



January 2015

Influence Of A Physical Activity Intervention On Perceived Barriers And Benefits In Women

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INFLUENCE OF A PHYSICAL ACTIVITY INTERVENTION ON PERCEIVED
BARRIERS AND BENEFITS IN WOMEN

by

Kathryn Elizabeth Lundberg
Bachelor of Science, University of North Dakota, 2013

A Thesis

Submitted to the Graduate Faculty

of the

University of North Dakota

In partial fulfillment of requirements

for the degree of

Master of Science

Grand Forks, North Dakota
May 2015

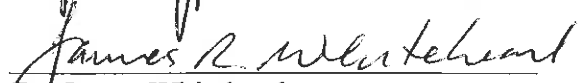
This thesis, submitted by Kathryn Elizabeth Lundberg in partial fulfillment of the requirements for the Degree of Master of Science from the University of North Dakota, has been read by the Faculty Advisory Committee under whom the work has been done and is hereby approved.



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Kathryn Elizabeth Lundberg
3/29/15

TABLE OF CONTENTS

LIST OF TABLES	vi
ACKNOWLEDGEMENTS	vii
ABSTRACT	viii
CHAPTER	
I. INTRODUCTION	1
II. LITERATURE REVIEW	7
The “Freshman 15”	7
Physical Activity	9
Gender Differences	11
Gender Differences in Physiological Responses	12
Accelerometry	14
The Health Belief Model	15
Perceived Physical Activity Barriers/Benefits	16
Summary	19
III. Method	21
Participants and Design	21
Measures	22
Procedures	24
Data Analysis	27
IV. RESULTS	28

Participant Characteristics	28
V. DISCUSSION	32
Strengths & Weakness	37
Conclusion	38
APPENDICES	40
Appendix A: Intervention Group Informed Consent	41
Appendix B: Control Group Informed Consent.....	46
Appendix C: Recruitment Flier.....	51
Appendix D: PAR-Q Form	52
Appendix E: Exercise Benefits and Barriers Scale Questionnaire	53
Appendix F: Bod Pod® Data Collection Form	58
Appendix G: Body Composition Data Collection Form.....	60
Appendix H: Physical Activity Intervention Outline	62
REFERENCES	69

LIST OF TABLES

Table	Page
1. Physical Activity Intervention Description.....	26
2. Participant Characteristics	29
3. Changes in EBBS Subscales Between Intervention and Control	30
4. Changes in Physical Activity Between Intervention and Control	30
5. Changes in Body Composition Between Intervention and Control.....	31

ACKNOWLEDGEMENTS

I would like to thank my advisor, Dr. Tanis Walch, for the countless hours spent mentoring me. I am thankful for everything she has done for me, and all the time she has spent fostering my education. I would also like to thank Drs. Fitzgerald and Whitehead for all their time and advice they gave for my thesis. In addition, I would also like to thank Stephanie Hoffman for allowing me to collaborate with the University of North Dakota Wellness Center to ensure I was given the most accurate tools for my research.

I would like to thank my parents for all of their endless support and for always believing in me.

ABSTRACT

Young adults face the opportunity to make an abundance of behavior choices when entering college. One important decision is to regularly participate in physical activity. Common barriers to physical activity may hinder an individual's decision to make healthy behavior choices, such as physical activity. The purpose of this study was to examine the impact of a women's physical activity intervention on perceived benefits and barriers, body composition, and energy expenditure. This study took place at the University of North Dakota in the fall of 2014 using a non-randomized experimental design between two groups (n=50) of college-aged women. The first group was enrolled in one of two one-credit physical activity courses (intervention; n=15, age=21.93 years). The second group was enrolled in a freshman general requirement course (control; n=35, age=19.8 years). The intervention included a 7-week physical activity program (150 minutes/week) developed based on the Health Belief Model, which targeted perceived barriers and benefits to exercise. Each session highlighted behavior change strategies targeting barriers and benefits, followed by a physical activity session. This approach was used to promote enjoyment and lifelong engagement in physical activity. Pretest and posttest measurements included perceived benefits and barriers, body composition, and energy expenditure (SenseWear armband). Data was analyzed using ANCOVA (SPSS). The results showed that intervention women increased fat-free mass (0.49kg) compared to a loss of fat-free mass in control (-2.5kg; p=0.03). Physical performance, a benefit

subscale to exercise, also showed a trend (control= -0.07; intervention= 0.13, $p= 0.07$).

