developed and used to collect data from college undergraduate students, (*n*=1339) about previous high school physical education and sport participation experiences and current college behaviors including body mass index, days of: aerobic, muscle strength, and flexibility and minutes of sport activity. Correlation, regression, ANOVA, and chi-square analyses revealed relationships of statistical and practical significance. More physical education classes was associated with higher adult activity levels (PE explained between 0.5%- 2% of unique variance). Tracking effects were identified and those who participated in either program reported higher activity levels than those who participated in minimum requirements or neither program (mean differences ranged from .91 days to 1.65 days more activity). National recommendations were used to compare groups on rates of healthy activity behaviors. Those who participated in physical education, both programs, and sport only reported the least, middle, and most individuals meeting recommendations for weekly activity

respectively (effect sizes ranged from .092-.123). The HS PE requirement for graduation is too low to support healthy behavior tracking. Increasing the graduation requirement to daily physical education for all four years is recommended. Additional evidence for long-term health behavior benefits of sport participation was also discovered.

Chapter I: Introduction

Overview of the Problem

There is a lifestyle related disease epidemic in the United States. In addition to soaring rates of obesity, diabetes, hypertension, dyslipidemia and heart disease, there are also extremely low rates of individuals meeting daily health recommendations for physical activity behaviors (Center for Disease Control and Prevention, 2012). According to the Centers for Disease Control and Prevention (CDC) it is estimated that nearly 2/3 of the American population live a sedentary lifestyle and that less than 20% get the regular physical activity that supports physical, mental, and emotional health and keeps risk for disease low (Centers for Disease Control and Prevention, 2013). Research has shown that the epidemic of sedentary behavior contributes to the epidemic of lifestyle related diseases (Centers for Disease Control and Prevention, 1996). Obesity, diabetes, hypertension, dyslipidemia and heart disease, once viewed as diseases of late adulthood, have t are now diagnosed in young children (Daniels, 2008). The overall estimated cost of these diseases directly linked to obesity is nearly $150 billion (Cawley, 2012). It is difficult to know just how much of that is directly related to sedentary behavior however, a study done in 2000 estimated that the direct health care costs for inactive people was about $540 more than active people per year (Pratt, 2000).

Rates of sedentary lifestyle are highest among adults, but have become increasingly prevalent among adolescents and children (Sisson, 2009). Many new programs have been introduced with the aim of improving health behavior, however, some programs that already exist have not been adequately examined as to their claims to

support and instill health behaviors, or in other cases, their incidental impact on health (Malina, 2001; R. Pate, R., O'Neill, J. R., and McIver, K. L., 2011). Two well-established programs in need of further exploration are high school physical education (HS PE) and high school (HS) interscholastic sports (R. Pate, R., O'Neill, J. R., and McIver, K. L., 2011; R. R. Pate, Trost, S. G., Levin, S., Dowda, M., 2000).

One of the goals of PE in the United States is to adequately prepare individuals to be active for a lifetime. Forty-five states require some form of PE credit be completed for graduation from HS (AHA, 2010). HS PE is a program that 1) can have a lasting impact on a large portion of the population and 2) needs further investigation to ascertain its efficacy to fulfill its goals. A second program that is already in place all over the country is HS interscholastic sports. In the United States 67% of High School students engage in HS sports (National Federation of State High School Associations, 2011). Although some recent studies have investigated the lasting effects of HS athletic participation, little is known about the long-term health behavior impact adolescent sport participation may impart, (Everhart et al., 2005; Mears, 2010; R. R. Pate, Trost, S. G., Levin, S., Dowda, M., 2000). In order to investigate if the experiences gained through these programs have an ongoing impact on health behaviors, it is necessary to collect information after the experiences have occurred. A majority of HS graduates go on to a 4-year college or university (Institute of Educational Statistics, 2012). Therefore, the purpose of this study is to fully investigate the impact of HS PE and HS sport experiences on subsequent adult physical activity health behaviors in undergraduate college students.

Purpose of the Study

The primary purpose of this quantitative study is to examine the long-term impact of HS physical activity program participation, specifically HS PE and HS sport participation. A secondary aim is to describe the people who do and do not participate in these programs. Finally, this study also aims to better understand the relationships between participation in these programs and young adult health behaviors.

Based on the literature and previously completed studies the following outcome variables will be included: adult BMI, number of days per week of at least 30 minutes of aerobic activity, number of days per week of muscle strengthening activity and number of days per week of flexibility activity as well as number of minutes spent in sport specific physical activity as part of an exercise routine.

A four part online survey was made available to undergraduate students at a mid-western university. Data was used to investigate the relationships among self-reported demographic variables, PE participation, and sport participation in high school and subsequent adult BMI and physical activity behaviors in the young adult college years. The aims described here were explored through research questions below.

Organization of the Manuscript

Throughout the remainder of this manuscript there are sections where specific parameters about each research question are addressed. These sections are divided into three parts, one for each of the main research questions. The heading will designate which specific research question is being described in the following content. The abbreviation RQ will be used in place of writing out Research Question when

appropriate. When the chapter or section does not include these headings the information refers to the study in general.

Research question 1: Number of HS PE classes.

Research question 1a: What demographic variables are associated with reported number of HS PE classes, (Age, Gender, Race/Ethnicity, estimated family SES, College Year, College GPA)?

Research question 1b: Is the number of HS PE classes reported significantly related to the number of days of adult physical activity behaviors (aerobic, muscle strengthening, flexibility, and sport minutes) or adult BMI? If so, does the number of reported HS PE classes significantly predict the number of days of adult physical activity or adult BMI?

Research question 1c: Is number of HS PE classes reported significantly related to meeting health recommendations for adult physical activity and BMI? If so, does the reported number of HS PE classes significantly predict the odds of meeting the recommendation for adult BMI or physical activity health behaviors (days per week of aerobic, muscle strengthening and flexibility activity)?

Research question 2: Level of reported HS PE participation.

Research question 2a: What demographic variables are associated with level of HS PE experience, (Age, Gender, Race/Ethnicity, estimated family SES, College Year, College GPA)?

Research question 2b: Is there a difference in BMI or adult physical activity behaviors, (aerobic, strength, flexibility, or sport minutes) for individuals reporting different levels of HS PE experience?

Research question 2c: What is the relationship between reported level of HS PE experience and meeting the health recommendations for BMI and physical activity behaviors (days per week of aerobic, muscle strengthening, and flexibility activity)?

Research question 3: HS PE and sport participation.

Research question 3a: What demographic variables are associated with different levels of HS PE and HS Sport experiences, (Age, Gender, Race/Ethnicity, estimated family SES, College Year, College GPA)?

Research question 3b: Is there a difference in adult BMI or activity behaviors (days per week of aerobic, muscle strengthening, flexibility, and sport minutes) and reported level of experience in HS PE and HS Sport?

Research question 3c: What is the relationship between HS PE and HS Sport participation and meeting health recommendations for adult BMI and physical activity behaviors, (days of aerobic, muscle strengthening, and flexibility activity)?

Definition of Terms

A common understanding of key concepts and descriptive language is paramount to the correct representation of the procedure, results, and findings of this study. Table 1 and Table 2 include all the definitions of key terms found throughout this manuscript.

Basic Assumptions

This study involved four basic assumptions. The first assumption was that the participants understood the instrument used to collect information as it is intended. The second assumption was that the instrument measures what it intends to measure. The researcher also acknowledges the assumption inherent in retrospective studies, that participants' memories are sufficient to accurately report previous experience. Finally, this study assumes that participants responded truthfully and honestly and did not intentionally give biased or inaccurate responses.

Delimitations and Limitations

Delimitations. This study was delimited to one Midwestern University and invited only undergraduate participants to respond. The study was delimited to those who completed HS in the United States. Of the many demographic variables that can be collected, this study was delimited to the following descriptive variables: age, race/ethnicity, biological sex, undergraduate year, college grade point average, (GPA), and estimated family socioeconomic status. Additionally, this study included only those participants who completed the survey instrument online.

Limitations. This study used exclusively self-report responses from adults, introducing a common method bias (Creswell, 2005). In offering total anonymity, it was the hope of the researcher that this limitation will be minimized. The cross-sectional design does not allow determination of cause and effect of HS PE participation and later health behaviors, but rather a description of the relationship. This study provides only a brief glimpse of health behavior at a single time point. A retrospective study also has

inherent methodology limitations. It is believed that by recruiting undergraduates that the time between HS and the time of participation in the study will be minimized, therefore decreasing the possibility of memory discrepancies from the participants. The survey was exclusively offered online, and could have left out anyone who self-selects not to participate in online activities.

Only 68% of HS graduates go on to higher education, and even fewer go on to 4-year institutions. Therefore, generalizability of the results of this study are limited to only the portion of high school graduates who go on to 4-year institutions of higher learning as well as those who attended this Midwestern university.

Nature of the Study

The literature suggests that long-term effects exist between HS physical activity program participation and adult physical activity behavior. This study seeks to examine the specific relationships between the amount, type, and level of participation and adult physical activity behavior among young adults.

The qualitative design was chosen for this study because the variables are known. The retrospective cross-sectional design was chosen to capture the best information from both previous HS experience as well as current habits of physical activity. This design also produced a sample that described all levels of participation in HS physical activity programs. A robust sample size was obtained using this design, which allowed for adequate description of the population and generalizable results.

This self-report study design asked respondents to report the number of HS PE classes they took. This study asked specifically about the class type (online, traditional,

substitution) they received credit for. HS sport was measured in a single yes/no question but the item described the specific sports included in the definition of 'sport' for study purposes. The dependent variables in this study were adult physical activity behaviors. Participants were asked to report their recent physical activity behaviors. Unlike some other instruments, this study asked specifically for the number of days in the past week they had completed each type of physical activity. Another question, not included in many studies of this kind, was one that specified number of minutes during an average session of physical activity or an average day was spent in activity specific to sports.

A demographic survey was included to collect information on individual characteristics that would help to describe potential differences between groups on the independent variables. Of particular interest was the description of differences between those who had significantly different participation levels in the two HS programs.

The survey was developed and checked for reliability and validity on a single mid-western university that has an undergraduate population of 24,600. Inclusion criteria included informed consent, and enrollment at the university. The survey was administered on the internet using an online survey tool company named Qualtrics. Participants were recruited in person through professors of lecture courses. Once permission was granted, the survey link was provided on course websites for students to access over a 6 week period.

Statistical analyses included correlation to identify relationships between demographic variables and dependent and independent variables and linear regression to identify ability of the independent variables to predict outcome variables. One-way

analysis of variance was used to describe differences between groups on health behavior variables and chi-square to identify relationships between groups and health recommendations. Further detailed information about research methodology and statistical modeling is explained in Chapter III. Specific planned analyses for each research question are detailed in the last section of Chapter III.

Significance of the Study

It is important that the health promotion field understand the long-term impact of wide reaching existing High School programs (National Federation of State High School Associations, 2011; R. Pate, R., O'Neill, J. R., and McIver, K. L., 2011). Currently, there are missing links in the research on HS PE and HS sport participation's impact on young adult physical activity health behaviors. This descriptive study provides further information about the long-term health impact of existing programs that reach a majority of all U.S. adolescent students. The current research aimed to provide information that will help educational leaders and other leaders to make research based decisions about resources for these programs. This study provides information about physical activity health behaviors of young adults who have taken a variety of PE course types and sport participation experiences. This study adds to the evidence that the adolescent program participation has long-term impact on the potential for meeting health recommendations defined by the CDC (United States Department of Health and Human Services, 2010), which no other known study has done. Additionally, the relationship within and between these distinctively different experiences, was explored, adding to other research that

examined the combination with relation to subsequent adult physical activity health behaviors.

The unique contributions of this study include:

1. Designed and tested a new instrument for use in the study of long-term relationships between HS participation in physical activity and subsequent adult physical activity behaviors.
2. One of the first studies to describe groups who report taking HS PE, participating in both HS PE and HS Sport, and those who report participation in HS Sport only.
3. Contributes to the literature on the long-term health behavior impact of level and type of HS PE.
4. One of the first studies to examine the long-term health behavior impact of participation in HS sport
5. One of the first studies to examine the long-term health behavior impact of participation in both PE and sport
6. One of the first studies to describe the relationship between participation in HS PE and sport and its relationship to meeting health behavior recommendations for adults.
7. Contributes to the literature of health behavior tracking for both sedentary and physically active individuals.

Chapter II: Review of Literature

Theoretical Framework

This study is driven by the need for a better understanding of the effectiveness of existing programs, namely high school physical education and high school sports, ability to promote healthy physical activity (PA) behavior beyond program participation. Two behavioral theories help to explain the behavioral phenomena studied in this research. According to the Social Learning Theory, behaviors are learned through a variety of observational experiences, (Bandura, 1989). This theory explains that as humans, we learn by observing others performing behaviors, then, depending on our individual attention to the model we observed and our self-efficacy, we are capable of learning and imitating new behaviors (Bandura, 1986). The two programs being evaluated in the present study are socially based programs. Participants learn individual behaviors in an environment full of consistent and ongoing group interaction, (National Association for Sport and Physical Education, 2004; National Federation of State High School Associations, 2011). This study has a retrospective aspect that will help to identify relationships between past behaviors and current ones. Continuity theory, typically found in research on aging, states that elderly or older adults are likely to maintain both their internal and external constructs as they age (Atchley, 1989). This means that individual internal constructs like personality, beliefs, and ideas tend to stay fairly consistent as we age and external constructs like relationships, social roles, help to maintain a stable self-concept, (Atchley, 1999). This theory is important because several studies have confirmed that physical activity habits begin as early as childhood, and those habits have

significant impact on adult physical activity behavior, described frequently in the literature as tracking of activity behavior (Risto Telama et al., 2005; R. Telama, Yang, X., Hirvensalo, M., Raitakari, O., 2006; X. Yang, Telama, R., Hirvensalo, M., Viikari, JSA., and Raitakari, OT., 2009).

College in the United States represents a unique time in the lives of adolescents and young adults. This 4 or so year time period represents an opportunity for individuals to engage in academic pursuits, and social endeavors that no other life period offers. Many college campuses offer on-campus dining, living, recreation and numerous social opportunities. One of the unique offerings that a college experience entails is one of the earliest opportunity to forge individual behaviors. Students are frequently in a new city or even different state are given free reign of their time. They have the opportunity and availability to choose what activities to do, which groups to associate with, when to sleep and wake, each and every day. This specific group of the population was chosen in part to investigate the relationship between the behaviors learned in childhood and adolescence and the choices students make on their first attempt at life as an adult. Some studies have looked at the risk behaviors inherent in the freedoms found in this specific population (Skolnick, 1993). Behaviors forged during this time can linger on past the college years and into adulthood (Sparling, 2002). Much of the research in this area has focused on public health issues of risk-taking behavior but few have examined the long-term impact previous experiences in High school physical activity programs impart on health behaviors during the college years, (R. Pate, R., O'Neill, J. R., and McIver, K. L., 2011).

Billions of dollars in grant money and countless attempts to put new programming into place for children of all ages have been minimally successful in changing sedentary behavior (Wareham, 2007). Well-intentioned and theoretically based interventions have failed to provide evidence that these costly programs are effective at significantly increasing health behavior (Calfas et al., 2000). Despite the money, time, and effort spent on new programming, the evidence regarding the long-term health behavior benefit of two existing programs, HS PE and HS sport is limited. Currently, these programs are facing difficult opposition, so it is important to identify aspects that already support long-term healthy behaviors. Ascertaining the programming that helps to support long-term healthy behavior adoption can help to inform schools, parents, and communities the true health value of current programs. As the health status of the US population continues to deteriorate, it is imperative to identify and evaluate the factors that contribute to individuals choosing healthy lifestyles.

We already have two programs in place in public High Schools across the nation that either aim to teach and instill health-related behavior, or provide opportunity for ample physical activity to meet health needs. These programs include: physical education (PE), and inter-scholastic sport (National Association for Sport and Physical Education, 2011; National Federation of State High School Associations, 2012). These programs are prolific, offered in every state (American Heart Association and The National Association of Sport and Physical Education, 2012; National Federation of State High School Associations, 2011). They are also popular and enjoy a high rate of participation in each state. Important information about HS PE, health, and sport opportunities

regarding their lasting impact on physical activity (PA) are missing in the literature. Gaining insight into the impact of these programs on later young adult health will help to further inform decisions regarding the future of these programs.

High School Physical Education

Whether due to a requirement for graduation, or an interest in learning through movement, nearly all adolescent aged children in the United States take PE during HS (Centers for Disease Control and Prevention, 2013). Several years ago, Pate and colleagues (1996) analyzed the 1996 Youth Risk Behavior Scale data and found that among highly active adolescents reports from both genders and most major ethnic groups also included participation in sports, PE, and more desirable dietary intakes for health (R. R. Pate, Heath, Dowda, & Trost, 1996). That research indicated that sport and PE participation was related to meeting the minimum health recommendations for daily physical activity and significantly less screen time. Despite the soaring rates of sedentary behavior and overweight and obesity among adolescents, there are still places in the US where HS students are not offered or required to participate in physical activity programs. Currently 43 states in the US require PE be offered to High School (HS) students (American Heart Association and The National Association of Sport and Physical Education, 2012). There are requirements for graduation in most states, however only a handful of states in 2012, required daily PE all 4 years of HS (American Heart Association and The National Association of Sport and Physical Education, 2012). HS PE aims to promote the adoption of healthy physical activity behaviors and reaches nearly all adolescents. The question remains; is HS PE meeting its aim? Pate's research

explained that some of the physical activity reported by adolescents across the nation was attributed to PE participation. However, does participation in HS PE lead to long-term healthy PA behavior? Do HS PE graduates choose to continue health-supporting levels of physical activity behaviors in adulthood? If not, is there some other programming that is making a positive long-term health benefit, such as HS sport?

The Shape of the Nation report for 2012 indicates that 44 of the 51 states have mandates related to enrolling in and passing HS PE for graduation (American Heart Association and The National Association of Sport and Physical Education, 2012). The CDC, recommends that school aged children 18 years and younger need a minimum of one hour or 60 minutes of time spent in moderate to vigorous physical activity per day (Centers for Disease Control and Prevention, 2013). The average time of activity in a HS PE class is estimated at just under 45 minutes, offering nearly the full recommended amount to participants, (Lee, 2007). Despite mandates, and significant responsive changes made by PE departments to offer classes enjoyable for students with significant time spent in moderate to vigorous physical activity, there is still a wide variation in both the number of opportunities offered to HS students as well as the level of enrollment in PE classes by HS students (American Heart Association and The National Association of Sport and Physical Education, 2012; Lee, 2007; Penney, 2002). NASPE has one main goal, “to develop physically literate individuals who have the knowledge skills and confidence to enjoy a lifetime of healthful physical activity” (National Association for Sport and Physical Education, 2004). However, there is no formal evaluation of this goal, nor is there a realistic way in which to accomplish this on a comprehensive scale. The

aim of this research study is to help connect the program to its long-term impact in a Midwest college sample of the population. Some research efforts have determined that various aspects of health behavior track beyond participation in PE, they are discussed below.

Although much research has established the widespread concurrent benefits to PE participation, a limited number of research studies have examined the long-term effects of HS PE. Menschik, and colleague's surveyed students in 8th-12th grades then followed up 5 years later (Menschik, Ahmed, Alexander, & Blum, 2008). They found that in normal weight students, as the number of days PE per week increased the odds of being an overweight adult 5 years post HS significantly decreased (Menschik et al., 2008). This research indicates that greater levels of participation in PE leads to a greater likelihood of long-term maintenance of healthy adult weight.

In an experimental design Dale and colleague's (1998) collected data on the physical activity levels of over 1,000 participants 2 and 3 years after a PE intervention in 9th grade (Dale, Corbin, & Cuddihy, 1998). Results showed that boys who attended the intervention PE class 5 days per week later had a higher prevalence of meeting aerobic activity guidelines, while girls had higher prevalence of doing strengthening exercises as well as reported being less sedentary than their peers who took traditional PE 2 days per week (Dale et al., 1998). This study focused on the relationship between a year of daily PE and the activity level of students after graduation from HS. Improved activity levels for both male and female participants were reported, however, a gender difference was noted. There has long been discussion about the significant differences in opportunities

for males and females to participate in school sponsored programs centered on physical activity. Although PE and Sport have both seen significant increases in both opportunities offered, and in participation rates for females since Title IX, there is evidence that clearly identifies lingering challenges and disparities between and among gender and these programs, (Penney, 2002).

In conjunction with a large research study carried out in Canada called the Trois Rivieres Study, Trudeau and colleagues (1999) looked at the association between a 6-year primary school PE intervention and subsequent reports of adult physical activity (F. Trudeau, Laurencelle, L., Tremblay, J., Rajic, M., Shephard, R.J., 1999). During the study one class had PE 5 hours per week each of the 6 years of elementary school. Control participants had PE class once each week. Follow up questionnaires revealed that post HS graduation the male participants reported similar levels of adult physical activity in both the experimental and the control groups. Females from the intervention group reported higher levels of adult physical activity. Additional positive health impacts on adults in the experimental group included lower smoking rate and males reported statistically greater height's on average.

The results of the Trois Rivieres study indicates that perhaps the carry-over from primary school to adulthood is a difficult one to capture. It also shows the potential for gender based differences in response to physical activity programs. These results showed significant physical improvements for the intervention group over controls during the study. Despite daily PE throughout primary school, subsequent adult attitudes toward physical activity were not different from control participants. Results perhaps indicate

that children, while highly impressionable, and capable of forming habits, may not attend to these lifestyle habits in a way that supports carry-over into adulthood.

The studies included here represent some of the most closely related trials and analyses to the research questions asked in the current study. Many studies have researched the effectiveness of PE programs to impart lasting positive health impact on its graduates, but few have specifically examined the participation level only at the HS level. In addition, few have examined the behaviors of college undergraduates in the context of their HS PE program experiences. Finally, some studies have looked at the comparative factors and the combination of experiences in both HS PE and HS Sport participation. This study aims to examine the long-term health behavior impact of participation in both programs.

Due to the scope of the current study, the frequently employed research aims of determining engagement in activity and variety of topics covered in PE classes will not be investigated. In addition the extremely relevant topic of certified and educated physical educators teaching in the HS classroom will also not be included in this research study. The current research endeavor aims to look only at the amount of time spent participating in PE and sport programs, and not the quality of the leaders nor the measurable quality of the offered experiences.