There was no significant difference in energy expenditure between groups, but there was a significant decrease in average steps between groups ($p=0.04$). Interventions that emphasize overcoming barriers may be an effective strategy to preventing sedentary behavior and promoting physical activity in college-age populations. Policies that mandate a physical activity course in freshman students may be one way to protect against chronic disease and overweight/obesity.

CHAPTER I

INTRODUCTION

Physical activity is a vital component of overall health. Physical activity is associated with decreased risk of diabetes mellitus, obesity, hypertension, osteoporosis, depression, and some forms of cancer (Warburton, Nicol, & Bredin, 2006). In 2012, only 50% of adults aged 18 and over meet the guidelines for physical activity (at least 150 minutes of moderate-intensity, or 75 minutes of vigorous-intensity, or a combination of both) (Centers for Disease Control and Prevention, 2012). Thus, research is necessary to understand ways to increase lifestyle physical activity in the young-adult population.

College is a critical time for growth and development in young adults. Most students are experiencing life on their own for the first time and are learning to adjust to their newfound freedom. This transition from high school to college can impact an individual's participation in physical activity, which can lead to weight gain and obesity (Filla, 2013). According to the Centers for Disease Control and Prevention (CDC), overweight is defined as a body mass index (BMI) of 25 to 29.9 and obese is 30 or higher (Center for Disease Control and Prevention, 2011). Nearly 30% of all college students are overweight or obese based on self-reported measures of height and weight (Racette, Deusinger, Strube, Highstein, & Deusinger, 2008).

As of 2010, twelve of the fifty states had obesity prevalence rates of at least 30% (Gropper, 2012). These numbers are important to consider when focusing on the

university population, where students gain roughly 4 pounds over their first year of college. These students who are gaining weight often continue gaining weight after the time of the dreaded “Freshman 15,” and can see gains of 9 pounds in their sophomore year (Gropper, 2012).

Students often do not understand that excess weight gain in college can increase their risks for diseases such as cardiovascular disease (CVD), type 2 diabetes, arthritis, some cancers, and even mobility which ultimately will affect their ability to engage in physical activity (U.S. Surgeon General, 2010).

The Federal Government is working hard to promote a healthier society by implementing programs such as *Healthy People 2020* and *Healthy Campus 2020* to improve student health on college campuses. Based on the 2014 National College Health Assessment, over 30% of college students are overweight or obese based on estimated average BMI (American College Health Association, 2014). Since there is an increase in BMI throughout college, it is important to address the possible causes. Physical activity habits, alcohol intake, junk food, and dieting behaviors are some predictors of weight gain that have been researched (Holm-Denoma et al., 2008). Since BMI is an estimation of body composition, it is important to use this measure with discretion. Increases in BMI can also be contributed to overall changes in body composition, such as increases in lean mass.

There is a negative correlation between body composition and physical activity levels in the college-age population. As body weight and fat mass increase, the amount of physical activity decreases. It appears that this trend continues on into adulthood where currently only 50% of adults engage in the recommended amounts of physical activity

(National Health Interview Survey, 2012). Addressing these issues during college can help implement lifestyle changes in physical activity that will have positive effects on health after graduation and into adulthood.