High School Sport

HS Sport has been studied for its negative environmental and health impact on participants by a number of researchers. Many studies have found associations between athletes and an increase in a wide variety of risk taking behaviors, (Bovard, 2008; Sabo,

Miller, Melnick, Farrell, & Barnes, 2005; Wetherill & Fromme, 2007) and sport does come with inherent physical injury risk. Due to high participation rates, (National Federation of State High School Associations, 2011) and recent research, there is an increasing interest in the potential that this program may impart long lasting positive health benefits, (R. R. Pate, Trost, S. G., Levin, S., Dowda, M., 2000).

Several research efforts have focused on youth sport participation and its relation to adult physical health and activity. Among these studies, three studies were completed on a nationally representative scale and are discussed here. Telama and colleagues (2006) used the data from the Cardiovascular Risk in Young Finns Study to assess the tracking of activity behavior in Finland, (R. Telama, Yang, X., Hirvensalo, M., Raitakari, O., 2006). Participants responded to a questionnaire and had a physical examination three times between the ages of 9 and 18 and then again approximately 20 years later. Significant findings from the analyses revealed that adults who had participated in organized youth sports programs as children also reported increased adult activity, with males benefiting more than females. Importantly, those who reported participating for at least 3 consecutive years in youth sport showed the greatest long-term health benefit. The results of this longitudinal style research indicate the need to determine not only participation, but persistent participation, or the number of years HS students take PE or compete for a sports team.

Another study by a similar group of researchers, including Yang, Telama and colleagues (2009) found further benefits of youth sport participation in the form of reduced risk for metabolic dysfunction (X. Yang, Telama, Hirvensalo, Viikari, &

Raitakari, 2009). Using the same data from Finnish participants the association between risk factors for the metabolic syndrome (including increased risk for or occurrence of diabetes, hypertension, high waist circumference, and dyslipidemia) and youth sport participation. Those who participated for 3 or more years had lowest risk for metabolic syndrome, while those who had participated for at least 1 year had significantly lower risk than non-participants. These findings suggest that even some participation in organized physical activity programs can leave a long lasting physical health impact.

Very few studies have approached assessment of HS experiences specifically, those pertaining to similar outcome variables that will be addressed in the current study are discussed here. Curtis, McTeer and White (1999) completed a retrospective study in Canada. The HS sport programming is slightly different than those in the US, however, this work is still relevant to the current study outcomes (Curtis, 1999). In this study, interviews were conducted with adults age 20 and older with several participants reporting ages more than 60 years old. Participants of the nationally representative sample were asked to report both their current physical activity habits and their current organized sport involvement as well as their previous HS sport involvement.

The results indicated that of the three tiers of HS sport involvement those reporting competitive involvement were more likely to continue to be active in sport as adults. The effect size decreased some with age, however these results were statistically significant for both genders across all age groups up to the 50-59 year old group. These results make a strong case for the lasting impact HS sport can have. This study describes the two sport levels in HS are similar to an intramural league and an interschool league,

with the latter being the more competitive of the two. Although the greatest impact was observed in the participants who reported participating in the interschool league, those who reported playing sports in the intramural leagues also reported greater rates of adult activity and sport involvement in adulthood than those who did not participate in either league in HS.

Another study looked at HS sport participation retrospectively and found that sport increases rates of certain types of exercise. Everhart and colleagues (2005) surveyed a group of Texas undergraduate students studying kinesiology (Everhart et al., 2005). They asked about sport participation in HS in relation to PE participation. In Texas HS athletes are allowed to count their sport involvement as PE class therefore some reported only PE participation, some reported only sport participation and some reported both sport and PE. Participants were also asked to report current activity habits, including number of days engaging in specific activities such as team sports, strength training, swimming, abdominal exercises, etc.

The major conclusion was that those who reported not taking PE in HS reported higher rates of adult activity than their peers who reported taking HS PE in all categories except strength training. They also found that athletes without PE experiences were more active than their peers who had engaged in both programs in HS, specifically reporting more days of cardiovascular workouts and more days of team sports activity. Finally, those who reported taking PE, regardless of athletic participation reported more strength training, while those who did both and those who did PE only reported more days of abdominal exercise than athletes. This study had a relatively small number of participants

with 201 respondents with only 33 reporting sport only participation. With this study, Everhart and colleagues uncovered an important finding in the area of long-term health impact from HS activity programming and policy (Everhart et al., 2005). Arguably they showed one of the first examples of an activity program that does not explicitly set out to help students learn to choose healthy behaviors doing so, despite the stereotypes associated with HS athletics. This study helped to reveal that perhaps assessing mission statements and basing research on appearances rather than other impactful aspects of the programming such as time spent in activity, engagement, commitment, and other affective factors may be the underlying interaction factors that are key to understanding how long-term effects are accomplished.

In a very similar study of a larger, more geographically diverse sample, Mears, (2010) found no differences in students' physical activity behavior 1-5 years after HS graduation. After grouping students by those who reported taking PE in HS and those who reported having been given PE credit for participating in HS sports Mears found no differences in cardiovascular, strength, flexibility, or sport activity (Mears, 2010). A significant methodological difference employed in this study was the inclusion criteria related to certified teachers, states who do not require PE teachers to be certified to teach PE were not included. Participants who graduated from states that do not allow waivers for sport participation were also not included in the study analyses. Additionally, those who reported studying a PE- related major in college were eliminated from the study. Although Mears' study took into account the required number of courses taken for graduation, previous studies have not assessed number of PE courses taken in HS. The

inclusion criteria for this study may have led to the lack of differences found, however, arguably, none of the criteria were unfounded. The aim and scope of the current study does not include all of the criteria used in the Mears study.

Healthy Adult Physical Activity

Habitual sedentary behavior is associated with poor health outcomes in adults (Blair, 1993; Centers for Disease Control and Prevention, 2013). Walking for as little as 30 minutes most days a week and engaging in muscle strengthening activity can promote health and reduce the risk for poor health outcomes (Centers for Disease Control and Prevention, 2013). Despite compelling evidence that as little as moderate effort for thirty minutes a day can ward off conditions such as early death, coronary heart disease, stroke, high blood pressure, type 2 diabetes, breast and colon cancer, falls, and depression, strikingly few accomplish this level of regular physical activity (Centers for Disease Control and Prevention, 2013). In the United States close to 1/3 or 94.2 million American adults are sedentary and as few as 1/5 report meeting the recommendation for physical activity to maintain health (National Health Interview, 2012).

The following guidelines, supported by research, and published by the Centers for disease control and prevention will be utilized for determining healthy levels of adult activity(Center for Disease Control and Prevention, 2012). For cardiovascular or aerobic activity the recommendation is that 150 minutes is accumulated over a seven day week. This will be measured by reports of number of days of at least 30 minutes of moderate to vigorous activity, such as walking, cycling, swimming, etc. For muscle strengthening activity, the recommendation is at least two day out of a seven day week include muscle

strengthening activities. This will be measured by reports of number of days per week of muscle strengthening activity that includes body weight, circuit, or weight lifting movements of most of the major muscle groups. For flexibility the recommendation is at least two day of a seven day week include muscle flexibility activity (University of MIssouri-Extension, 2008). This will be measured by reported of number of days per week of flexibility activity that includes stretching or yoga type movements aimed at improving range of motion of the major joints. Finally, the CDC recommendations for BMI will be used to group participants into healthy adult body weight and overweight/obese body weight categories (Centers for Disease Control and Prevention, 2011). A healthy body weight for height will be considered a BMI of 18.5 through 24.9 and will be calculated using self-reported heights to the nearest inch and self-reported weights to the nearest pound.

Physical Activity Behavior Tracking

Some of the research on PE and sport has focused on the potential for activity habits to be maintained across lifestages and in 1996 Dr. Robert Malina summarized much of what had been done to that point in this area (Malina, 1996). There is evidence that physical activity habits formed through youth experiences track with low to moderate consistency into adulthood (Raitakari et al., 1994; Risto Telama et al., 2005; van Mechelen, 1995). The evidence is somewhat stronger for physical activity habits formed in adolescence to track with low to moderate consistency into adulthood (Beunen, 1992; Glenmark, 1994; Kelder, 1994; Kemper, 1990; Raitakari et al., 1994). The goal of instilling both an appreciation for personal health and physical activity's potent role in

health is part of the mission of physical education, (PE) (American Heart Association and The National Association of Sport and Physical Education, 2012). Reversing the physical activity health behaviors of nearly a billion people and reshaping the future vitality of our nation must begin with assessing what we are already doing that works to support healthy behavior in adults.

In addition to summarizing the work on tracking, Malina made an important observation regarding physical activity behavior tracking. He noted that not only do physical activity behaviors have some consistency across lifestages, but that sedentary behavior tracks as well (Malina, 1996). Currently, the emerging research is beginning to study sedentary behavior as a separate construct rather than a level or group of physical activity behavior. All of these studies discussed here were focused on activity rather than sedentariness but there is an obvious trend when considering the lowest activity group in each study. Curtis, McTeer and White concluded that those who did not participate at all in HS sport were least likely to be highly active and involved in sport as adults (Curtis, 1999). Telama and colleagues also found that those who reported no participation in youth sport were most likely to report little or no activity as adults (R. Telama, Yang, X., Hirvensalo, M., Raitakari, O., 2006). It is still unclear the level and type of physical activity is necessary to provide a high likelihood that physical activity behavior begun in adolescence will be carried on in adulthood. Thus far, however, it is clear that participation in youth or adolescent physical activity programming improves the chances of maintaining a healthy level of physical activity as adults, while non-participation

seems to perpetuate the habit of low activity or sedentary behavior across lifestages into and throughout adulthood.

It is known that health behaviors in physical activity have the propensity to track from childhood and adolescence into adulthood, (Malina, 1996). Malina established that the pathways for the tracking of physical activities longitudinally are: 1) level of activity in youth and adolescence, 2) health in youth and adolescence, and 3) health in adulthood. The current study examined only the first pathway, and only considered two specific adolescent programs for physical activity.

The School Health Policies and Programs Study of 2006 identified that nationally the mean number of minutes spent in physical activity in a HS PE class was 44.6 minutes (Lee, 2007). This is approximately 2/3 of the minimum recommendation for healthy growth, development, and disease prevention for children (Centers for Disease Control and Prevention, 2013). High School semesters are on average 16 weeks long in HS. In contrast a HS athletic season is about 12 weeks, and during the season while the number of minutes vary due to teaching of skills, strategies, and periods for rest and hydration, physical activity can be as much as 2 to 4 times the number of minutes of activity in a PE class (Lee, 2007; National Federation of State High School Associations, 2012).

For these reasons, and the reasons listed above based on the previous scholarly work of others in the field the current study will take into account both HS PE experience and HS sport experience, including participation in one, both or neither program. It is important to understand the long term impact HS physical activity experiences provide students to further understand the importance of current programing in the education

system, further, it is important that we understand who is enrolling in HS PE and why. This research is paramount to the efforts of health educators, physical education professionals and the health of our children and our communities (R. Pate, R., O'Neill, J. R., and McIver, K. L., 2011).

Chapter III: Materials and Methods

Instrument Development

The purpose of the survey was to collect information about college undergraduates' previous High School Physical Education (HS PE) and High School (HS) sport and their current adult health behaviors. A pilot study was conducted and expert input and suggestions resulted in editing and the use of several items from validated measurement tools. The survey consisted of approximately 75 questions, mostly close-ended. Demographic information was collected to describe the sample population. Survey items were carefully constructed, to include response items that reflected the sample population with regard to race, ethnicity, age, and biological sex, (Murphy, 2005). In order to collect information on health behaviors publicly available questions from the CDC's Youth Rick Behavior Survey (Centers for Disease Control and Prevention, 2009), and the National College Health Risk Behavior Survey (Centers for Disease Control and Prevention, 1997) were included.

In order to collect specific information regarding sport and PE experiences in HS, additional questions were assessed for face validity and were included (Peterson, 2012). Many of the items addressing HS PE and HS sport were designed to fill gaps in current literature and to understand the long-term impact of these programs, (Lee, 2007; Mears, 2010; R. Pate, R., O'Neill, J. R., and McIver, K. L., 2011). A question about status as a HS athlete was amended to include the following HS sports: Baseball, Basketball, Cheerleading, Competitive Dance Team, Cross Country, Ice Hockey, Golf, Gymnastics, Field Hockey, Football, Lacrosse, Soccer, Softball, Swimming & Diving, Tennis, Track

& Field, Water Polo, Wrestling, and Volleyball). Presenting this specific HS sport definition allowed participants to know if their HS activity experience was defined as a sport experience for the purposes of this research study. This list of sport activities was compiled using information from three different state High School activity associations as well as the National Federation of State High School Associations (Illinios High School Association, 2012; Missouri State High School Activities Association, 2012; National Federation of State High School Associations, 2012; Texas University Interscholastic League, 2012). The survey was built on Qualtrics™, a company that provides online, secure, survey instrument services.

Protection of Human Subjects

The Campus Institutional Review Board approval was obtained through the University of Missouri's Campus IRB office. Exempt status was granted. All study participants were notified of the IRB approval and given contact information of the researcher and campus IRB office. Participants completing the survey as part of the validity and reliability cohort created a code that allowed researchers to match the first and second response sets for analyses purposes but did not allow for personal identification of specific participants.

Recruitment and Participants

The survey instrument was made available to undergraduate students. In order to gain a representative sample of the undergraduate campus population, students from a variety of colleges were recruited. Professors from large lecture courses from a variety of colleges were contacted, (Human Environmental Sciences, College Of Business, College

of Health Professions, College Of Education, and College of Agriculture Food and Natural Resources). Permission was granted to recruit in 20 different undergraduate courses and one undergraduate degree program. The research study was announced as a volunteer opportunity during lecture and instructors posted the survey link on their respective course websites.

A link was generated by Qualtrics™ and was made available to potential participants, on course websites, after instructor permission was granted. The link took volunteers to the research study cover page (Appendix A). The cover page thanked them for their time and effort to complete the survey, reminded them that participation was voluntary and included contact information for the researcher and campus IRB. It also stated that if students were not yet 18 years of age they should not complete the study. The instrument was set up to allow forward and reverse movement throughout the survey, allowing participants to review their responses, or amend responses as necessary. There was no time limit for participants to complete the survey, other than the 8-week data collection period.

Sample Size

Prior to recruitment, a calculation was carried out to determine adequate sample size for the planned statistical analyses. To assess the reliability of the instrument a calculation based on detecting correlations from .4 to .9 and setting the alpha level at .05, a sample size of 337 was necessary. Students in a Human Environmental Science class were recruited to complete the survey two separate times, at least two weeks apart (Centers for Disease Control and Prevention, 2004). More than 800 participants

responded to at least one of the two recruitment times and 613 responded both times. Therefore, adequate sample size was reached for testing the reliability of the questions included in the survey.

To assess relationships among major study constructs an additional set of sample size calculations was completed. A power of 0.8 was used and is acceptable in behavioral social science research, (Cohen, 1988). Setting the probability (alpha) level at 0.05, a sample size was calculated. A Minimum of n= 620 for detecting differences among constructs with an effect size of 0.2 was needed. Groups of n= 32 were indicated for detecting differences between groups in a one-way ANOVA model.

The recruited sample included male and female, traditional full-time undergraduate adults of any age (18 years or older), race, ethnicity, college year, and economic status. The sample included 1,541 survey responses and was adequate to meet sample size recommendations indicated in the calculations reported above.

Treatment of the Data

Profile of participants. Several survey items were designed to allow for screening participants on inclusion criteria. An item about college enrollment status was used to include only full-time, degree seeking students, and to remove part-time, exclusively online, and non-degree seeking students. A current college rank was used to remove graduate student responses from the sample. An item asking about current Reserve Officer Training Core status was used to remove students who were currently active ROTC participants. Current Division I Varsity athletes were removed using an item about current varsity athlete status. Finally, participants who reported completing

HS in a country other than the United States were removed using an item that asked which state participants attended and completed HS.

Demographic Variables. Participants were asked to respond to items about specific personal characteristics. Biological sex, year in college, and college GPA were requested. Age responses were in number of years starting with 18 and continuing through 41, (Erikson, 1993). Race and Ethnicity were two separate items and instructions to participants indicated that they should mark all that applied to their racial and ethnic identity. Barrett's Simplified Measure of Social Status, a validated measure of estimated family social status was used to estimate family SES (Barrett, 2006). This method uses participant responses to items on parental education level, parental marital status, parental work status, and job type to estimate family SES of college students and provides a unit-less measure of social status between 8 and 66, with higher scores representing higher social status.

Outcome variables.

Adult BMI and BMI recommendation. Body Mass Index (BMI) was converted and calculated from self-reported weight in pounds and height in inches, using the conversion equation: BMI = (Weight (lbs)/Height(in)^2) * 703, (Centers for Disease Control and Prevention, 2011). Individual BMI's were placed in one of 3 categories: Underweight (<18.5), Normal Weight (18.5-24.9), Overweight/Obese (> 25 -29.9), following the CDC recommendations for weight to height ratio of risk assessment for lifestyle related disease risk (Centers for Disease Control and Prevention, 2013). The categories were coded '1'

for healthy (normal) weight and labeled ‘met’ and coded ‘0’ for underweight, overweight, or obese and labeled ‘not met’.

Adult physical activity and CDC recommendation variables. Current adult activity variables included self-reported number of days per week of engaging in at least 30 minutes of continuous aerobic activity, number of days per week of engaging in muscular strengthening activity, and number of days per week of engaging in flexibility activity. These were reported in number of days between zero and seven. A variable called ‘sport minutes’ was also included and consisted of self-reported, open response number of minutes of sport specific activity on an average day.

For each activity type the reported number of days per week was used to group individuals into one of two categories, those who met the recommendation and those who did not. Those who completed zero to three days a week of at least 30 minutes of aerobic activity were coded ‘0’ and labeled ‘not met’, while those who reported 4 or more days a week of at least 30 minutes aerobic activity were coded ‘1’ and labeled ‘met’ (Centers for Disease Control and Prevention, 2013). Similarly, each individuals report for number of days per week of muscle strengthening and flexibility activity was categorized into those who met and those who did not meet the recommendation for maintaining health. Those who completed zero or one day a week were coded ‘0’ and labeled ‘not met’, while those who reported two or more days a week were coded ‘1’ and labeled ‘met’, (Centers for Disease Control and Prevention, 2013). Number of minutes spent in sport activity does

not have a corresponding adult health recommendation and was not further categorized for analysis.

Independent variables.

Research Question 1: Number of HS PE classes. The independent variable in this study was number of self-reported semester long High School Physical Education courses taken. Responses ranged from 1 to 12 courses, with an additional option of 'I don't remember'. Those who chose the 13th option were coded as missing for analyses.

Research Question 2: Level of reported HS PE participation. PE experience responses on two questions were used to categorize individuals into one of four groups. One item asked respondents to mark the type of PE classes they took. Another item asked about the PE credit requirement for graduation at their HS. Those who reported taking no HS PE and having no PE graduation requirement were coded as a '1' (No PE). Those who reported using a substitution or waiver and meeting the graduation requirement without taking a HS PE class were coded as a '2' (Sub). Those who reported taking PE in HS and meeting the requirement for graduation were coded '3' (GradReq) and those who reported taking HS PE and more PE classes than required for graduation were coded '4' (PEMore).

Research Question 3: HS PE and sport participation. Three items were used to group participants into one of four HS physical activity program groups. Two HS PE experience items were used to group individuals. One item asked respondents to mark the

type of PE classes they took. Another item asked about the PE credit requirement for graduation at their HS. Individual responses to the survey item: “Did you participate in HS sports” were used to group individuals as HS athletes or HS non-athletes. Those who reported taking no PE in HS and having no PE graduation requirement and also reported not being a HS athlete were coded as a ‘1’ (Neither). Those who reported using a sport substitution and meeting the graduation requirement without taking a PE course in HS and reported being an Athlete were coded as a ‘2’ (Sport Only). Those who reported not being an athlete and reported taking PE in HS and meeting or taking more than the requirement for graduation were coded ‘3’ (PE Only) and those who reported being an athlete and reported taking HS PE and meeting or taking more PE classes than required for graduation were coded ‘4’ (Both PE and Sport).

Statistical analysis.

Psychometric procedures. Face validity of the instrument was assessed in detail by a sport scientist, three health educators, and two measurement specialists. Internal consistency was evaluated for groups of items measuring similar constructs. One model included the four adult physical activity behaviors. The second model used the three High school physical education items. The following scale for internal consistency was used: 0.7-0.79, acceptable, 0.8-0.89, good, >0.9 excellent, (Kline, 1999).

Before checking the reliability of individual survey items, individual responses were matched using the specifically designed survey item, (detailed in the cover letter in Appendix B). The original response set was merged with the time-two response set. The match cases function was used to match each individual who took the survey twice and

provided an identical ‘match’ item. It was not possible to match surveys without a time-one or time-two response set. Non-matching responses were not included in these procedures. Test-retest analyses using Kappa measure of agreement for categorical items and correlation for continuous items were completed.

Strength of relationships were defined as: < .5 low, .5-.69 moderate, .7-.79 as good and > .8 as very good agreement, (Peat, 2001). Pearson correlation procedures were used for continuous items (Pallant, 2010). Strength of relationships were defined as: r =.1-.29 small, r =.30-.49 medium and r =.5-1, large, (Cohen, 1988).

Data set preparation. A priori data examinations were thorough and careful consideration was employed in removal of any data. Data were checked for duplicate responses using the ‘identify duplicate cases’ function. Surveys with missing height and weight responses were identified using the ‘sort data ascending’ function. Responses missing significant chunks or sections of responses were identified using the sort function and the reports function. Using the ‘sort data ascending’ function, overall outliers were identified as those who had responded in the extreme on several survey items in contradictory or unrealistic ways. This study focused on those students who were currently full-time undergraduate students, attended and completed HS in the United States, were not enrolled in the Reserved Officer Training Core, and were not Division 1 Varsity student athletes. After selecting valid cases, 1,339 total participants were included.

Descriptive analyses, including frequencies, means, and standard deviations were calculated to describe the sample. Sample size was adequate to allow the power of .8, except where described below (Stevens, 1996). An alpha level of .05 was used to determine significance and to avoid the occurrence of a type 1 error. IBM's SPSS version 20 was used for these analyses.

Assumptions. Data were checked for assumptions specific to each planned analysis and according to the following widely accepted lists of inherent statistical understandings (Pallant, 2010; Tabachnick, 2006). ANOVA assumptions were checked and include: dependent variable is interval or ratio level data, random sampling, independence of observations, normal distribution of dependent variable on the grouping variable, (histograms were visually inspected and if violations were noted, the procedure was carried out because, this test is robust if group $n \geq 30$, (Pallant, 2010; Tabachnick, 2006), and homogeneity of variance, (Levene's statistic was used to evaluate similarity of variances between groups, when significant, the size differences between group counts were compared (largest group/smallest group = 1.5) to determine if the technique was robust to this assumption, (Pallant, 2010; Stevens, 1996) . For group comparisons the following effect size ranges were used: small is .01; medium is .06; large is .14 or greater, however, as suggested, the practical significance will also be explored, and discussed (Cohen, 1988).

Linear and direct logistic regression and correlation assumptions were checked and include: the data were interval or ratio level of measurement (if the independent

variable is dichotomous there should be roughly the same number in each of the two groups), both variables should have a response from each respondent (exclude cases pairwise was selected to ensure responses for both variables were present during analyses), observations are independent of one another, normal distribution of variables (histograms were visually inspected to establish normality), a linear relationship between the two variables (scatter plots were visually examined to ensure this assumption was satisfied), and homoscedasticity (plots of the error variance were requested during analyses and inspected visually). To estimate the strength of the relationships, where significant, the following cut points were used, small r =.10 to .29; medium r =.30 to .49; and large r =.5 to 1.0, (Cohen, 1988).

Chi-square test for Independence was used and assumptions were checked including: data are a random sample, observations are independent, 80% of expected cell frequencies are greater than n > 5, (if 2x2 then expected cell frequencies should be >10). When 2x2 analyses were used, Yates continuity correction was used to compensate for the overestimation of chi-square tests in that configuration, (Pallant, 2010). The following effect sizes were used: small = .01; medium= .30; large=.50, (Gravetter, 2004) .

Research Question 1: Number of HS PE Classes. To examine the relationship between demographic variables and reported number of HS PE courses Pearson's Correlation Coefficient, and Spearman's rho correlation were used. After preliminary checks of assumptions were completed a correlation matrix was generated. Linear regression and ANOVA were used to further assess significant correlations.

To examine the relationship between BMI and adult health behavior variables (aerobic, strength, flexibility and sport minute activity) and reported number of HS PE courses Pearson's Correlation Coefficient, and Spearman's rho correlation were used. When significant correlations were identified, preliminary analyses to check for assumptions were conducted and linear regression procedures were followed to further examine relationships.

Correlation analyses were conducted to identify significant correlations between adult recommendations for BMI and physical activity behaviors and number of HS PE classes. Finally, where indicated by significant correlation, direct logistic regression was used to predict the likelihood of meeting the health recommendations based on reported number of PE courses taken in HS.

The analyses for this study were based on responses to a survey item about the number of PE courses taken in HS. Participants who reported not taking PE or reported taking PE but could not remember the number of PE courses they took in HS were not included in the analyses, leaving a total n= 1,275 undergraduate student respondents.

Research Question 2: Level of Reported HS PE Participation. To examine relationships between demographic variables and reported HS PE experience, Chi-square test for independence and one-way ANOVA procedures were followed (Pallant, 2010). After preliminary analyses to check for assumptions, ANOVA procedures were followed to ascertain the difference between group means on each of the four health variables (aerobic, strength, flexibility and sport minute activity) and BMI (Pallant, 2010). Finally,

Chi-square tests for independence were used to evaluate the associations between HS PE groups on each of the health recommendation variables for physical activity as well as the BMI recommendation.

The analyses for this study included responses to survey items about HS PE experiences; participants who did not respond to those items were not included in the analyses, leaving total n= 1,328 undergraduate student respondents.

Research Question 3: HS PE and Sport participation. To examine relationships between demographic variables and reported HS PE experience, Chi-square tests for independence and one-way ANOVA procedures were followed (Pallant, 2010). After preliminary analyses to check for assumptions, ANOVA procedures were followed to ascertain the difference between group means on each of the four health variables (aerobic, strength, flexibility and sport minute activity) and BMI (Pallant, 2010). Finally, Chi-square tests for independence were used to evaluate the associations between HS PE experience groups on each of the health recommendations for physical activity as well as the BMI recommendation.

The analyses for this study included responses to survey items about HS sport and PE experiences; participants who did not respond to those questions were not included in the analyses, leaving total n= 1,305 undergraduate student respondents.

Research questions and analysis plans.

Research Question 1: Number of HS PE Classes

Research question 1a: What demographic variables are associated with reported number of HS PE classes, (Age, Gender, Race/Ethnicity, estimated family SES, College Year, College GPA)?

Analysis Plan: Correlation analysis using Pearson Product Moment Correlation Coefficients or Spearman's Rank Order Correlation, Linear Regression for continuous demographic variables and ANOVA for categorical demographic variables to explain unique variance.

Rationale: A correlation table including all demographic variables and number of HS PE classes was calculated to determine significant relationships. Correlation analysis is used to identify the strength and direction of a relationship between two variables, (Brewerton, 2001). Further analyses were completed to describe the unique variance explained by demographic variables with significant relationships to HS PE classes. This procedure allowed for a description of the sample through associations between number of HS PE classes and demographic characteristics. These analyses allowed for a description of the sample population who reported taking HS PE.

Research question 1b: Are number of HS PE classes significantly related to level of adult physical activity behaviors (aerobic, muscle strengthening, flexibility, and sport

minutes) or adult BMI? If so, does the number of reported HS PE classes significantly predict the number of days of adult physical activity or adult BMI?

Analyses: Correlation using Pearson Product Moment Correlation Coefficients or Spearman's Rank Order Correlation, and Linear Regression procedures were used to assess the relationship and predictive ability of HS PE class number in adult health behaviors.

Rationale: Correlation analysis is used to identify the strength and direction of a relationship between two variables, (Brewerton, 2001). Further analyses were completed to describe in detail the unique variance explained by number of HS PE classes. These procedures allowed for determination of the long-term effects that number of HS PE classes had on physical activity behaviors.

Research question 1c: Is number of HS PE classes reported significantly related to meeting health recommendations for adult physical activity and BMI? If so, does the reported number of HS PE classes significantly predict the odds of meeting the recommendation for adult BMI or adult physical activity health behaviors (aerobic, muscle strengthening and flexibility activity)?

Analyses: Correlation using Pearson Product Moment Correlation Coefficients or Spearman's Rank Order Correlation, and Direct Logistic Regression Models were used to determine the predictive ability of HS PE class number on meeting recommendations for adult BMI and physical activity where significant correlations were identified.

Rationale: Correlation analysis is used to identify the strength and direction of a relationship between two variables, (Brewerton, 2001). Direct logistic regression used to assess a variable's ability to correctly classify cases into correct groups on a dichotomous dependent variable. These analyses were completed to describe in detail the unique ability of number of HS PE classes to predict adult behaviors. This procedure allowed for the assessment of HS PE's long-term impact in relation to the *Healthy People 2020 Goals for Americans,(United States Department of Health and Human Services, 2010).*

Study 2: Level of Reported HS PE Participation

Research question 2a: What demographic variables are associated with HS PE type and level experience groups, (Age, Gender, Race/Ethnicity, estimated family SES, College Year, College GPA)?

> *Analysis: Chi-square tests for independence for categorical level data and One-way ANOVA for ratio level data were used to examine the relationship between demographic characteristics of the groups on the HS PE and physical activity experience group variable.*

Rationale: Chi-square test for independence is used to examine the relationship between two categorical variables. The expected count of individuals in each group based on no association between variables is compared to the proportion of cases that are observed in the sample. One-way ANOVA is used to compare group means on a ratio level variable. This procedure helped to identify trends in personal characteristics between groups on the

HS PE and activity groups. These analyses allowed for a description of the sample population who reported taking different levels and types of HS PE.

Research question 2b: Is there a difference in BMI or adult physical activity behaviors, (aerobic, strength, flexibility, or sport minutes) for individuals in the PE only, Sub, PEMore or PEMet groups?

Analyses: One-Way ANOVA was used to assess the difference between groups on adult BMI and days of aerobic, muscle strengthening, flexibility, and sport (minutes) physical activity behaviors.

Rationale: One-way ANOVA is used to compare group means on a ratio level variable. This procedure helped to determine if different PE experiences have different long-term effects on physical activity behaviors. Identifying the differences between groups helped to describe the tracking effects of HS PE experience on adult physical activity.

Research question 2c: What is the relationship between HS PE and HS physical activity experience group and meeting the health recommendations for BMI and physical activity behaviors (days of aerobic, muscle strengthening, and flexibility activity)?

Analysis: Chi-Square tests for independence were used to determine if relationships existed between reported levels of HS physical activity experience and adult BMI or physical activity behaviors that met recommendations for health, (days of aerobic, muscle strengthening, and flexibility activity).

Rationale: Chi-Square test for independence is used to determine if relationships exist between two categorical variables. This procedure allowed for the assessment of type and level of HS PE experiences' long-term impact in relation to the *Healthy People 2020 Goals for Americans,(United States Department of Health and Human Services, 2010).*

Study 3: HS PE and Sport participation

Research question 3a: What demographic variables are associated with different levels of HS PE and HS Sport experience groups, (Age, Gender, Race/Ethnicity, estimated family SES, College Year, College GPA)?

> *Analysis: Chi-square tests for independence for categorical level data and One-way ANOVA for ratio level data were used to examine the relationship between demographic characteristics of the groups on the HS PE and HS Sport experience variable.*

Rationale: Chi-square test for independence is used to examine the relationship between two categorical variables. The expected count of individuals in each group based on no association between variables is compared to the proportion of cases that are observed in the sample. One-way ANOVA is used to compare group means on a ratio level variable. This procedure helped to identify trends in personal characteristics between groups on the HS PE and HS Sport experience groups. These analyses allowed for a description of the sample population who reported participation in HS PE and/or HS Sport.

Research question 3b: Is there a difference in adult BMI or activity behaviors (aerobic, muscle strengthening, flexibility, and sport minutes) and individuals in the PE Only, Both PE and Sport, or the Sport Only groups?

Analyses: One-Way Analysis of Variance was used to assess the difference between groups on adult BMI and levels of aerobic, muscle strengthening, flexibility, and sport physical activity behaviors.

Rationale: One-way ANOVA is used to compare group means on a ratio level variable. This procedure helped to determine if different PE experiences have different long-term effects on physical activity behaviors. Identifying the differences between groups helped to describe the tracking effects of HS PE and HS Sport experiences on adult physical activity.

Research question 3c: What is the relationship between HS PE and HS Sport participation and meeting health recommendations for adult BMI and physical activity behaviors, (days of aerobic, muscle strengthening, and flexibility activity)?

Analysis: Chi-Square test for independence were used to determine if significant relationships exist between reported levels of HS PE and HS sport participation and meeting adult BMI and adult physical activity behavior recommendations.

Rationale: Chi-square test for independence is used to examine the relationship between two categorical variables. The expected count of individuals in each group based on no association between variables is compared to the proportion of cases that are observed in the sample. This procedure allowed for the assessment of type and level of HS PE

experiences' long-term impact in relation to the *Healthy People 2020 Goals for Americans,(United States Department of Health and Human Services, 2010).*

Chapter IV: Results and Discussion

Results

Psychometric properties. Chronbach's alpha was used to examine the internal consistency of two subsets of outcome variables. The adult physical activity subset of 4 items (α= .721), and the HS PE subset of 3 items, (α= .732), both showing acceptable internal consistency, (Kline, 1999).

Participants were recruited twice and n= 805 surveys were submitted in time one and time two combined. Match procedures identified that n= 657 provided responses from time one and time two. A priori data cleaning procedures were completed. After merging, duplicate cases were identified. Participants who responded multiple times during time one or time two, n= 44, were not included in the test-retest procedures and the total responses for these analyses was n= 613.

Correlations and level of agreement ranged from Kappa= 0.46 (mother's occupation group selection on BSMSS) to Kappa=1.0 (biological sex). Each item tested using the Kappa measure of agreement had moderate, good, or very good agreement, (Peat, 2001). Each item tested using the Pearson's correlation had medium or large correlation coefficient, (Cohen, 1988). The individual survey item results are presented in Table 3 and 4.

Data preparations. A priori data cleaning procedures were completed. Duplicate cases, response sets missing entire sections pertinent to this study, responses that provided outliers on several survey items, were all removed from the data set, total removed n= 42. Survey's from international students were removed, n= 40. ROTC n= 51,

and current Division I varsity athletes n= 127, were removed. Graduate students were also removed, n= 15. Additionally, individuals who did not report being full time on campus, degree seeking students were omitted from these analyses, n= 30. Some individuals marked more than one of these items, (e.g. graduate student and international HS), so the total number removed cannot be calculated by summation of these counts. A total of 202 cases (13.11%) were removed prior to analysis leaving the total sample size of 1,339. This is within the parameter for an acceptable amount of cases to delete, (Tabachnick, 2006).

Sample description. The total number of responses included was n= 1,339. The mean age was $\bar{X}$= 19.65. The sample was comprised of 35.3% males and 64.7% females. The sample mean GPA was $\bar{X}$= 3.14 and the sample mean BMI was $\bar{X}$= 23.48. Further information about the sample population is included in Table 5.

Research question 1: Number of HS PE classes

Demographic variables, (RQ1a). The rate of individuals reporting specific number of HS PE classes are shown in Table 6, with most reporting one, two, three, or four HS PE classes. After appropriate preliminary analyses were performed to ensure assumptions were met, a correlation table was generated, Table 7. Only two demographic characteristics had significant correlation to number of HS PE classes: biological sex and estimated family SES. There was a small, negative correlation between sex and number of HS PE classes, r = -.195, n= 1275, $p < .001$, and males were associated with reporting higher number of HS PE classes, accounting for 3.8% of shared variance. There was a *very* small, positive correlation between estimated family SES and number of HS PE

classes, r = .059, n= 1268, p < .05, with higher estimated family SES associated with reporting higher number of HS PE classes accounting for 0.35% of shared variance.

After checking assumptions for linear regression the analysis was completed. Estimated family SES was significantly related to reported number of HS PE classes, β= .836, t (1268) = 54.303, p<.01. Estimated family SES also explained unique variance in reported number of HS PE classes, R^2= .699, F (1, 1267) = 2948.844, p< .01. The trend of this relationship is depicted in Figure 2. After checking assumptions for a one-way ANOVA, Levene's test was significant, however, the robust test of equality of means is reported, (Pallant, 2010). Significant differences between mean number of HS PE classes between male and female participants were indicated, *Welch's F* (1, 834.4) = 38.707, p = .0001. Males reported more HS PE classes, ($\bar{X}$=4.16, SD=2.326) than females, ($\bar{X}$=3.34, SD=2.082), shown in Figure 1. Statistically significant relationships were not indicated for age, college year, college GPA, or reported race/ethnicity. Results, means and percentages are shown in the correlation table, (Table 7) and Table 8.

Adult BMI and physical activity behaviors, (RQ1b). After appropriate preliminary analyses were performed to ensure assumptions were met, a correlation table (Table 9) was generated. BMI was significantly correlated to number of reported HS PE classes, r = .104, n= 1274, p < .01, with more PE classes associated with higher BMI. This was a small positive correlation and the shared variance was small, 1.08%. Two of the adult physical activity behaviors were significantly correlated with number of HS PE classes including: days of aerobic activity and days of muscle strengthening activity. There was a *very* small, positive correlation between days of aerobic activity and number

of HS PE classes, $r = .077$, n= 1277, $p < .05$, with more HS PE classes associated with more days of aerobic activity as adults accounting for 0.59% shared variance. There was a small, positive correlation between days of muscle strengthening activity and number of HS PE classes, $r = .140$, n= 1273, $p < .01$, with more HS PE classes correlated with more days of muscle strengthening activity as adults accounting for 1.96% of shared variance.

Assumptions of normality, linearity, and homoscedasticity were checked. HS PE course number did not predict unique variance in college BMI, t(1272)= 1.877, p= .061. PE course number significantly predicted days of aerobic activity of at least 30 minutes, $\beta = .071$, $t(1267) = 2.745$, $p < .05$. PE course number explained a statistically significant proportion of the variance, $R^2 = .006$, $F(1, 1267) = 7.535$, $p < .05$, shown in Figure 3. PE course number significantly predicted days of muscle strengthening activity, $\beta = .124$, $t(1271) = 5.056$, $p < .001$, and explained a statistically significant proportion of the variance, $R^2 = .02$, $F(1, 1271) = 25.564$, $p < .001$, also shown in Figure 3. Statistically significant relationships where not indicated for days of flexibility activity or minutes of sport activity, and further analysis was not warranted for these variables. Results of these analyses are summarized in Table 10.

Adult health behavior recommendations, (RQ1c). A Spearman's Rho correlation matrix was generated and only the recommendation for muscle strengthening activity was correlated with number of HS PE classes. There was a small, positive correlation between number of HS PE classes and meeting the adult recommendation for muscle strengthening activity, $r_s = .126$, n= 1273, $p < .01$, with more days of HS PE correlated with meeting the recommendation of 2 days per week of muscle strengthening

activity in adulthood. To understand this relationship, logistic regression was performed to assess the impact of PE course number on the likelihood that respondents would report meeting the recommendation. The logistic model on muscle strengthening was statistically significant, χ^2 (1, 1273) = 15.280, p <.001, indicating that the model was able to distinguish between individuals who did and did not meet the recommendation for muscle strengthening activity. The model as a whole explained between 1.2% (Cox and Snell R square) and 1.6% (Nagelkerke R squared) of the variance in meeting the adult strength recommendation and correctly classified 55% of cases. This indicates that for every additional PE course taken in HS; respondents were 1.106 times more likely to report meeting the recommendation for at least 2 days per week of muscle strengthening activity. The rate of adults who reported meeting the muscle strengthening activity recommendation by number of HS PE classes reported is shown in Figure 4. Adult BMI, and aerobic and flexibility activity recommendation variables were not correlated with number of HS PE classes and were not further investigated in this study.

Research Question 2: Level of Reported HS PE Participation

Demographic variables, (RQ2a). This sample included 40.5% (N= 538) of individuals who reported taking more PE than required for graduation, 52% (N=691) reported meeting the requirement for graduation, 3.2% (N= 43) reported substituting sport for PE credit and 4.2% (N= 56) reported no requirement and taking no PE in HS. Gender was significantly different between groups, χ^2 (3, n=1328) =107.141, *p*<.001, and Cramer's *V* was small, .284. There were significantly more females (62.3% of female; 32.9% of males) in the GradReq group, and significantly more males (58.1% of males;

31.1% of females) in the PEMore group, shown in Figure 5. No significant associations were detected between race and HS physical education experience, χ^2 (6, n=1328) =4.590, *p*= .597. Reported year in college was also not different, χ^2 (9, 1328) =4.137, *p*=.902. The other three demographic variables collected were not significantly associated with reported HS PE experience, and included: age, *F* (3, 1319) =1.346, *p*=.258; reported college GPA, *F* (3, 1305) =1.124, *p*=.338; and estimated family SES, *F* (3, 1316) =1.416, *p*=.237. Group means for these variables are presented in Table 11.

Adult BMI and physical activity behaviors, (RQ2b). Preliminary analyses indicated some variables violated the assumption of homogeneity of variance. ANOVA is robust to violations of this assumption and an alternative is acceptable, where appropriate, Welch's test is reported, (Pallant, 2010). Levene's test was significant in the model for adult BMI and HS PE experience groups; because of the unequal group sizes this variable was not further investigated. Figure 6 depicts the mean differences reported here. There were statistically significant differences in group means on days of aerobic activity, *Welch's F* (3, 126.733) =5.747, *p*=.001. Post hoc comparisons indicated that individuals in the SUB group reported more days on average ($\bar{X}$=3.74; SD= 2.048) than all other groups; No PE ($\bar{X}$=2.29, SD=1.755); GradReq ($\bar{X}$=2.51, SD=2.110) and PEMore ($\bar{X}$= 2.61, SD= 2.062). There were statistically significant differences in group means on mean days of strengthening activity, *F* (3, 1326) =9.375, *p*<.001. Post hoc comparisons indicated that individuals in the PEMore group reported more mean days of muscle strengthening activity, ($\bar{X}$=2.21, SD=1.978) than those in the GradReq group, ($\bar{X}$=1.65,

SD=1.887). There were statistically significant differences in group means on reported flexibility activity days, *Welch's F* (3, 123.379) =3.095, *p*=.029. Post hoc comparisons indicated that individuals in the SUB group reported more days of flexibility activity on average, ($\bar{X}$= 2.05; SD= 2.058) than those in the GradReq group, ($\bar{X}$=1.27, SD=1.76) and those in the PEMore group, ($\bar{X}$=1.13, SD=1.61). There were no statistically significant differences in group means on reported number of minutes spent in sport activity, *Welch's F* (3, 34.152)=1.707, *p* =.184.

Adult health behavior recommendations, (RQ2c). Chi-square tests for independence indicated several relationships between groups on health recommendations. The results are summarized in Table 12 and depicted in Figure 7. Significant associations between BMI and HS PE groups were indicated, χ^2 (6, n=1327) =23.948, *p*< .05, and Cramer's *V* was small, .134. Individuals in the NO PE group reported more overweight/obese BMI's and fewer healthy BMI's than individuals in the SUB group. The SUB group reported the greatest proportion of healthy BMI's (90.7% compared to other groups 66.73%).

A chi-square test for independence indicated significant associations between groups on meeting the recommendation for 30 minutes of aerobic activity most days a week, χ^2 (3, n=1322) =18.824, *p*< .001, and Cramer's *V* was small, .119. Fewer individuals in the No PE group reported meeting the recommendation (21.4%) than their peers in the SUB group (60.5%).

A chi-square test for independence indicated differences between groups on meeting the recommendation for muscle strengthening activity, χ^2 (3, n=1326) =17.028, p< .01, and Cramer's *V* was small, .113. Fewer individuals in the GradReq group reported meeting the muscle strengthening recommendation of 2 days per week (43.1%) than their peers in the SUB group (58.1%).

A chi-square test for independence indicated a significant association between groups and meeting the recommendation for flexibility activity, χ^2 (3, n=1325) = 14.580, p < .01, Cramer's *V* was small, .105. More individuals in the SUB group reported meeting the recommendation (55.8%) than their peers in all other groups (31.67%).

Research Question 3: HS PE and sport participation

Demographic variables, (RQ3a). After preliminary checks were preformed, those in the 'Neither' group were excluded from the analyses. Based on the power analysis the group was too small, additionally, the group was not normally distributed on outcome variables, (n= 19). Therefore, analyses and results refer to groups '2' (PEOnly), '3' (Both PE and Sport) and '4' (SportOnly). A summary of these results are included in Table 13.