In the United States, a typical description of weight gain in college is known as the “Freshman 15.” According to a recent study, more than 90% of the college students surveyed were aware of the Freshman 15 (Jung, Bray, Ginis, 2008). Recent research suggests that the notion of the Freshman 15 may be exaggerated, however college freshmen are still gaining weight at a rate higher than the rest of the general population (Mihalopoulos, Auinger, & Klein, 2008). Research shows that most college freshman gain roughly 2.5 pounds over a semester (Megel, Wade, Hawkins, & Norton, 1994). Although the actual weight gain is far less, this extra fat mass still puts students at increased risk for obesity and other health implications. Weight gain at the start of college may also be explained through growth and maturation, particularly in men who develop later than women (Gillen & Lefkowitz, 2011).

According to the American Heart Association and American College of Sports Medicine (AHA/ACSM) recommendations, young adults should engage in moderate-intensity aerobic physical activity for at least 30 minutes a day, 5 or more days a week for a total of 150 minutes. Young adults can also engage in vigorous aerobic physical activity 20 minutes a day, 3 or more days a week, for a total 75 minutes. Young adults may also engage in a combination of moderate and vigorous physical activity. AHA/ACSM recommends that young adults also complete two to three days of resistance training a week (Garber et al., 2011). Recent data from a national sample of college students surveyed by The American College Health Association indicates that the bulk of college

students do not meet AHA/ACSM's physical activity guidelines (American College Health Association, 2014). From the sample survey, only 22.0% of college students engage in moderate-intensity physical activity 150 minutes per week and 33.6% engage in vigorous physical activity 75 minutes per week (American College Health Association, 2014). It is important to address these statistics because young adults develop physical activity habits that they carry into adulthood, when physical activity is known to gradually decline (Schoenborn & Adams, 2005-2007).

Although guidelines are in place for physical activity and the notion of the "Freshman 15" is apparent to the college population, both college-aged men and women are still at risk. Body composition and physical activity changes seen in college students are not necessarily differentiated by gender. Both males and females see a significant increase in weight and fat mass over their freshman year of college. However, compared to males, females typically engage in less physical activity (Talbot et al., 2000). In a recent study, 66% of women who gained weight over their freshman year decreased their physical activity levels from baseline (Jung et al., 2008). Pairing weight gain and inactivity put women at an increased risk for health complications, which increases the importance for a physical activity intervention in this population.

Low physical activity levels in college students, especially women, are concerning. Regular physical activity improves not only cardiorespiratory fitness, but also psychological health (Jones, Ainsworth, & Croft, 1998). Sedentary students who do not understand the importance of physical activity may not create healthy lifestyle habits. This is important because many adult health behaviors are established during early adulthood (Buckworth & Nigg, 2004). During the transition period from high school to

college, students experience different factors that may affect their ability to complete physical activity. Some of these factors have been defined as demographic variables, knowledge, attitudes and beliefs toward physical activity (Dishman, 1994). Attitude toward physical activity can be both positive and negative. Women who perceive more benefits from exercise, and less barriers, are usually more active than those who reported more perceived barriers and less benefits (Vaughn, 2009). Perceived benefits and barriers are two constructs of the Health Belief Model. The Health Belief Model (HBM) is conceptual model for examining health-related behaviors, either evaluating change in or maintenance of health behaviors, such as physical activity (Champion & Skinner, 2008). By using HBM theory to evaluate perceived barriers and benefits to exercise, researchers can gain understanding of how they affect physical activity in college women.

The primary purpose of this study was to examine the common benefits and barriers that influence physical activity in college-aged women. We hypothesized that barriers to physical activity would decrease and benefits would increase in the physical activity intervention group compared to control. The secondary purpose of this study was to evaluate female college student's change in body composition and engagement in physical activity via accelerometry. We hypothesized that those women who were enrolled in the physical activity course would experience positive changes in body composition and increase their physical activity throughout the semester compared to the control group. The use of the Exercise Benefits and Barriers Scale Questionnaire (EBBS) gave us a better understanding of the common barriers that decrease the amount of physical activity in women throughout college. Recording objective measurements of