The PE Only group comprised, 16% (n= 209) of the sample, 5.9% (n= 77) reported doing HS Sport Only and 78% (n=1019) reported participating in both HS PE and HS sport. Demographic variables were examined and differences were identified for estimated family SES, F (2, 1296) =3.539, p<.05. The Tukey's HSD post hoc comparisons indicated that those who reported participating in both PE and sport in HS reported statistically higher family estimated SES, ($\bar{X}$= 49.47, SD= 12.36) than those who reported PE only in HS, ($\bar{X}$=47.11, SD=13.22).

Further differences were not identified between groups on the remaining demographic variables. Chi-square tests for independence indicated no significant association between gender and participation groups, χ^2 (2, n=1305) =1.896, *p*=.388; and no significant association between groups on the college year variable, χ^2 (6, n=1305) =1.807, *p*=.937. ANOVA results did not identify differences in group means on age, *F* (2, 1298) = .072, *p*= .931, or on College GPA, *F* (2, 1283) = .406, *p*= .667. Although the sample size was large enough for primary analyses on outcome variables, they were not adequately distributed to compute differences between groups on the Race/Ethnicity variable.

Adult BMI and physical activity behaviors, (RQ3b). The findings described here are summarized in Table 14 and depicted in Figure 8. The BMI variable violated the assumptions of normality and the homogeneity of variance on groups in the HS PE and Sport variable; the findings were not valid and not reported here. There was a statistically significant difference in mean days per week of aerobic activity of at least 30 minutes between groups, *F* (2, 1296) =8.722, *p*<.001. Post hoc comparisons indicated that individuals in the PEOnly group, ($\bar{X}$=2.13, SD=2.089) reported significantly fewer days per week than all other groups, SportOnly group, ($\bar{X}$=3.13, SD=2.022) and the Both group, ($\bar{X}$=2.68, SD=2.049). Mean days of muscle strengthening activity were different between groups, *Welch's F* (2, 179.318) = 22.498, *p*< .001. Post hoc comparisons indicated that individuals in the PEOnly group reported significantly fewer days of muscle strengthening activity ($\bar{X}$= 1.20, SD= 1.663) than all other groups, the Both group, ($\bar{X}$= 2.03, SD= 1.971) and those in SportOnly, ($\bar{X}$= 2.32, SD= 2.035). There was

statistically significant differences in mean days of flexibility activity between groups, *Welch's F* (2, 173.583) = 8.618, $p < .001$. Post hoc comparisons indicated that individuals who reported taking PE only reported significantly fewer days of flexibility activity ($\bar{X}$= 0.85, SD= 1.619) than all other groups, the Both group, ($\bar{X}$= 1.28, SD= 1.7) and the Sport Only group, ($\bar{X}$= 1.73, SD= 1.978). There were differences between groups on the minutes of sport activity variable, Welch's F (2, 178.179) = 28.322, p< .01. Post hoc comparisons indicated that individuals who reported taking PE only reported significantly fewer sport minutes ($\bar{X}$= 7.16, SD= 24.34) than all other groups, the Both group, ($\bar{X}$= 22.26, SD= 38.47) and the Sport Only group, ($\bar{X}$= 30.00, SD= 52.61).

Adult health behavior recommendations, (RQ3c). A chi-square test for independence indicated significant associations between BMI recommendations and HS activity groups, χ^2 (6, n=1304) =19.976, $p < .01$, Cramer's *V* was small, .124. Individuals in the PEOnly group reported more overweight/obese BMI's (40.7%) than their peers in the Sport only group (22.1%).

Significant association between groups were indicated on meeting the recommendation for days per week of aerobic activity, χ^2 (2, n=1299) =11.107, $p<.01$, and Cramer's *V* was small, .092. More individuals in the SportOnly group (42.9%) reported meeting the recommendation of at least 4 days per week of 30 minutes or more of aerobic physical activity than those in the PE only group (24%).

A chi-square test for independence indicated a significant association between groups and meeting the recommendation for muscle strengthening activity, χ^2 (2, n=1303) = 26.446, $p<.001$, and Cramer's *V* was small, .142. Fewer Individuals in the PE

only group (32.5%) reported meeting the recommendation for muscle strengthening activity, than their peers in the Sport Only group (57.1%).

Significant association between groups on meeting the recommendation for flexibility activity was indicated, χ^2 (2, n=1302) =19.558, p<.001, and Cramer's *V* was small, .123. Fewer individuals in the PE Only group (20.7%) reported meeting the recommendation for flexibility activity than their peers in the Sports Only group (46.8%). Table 14 summarizes the results presented here, and Figure 9 depicts the significant relationships.

Discussion

Survey instrument psychometric properties. Ensuring that the survey included items that would yield responses to address research questions was important. Face validity was determined before data were collected. After determining that the items included were valid for answering research questions, reliability procedures were carried out. Test-retest procedures described in the Youth Risk Behavior Surveillance Survey were used to assess the reliability of each instrument item and the individual item results are listed in Table 3 and 4, (Centers for Disease Control and Prevention, 1997). One of the HS PE questions had lower than expected agreement, however, this item was not used by itself, and the impact of its moderate reliability is likely minimal. Finally, internal consistency of the HS PE items and the adult physical activity behaviors were assessed and found to have an acceptable level of consistency, (Kline, 1999) . This instrument is a tested tool to help describe the young adult sample population, and to begin to evaluate the long-term health impact of HS PE and HS sport programs.

Sample population. The data collected for this study includes 5% of the population from which it was taken, (undergraduates on a major Midwestern university campus). The sample is, representative of the population with regard to race and similar in age. Females were over sampled; the population is 47% male and 53% female, while the sample included 36% male and 64% female.

Research Question 1: Number of HS PE classes.

Demographic variables, (RQ1a). Students reported taking an average of $\bar{X}$= 3.63 PE courses during four years of HS, which is slightly higher than the mean HS graduation requirements represented by the sample, $\bar{X}$ = 2.97, (American Heart Association and The National Association of Sport and Physical Education, 2012). The number of PE courses reported was not correlated to: reported Race/Ethnicity, age, current college year, or college GPA. Statistically, PE course number was associated significantly with reported family estimated SES. This association was positive, and very weak (Cohen, 1988), explaining less than one half of one percent of the variance in PE course number taken in HS. Individuals reporting higher family SES reported taking more PE courses in HS. While statistical differences may be detectible in this sample, these differences need further investigation before well informed conclusions can be drawn.

The National Association of Sport and Physical Education sets forth the parameters for implementing quality PE programs in the United States. One of the guidelines states that PE is offered to all students, regardless of gender, (American Heart Association and The National Association of Sport and Physical Education, 2012).

Additionally, Title IX requires that equitable access to HS PE classes be available for males and females, (Carpenter, 2005). Significant research has shown that although PE is offered to all students, the curriculum, and gender composition of the classes impacts the level of engagement, learning, and performance of physical activity in both males and females (Penney, 2002). The mean number of PE classes reported for the sample was 3.63 classes. The mean number of PE classes reported by males was 4.14 classes or one semester long PE class each year for four years, while females reported a mean of 3.34 PE classes, or one PE class for three of the four years of HS; Figure 1 depicts the sex specific enrollment reports. As Penney summarizes, the enrollment levels found in this study could be a result of lingering effects of gender stereotypes, the types of curriculum offered, or the gender composition of PE classes. Another possible explanation is that students going on to college may be less likely to enroll in PE class. Since the beginning of the 21st century females have outnumbered males in undergraduate college enrollment, (Francis, 2006). Succeeding on college entrance exams, compelling activities resumes and impressive transcripts are the best chance at gaining acceptance at a college or University. Taking physical education beyond the minimum requirement may coincide with time for college preparatory coursework. Other than additional credits of passing grades, physical education is further devalued by the fact that college entrance requires no HS PE credits (American Council on Education and The Lumina Foundation for Education, 2013).

The School Health Policy Program Study (SHPPS) data indicated that the average number of minutes spent in physical activity during a HS gym class was 44 minutes (Lee,

2007). This study found that neither sex is offered adequate opportunity for physical activity in PE classes to accumulate the recommended minimum 60 minutes per day each day during all four years of HS (American Heart Association and The National Association of Sport and Physical Education, 2012; Centers for Disease Control and Prevention, 2013).

Adult BMI and physical activity behaviors, (RQ1b). The concurrent benefits of HS PE are well documented in the literature, and range from physical fitness, to social interaction and communication skills, (American Heart Association and The National Association of Sport and Physical Education, 2012; Physical Activity Council, 2012). Few studies have focused on evaluating PE's lasting impact on physical activity behavior, despite the fact that a main goal of quality PE is to encourage and promote the adoption of a physically active lifestyle throughout adulthood (National Association for Sport and Physical Education, 2004). There is evidence for tracking of physical activity behavior from childhood to adulthood, (Malina, 1996; Raitakari et al., 1994; R. Telama, Yang, Laakso, & Viikari, 1997; F. Trudeau, Laurencelle, Tremblay, Rajic, & Shephard, 1999). Some tracking studies show that the number of years of activity is an important factor and that more exposure leads to stronger tracking effects, (Curtis, 1999; R. Telama et al., 1997; Risto Telama et al., 2005; François Trudeau et al., 2000). This study adds to the evidence that HS PE experience imparts long-term benefits. It also supports the previous literature that more physical activity in adolescence leads to improved levels of adult physical activity. If HS PE aims to provide a basis for healthy adult physical activity behavior habits, the results of this study show that more is better. Specifically, a

positive association was found between reporting more HS PE classes and reporting higher rates of aerobic, muscle strengthening, and sports activity, (Figure 3).

Adult health behavior recommendations, (RQ1c). In this study as the number of reported HS PE classes increased, the likelihood of meeting the recommendation for muscle strengthening improved, shown in Figure 4. Other studies have looked at young adult muscle strengthening activities and its association with HS PE experiences. Everhart and Kernodle found that those who took PE were more likely to report engaging in muscle strengthening activity than those who were allowed to substitute sport participation for PE credits, (Everhart et al., 2005). Conversely, Mears found no differences between those who took PE and those who reported not taking PE in HS, (Mears 2010). Mears's study looked into teacher certification, professional development and PE curriculum content, while this study focused on the amount of PE taken in HS only. The differences in inclusion criteria, could explain the variation in long-term effects described by other studies.

Research Question 2: Level of reported HS PE participation.

Demographics variables, (RQ2a). The grouping criteria used were validated by cross checking the reported HS state. The grouping criteria were valid and adequate representation of the HS graduate requirements of the states reported for HS attendance. The requirements of this sample range from no graduation requirement daily PE all four years of HS, (American Heart Association and The National Association of Sport and Physical Education, 2012). Most students reported at least some HS PE participation. The low number of individuals reporting No HS PE and Substitution's for PE, led to some

statistical challenges. A more geographically diverse sample would ease these difficulties in the future. The four groups were similar in their demographic characteristics including: age, college year, college GPA, estimated family SES, or Race/Ethnicity, (Table 11).

This study indicated that differences in biological sex existed between groups with different HS PE experiences. Males were more likely to report taking extra HS PE classes, while females were more likely to report taking the graduation requirement. Males and females reported equal rates of activity substitution for HS PE credit and equal rates of taking no HS PE, (Figure 5). The research on gender differences in physical education point to the variety of ways that males and females view and approach HS PE class (Penney, 2002). This study did not aim to examine the reason for the disparity between males and females, but this finding is consistent with previous literature. Sedentary behavior has been identified in the body of literature as a behavior that has a strong propensity to track from one life stage to another, (Malina, 1996). This study found with resounding consistency that the required amount of PE is not enough to illicit the desired long-term health behavior benefits, regardless of biological sex. Concurrent benefits of HS PE class are lost on those who take less HS PE, however, this study found that there are additional long term benefits lost to those who take only the required amount of HS PE. The trend found in this study, that females choose only to take the HS PE classes required for graduation represents an increased risk of females becoming sedentary young adults. Several researchers have identified a strong tracking effect of sedentary behavior from childhood to adulthood (Glenmark, 1994; R. Pate, R., O'Neill, J. R., and McIver, K. L., 2011; R. Telama et al., 1997; Risto Telama et al., 2005; X. Yang,

Telama, R., Hirvensalo, M., Viikari, JSA., and Raitakari, OT., 2009). If the HS PE requirement for graduation remains below daily PE, the result will be increased rates of sedentary behavior for adult females. Females will be left at a health deficit, with higher risk for major lifestyle and chronic diseases.

Adult BMI and physical activity behaviors, (RQ2b). An encouraging public health finding in this sample was that over 60% of the sample reported BMI in the healthy or lowest risk for disease category. Based on previous study findings, differences in BMI were expected. The group means were all below the cut point, of overweight or increased risk for disease, of 25 kg/m^2, listed in Table 12. Menschik and colleagues examined BMI and showed that among normal weight HS students, those who participated in daily HS PE were 25% more likely to be normal weight as young adults than those who participated in less HS PE (Menschik et al., 2008). Wardle and researchers also found a positive correlation between odds of maintaining a healthy BMI into adulthood and number of PE classes per week in pre-adolescent boys but not girls (Wardle, Brodersen, & Boniface, 2007). Research has shown that adequate physical activity can help to maintain a healthy weight, but that several other factors impact individual weight for height ratio's (Centers for Disease Control and Prevention, 2011). This study failed to identify significant differences in BMI between groups, and further research is necessary to further identify the long-term health behavior impact of HS physical activity programming.

No PE group. One important aspect of HS PE participation this study set out to examine was the difference between individuals who report taking no PE and those who

report taking no PE because they are active in other programs. The comparisons between groups in this set of analyses showed that there are distinct differences in the long-term physical activity behaviors of these two different participation groups. Individuals reporting no HS PE reported the lowest mean days of aerobic activity and mean sport minutes. Individuals in this group reported an average of 2.29 days of aerobic activity per week while the individuals in the substitution group reported an average of 3.74 days of aerobic activity. HS PE aims to educate students to be active for a lifetime. This study shows that students who report taking no HS PE and not participating in other physical activity based programs in HS are subject to long-term negative health behavior impacts. Malina and Kelder, both noted that the lack of physical activity behavior, tracks across life stages, (Kelder, 1994; Malina, 1996). This study adds to the evidence that the full range of habitual physical activity behavior, including sedentary behavior has the capability to track through life stages.

GradReq group. Although research has yet to identify the number of years, number of PE classes, or minutes of activity it takes to ensure the best chances of physical activity to carry over into adulthood, the results of this study support previous findings, that when the required amount of PE is less than daily PE, more than the required amount of activity in HS is necessary for long-term benefit, (Shepard, 2000; F. Trudeau et al., 1999). On average, the individuals who reported taking only the graduation requirement reported 1.65 days per week of strengthening activity while those who reported taking more than the requirement reported 2.21 days per week. These individuals also reported the lowest average minutes spent in sport activity at 14.6

minutes while the group average for those who took more PE was 26.1 minutes and those who substituted activity programs for PE reported 29 minutes on average. The findings here are compelling evidence that the required amount of HS PE is too low to achieve the long-term health behavior benefits the program strives for.

Another finding was that those who reported meeting the requirement for HS PE also consistently reported significantly lower rates of all four adult physical activity behavior types than some of their peers. On average, the individuals who reported taking only the requirement for graduation reported 2.51 days of aerobic activity while the individuals in the substitution group reported 3.74 days of aerobic activity per week. They also reported fewer days of flexibility activity per week, averaging only 1.27 days compared to the substitution groups who reported 2.05 days per week. Social learning theory supports these results (Thomas, 1990). Students who are exposed to more activity behaviors and given more opportunities to practice the behaviors are significantly more likely to adopt the behaviors as habits and carry them over into adulthood, (Perry, 1990).

PEMore group. Consistently, in three of the four activity types, individuals who reported taking more PE than required reported more adult activity than those who took only the graduation requirement. The significant differences were in the muscle strengthening and the number of sport minutes. The results of this study are similar to those of Trudeau and researchers, who found physical activity differences in women 20 years after a HS PE intervention that provided daily PE compared to twice weekly PE (F. Trudeau et al., 1999). In addition, this research adds to what Glenmark and colleagues found in a retrospective study showing that those who took PE and participated

successfully had improved adult physical activity behavior. HS PE performance tests, physical characteristics, PE grades, and physical activity level in HS could significantly predict level of physical activity in adulthood, (Glenmark, 1994). The findings in this sample consistently reaffirm that the required level of HS PE is not enough to meet the program's goal of long-term benefits.

Although the mean adult behaviors for those who took more PE than required for graduation were higher, the differences were not all statistically significant. There are several reasons students might take more PE classes than required. The variety of these reasons may explain the variability in the results. The high rate of sedentary behavior in adults will continue if changes are not made to this program, because the sedentary behavior learned in adolescence will track across life stages, (Malina, 1996). One of two things mush happen, either an increase in the graduation requirement must be adopted, or an increase in alternative programming for physical activity opportunities must be put in place.

Sub group. The results of this study showed that students who substituted an activity for PE class reported statistically higher rates of aerobic and flexibility activity. Because of the smaller size of this group statistical significance could not be reliably computed for minutes of sport activity. The substitution group consistently across all four adult activity behaviors studied reported the highest average activity levels of all groups. In this sample, mean days of aerobic activity was 3.74 days per week for individuals in the substitution group; more than 1 full day above the means for all other group (Figure 6). This group also reported more days per week of flexibility activity than both the

graduation required and the more PE groups, (Figure 6). These findings are likely consistent with other research. Everhart and Kernodle found that students who reported substituting participation in HS athletics also reported higher rates of total physical activity, aerobic workouts, team sports, aquatic workouts and abdominal workouts as adults than did their peers who took HS PE and were not HS athletes (Everhart et al., 2005).

The current results cannot conclusively be attributed to participation in HS sport, because this study did not take into account specifically why students were granted waivers or substitutions for HS PE class. It is known, however, that states where substitutions and waivers are used to bypass physical education class, the most used substitutions are HS sport, marching band or enrollment in an ROTC program. All of these programs include significant amounts of physical activity, (American Heart Association and The National Association of Sport and Physical Education, 2012; National Association for Sport and Physical Education, 2006; Physical Activity Council, 2012).

Adult health behavior recommendations, (RQ2c). Meeting physical activity guidelines for prevention of disease is a major goal for American's set by the Centers for Disease Control and Prevention, (Centers for Disease Control and Prevention, 2013). In this study, participation in HS physical activity programs was associated with increased young adult physical activity behavior. Students who reported no participation in HS physical activity programs (NO PE group) had the lowest rates of meeting adult recommendations for BMI and aerobic activity, with only 20% of individuals in that

group reporting adequate adult aerobic activity. Those who took the required amount of HS PE reported the lowest rate, less than 50% of individuals meeting the recommendation for muscle strengthening activity. Participants from the substitution group reported the highest rates of meeting adult recommendations in all categories of all the groups, (Figure 7).

The research on tracking of physical activity behaviors across life stages has concluded that both sedentary behavior and physical activity behaviors seem to transfer from adolescence to adulthood (Malina, 1996). Other research has suggested that the high active and low active individuals on the behavior continuum show the greatest tracking effects across time (Kelder, 1994). The results of this study support these previous findings regarding adolescent physical activity behaviors tracking into young adulthood. The results presented here indicate that the trend to require fewer HS PE classes and the corresponding long-term health impact is in direct conflict with the recommendations for healthy people, and the *Health People 2020* goals (American Heart Association and The National Association of Sport and Physical Education, 2012; Centers for Disease Control and Prevention, 2013; Lee, 2007).

Other research has examined the difference between daily HS PE and less HS PE. In that research, daily PE was found to be superior for long-term health behavior impact (Dale et al., 1998; Menschik et al., 2008; F. Trudeau, Laurencelle, L., Tremblay, J., Rajic, M., Shephard, R.J., 1999; Wardle et al., 2007). In the current study, those who reported taking more PE in HS than required reported higher rates of meeting 3 of the four studied recommendations than both those in the no PE group and the group who took only the

required amount of PE. This study lends further evidential support to reversing the current trend of requiring less HS PE, to requiring more PE, or daily PE in HS.

The group with the highest rates of meeting recommendations was the substitution group. More than 50% of this group met each recommendation, with 91% reporting a healthy BMI. The School Health Policies and Programs Study of 2006 identified that nationally the mean number of minutes spent in physical activity in a HS PE class was $\bar{X}$= 44.6 minutes (Lee, 2007). High School semesters are on average 16 weeks long in HS. Forty-five minutes is only 2/3 of the minimum recommendation for healthy growth, proper development, and disease prevention for children (Centers for Disease Control and Prevention, 2013). In contrast a HS varsity athletic regular season is about 12 weeks. During the season the number of physical activity minutes varies due to teaching of skills and strategies, and periods for rest and hydration, but can be up to 5 hours, or 300 minutes. A typical practice would provide about 90-120 activity minutes but could be as much as 2 to 4 times the number of minutes of activity in a PE class (Lee, 2007; National Federation of State High School Associations, 2012). Although this study did not specifically ask participants to include the specific activity that was counted as PE credit, most states that allow substitutions do so for interscholastic athletic team participation, marching band participation, and ROTC participation (American Heart Association and The National Association of Sport and Physical Education, 2012; Lee, 2007).

As previously stated, this study did not explicitly ask participants to indicate what the substitution activity was used to earn PE credit. Further investigation is necessary

before conclusions can be made about the long-term health impacts of substitution activity for PE credits and specifically about HS sport participation.

Research Question 3: HS PE and sport participation.

Demographic variables (RQ3a). The grouping criteria used were validated by cross checking the reported HS state and mandates about PE substitution practices for those states. The grouping criteria were valid and the distribution of individuals across the four groups in this study represent the HS PE waiver and substitution mandates of the state they reported attending HS, with most students reporting at least some HS PE participation. Several of the states, but not all represented in this sample allow waivers for sport participation for PE credit, (American Heart Association and The National Association of Sport and Physical Education, 2012). The low number of individuals reporting No HS PE *and* no substitution's for PE resulted in no analyses on that group. Additional statistical challenges were encountered, due to the distribution of the sample. A more geographically diverse sample would ease these difficulties in the future. Understanding the long-term impact of participation in neither program is a very important part of this discussion, and further research is warranted.

Demographic variables in this study were not different between groups on biological sex, age, college year, college GPA, and race, (Table 13). Statistically, estimated family SES was lower in the PE only group than in the both group. This is the first study to examine the potential impact of social status on program participation and subsequent adult health behaviors. The differences are around the sample mean of $\bar{X}$= 49.17, and are well within the first standard deviation of the sample estimates, (SD= 12.51). Based on

other social status estimating instruments, the estimated poverty level is near 31 on this scale, (Families USA, 2013; Hollingshead, 1975). Because the differences are near the mean for the sample and well above the poverty line, the practical difference is interpreted to be very small, (47.1 < 49.5, on a scale from 8-66 represents a 4% difference).

Schools and school districts go to great lengths in transportation planning and other accommodations to make extracurricular opportunities available to all students who are interested in participating. Some research has shown significant differences between rural and urban schools in the opportunity to participate, with urban schools offering greater variety and greater number of opportunities for participation, (Lippman, 1996; McCracken, 1991). In addition, Pate and colleagues (1996) in a nationally representative sample of adolescents identified gender and race/ethnicity differences in health behaviors and participation rates in physical activity programs (community based and school based). The researchers suggested that sociocultural factors may significantly interact with physical activity outcomes (R. R. Pate et al., 1996). The results in this sample, reflect previous literature, and may indicate inequity of opportunity to participate. Further evidence is necessary before significant conclusions can be made. Due to the existing health disparities between low and high SES children and families, in conjunction with the long-term positive health impact of the programs discussed here, this area of research is of paramount importance in reducing health disparities in social class groups.

Adult BMI and physical activity behaviors, (RQ3b).

PEOnly group. The PE only group reported the lowest, (highest for BMI) means for all adult health behaviors. These differences were statistically significant except for BMI. Individuals in the PE only group reported fewer days of activity and minutes of sport activity than the sport only group and the both group. The results found here are similar to other research and can largely be explained by the disconnect between best practice and the current state of HS Physical Education. According to Social Learning Theory, teaching individuals the importance of regular and daily physical activity is not an effective way to ensure habitual behaviors are adopted. Nor is it likely that encouraging lifetime habits through emphasizing the health benefits will result in those behaviors being adopted and maintained over several years. In order for tracking to take place, a program must allow for adequate and significant amounts of time spent modeling and practicing these healthy behaviors (American Heart Association and The National Association of Sport and Physical Education, 2012; Perry, 1990). As previously stated the average time spent in actual physical activity in a HS PE class is about 45 minutes. However, some schools no longer offer PE and as discussed previously, few students take HS PE daily, resulting in almost no HS students today are getting adequate physical activity from PE.

Due to a convergence of several social and political shifts PE has not only been deprioritized, but has also been physically pushed into a corner, or even removed from school budgets and subsequently extinguished in some places, (American Heart Association and The National Association of Sport and Physical Education, 2012). Many school districts face dire budgetary situations and increased pressure to improve

standardized testing performances, (Le Masurier, 2006; Lynn, 2007). Despite having all the necessary requirements of an academic subject, PE does not appear as a section on any standardized tests, (American Council on Education and The Lumina Foundation for Education, 2013; National Association for Sport and Physical Education, 2010). Overcrowding, and budgetary constraints leave many schools with little choice but to transform indoor activity space into multipurpose cafeteria's, or even divide gymnasiums into classrooms, (Lee, 2007).

The evidence for concurrent health benefits with HS PE and HS sport are well established. In an analysis of a nationally representative sample of US adolescents, Pate and colleagues found that those who were in PE class reported higher rates of daily physical activity (R. R. Pate et al., 1996). In another study, he found those who were participating in a sport, school or community sponsored were more likely to accumulate the recommended 60 minutes per day of activity than non-athletes, (R. R. Pate, Trost, S. G., Levin, S., Dowda, M., 2000). Despite overwhelming evidence of HS PE's concurrent health benefits, the nationwide trend is to decrease the opportunities students have to choose PE, (American Heart Association and The National Association of Sport and Physical Education, 2012; Lee, 2007). Failing to offer attractive opportunities for daily physical activity will result in tracking of sedentary behavior, contributing to the high risk of lifestyle related disease. This study adds to the evidence that the level of activity in HS PE classes is too low to impact long-term behavior. Additionally, participation in this program only appears to have the poorest long-term young adult outcomes. If the low

requirement for participation and low participation rates during adolescence will track into young adulthood, perpetuating the sedentary lifestyle epidemic.

Both HS PE and HS sport group. The second physical activity program explored in this study is scholastic sports. In HS's across the nation, these activity opportunities are popular and have high rates of participation, (National Federation of State High School Associations, 2012). The mission and aim of school-sponsored sports are not purely scholarly, however, substantial learning and development does occur for those who participate (National Federation of State High School Associations, 2011). Many public schools have facilities for many Olympic sports and room in their budget to pay teachers a stipend to coach a team each year (Lee, 2007).

Adults who reported participating in Both HS PE and Sport programs reported on average more days of aerobic, muscle strengthening, flexibility physical activity and minutes of sport activity than those who reported taking HS PE only. These findings are consistent with Everhart and Kernodle, who found that adults who were HS athletes and also took PE reported higher rates of physical activity than peers who reported participation in only HS PE (Everhart et al., 2005). Additionally, Curtis did a study in older adults in Canada and found similar results. Canadian PE and sport programs are distinctly different from those in the United States. Curtis and researchers found that those who had not participated in any of the sport leagues in HS reported lower rates of adult leisure sport activity, and less physical activity than those who had taken part in the low level competitive leagues, (Curtis, 1999).

Based on both Social Learning Theory and Continuity theory, the results discussed here fit the theoretical framework. Individuals who reported participating in HS PE and HS Sport would have spent more time in activity than those who did not report participating in HS Sport. Making the choice to participate in an additional physical activity opportunity (sport) would lead to an increase in the internalization of the value of that activity for participants. The result would lead to increased young adult physical activity behavior, because these individuals had more opportunity for practice and skill acquisition and were more likely to value the additional voluntary program participation.

SportOnly group. The highest group means reported for each of the physical activity types were from the Sport only group. Mean days of aerobic activity and mean number of sport minutes had the largest practical difference. The Sport only group reported a full day more aerobic activity on average than the PE only group, and a half day more than the Both group. A mean of 30 minutes of sport activity was reported by the individuals in the sport only group, while the PE only group reported 7 minutes and the both group reported 22 minutes. These finding's suggests that those who participate in HS sport exhibit the highest propensity for the tracking of physical activity behaviors from adolescence to adulthood. This finding is supported by previous literature, but perhaps challenges the theoretical framework used here. Many studies have shown participation in youth and adolescent sports programs are more active than their peers in adulthood, (Curtis, 1999; Raitakari et al., 1994; R. Telama et al., 1997; Risto Telama et al., 2005; van Mechelen, 1995; Vanreusel, 1993b; X. Yang, Telama, R., Hirvensalo, M., Viikari, JSA., and Raitakari, OT., 2009).

This study consistently shows that participation in one program far out performs the other in long-term impact. One explanation for this could simply be the difference in the amount of time spent or opportunity for time spent in activity. In general, participation in sport leads to significantly more activity time than in PE. However, using this explanation only does not help to define the phenomenon of the results reported by the Both PE and Sport individuals. In this study, Sport participation alone was the most effective way to improve physical activity in young adulthood. Additional theories will need to be identified to fully understand the reason participation in both programs does not add to the best long-term outcomes for health. Further research on behavioral aspects of HS PE and sport programs is necessary to fully understand the long-term health behavior benefits of both HS PE and HS sport programs, however, this study does definitively show that participation in sport or in both programs is an important factor in promoting healthy adult physical activity behaviors.

Adult health behavior recommendations, (RQ3c). The CDC has set goals for American's to improve rates of daily physical activity by 2020, (United States Department of Health and Human Services, 2010). There is evidence that habits formed in childhood and adolescence can impact adult health behaviors, (Malina, 1996). In all four recommendations, participants in the PE Only group reported the lowest rates of meeting the recommendations as adults. This result reflects the low requirement for PE in HS (American Heart Association and The National Association of Sport and Physical Education, 2012). It is also reflective of the national average of physical activity minutes

44.6, in HS PE classes (Lee, 2007). When comparing the study groups to the United States young adult average for meeting aerobic and strength activity recommendations, the PE only group was strikingly similar, (Centers for Disease Control and Prevention, 2010). The PE only group reported 24% met the aerobic recommendation and 32% met the strength recommendation. The national average in 2010 was 29.7% met the aerobic recommendation and 20.9% met the strength recommendation. The other two study groups outperformed the national average significantly, reporting higher rates of meeting each of the three recommendations studied. This evidence reiterates that HS PE must undergo significant change in order to positively impact long-term health behavior impact. Because of the number of individuals this program affects, and the long-term potential of health behaviors formed in adolescence, this is a public health concern that needs immediate attention.

Individuals who reported participating in both programs consistently reported meeting more physical activity recommendations and reported more healthy BMI's than those in the PE only group. The Both PE and Sport group also consistently reported fewer individuals meeting recommendations than the Sport Only group. This finding is somewhat consistent with previous research, (Everhart et al., 2005; Mears, 2010). The study results presented here challenge the way PE and sport are viewed with regard to their contribution to long-term health behavior impact. Further research is necessary to determine the common threads that lead to the positive health impact needed to turn the sedentary lifestyle epidemic around.

This is the first study to show that HS athletes who report *not* taking PE are more likely to meet recommendations for healthy levels of physical activity in aerobic, muscle strengthening, and flexibility activity, than their peers. In this study the Sport Only group also had the highest percentage of healthy BMI's reported, indicating in a population known for discrete weight gain (Grapper, 2009); former athletes may resist this trend better than their peers.

The findings in this study are similar to others who have compared daily PE programs to those with less PE. Many others have found that as participation increased from one, low physical activity opportunity program, to participation in more than that one program, or a program that involves more competition, the probability of positive health behavior tracking increased (Curtis, 1999; Dale et al., 1998; Menschik et al., 2008; F. Trudeau, Laurencelle, L., Tremblay, J., Rajic, M., Shephard, R.J., 1999; Wardle et al., 2007).

General discussion. The main focus of HS athletics is not physical health; however, the number of minutes of opportunity for physical activity in sport participation may be a simple explanation as to why these behaviors track so consistently from adolescence to adulthood. As mentioned above, the national average number of physical activity minutes in HS PE is about 45, while an athletics practice can range not only in intensity, but also in time from less than 45 minutes to nearly 5 hours during some parts of the season in some sports, (Missouri State High School Activities Association, 2012; National Federation of State High School Associations, 2012). HS sport participation affords individuals ample physical activity time to meet the recommendation. Because

sport is not mandated, another explanation could be that voluntary participation allows for an additional level of value to be assigned to the activity and behavior's learned by those who participate. This second explanation would also apply to the finding in the second research question that those who reported taking more PE than required had higher rates of young adult activity. What is clear is that those who report participating in HS Sport also report long-lasting positive health behavior impact.

An important but unexpected finding from this study is that participation in both programs does not lead to additive impact on long-term behavior. Participating in both PE and sport does not lead to the strongest tracking effects, with regard to long-term health behavior benefits. Social cognitive theory suggests that spending time in modeling and practicing of health behaviors leads to the continuation of those behaviors across life stages, (Perry, 1990; Thomas, 1990). It appears that there are factors underlying the adoption of physical activity behaviors that mediate effective tracking of these habits from adolescence to adulthood. Two potential areas that may be of relevance for future research endeavors are the type of influence (positive or negative) previous participation experiences had on physical activity attitudes and the identity theory. In social learning theory the idea of a positive experience is based on the feedback. A behavior that is enjoyed, or brings positive social, personal, physical, or emotional outcomes is a behavior that is valued and adopted, (Bandura, 1989). The distribution, and lack of consistency of adult health behavior activity, may in part be mediated by the positive or negative experiences of the individual from one or both of these HS physical activity programs. Role identity may also play a strong part in the process of health behavior tracking.

Soukup and colleagues used the exercise identity scale to evaluate the exercise identity of college students who had participated in either PE or sport in HS and found that those who reported being athletes had significantly higher exercise identity scores than those who had participated in PE, (Soukup, 2011). Further study is needed to identify the potential impact identity has on health behavior.

The results here were not meant to compare the effectiveness of PE and that of HS sport programs. This study set out to evaluate the kind of activities HS students are offered, to explore which kids are participating in each program, and how each program impacts subsequent adult behavior. The findings presented here indicate that in addition to the differences in the academic rigor, main goals, and amount of time spent in physical activity between HS PE and HS Sport, the impact each has on adult health behaviors is significantly different as well.

Chapter V: Summary and Conclusions

This chapter will provide an overall summary of the study, a brief overview of the results from each research question, implications for public health policy and research, as well as limitations and recommendations for future research.

Summary of the Study

Research supporting the tracking of physical activity behaviors from adolescence to adulthood exists in the literature, however, few studies have examined the effectiveness of HS PE and HS sport participation to impart long-term health behavior benefits to participants. The importance of the relationship between adolescent participation in physical activity programming has been established by previous work in the field. This work has consistently demonstrated that those who participate in youth and adolescent physical activity programming are also more likely to be active adults, while those who do not participate are likely to maintain low activity levels or sedentary behavior as adults. Several studies discussed in Chapter II indicated that high levels of activity gained as part of participation in either PE or sports programs as youth or adolescents lead to improved healthy activity outcomes as adults. Some research found the tracking to be less significant than others and several methodological differences were used by the varying researchers. The importance of continued work in this area is anchored by the need to validate the long-term health benefits of participation in activity programs such as HS PE and HS sport. The purpose of this study was to describe the sample population with regard to their participation in the HS physical activity programs, to examine the relationship between level and type of participation in HS PE and HS

sport activities and their impact on subsequent young adult physical activity behaviors, as well as to explore the impact on meeting health behavior recommendations.

This quantitative retrospective study recruited participants from all colleges in an effort to capture a representative sample of the overall undergraduate population on a Midwestern University campus. A total of 1,541 responded to the request for participation and 1,339 survey responses were used in the final analyses after cleaning. Only participants who attended HS in the United States, were enrolled as full-time, on-campus, degree-seeking undergraduate students, who were not active Varsity Athletes or ROTC members were included in the final sample. This study was successful in reaching all parts of the undergraduate campus and overall the sample was representative of the population.

Overview of Results

This section will present the major findings from the study. Findings are presented separately for each of the major research questions.

Research question 1: Number of HS PE classes. Number of HS PE classes was significantly associated with biological sex and estimated family SES. Males reported higher number of PE classes on average than females. A positive relationship between estimated family SES and number of HS PE classes reported. The shared variance was less than 5% in each case. Positive and small correlational relationships were identified between number of HS PE classes and days per week of aerobic and muscle strengthening activity, as well as number of sport minutes of activity. The shared

variance for these relationships was less than 5% in each case. For each additional HS PE class reported, adults had increased odds (1.106) of meeting the recommendation for two days per week of muscle strengthening activity. Despite the small effect sizes indicated by this sample data, it is clear that taking more HS PE classes leads to improved adult physical activity behavior. Currently the average number of classes required is about three classes, or 1.5 years of HS PE. If schools nationwide increased the requirement for number of PE classes required for graduation to six classes or three years of HS PE, according to this study we could see a 10% or more decrease in sedentary adult behavior.

Research question 2: Level of reported HS PE participation. When assessing the level and type of PE classes taken in HS four groups were defined and included: 1) those who reported taking no HS PE, 2) those who reported using a substitution in lieu of taking PE class, 3) those who took the required number of PE classes for graduation, and 4) those who reported taking more than the required number of PE classes. Males were more likely to report taking more PE classes than required for graduation, while females were more likely to report taking only the required number of HS PE classes to graduate.

Groups were different on all 4 adult activity variables. Those who reported using a substitution reported more days per week of aerobic activity than all other groups and more days per week of flexibility activity than the other two PE groups. Additionally, the substitution group reported higher rates of meeting adult recommendations than those who reported taking no PE in HS for three of the four recommendations studied, including: BMI, aerobic activity and flexibility activity. Those who reported taking more

PE reported more days per week of muscle strengthening activity and more minutes of sport activity than those who reported taking only the required number of PE classes. Those taking more PE also reported more individuals meeting the recommendation for muscle strengthening activity than those meeting the requirement only. Those who took only the required amount reported the fewest individuals meeting the recommendation for muscle strengthening. The greatest mean differences were the days per week of aerobic activity and those in the substitution group reported between 1.064 and 1.46 days more than the other three groups.

The results of this study point directly to the low number of PE classes required for graduation in HS PE. The research indicates that daily activity is an important part of a healthy lifestyle and the recommendation reflects that research. In HS, PE is required daily by a handful of states and the remaining states require it for less than three of the four years. The findings of this study point to a clear disconnect between the opportunities offered to HS students and the research based best practice. The most significant finding is that the lack of opportunity to practice the healthy lifestyle habits results in a continuation of low activity in young adulthood. Additionally, those who use a substitution for PE class appear to be taking part in another program that is effective in promoting healthy activity levels. This study found that other activity programs likely include junior ROTC, marching band, and interscholastic sports participation. Although this research did not aim to evaluate any of these programs specifically, or to compare the long-term impact to HS PE, there appears to be significant long-term gain for participants of these programs.

Research Question 3: HS PE and sport participation. A similar trend in long-term impact of physical activity program participation in adolescence was noted in these analyses. Reported experiences were used to create three groups, 1) those who took PE and did not participate in sport, 2) those who participated in both PE and Sport, and 3) those that did not take PE classes and did participate in sport. There were some individuals who reported participating in neither program, but not enough to include as a group in this study.

Those who reported only taking PE had lower estimated Family SES than those who reported participating in Both PE and Sport. The mean differences were small, with uncertain practical significance. Those who reported only sport participation reported significantly lower mean BMI than those who only took PE.

The former athletes also reported significantly higher mean physical activity behaviors in all four adult activity types studied, (days per week of aerobic, muscle strengthening, flexibility, and minutes of sport activity) than both of the two other groups. The mean differences ranged from 0.88 days of flexibility activity, to 1.12 days of muscle strengthening activity. These findings represent significant practical differences. On average an individual who reported participating in only PE and not sport reported a full day per week less activity than those who reported participating in only sport and not PE. There was a consistent finding across four of the five adult health behavior variables (not BMI). Young adults who were former athletes reported the highest rates of activity, those who reported participation in both programs reported less activity than former athletes

but more activity than those who took PE only and the PE only group reported the least amount of adult activity.

One way to discuss the practical significance of these differences is to discuss the differences in terms of meeting recommendations for health. The sport only group reported the most individuals meeting all four recommendations. Former athletes reported significantly more healthy BMI's than those who took only PE. The sport only group reported significantly more individuals meeting the recommendation in all three adult activity types than both of the other two groups.

Given what we know about the propensity of health behaviors formed in adolescence to track across the lifespan, the results described here are both confounding and promising, (Malina, 1996; Perry, 1990). The idea that participation on a sports team in HS can lead to a physically active and healthy young adult lifestyle is significant for health promotion professionals. The evidence presented here is in contrast to the intuitive nature of human behavior as viewed through the social learning theory, however, individuals who reported participating in both PE and sport in HS did not report the highest levels of adult behavior, and in fact reported significantly less than those who participated in sport only, (Perry, 1990).

Implications for Theory

The survey used to collect data in this research was tested and demonstrated to be a useful and accessible tool for gathering information from college students. By utilizing previously validated questions and question sets, most of the data collected was useful without further psychometric testing. The parts that were created for this study were

found to be adequately reliable. One of the questions related to HS PE had a lower than desirable reliability coefficient and should be amended. It is likely that the wording used was either unfamiliar or interpreted to have a slightly different meaning that the original intent of the question. By adding an additional question to clarify why students who report using a substitution or waiver for PE credit, a more specific conclusion can be drawn about students who use an alternative activity for their PE credits in HS.

Based on the unexpected results from the long-term impact of participation in both HS PE and HS sport, it is likely that an underlying factor, not studied in this research exists and modifies the tracking of physical activity behaviors into young adulthood. A few possible explanations are discussed here.

First, this study did not consider the number of years or number of sport teams that defined each individual's athletic participation. The level of competition and the number of years of participation have both been implicated as factors in physical activity behavior tracking, (Curtis, 1999; Risto Telama et al., 2005). Gathering important details about the level of participation would help to further describe the variety of experiences that exist within each group. The number of experiences and time spent in participation may help to identify additional factors not studied here. For example, if most of the individuals in the both PE and sport group participated in only one sport for only one year it could explain the lack of an additive effect.

The social learning theory was used to guide the current study. Much of the findings in this study are explained by the theory. Those students that reported less participation in PE and sport programs in HS, in general, reported less participation in

activity in young adulthood. This finding is also supported by the continuity theory. When HS sport is viewed in terms of the number of minutes of possible participation in physical activity, these findings are also explained by social learning theory and the continuity theory. The remaining results, however, indicate that additional theoretical frameworks may better describe the observed phenomena. According to social learning theory more time spent practicing a behavior, more involvement and more peer and modeling leads to greater participation. In this case the results of those who reported participation in both PE and sport should have significantly greater participation in physical activity as adults. Consistently, across all adult behaviors measured, the sport only group reported significantly more activity than the both group.

The Continuity theory also explained the results from the PE only and the Sport only groups, but not those who reported participating in both programs in HS. An important detail in the continuity theory begins to support this seemingly inconsistent finding. This theory suggests that it is the behaviors that we find rewarding, enjoyable, and become a part of how we identify ourselves are the behaviors we continue to do across life stages. With this part of the theory we can begin to develop an understanding that the behaviors observed in this study depict the underlying psychological aspects of the level of enjoyment in participation. Although it is likely that the amount of time spent in participation is related to the level of reward individuals attached to participation they are different constructs that very likely explain unique variance in long-term effects in health behaviors. Future studies should include a variable related to the level of identity each group has with physical activity. Another potential construct to study in the future is

the impact of the affective part of the experience. A positive or negative experience in one or both programs could explain the additional unique variance.

In summary this study provides support for studying tracking of physical activity behavior by examining previous participation in HS physical activity programs. It also supports the use of the social learning theory, and the continuity theory to understand the continuation of physical activity behaviors across stages of the lifespan. Additional research should include investigation of the identity theory and the affective aspects of program participation on long-term health behavior impact.