physical activity and body composition at the beginning and end of the seven-week course gave us insight into the changes that occur. Previous studies have used self-reported measures, so introducing accelerometers assumed increase in the reliability and validity of our results. Although increasing physical activity over all populations is of public health concern, research has reported very few studies on the college population. This is important because more college students than ever have been adopting sedentary behaviors (Keating et al., 2005). Therefore, this research will help investigate common barriers to physical activity that may lead to decreased likelihood of engaging in physical activity throughout life. These data may have important implications for health and fitness professionals to understand why women decrease physical activity. These results can help in the design of new programs and ways for universities to help students engage in physical activity.

CHAPTER II

LITERATURE REVIEW

Physical activity is an important component of overall health, decreasing the risk for coronary heart disease, diabetes, colon cancer, hypertension, osteoporosis, anxiety, and depression (Pate et al., 1995). Obesity is an important public health concern as there are over 142 million Americans who are overweight and obese across all ages and ethnic groups (Rosamond et al., 2008). Physical activity interventions are necessary to prevent this number from drastically increasing, and ideally decrease the percent of the population that is overweight and obese.

The sharpest declines in physical activity occur during the transition from adolescence to young adulthood (Caspersen, Pereira, & Curran, 2000). There are many speculations as to why this decrease in physical activity occurs. The transition from high school to college can be a period of adjustment for most students, which can impact their weight and physical activity levels. Currently, there are more than 10 million students enrolled in college in the United States (Racette et al., 2008). Since such a significant portion of these students decrease their physical activity levels and gain weight during college, it is important to examine the reasons behind this public health issue.

The “Freshman 15”

The popular phenomenon known as the “Freshman 15” refers to the idea that the average college freshman gains fifteen pounds their first year. Although this idea has been used to address the weight change in college freshman, it has not been widely tested. The studies, which have looked into the “Freshman 15,” have received mixed results. Most of these studies have not seen an average weight gain as high as fifteen pounds. A study by Graham & Jones (2002) suggests that the freshman year of college does not bring about a tremendous weight gain. Other research shows there is a gradually change in weight over the first year. Hovell, Mewborn, Randle, & Fowler-Johnson (1985) saw an increase of 0.73 pounds per month, 4.2 pounds over 12 weeks was reported by Levitsky, Halbmaier, & Mrdjenovic (2004), and as much as 2.5 pounds was reported over the semester by Megel et al (1994). Based on these results it is important to understand that we do not know on average how much weight freshman are gaining over the course of the year, but this gain is significant.

In a recent study, high school seniors were mailed a survey during spring semester regarding their overall health and well-being. Those who participated were sent a follow-up survey three times during their freshman year. The purpose of this study was to examine the relationship between demographics, physical activity, eating patterns, and self-esteem with their self-reported weight change during their first year in college. Results of this study showed that both men and women reported significant weight gain, 3.5 pounds and 4.0 pounds respectively (Holm-Denoma & Joiner Jr, 2008). These findings are in line with similar studies; both men and women tend to gain weight after the transition from high school to college. It is important to understand why these

increases are occurring and if they are due to lifestyle changes such as a decrease in physical activity.

In a similar self-reported study by Filla and colleagues (2013), changes in body weight, food intake, and physical activity were studied between senior year and freshman year of college. Participants were asked to recall dietary intake and physical activity during senior year and again for their freshman year. There was a significant increase in weight in both sexes ($+ 2.7 \pm 4.9$ kg, $p=0.008$). The results also showed a decrease in the amount of time per week students spent participating in vigorous activity from high school to freshman year (64.5 minutes in high school to 6.1 minutes in college, $p=0.001$). There was, however, a significant increase in the amount of time spent walking and biking for transportation, which could be associated with the need to commute across campus ($+43.9$ minutes, $p<0.001$). (Filla, Hays, Gonzales, & Hakkak, 2013). Although there was an increase in physical activity for transportation, there was still a lack of physical activity overall that could contribute to this increase in weight. These studies show a weight change occurring in men and women, as well as a decrease in physical activity. Researching physical activity specifically as a factor to weight gain may bring insight into this issue.