Implications for Policy and Practice

In the midst of the nationwide trend to offer and require less participation in HS physical activity, another important trend emerged. Educators began to offer greater variety in curriculum and more classes that focused on teaching fitness skills that are useful for a lifetime. This transition is a move away from team sports based curriculum to active lifestyle curriculum. PE became a class about cross-training, walking, or an outdoors class rather than weight training for sport and team sports. There is significant value in offering a variety of opportunities to entice and encourage more participation. The current study endorsed the need to increase the level of enrollment in HS PE classes during all four years of HS. The finding in this study provides further evidence that when the graduation requirement is less than daily PE it is not enough to impart the necessary long-term health impact the program's mission states.

High School Physical Education is an important source of physical activity for adolescents. This study found positive associations between increased number of HS PE

classes taken and increased adult physical activity behavior, providing evidence that the number of HS PE classes is important to the adoption of health adult behaviors. The results of this research also indicate that daily HS PE could make a significant impact on the epidemic of adult sedentary behavior. The difference in male and female rates of taking PE classes reflects the need to continue the work toward what equal effective access really is in HS PE. Physical educators and health educators should continue to work with administrators and communities to support increasing the number of PE classes offered to HS students. In addition, the allotment of space, resources, professional development, and quality curriculum content should be of top concern in order to provide the kind of opportunity for activity that leads to long-term health benefits.

This study consistently found that more PE is better, which is strong evidence for increasing the number of PE classes required for graduation from HS. It is important that we determine and seek to understand what other factors motivate students to sign up and participate in HS PE, beyond the requirement for graduation. Exerting individual volition seems to be a consistent construct that leads to increased tracking of positive physical activity health behaviors. Increasing options and increasing requirements are both effective ways to increase enrollment. This study showed that having PE experience in HS is an important contributing factor to increasing healthy rates of physical activity in young adulthood. It is paramount to the health and future of the United States that policy makers heed the research findings here and in other fields. PE has concurrent and long-term positive impacts on health and decreases risk for major diseases, but if it is not

supported through legislation, budgetary allotment and quality instructor standards, the benefits will be lost.

There were mixed results indicating that participation in HS PE and HS sport activities increased the level of reported adult physical activity, but that dual participation did not result in an additive effect for adult activity. This study identified that school sponsored opportunities for physical activity other than PE may also offer substantial long term health benefits. Further research is needed to confirm the kinds of activity and the level of participation necessary to impart that benefit. It is recommended that youth educators be supportive toward all opportunities for physical activity and encourage students to be involved and take opportunities to participate as often as possible in programs offering opportunities for physical activity. Administrators and policy makers should consider opportunities for physical activity for HS students to be a decision to protect and support the health of all students. School officials and policy makers must consider ways to expand opportunities for all students to be involved in some program for physical activity on a daily basis.

Finally, this study found that the tracking effects of physical activity behavior of those who reported being HS athletes was the strongest. When comparing the mission and goals of the two programs the outcomes of this study would be the opposite of the current findings. The amount of time spent in physical activity in sport can be approximately 2-5 times more physical activity than a HS PE student across a single semester. From a health behavior perspective the mission of HS sport does not explain why long-term health behaviors are taken up by these individuals. This study shows that

sport can be an effective promoter of health behavior long after participation has ceased. Keeping these opportunities available to all students and supporting positive environments for safe, challenging, and enjoyable experiences is important to promoting the long-term benefit of participation.

Limitations

The limitations of the research design of this study were outlined in Chapter I. After analyzing the data and evaluating the results, a few additional limitations were noted and are described here.

Self-report survey responses are known to be affected by social desirability. In relation to height weight and other health related behaviors underreporting and over reporting are an implication of this study design, (Brewerton, 2001). In order to decrease this bias the survey was offered as completely anonymous and for dissertation research purposes only, (not connected to course grades or health judgments). However, the bias could have resulted in more socially desirable or favorable responses form some participants.

Although many of the target population are technologically savvy and use electronic versions of many applications, some self-selection could have occurred. Because this survey was only offered in an electronic, online format, it is unknown what differences in experience were not collected by those who choose not to participate in online, electronic research opportunities.

Finally, although the sample was representative of the undergraduate population at this particular institution, the oversampling of females may limit the generalizability of

the results. Caution must be used in interpreting the results of this study because of the small geographical region that the sample represents, and the low level of diversity of the respondents. As stated previously, this study did not survey HS students who did not graduate, those who graduated and went into the workforce, and those who graduated and attended higher education at a school other than a four year state university. Therefore the results cannot be used to describe these segments of the population, nor can it be used to describe all HS students.

Recommendations for Future Research

This study has highlighted a variety of ways to inform future research. First, continuing to study the differences between groups of individuals who report participation in HS PE and HS sport will continue to monitor the equity of opportunity for all students to engage and participate in these programs. This study was the first to include an analysis of the impact of estimate of family SES. Although most groups were not different, and practical interpretation was challenging, future research should continue to describe the relationship between rates of participation in HS physical activity programs and family social status. As long as social status continues to define significant health disparities in both children and adults, programs must strive to be equally available to all students.

This study shows that continuing to examine health behaviors across life stages is an important way to approach the evaluation of programming that aims to have long-term health benefits. The social learning theory and the continuity theory should be a part of what defines the theoretical framework for future research. However, the results of this

study also indicate that other factors will need to be included. Additional theoretical framework or additional constructs within the original theories will help tell the whole story of why health behaviors have continuity across life stages.

Two possible theories that are recommended for future studies include the role of exercise identity in the tracking of physical activity behavior. Previous research has shown that athletes and PE students have significantly different role identities in exercise (Soukup, 2011). This could be a significant factor in the explanation of the transfer of participation in HS and adult health behaviors. Secondly, examining the positive or negative impact participation in either PE or sport has on the individual. The feedback, emotional, physical and psychological experiences that participation in these programs leaves behind could also explain a distinct part of the variance in adult behavior.

Due to differences at the state level for HS PE requirements and substitution and waiver policies, a more geographically representative sample is desirable to enable better overall understanding of the impact these HS programs have on the population in the United States. Due to unequal and non-normal distribution of the sample, some of the groups and some of the health outcomes were not described in this study. Further research could also examine different parts of the population, including those who enter the workforce after graduation, those who attend community, technical, and specialized training programs after HS graduation. In addition, this study did not include those students who were attending the institution part time, another group which needs to be examined with regard to the phenomenon of behavior tracking.

Conclusions

The programs of high school Physical Education and high school sport have long enjoyed high rates of participation and significant levels of support. Recently however, this support has been slowly eroding as schools are challenged to close the gap in the international academic arena. PE programs have had to make difficult decisions to fit new budgets, less space, and fewer minutes to deliver their curriculum, but meet the same goals and standards. Many of these changes required direct opposition to best practices. A new focus on lifestyle physical activity has emerged and renewed commitments to maximizing minutes of activity have done little to slow the erosion of funding and support at the policy level. Sport programs are also beginning to suffer from slashed budgets, program reductions or discontinuations. Many have turned to private sector funding, corporate advertising, and alumni booster programs to bear the complete financial responsibility to keep facilities, coaches, and programs in place.

Research Question 1: number of HS PE classes. Although there is some research about the tracking of physical activity habits from adolescence to adulthood, this is the first study to show that the number of HS PE classes taken is related to adult physical activity behavior. This study shows that although much of the variance in adult physical activity behavior is likely related to a great variety of factors, the number of HS PE classes taken plays a significant role in the likelihood of an adult continuing to have healthy activity behaviors during the young adult years. It is important for policy makers and school administrators recognize that gender differences related to PE in HS still exist.

Care should be taken to offer not only equal opportunities for male and female students, but also ensure that class offerings provide access to safe environments, successful learning, and opportunity's for physical activity for all students. This study adds to the evidence in support of daily PE in High School. Increasing HS PE graduation requirements and providing quality, daily PE to all students would make a significant positive impact in the epidemic of adult sedentary behavior.

In school activities are one of the few opportunities for adolescents to be physically active (Centers for Disease Control and Prevention, 2013). It is important that these opportunities are not only continued but expanded (National Association for Sport and Physical Education, 2004). Despite many years and much progress, there is still work to be done in offering opportunities that both males and females will choose in HS. Future research in this area should focus on adequate sample size to determine how many PE classes lead to the biggest improvement in young adult physical activity behavior. Identifying other underlying factors that contribute to the variance in tracking of physical activity behaviors for healthy adult lifestyles is also a necessary part of future research.

Research Question 2: level of reported HS PE participation. This study adds to the evidence that both sedentary and activity behaviors have the ability to track or continue from adolescence to adulthood. The findings from this study provide evidence that the current down trend in PE requirement for graduation will have a substantial negative impact on the epidemic of sedentary behavior. This study shows that although much of the variance in adult physical activity behavior is likely related to a great variety

of factors, HS PE plays a significant role. It is important for policy makers and school administrators to recognize the significant gender differences still detectible in HS PE enrollment. Care should be taken to offer equal opportunities for male and female students, and to ensure that class offerings provide access to safe environments, successful learning and physical activity for all students. This study adds to the evidence based support that daily PE in HS would make a significant positive impact on the epidemic of sedentary behavior.

Previous findings have shown that more HS PE increases the long-term health benefits but this study definitively identifies that there are significant differences in the long-term health benefits between participation in HS PE and participation in other HS physical activity programs used to waive PE class. Taking no HS PE credits and reporting no other HS activity participation as well as only taking the required amount of HS PE is associated with the poorest young adult physical activity behavior rates. Significant long-term health benefits were indicated in this sample for individuals who took more PE than required and those who reported substituting other HS activity for HS PE credit.

Research Question 3: HS PE and sport participation. Further research should continue to investigate the potential difference in social status among HS physical activity program participation. The findings from this study provide evidence that the PE requirement is too low to produce the long-term health benefits it aims for in the program's mission. The current findings add to the evidence that daily participation in a

physical activity program such as a combination of HS PE and HS sport makes a significant positive impact in the likelihood of meeting health recommendations for adult physical activity. Finally, this study definitively identifies that there are significant differences in the long-term health behavior levels between participation in HS PE and participation in HS sport.

Generally, this study adds to the evidence that participation in HS sport has a lasting and positive health impact on participants. Individuals who report participation in HS sport also report significantly higher rates of adult physical activity and healthier body weights as young adults than those who report any other type and level of participation.

General Conclusions. This study provides important information for physical educators and health educators across the nation, as well as researchers studying the tracking of physical activity behaviors, and those interested in the long-term impact of HS physical activity programs. This study is unique in its examination of two programs simultaneously in a large segment of the population who participated in those programs. It also provides insight for future evaluation and health behavior research on two programs that impact over 2/3 of the youth in the United States.

References

AHA, N. a. (2010). *2010 Shape of the nation report: Status of physical education in the USA.* Reston, VA: National Association for Sport and Physical Education.

American Council on Education and The Lumina Foundation for Education. (2013). KnowHow2Go.org. *High School Freshman- Get Ready!* Retrieved 02/24/2013, 2013, from http://www.knowhow2go.org/freshmen_ready.php

American Heart Association and The National Association of Sport and Physical Education. (2012). 2012 Shape of the nation report: Status of physical education in the USA. (pp. 91). Reston, VA: National Association for Sport and Physical Education.

Atchley, R. C. (1989). A continuity theory of normal aging. *The Gerontologist, 29*(2), 183-190.

Atchley, R. C. (1999). *Continuity and adaptation in aging: creating positive experiences*. Baltimore, MD: Johns Hopkins University Press.

Bandura, A. (1986). *Social Foundations of Thought and Action*. Englewood Cliffs: Prentice-Hall.

Bandura, A. (1989). Human agency in social cognitive theory. *American Psychologist, 44*(9), 1175-1184.

Barrett, W. (2006). *The Barratt Simplified Measure of Social Status (BSMSS)*. Indiana State University. Retrieved from http://socialclass-bpd.wikispaces.com/file/view/Barratt_Simplifed_Measure_of_Social_Status.pdf

Beunen, G., Lefevre, J., Claessens, A. L., Lysens, R., Maes, H., Renson, R., Simons, J., Vanden Eynde, B., Vanreusel, B., & Van Den Bossche, C. (1992). Age-specific correlation analysis of longitudinal physical fitness levels in men. *European Journal of applied Physiology, 64*, 538-545.

Blair, S. N. (1993). Physical Activity, Physical Fitness, and Health. C.H. McCloy Research Lecture: 1993. *Research Quarterly for Exercise and Sport, 64*(4), 365-376.

Bovard, R. S. (2008). Risk behaviors in high school and college sport. *Curr Sports Med Rep, 7*(6), 359-366. doi: 10.1249/JSR.0b013e31818f0bed 00149619-200811000-00014 [pii]

Brewerton, P., & Millward, L. (2001). *Organizational Research Methods.* London: Sage Publications.

Calfas, K. J., Sallis, J. F., Nichols, J. F., Sarkin, J. A., Johnson, M. F., Caparosa, S., . . . Alcaraz, J. E. (2000). Project GRAD: two-year outcomes of a randomized controlled physical activity intervention among young adults. *American Journal Of Preventive Medicine, 18*(1), 28-37. doi: 10.1016/s0749-3797(99)00117-8

Carpenter, L. J., Acosta, R. Vivian. (2005). *Title IX*. Champaign, Ill: Human Kinetics.

Cawley, J. a. M., C. (2012). The medical care coses of obesity: An instrumental variables approach. *Journal of Health Economics, 31*(1), 219-230.

Center for Disease Control and Prevention. (2012). Physical Activity for Everyone. Retrieved 7/29/12, 2012, from http://www.cdc.gov/physicalactivity/everyone/health/index.html

Centers for Disease Control and Prevention. (1996). Physical Activity and Health: A Report of the Surgeon General. Washington DC: US Department of Health and Human Services.

Centers for Disease Control and Prevention. (1997). Youth Risk Behavior Surveillance: National College Health Risk Behavior Survey -- United States, 1995. *Mortaility and Morbidity Weekly Report, 46*(SS-6), 1-54.

Centers for Disease Control and Prevention. (2004). Methodology of the Youth Risk Behavior Surveillance System. *MMWR, 53*(RR-12).

Centers for Disease Control and Prevention. (2009). *Youth Risk Behavior Surveillance System*. Atlanta, GA: U.S. Government Retrieved from http://www.cdc.gov/HealthyYouth/yrbs/index.htm.

Centers for Disease Control and Prevention. (2010). Physical Activity Statistics. Atlanta GA: Department of Health and Human Services.

Centers for Disease Control and Prevention. (2011). *Healthy Weight: About BMI for Adults*. www.cdc.gov: USA.gov Retrieved from

http://www.cdc.gov/healthyweight/assessing/bmi/adult_bmi/index.html#Definition.

Centers for Disease Control and Prevention. (2013). Nutrition, Physical Activity, and Obesity *HealthyPeople.gov* (Vol. Leading Health Indicators).

Cohen, J. W. (1988). *Statistical Power Analysis for the Behavioral Sciences* (2nd Edition ed.). Hillsdale NJ: Lawrence Erlbaum Associates.

Creswell, J., & River, N. (2005). *Educational research: Planning , conducting, and evaluating quantitative and qualitative research.* Upper Saddle River: Pearson Education, Inc.

Curtis, J., McTeer, W., White, P. (1999). Exploring Effects of School Sport Experiences on Sport Participation in Later Life. *Sociol Sport J, 16*, 348.

Dale, D., Corbin, C. B., & Cuddihy, T. F. (1998). Can conceptual physical education promote physically active lifestyles? *Pediatric Exercise Science, 10*(2), 97-109.

Daniels, S. R., Greer, F.R., & the Committee on Nutrition. (2008). Lipid Screening and Cardiovascular Health in Childhood. *Pediatrics, 122*(1).

Erikson, E. H. (1993). *Childhood and Society*. New York, NY: W.W. Norton & Company Inc.

Everhart, B., Kernodle, M., Ballard, K., McKey, C., Eason, B., & Weeks, M. (2005). Physical activity patterns of college students with and without high school physical education. *Percept Mot Skills, 100*(3 Pt 2), 1114-1120.

Families USA. (2013). *2013 Federal Poverty Guidelines*. Atlanta, GA: US Department of Health and Human Services Retrieved from http://www.familiesusa.org/resources/tools-for-advocates/guides/federal-poverty-guidelines.html.

Francis, D. (Ed.). (2006). *Why Do Women Outnumber Men in College*. Cambridge, Ma: The National Bureau of Economic Research.

Glenmark, B., Hedberg, G., & Jansson, E. (1994). Prediction of physical activity level in adulthood by physical characteristics, physical performance and physical activity in adolescence: An 11-year follow-up study. *European Journal of applied Physiology, 69*, 530-538.

Grapper, S. S., Simmons, K. P., Gaines, A., Drawdy, K., Saunders, D., Ulrich, P., Connell, L. J. (2009). The Freshman 15 - A Closer Look. *Journal of American College Health, 58*(3), 223-231.

Gravetter, F. J. W., L.B. (2004). *Statistics for the behavioral sciences* (6th ed.). Belmont CA: Wadsworth.

Hollingshead, A., B. (1975). *Four Factor Index of Social Status*. Sociology. Yale University. New Haven, CT.

Illinios High School Association. (2012). Illinois High School Association Sports and Actvities. Retrieved July 28 2012, 2012, from http://www.ihsa.org/default.aspx

Institute of Educational Statistics. (2012). Immediate Transition to College. Retrieved 7/31/12, from http://ies.ed.gov/

Kelder, S. H., Perry, C. L., Klepp, K-I., Lytle, L. L. (1994). Longitudinal tracking of adolescent smoking, physical activity and food shoice behaviors. *American Journal of Public Health, 84*, 1121-1126.

Kemper, H. C. G., Nels, J., Verschuur, R., & Storm-van Essen, L. (1990). Tracking of health and risk indicators of cardiovascular diseases from teenager to adult: Amsterdam Growth and health Study. *Preventive Medicine, 19*, 642-655.

Kline, P. (1999). *The handbook of psychological testing* (2nd ed.). London: Routledge.

Le Masurier, G. a. C., Charles, B. (2006). Top 10 Reasons for Quality Physical Education. *Journal of Physical Education Recreation and Dance, 77*(6), 44-53.

Lee, S. M., Burgeson, C. R., Fulton, J. E., Spain, C. G. (2007). Physical Education and Physical Activity: Results from the School Health Policies and Programs Study 2006. *Journal of School Health, 77*(8), 435-463.

Lippman, L., Burns, S., McArthur, E. (1996). *Urban Schools The Challenge of Location and Poverty*. Washington D.C.: National Center for Education Statistics.

Lynn, S. (2007). The Case for Daily Physical Education. *Journal of Physical Education Recreation and Dance, 78*(5), 18-21.

Malina, R. M. (1996). Tracking of Physical Activity and Physical Fitness Across the Lifespan. *Research Quarterly for Exercise and Sport, 67*(3), S-48- S57.

Malina, R. M. (2001). Physical activity and fitness: Pathways from childhood to adulthood. *American Journal of Human Biology, 13*(2), 162-172. doi: 10.1002/1520-6300(200102/03)13:2<162::aid-ajhb1025>3.0.co;2-t

McCracken, J. D., Barcinas, J. D. T. (1991). Differences Between Rural and Urban Schools, Student Characteristics, and Studint Aspirations in Ohio. *Journal of Research in Rural Education, 7*(2), 29-40.

Mears, D. (2010). Physical Education Waivers and Young Adult Activity. *Physical Educator, 67*(2), 90-100.

Menschik, D., Ahmed, S., Alexander, M. H., & Blum, R. W. (2008). Adolescent physical activities as predictors of young adult weight. *Archives of Pediatrics & Adolescent Medicine, 162*(1), 29-33.

Missouri State High School Activities Association. (2012). Missouri State High School Activities Retrieved July 28 2012, 2012, from http://www.mshsaa.org/

Murphy, K. R., and Davidshofer, C. O. (2005). *Psychological testing: Principles and Applications* (6th Ed.). Upper Saddle River, NJ: Prentice hall.

National Association for Sport and Physical Education. (2004). *Moving Into the Future: National Standards for Physical Education.* (2nd ed.). Reston, VA: National Association for Sport and Physical Education.

National Association for Sport and Physical Education. (2006). Position Statement: Opposing Substitution and Waiver/Exemptions For Required Physical Education. In NASPE (Ed.), *American Alliance for Health Physical Education Recreation and Dance,* (pp. 2). Reston VA.

National Association for Sport and Physical Education. (2010). Physical Education is an Academic Subject. Reston VA: Author.

National Association for Sport and Physical Education. (2011). Physical education is critical to educating the whole child: Reston, VA: Author.

National Federation of State High School Associations. (2011). The Case for High School Activities *http://www.nfhs.org/* (National High School Activities Week ed.).

National Federation of State High School Associations. (2012). Athletic Activities page. Retrieved July 28 2012, 2012, from http://www.nfhs.org/

National Health Interview. (2012). *Lack of Leisure Time Physical Activity*. Health Indicator Warehouse. Retrieved from http://www.healthindicators.gov/Indicators/Noleisure-timephysicalactivity_1313/Profile/Data

Pallant, J. (2010). *SPSS Survival Manual* (4th ed.). New York NY: McGraw-Hill Education.

Pate, R., R., O'Neill, J. R., and McIver, K. L. (2011). Physical Activity and Health; Does Physical Education Matter? *Quest, 63*, 19-35.

Pate, R. R., Heath, G. W., Dowda, M., & Trost, S. G. (1996). Associations between Physical Activity and Other Health Behaviors in a Representative Sample of US Adolescents. *American Journal of Public Health, 86*(11), 1577-1581.

Pate, R. R., Trost, S. G., Levin, S., Dowda, M. (2000). Sports Participation and Health-Related Behaviors Among US Youth. *Arch Pediatr Adolesc Med, 154*(Sep), 904-911.

Peat, J. (2001). *Health science research: A handbook of quantitative methods*. Sydney: Allen & Unwin.

Penney, D. (2002). *Gender and Physical Education: Contemporary Issues and Future Directions* (D. Penny Ed.). New York: Routledge.

Perry, C. L., Baranowski, T. & Parcel, G.S. (1990). How individuals, environments and health behavior inteact: Social learning theory. *Health behavior and health education* (K. Glanz, F.M. Lewis & B.K. Rimer ed., pp. p 153-178). San Francisco: Jossey-Bass.

Peterson, L., Asigbee, F., Bacon, R. (2012). *Psychometrics of the High School Physical Activity and College Health Behaviors Survey 2012*. Educational School and Counseling Psychology. University of Missouri. Columbia.

Physical Activity Council. (2012). The Physical Activity Council's annual study tracking sports, fitness and recreation participation in the USA (pp. 24): Physical Activity Council.

Pratt, M. M., C.A., Wang, G. (2000). Higher direct medical costs associated with physical inactivity. *The Physician and Sportsmedicine, 28*(10), 63-70.

Raitakari, O. T., Porkka, K. V., Taimela, S., Telama, R., Räsänen, L., & Viikari, J. S. (1994). Effects of persistent physical activity and inactivity on coronary risk

factors in children and young adults. The Cardiovascular Risk in Young Finns Study. *American Journal of Epidemiology, 140*(3), 195-205.

Sabo, D., Miller, K. E., Melnick, M. J., Farrell, M. P., & Barnes, G. M. (2005). HIGH SCHOOL ATHLETIC PARTICIPATION AND ADOLESCENT SUICIDE: A Nationwide US Study. *Int Rev Sociol Sport, 40*(1), 5-23. doi: 10.1177/1012690205052160

Shepard, R. J., and Trudeau, Francois. (2000). The Legacy of Physical Education: Influences on Adult Lifestyle. *Pediatric Exercise Science, 12*, 34-50.

Sisson, S. B., Church, T.S., Martin, C.K., Tudor-Locke, C., Smith, S.R., Bouchard, C., Earnest, C.P., Rankinen, T., Newton Jr, R.L., and Katzmarzyk, P.T. (2009). Profiles of sedentary behavior in children and adolescents: The US national Health and Nutrition Examination Survey, 2001-2006. *International Journal of Pediatric Obesity, 4*, 353-359.

Skolnick, A. A. (1993). Studies Raise Doubts about Benefit of Athletics in Reducing Unhealthy Behavior Among Adolescents. *JAMA, 270*(7), 798-800.

Soukup, G. J., Sr. Henrich, T. W., and Barton-Weston, H. M. (2011). Differences in Exercise Identity Between Secondary Physical Education Students and Athletes. *Journal of Research, 5*(1), 33-36.

Sparling, P. B., Snow, T. K. (2002). Physical activity patterns in recent college alumni. *Research Quarterly for Eercise and Sport, 73*, 200-205.

Stevens, J. (1996). *Applied multivariate statistics for the social sciences* (3rd ed.). Mahwah, NJ: Lawrence Erlbaum.

Tabachnick, B., G., and Fidell, L. S. (2006). *Using Multivariate Statistics, 5th Edition*. Boston, Massachusetts: Pearson Education.

Telama, R. (2009). Tracking of Physical Activity from Childhood to Adulthood: A Review. *Obesity Facts, 3*, 187-195.

Telama, R., Yang, X., Laakso, L., & Viikari, J. (1997). Physical activity in childhood and adolescence as predictor of physical activity in young adulthood. *American Journal Of Preventive Medicine, 13*(4), 317-323.

Telama, R., Yang, X., Viikari, J., Valimaki, I., Wanne, O., & Raitakari, O. (2005). Physical activity from childhood to adulthood: A 21-year tracking study. *American*

Journal Of Preventive Medicine, 28(3), 267-273. doi: 10.1016/j.amepre.2004.12.003

Telama, R., Yang, X., Hirvensalo, M., Raitakari, O. (2006). Participation in Organized Youth Sport as a Predictor of Adult Physical Activity: A 21-year Longitudinal Study. *Pediatric Exercise Science, 17*, 76-88.

Texas University Interscholastic League. (2012). Texas High School Sports page. Retrieved July 28 2012, 2012, from Texas University Interscholastic League

Thomas, R. M. (1990). *Encyclopedia of human development and education: Tehory, research and Studies*. New York: Pergamon.

Trudeau, F., Espindola, R., Laurencelle, L., Dulac, F., Rajic, M., & Shephard, R. J. (2000). Follow-up of participants in the Trois-Rivières Growth and Development Study: Examining their health-related fitness and risk factors as adults. *American Journal Of Human Biology: The Official Journal Of The Human Biology Council, 12*(2), 207-213.

Trudeau, F., Laurencelle, L., Tremblay, J., Rajic, M., & Shephard, R. J. (1999). Daily primary school physical education: effects on physical activity during adult life. *Medicine & Science in Sports & Exercise, 31*(1), 111-117.

Trudeau, F., Laurencelle, L., Tremblay, J., Rajic, M., Shephard, R.J. (1999). Daily primary school physical education: efects on physical activity during adult life. *Med Sci Sports Exerc, 31*(1), 111-117.

United States Department of Health and Human Services. (2008). Physical Activity Guidelines for Americans. *The Oklahoma Nurse, 53*(4), 25.

United States Department of Health and Human Services. (2010). Healthy People 2020. In Office of Disease Prevention and Helth Promotion (Ed.), *healthypeople.gov* (Vol. B0132). Atlanta, GA: U.S. Government.

United States Department of Health and Human Services. (2011). Types of Physical Activity. *Explore Physical Activity and your Heart.* Retrieved 3/27/2013, 2013, from http://www.nhlbi.nih.gov/health/health-topics/topics/phys/types.html

University of MIssouri-Extension. (2008). My Activity Pyramid for Adults (18-64). In U. o. M. H. Extension (Ed.), (pp. 1).

van Mechelen, W., & Kemper, H. C. G. (1995). Habitual physical activity in longitudinal perspective. *The Amsterdam Growth Study: A longitudinal analysis of health, fitness, and lifestyle* (Vol. H. C. G. Kemper Edition, pp. 135-158). Champaign, IL: Human Kinetics.

Vanreusel, B., Renson, R., Beunen, G., Claessens, A.L., Lefevre, J., Lysens, R., Maes, H., Simons, J., & Vanden Eynde, B. (1993b). Involvement in physical activity from youth to adulthood: A longitudinal analysis. *World-wide variation in physical fitness* (Vol. Lefevre & B. Vanden Eynde Edition, pp. 187-195). Leuven: Katholieke Universiteit Leuven.

Wardle, J., Brodersen, N. H., & Boniface, D. (2007). School-based physical activity and changes in adiposity. *International Journal of Obesity, 31*(9), 1464-1468. doi: 10.1038/sj.ijo.0803651

Wareham, N. (2007). Physical activity and obesity prevention. *Obesity Reviews, 8*, 109-114. doi: 10.1111/j.1467-789X.2007.00328.x

Wetherill, R. R., & Fromme, K. (2007). Alcohol use, sexual activity, and perceived risk in high school athletes and non-athletes. *J Adolesc Health, 41*(3), 294-301. doi: S1054-139X(07)00195-4 [pii]10.1016/j.jadohealth.2007.04.019

Yang, X., Telama, R., Hirvensalo, M., Viikari, J. S. A., & Raitakari, O. T. (2009). Sustained participation in youth sport decreases metabolic syndrome in adulthood. *Int J Obes, 33*(11), 1219-1226.

Yang, X., Telama, R., Hirvensalo, M., Viikari, JSA., and Raitakari, OT. (2009). Sustained participation in youth sport decreases metabolic syndrome in adulthood. *International Journal of Obesity, 33*, 1219-1226.

Appendices

Appendix A
Research Study Survey Cover Page

High School Physical Activity and College Health Behaviors

Thank you for taking the time to thoughtfully and honestly complete our survey. Your participation is greatly appreciated and will tremendously benefit our research. We hope to determine whether or not high school physical education and sport involvement have an impact on adult health behaviors. This survey is part of a research study.

Your responses will remain anonymous. None of your responses will be matched to your identification during the analysis or publication process. Please keep in mind that participation is strictly voluntary. Your responses to the survey will be confidential. Also, your responses will not be identified within the research, nor will your specific responses to the survey have an impact on your academic standing in this course. The surveys will be kept in a secure location for seven years, and only those who are actively researching the project will have access to this information.

If you have any questions or concerns regarding this research, please contact Liz Peterson or Fiona Asigbee. If you have any additional concerns regarding this research please feel free to contact the Institutional Review Board (IRB).

To begin the survey click the " >>" button.

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Appendix B
Research Study Validity Survey Cover Page

High School Physical Activity and College Health Behaviors

Thank you for taking the time to thoughtfully and honestly complete our survey. Your participation is greatly appreciated and will tremendously benefit our research. We hope to determine whether or not high school physical education and sport involvement have an impact on adult health behaviors. This survey is part of a research study.

In order to match the first and second survey completions, we ask that you create a unique identifier (your 2-digit birth year, your middle initial, the last 4 digits of your phone number, and your favorite color). You will be asked to enter this again when you take the survey in 2-4 weeks. The researchers will not use this identifier other than when analyzing the survey instrument for validity and reliability.

Your responses will remain completely confidential. None of your responses will be matched to your identification during the analysis or publication process. Please keep in mind that participation is strictly voluntary. Your responses to the survey will be confidential. Also, your responses will not be identified within the research, nor will your specific responses to the survey have an impact on your academic standing in this course. The surveys will be kept in a secure location for seven years, and only those who are actively researching the project will have access to this information.

If you have any questions or concerns regarding this research, please contact Liz Peterson or Fiona Asigbee. If you have any additional concerns regarding this research please feel free to contact the Institutional Review Board (IRB).

***To begin the survey click the " >>" button*.**

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Tables and Figures

Tables

Table 1.
Definitions of Key Outcomes and Study Constructs

Construct	Definition and Description
Physical activity behavior (PA)	Leisure time physical activity, body movements including continuous repetitive movements (like running), muscle strengthening (calisthenics or resistance exercise), flexibility (stretching), and sport specific activity (pick-up game of basketball), (Centers for Disease Control and Prevention, 2013)
Body Mass Index (BMI)	Body Mass Index, a ratio of weight to height, converted from pounds and feet/inches to kilograms and meters expressed in kg/m^2 (Centers for Disease Control and Prevention, 2013). Commonly used field measurement to describe risk for major lifestyle diseases including obesity, diabetes, heart disease, hypertension, and high cholesterol.
Aerobic activity	… or "cardio" is using the large muscle groups over an extended time period where the energy is supplied by the oxygen, gets you breathing harder and your heart beating faster. dancing, biking, running – all types of activities count, (Centers for Disease Control and Prevention, 2013)
Muscle strengthening activity	Movements that improve the strength, power and endurance of your muscles, doing push-ups, and lifting weights, (United States Department of Health and Human Services, 2011)
Flexibility activity	Stretching your muscles by opening joints such as touching your toes, side stretches and yoga are all examples, (United States Department of Health and Human Services, 2011)
Sport specific activity	Minutes of time spent playing sport related games in a recreational league, or as a pick-up game, for the purposes of leisure time physical activity, (Physical Activity Council, 2012)
Aerobic recommendation	30 minutes of moderate to vigorous intensity activity four or more days a week, (United States Department of Health and Human Services, 2008)
Muscle strengthening recommendation	2 or more days per week of activity that strengthens the major muscle groups (legs, hips, back, abdomen, chest, shoulders, and arms), (United States Department of Health and Human Services, 2008).
Flexibility recommendation	2 or more days per week of activity that improves or maintains flexibility and range of motion across joints, (United States Department of Health and Human Services, 2008)
Healthy BMI recommendation	The normal category of BMI is associated with the lowest risk for infection, major and lifestyle related diseases, ≥ 18.5 kg/m^2 and ≤ 25 kg/m^2, (Centers for Disease Control and Prevention, 2011).

Table 2.
Definition of Key Terms and Study Constructs.

Construct	Definition and Description
Sedentary lifestyle	Habitual lack of or irregular bouts of PA other than those of daily living, examples include sitting, lying down, watching TV, playing video games, or computer use, leads to increased risk for major and lifestyle related diseases, (Centers for Disease Control and Prevention, 1996).
Physical activity behavior tracking	"a tendency of individuals to maintain their rank or position within a group over time, Tracking also means the ability to predict subsequent observations on the basis of earlier values", (R. Telama, 2009).
High school physical education (HS PE)	Is an academic subject that uses a planned sequential program of curricula and instruction based on state and/or national standards, in elementary, middle and high schools, (National Association for Sport and Physical Education, 2010).
High school sport (HS Sport)	Education-based (school sponsored) interscholastic extracurricular competitive activities that help students succeed in life, (National Federation of State High School Associations, 2012). Sports included: Baseball, Basketball, Cheerleading, Competitive Dance Team, Cross Country, Ice Hockey, Golf, Gymnastics, Field Hockey, Football, Lacrosse, Soccer, Softball, Swimming & Diving, Tennis, Track & Field, Water Polo, Wrestling, and Volleyball.
Traditional PE	An academic class in which students must be physically present, where learning experiences encourage psychomotor learning in a play or movement exploration setting, usually in a gymnasium or outdoor space, (National Association for Sport and Physical Education, 2010).
Online PE	An academic class in which students learn concepts by reading, watching, and learning concepts via pre-specified content on the internet and are not required to physically meet in a classroom at a school on a regular basis, (National Association for Sport and Physical Education, 2010).
HS PE class	A HS PE class is defined as a 1 semester (1/2 school year) long class that meets daily for 1 school period, usually less than 60 minutes. This is typically .5 academic credits, (American Heart Association and The National Association of Sport and Physical Education, 2012).
PE substitution/ waiver	A policy that, in 33 states, allows HS students to be exempt from taking PE class by participating in JROTC, interscholastic sports, marching band, and cheerleading, (American Heart Association and The National Association of Sport and Physical Education, 2012).
Physical Education (PE) professional	A teacher who teaches, nurtures and develops student's psychomotor skills and knowledge and skills and motivation, self-esteem and ability to be physically active for a lifetime, (National Association for Sport and Physical Education, 2004).

Table 3.
Reliability of Demographic Survey Items

Survey Instrument Item	Test	n	Coefficient of Agreement	p-value
Age	Pearson	418	0.843	0.0000
Height (ft)	Pearson	420	0.955	0.0000
Height (in)	Pearson	420	0.946	0.0000
Weight (lbs)	Pearson	420	0.865	0.0000
College GPA	Pearson	409	0.802	0.0000
Sex	Kappa	420	1	0.0000
Ethnicity Latino/a	Kappa	412	0.853	0.0000
Race-Asian	Kappa	420	0.945	0.0000
Race-Black/African American	Kappa	420	0.985	0.0000
Race-Middle Eastern	Kappa	420	0.748	0.0000
Race-Native American/ Native Alaskan	Kappa	420	0.898	0.0000
Race-Native Hawaiian/Pacific Islander	Kappa	420	0.495	0.0000
Race-White	Kappa	420	0.945	0.0000
College year	Kappa	419	0.971	0.0000

Table 4.
Reliability of Physical Activity Survey Items

Survey Instrument Item	Test	n	Coefficient of Agreement	p-value
Aerobic days	Pearson	414	0.699	0.0000
Strength days	Pearson	418	0.738	0.0000
Flex days	Pearson	419	0.602	0.0000
Sport minutes	Pearson	116	0.655	0.0000
PE course total	Pearson	413	0.739	0.0000
PE requirement	Kappa	419	0.77	0.0000
PE course type	Kappa	420	0.505	0.0000
HS Sport	Kappa	420	0.845	0.0000

Table 5.
Reliability of Estimated Family SES Items

Survey Instrument Item	*n*	*Kappa* coefficient	p-value
BSMSS Q1 Mother and Father in Household	413	0.845	0.0000
BSMSS Q2-3-Does NA/did not grow up with Father/Mother-Father's Education	420	0.749	0.0000
BSMSS Q2-3-Does NA/did not grow up with Father/Mother-Mother's Education	420	0.397	0.0000
BSMSS Q2-3-Less than 7th grade-Father's Education	420	-0.006*	0.0000
BSMSS Q2-3-Less than 7th grade-Mother's Education	420	-0.003*	0.0000
BSMSS Q2-3-Completed Junior High/Middle School- (9th gr)-Father's Education	420	0.496	0.0000
BSMSS Q2-3-Completed Junior High/Middle School- (9th gr)-Mother's Education	420	0.216	0.0000
BSMSS Q2-3-Completed Some high School (10th-11th grade)-Father's Education	420	0.619	0.0000
BSMSS Q2-3-Completed Some high School (10th-11th grade)-Mother's Education	420	0.389	0.0000
BSMSS Q2-3-High School Graduate-Father's Education	420	0.782	0.0000
BSMSS Q2-3-High School Graduate-Mother's Education	420	0.764	0.0000
BSMSS Q2-3-Partial college or special training (at least 1 year)-Father's Education	420	0.876	0.0000
BSMSS Q2-3-Partial college or special training (at least 1 year)-Mother's Education	420	0.833	0.0000
BSMSS Q2-3-Standard College or University graduate-Father's Education	420	0.771	0.0000
BSMSS Q2-3-Standard College or University graduate-Mother's Education	420	0.746	0.0000
BSMSS Q2-3-Graduate Degree-Father's Education	420	0.826	0.0000
BSMSS Q2-3-Graduate Degree-Mother's Education	420	0.749	0.0000
BSMSS Q4-5-Did not grow up with this parent-Father's Occupation	420	0.956	0.0000
BSMSS Q4-5-Did not grow up with this parent-Mother's Occupation	420	0.655	0.0000
BSMSS Q4-5-Not employed outside the home-Father's Occupation	420	0.454	0.0000
BSMSS Q4-5-Not employed outside the home-Mother's Occupation	420	0.853	0.0000
BSMSS Q4-5-Day laborer, janitor, house cleaner.-Father's Occupation	420	0.386	0.0000
BSMSS Q4-5-Day laborer, janitor, house cleaner.-Mother's Occupation	420	0.4	0.0000
BSMSS Q4-5-Garbage collector, shoe sales. -Father's Occupation	420	0.118	0.0000
BSMSS Q4-5-Garbage collector, shoe sales.-Mother's Occupation	420	0.397	0.0000
BSMSS Q4-5-Painter, general office clerk.-Father's Occupation	420	0.592	0.0000
BSMSS Q4-5-Painter, general office clerk.-Mother's Occupation	420	0.507	0.0000
BSMSS Q4-5-Mechanic, hairdresser.-Father's Occupation	420	0.575	0.0000
BSMSS Q4-5-Mechanic, hairdresser.-Mother's Occupation	420	0.448	0.0000
BSMSS Q4-5-Secretary.-Father's Occupation	420	0.559	0.0000
BSMSS Q4-5-Secretary-Mother's Occupation	420	0.46	0.0000
BSMSS Q4-5-Supervisor, military enlisted personnel, -Father's Occupation	420	0.569	0.0000
BSMSS Q4-5-Supervisor, military enlisted personnel -Mother's Occupation	420	0.551	0.0000
BSMSS Q4-5-Nurse, therapist.-Father's Occupation	420	0.544	0.0000
BSMSS Q4-5-Nurse, therapist.-Mother's Occupation	420	0.714	0.0000
BSMSS Q4-5-Educator or technician -Father's Occupation	420	0.577	0.0000
BSMSS Q4-5-Educator or technician -Mother's Occupation	420	0.758	0.0000
BSMSS Q4-5-Professional -Father's Occupation	420	0.782	0.0000
BSMSS Q4-5-Professional -Mother's Occupation	420	0.795	0.0000

*These negative values are likely due to the low number of 'yes' responses on the items.

Table 6.
Sample Description

		n	%	Mean	Min.	Max.
Sex	Male	473	35.32			
	Female	866	64.68			
Race	Caucasian	1124	83.94			
	Black	95	7.09			
	Other Race	31	2.32			
	Multiracial	89	6.65			
Ethnicity	Hispanic or Latino/a	43	3.24			
	Not Hispanic or Latino/a	1286	96.76			
College Year	Freshman	308	23.00			
	Sophomore	579	43.24			
	Junior	263	19.64			
	Senior	189	14.12			
Age (yr)				19.65	18.00	41.00
Estimated Family SES				49.17	.00	66.00
College GPA				3.14	.00	4.00
BMI (kg/m^2)				23.48	15.66	45.35

Research Question 1: Number of HS PE Classes

Table 7.
Reported Number of PE Classes

#	N	%
1	146	11.5
2	346	27.1
3	231	18.1
4	240	18.8
5	91	7.1
6	62	4.9
7	38	3.0
8	94	7.4
9	7	0.5
10	6	0.5
11	2	0.2
12	12	0.9

Note: 1 PE class is ½ of a school year, (1 semester long)

Table 8.
Correlation of Demographic Characteristics with # of HS PE Classes

	# PE Classes	Age	Est.Family SES	College GPA	Biological Sex	Race/ Ethnicity	College Year
# HS PE Classes	---	.046	.059*	-.033	-.195**	-.019	.038
Age		---	-.048	-.141**	-.087**	.008	.869**
Est. Family SES			---	.088**	-.008	-.120**	-.025
College GPA				---	.112**	-.153**	-.131**
Biological Sex					---	.030	-.030
Race/Ethnicity						---	.007
College Year							---

** correlation is significant at the p < .05 level*
** * correlation is significant at the p< .001 level*

Table 9.
Sample Description

		Mean	*n*	%
Age		19.65		
Estimated Family SES		**49.17**		
College GPA		3.14		
Sex	Male		**473**	35.3
	Female		**866**	64.7
Race	Caucasian		1124	83.9
	Black		95	7.1
	Other Race		31	2.3
	Multiracial		89	6.6
College Year	Freshman		308	23.0
	Sophomore		579	43.2
	Junior		263	19.6
	Senior		189	14.1
TOTAL			1339	

Note: Significant relationships (p< .05) with # of HS PE Classes appear in boldface

Table 10.
Correlation of Adult PA Behaviors with # of HS PE Classes

Measure	# PE Classes	BMI	Days of Activity: Aerobic	Days of Activity: Muscle Strength	Days of Activity: Flexibility	Sport Minutes
# of PE Classes	---	.104**	.077**	.140**	.049	.164
BMI		---	-.045	-.026	-.072**	.007
Aerobic Days			---	.521**	.386**	.084
Strength Days				---	.431**	-.050
Flexibility Days					---	.085
Mean	3.627	23.478	2.616	1.923	1.248	19.943
SD	2.20	2.33	2.06	1.96	1.72	37.81

** correlation is significant at the p < .05 level*
** * correlation is significant at the p< .001 level*

Table 11.
Reported Number of HS PE Classes and Adult PA Behaviors

		Min.	Max.	Mean	SD
	Sample	1	12	3.627	2.20
HS PE Class #	Male	1	12	**4.158**	2.33
	Female	1	12	**3.340**	2.08
	BMI (kg/m^2)	15.66	45.35	23.478	3.95
	Aerobic (30 min.)	0	7	**2.616**	2.06
Days of	Muscle strengthening	0	7	**1.923**	1.96
	Flexibility	0	7	1.248	1.72
Minutes	Sport	0	240	19.943	37.81

Note: Significant relationships (p<.05) with HS PE class are in boldface.

Research Question 2: Level of Reported HS PE Participation

Table 12.
Demographic Information by PE Experience Group

		NO PE		SUB		GradReq		PEMore	
		N	Mean	N	Mean	N	Mean	N	Mean
Sex	Male	24		18		**153**		**270**	
	Female	32		25		**538**		**268**	
Race/ Ethnicity	Caucasian	43		34		582		457	
	Black	6		3		52		34	
	Other Race	5		3		9		13	
	Multiracial	2		3		48		34	
Age			19.818		19.465		19.565		19.728
Estimated Family SES			48.519		52.814		49.278		48.828
College GPA			3.191		3.092		3.168		3.110
College Year	Freshman	14		10		165		117	
	Sophomore	25		18		299		233	
	Junior	10		10		140		102	
	Senior	7		5		87		86	
TOTAL		56		43		691		538	

Note: Statistically significant differences (p<.05) between groups are in boldface.

Table 1.
Adult PA Behaviors, Adult Recommendations by HS PE Experience Group

		No PE			SUB			GradReq			PEMore		
		Mean	SD	%	Mean	SD	%	Mean	SD	%	Mean	SD	%
BMI		23.59	3.28		22.53	2.82		23.23	4.14		23.84	3.82	
Days per Week	Aerobic	2.29	1.76		3.74[a]	2.05		2.51	2.11		2.69	2.00	
	Strength	2.16	2.04		2.30	1.99		1.65	1.89		2.21[b]	1.98	
	Flexibility	1.37	1.78		2.05	2.06[c]		1.27	1.76		1.13	1.60	
Sport Minutes		22.68	45.98		29.02	53.47		14.65	33.67		26.10	39.72	
% meeting the recommendation	BMI			60.7			90.7[d]			71.7			67.8
	Aerobic			21.4			60.5[e]			31.4			32.8
	Strength			51.8			58.1[b]			43.1			54.3
	Flexibility			35.7			55.8[a]			30.8			28.5

a. Indicates significantly higher than all other groups, p< .01
b. Indicates significantly higher than GradReq group, p< .01
c. Indicates significantly higher than GradReq and PEMore groups, p< .05
d. Indicates significantly higher than the NoPE group p< .05.
e. Indicates significantly higher than NoPE group p< .01

Research Question 3: HS PE and Sport Participation

Table 2.
Demographic Information by HS Physical Activity Group

		PE only			Sport Only			Both PE and Sport		
		%	Mean	SD	%	Mean	SD	%	Mean	SD
Biological Sex	Male	31.1			39.0			35.1		
	Female	68.9			61.0			64.9		
Race/ Ethnicity	Caucasian	82.3			81.8			85.0		
	Black	8.6			9.1			6.7		
	Other Race	4.3			5.2			1.3		
	Multiracial	4.8			3.9			7.1		
Age			19.61	1.43		19.69	2.73		19.64	1.61
College GPA			3.11	.55		3.16	.59		3.15	.61
Estimated Family SES			47.11	13.22		50.44	12.33		49.47*	12.37
College Year	Freshman	23.4			26.0			22.9		
	Sophomore	40.7			44.2			43.9		
	Junior	21.1			19.5			19.3		
	Senior	14.8			10.4			13.9		
Total		N= 209			N= 77			N= 1019		

** Significantly Different at the p<.05 level.*

Table 3.
Adult PA Behaviors and Adult Recommendations by HS PA Experience Group

		PE Only			Sport Only			Both PE and Sport		
		Mean	SD	%	Mean	SD	%	Mean	SD	%
BMI		24.15	5.20		23.17	3.05		23.37	3.71	
Days per Week	Aerobic	2.13*	2.09		3.13	2.02		2.68	2.05	
	Muscle Strength	1.20*	1.66		2.32	2.04		2.03	1.97	
	Flexibility	.85*	1.62		1.73	1.98		1.28	1.70	
Sport Minutes		7.16*	24.34		30.00	52.61		22.26	38.47	
% meeting recommendation	BMI			59.30**			77.90			72.20
	Aerobic			24.00**			42.90			33.60
	Muscle Strength			32.50**			57.10			51.10
	Flexibility			20.70**			46.80			31.70

** Indicates significantly lower than other groups at the p<.01 level*
*** Indicates significantly lower % than other groups at the p< .01 level.*

Figures

Research Question 1: Number of HS PE Classes

Figure 1.
Rates of Reported Number of HS PE Classes by Sex.

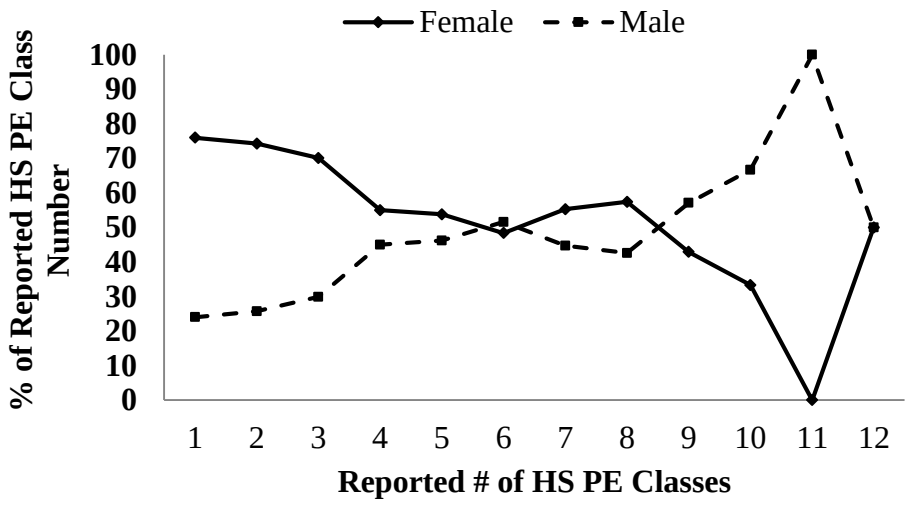


Figure 2.
Number of HS PE Classes and Estimated Family SES

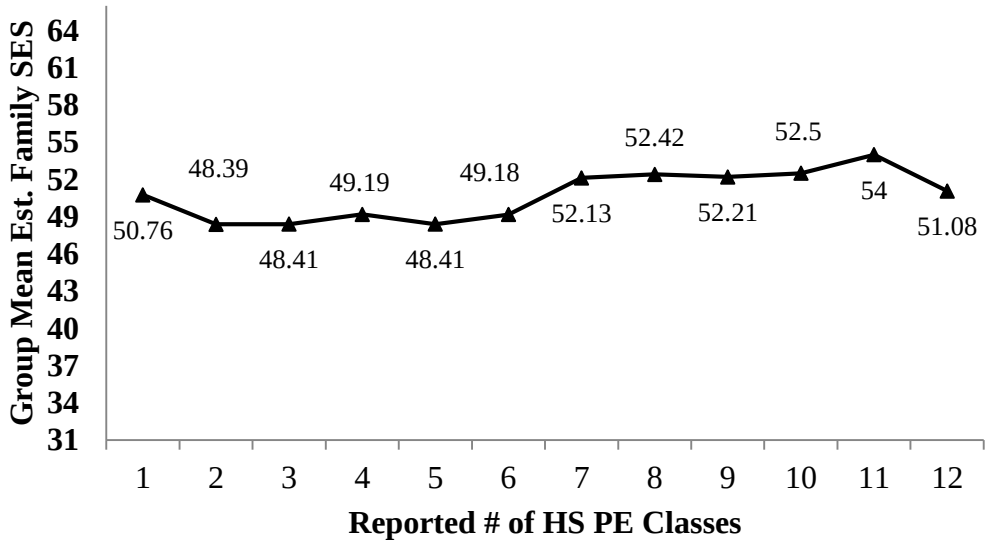


Figure 3.
Number of HS PE Classes and Mean Days of Adult Activity

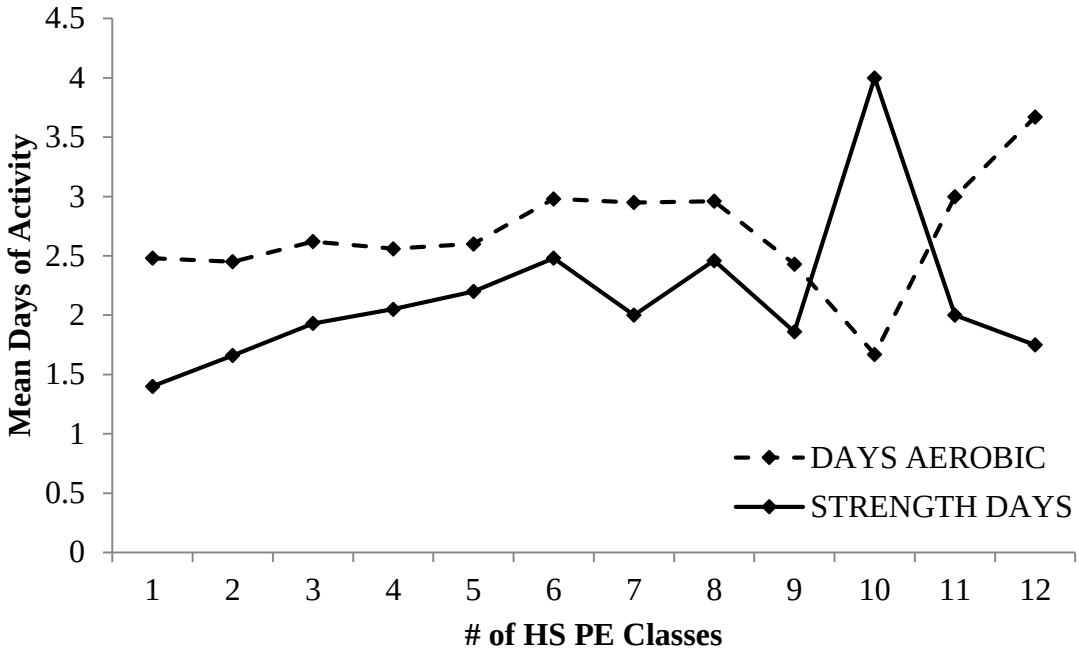
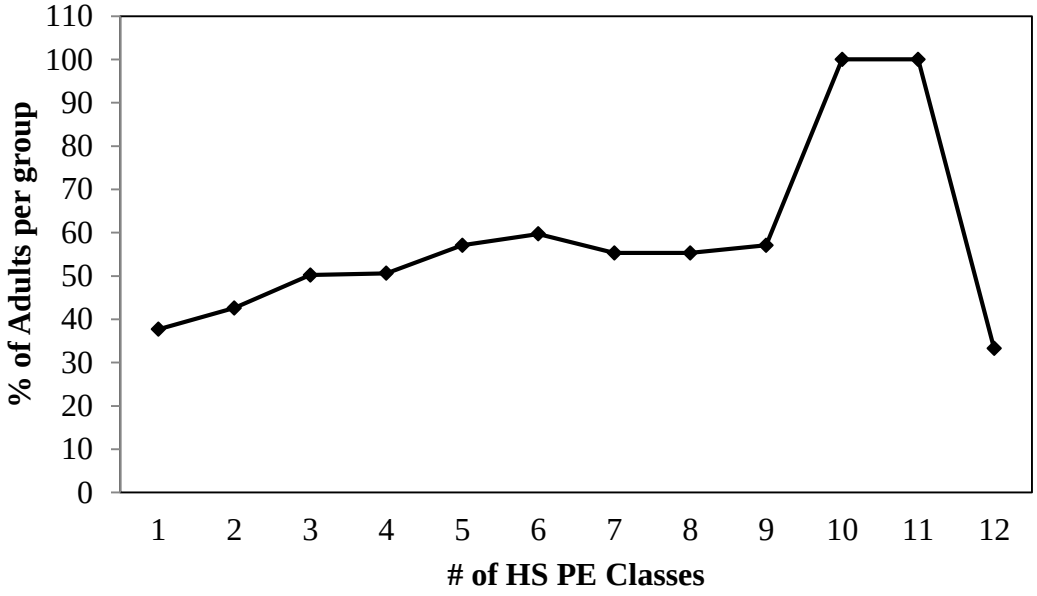
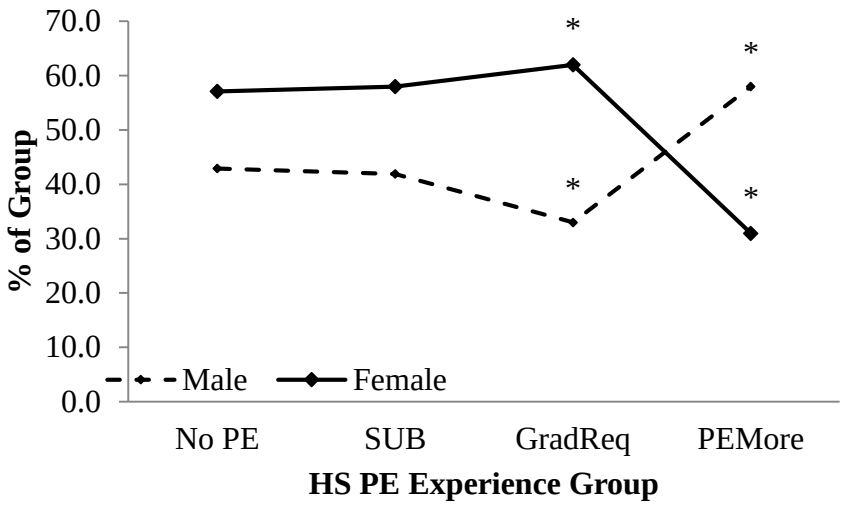


Figure 4.
Number of HS PE Classes and Rate of Meeting Muscle Strengthening Rec.



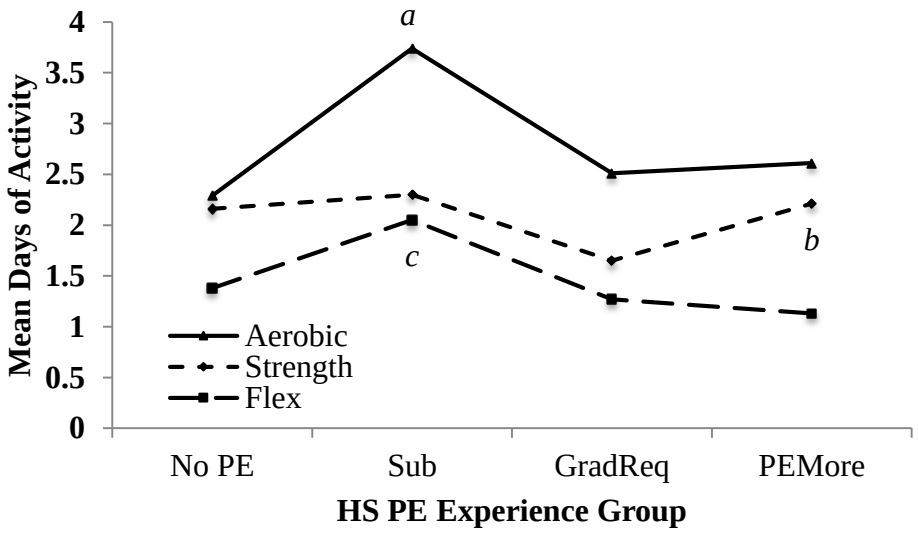
Research Question 2: Level of Reported HS PE Participation

Figure 5.
Differences in Biological Sex by HS PE Experience Group



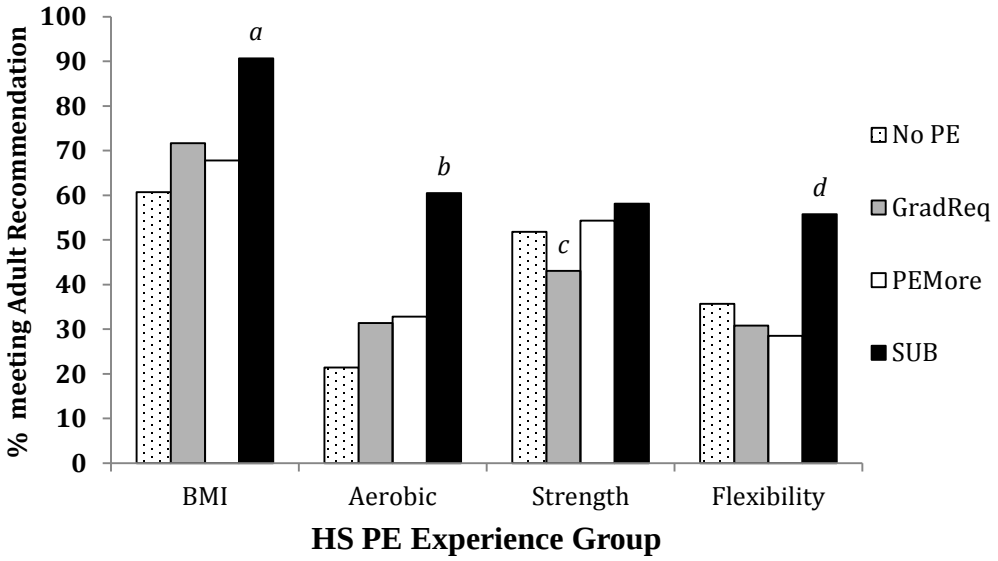
**. Indicates significant differences at the p< .01 level.*

Figure 6.
Mean Adult Physical Activity Days by HS PE Experience Group



a. Indicates significantly higher than other groups at the p<.01 level
b. Indicates significantly higher than GradReq group p< .01 level.
c. Indicates significantly higher than GradReq and PEMore groups p< .01.

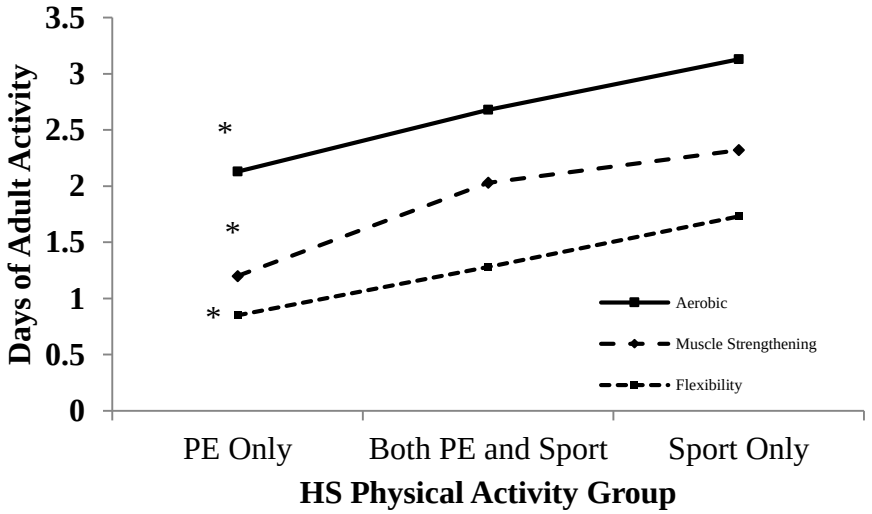
Figure 7.
HS PE Group Rates of Meeting Adult Recommendations



a. Indicates significantly higher than No PE group at the p<.05 level
b. Indicates significantly higher than No PE group at the p<.01 level
c. Indicates significantly lower than SUB group p< .01 level.
d. Indicates significantly higher than other group's p< .05.

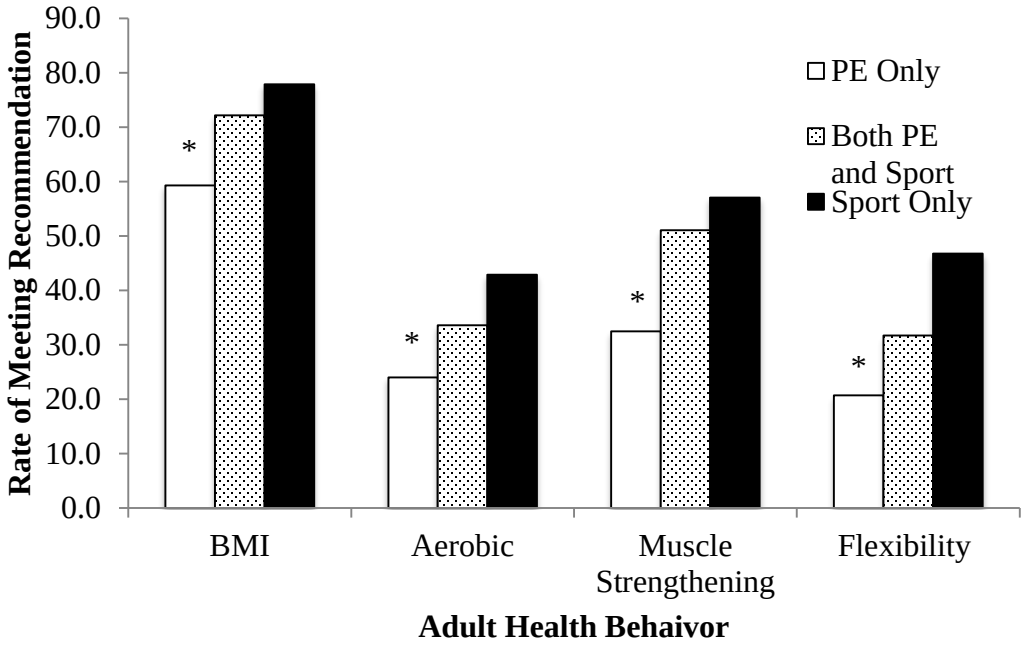
Research Question 3: HS PE and Sport Participation

Figure 8
HS Physical Activity Group Mean Days of Adult Physical Activity



** Indicates significantly lower than other groups, p< .01.*

Figure 9
HS Physical Activity Group Rates of Meeting Adult Recommendations



** Indicates significantly lower than Sport Only group, p< .01.*

Vita

Liz Peterson was born and brought up in Jefferson City, Missouri. She was a decorated Big XII multi-event athlete for the University of Missouri Tigers during her undergraduate and master's studies. Liz is one of four children and is very close with her family. She has one son, Isaac, is married to Derrick L. Peterson and lives with them and her daughters Athena and Charlotte in Columbia, Missouri. She has accepted her first academic position, a tenure-track position with the College of Education at Westminster College in Fulton, Missouri for the 2013-14 school year. When she has the luxury to choose her activities she loves to read and be physically active, running, biking, hiking, dancing and lifting weights. Mostly, she loves being with her children, helping them to explore the wonder of the world hoping they will, as she does, maintain a constant state of inquisition and learning.