Physical Activity

These increases in weight change may be associated with different factors that occur during the freshman year transitional period, especially changes in physical activity levels. According to AHA/ACSM, young adults should engage in at least 30 minutes of moderate-intensity physical activity, 5 or more days a week for 150 minutes. A total of

75 minutes of vigorous-intensity physical activity for 20 minutes a day, 3 or more days a week or a combination of both moderate-intensity and vigorous-intensity physical activity. Young adults should also engage in two to three days of resistance training per week involving all major muscle groups (Garber et al., 2011). However, young adults are not meeting this recommendation, and college-aged women tend to be less physically active than men (Talbot, et al., 2000). According to research conducted by Crombie, Ilich, Dutton, Panton, & Abood (2009), individuals who engage in less physical activity or at a lower intensity are more likely to have a high BMI or be overweight. Individuals who increased their physical activity to a more vigorous intensity saw a larger change in their BMI at follow-up than those who maintained a low to moderate intensity level. This shows that there may be an association between the amount and frequency of physical activity and an individual's body mass.

A cross-sectional study of freshman African American students found that 82% of women and 71% of men had very poor aerobic fitness based on a Cooper walk/run test (Ainsworth, Berry, Schnyder, & Vickers, 1992). Although many studies find a drop in physical activity level in the first year of college, one study found no significant change. At the start of college, 18.1% of the sample participated in low intensity, 56% at moderate, and 24.9% at high intensity exercise. The second data collection yielded similar results, 20.2% in the low intensity category, 48.2% moderate, and 31.6% participated in high intensity physical activity. Participants were more likely to remain within their previous physical activity level than increase or decrease intensity ($p > .001$) (Kasperek, Corwin, Valois, Sargent, & Morris, 2008). This study presented promising evidence that not all college-age individuals are lacking physical activity.

Although some research shows there are no changes in physical activity in college, these changes may still be seen. Only 35% of college students participate in physical activity on a regular basis. Men participate in physical activity more often than women, 40% and 32% respectively (Pinto et al., 1998). This was also shown by Silliman and colleagues (2004), in a self-reported measure of physical activity habits, body image, and perceived barriers to physical activity they found that 84% of all participants said they currently engage in physical activity, but 42% of the participants reported that they engaged in physical activity less since attending college. Of that population, men engaged in physical activity more frequently and at a greater intensity level than women (Silliman, Fortier, & Neyman, 2004). Thus, strategies to increase physical activity in women are needed.

Gender Differences

Exercise-type or intensity may vary between males and females but that does not mean that weight gain is limited to only one sex. Many studies of physical activity and weight change are conducted on both male and female participants. Results suggest that weight change can be seen in both men and women. University students are expected to gain twice as much weight as those adults in their age range who do not attend college (Holm-Denoma et al., 2008). This weight gain and decrease in physical activity can be seen to continue into adulthood, as only about 50% of American adults engage in the recommended levels of physical activity (CDC, 2012). Both genders tend to gain weight, but women often gain weight because of decreased physical activity levels (Talbot et al., 2000). Research conducted on freshman women found that all participants decreased

their physical activity levels during the first 8 weeks of school. By the end of the year, 34% of the women who lost weight returned to physical activity levels higher than baseline and decreased their daily caloric intake, whereas 66% of the women who gained weight significantly decreased their physical activity and caloric intake from baseline (Jung et al., 2008).

Many studies have also been conducted on physical activity and body composition changes in men, mostly in the area of resistance training. One such study researching a male population, found that between the summer before, and the end of freshman year men significantly increased fat mass by 0.7% and body weight by 6.6 pounds. These gains were unrelated to changes in energy or dietary intake and resistance training but may have been associated with the significant decrease in aerobic physical activity ($p < 0.0001$) and the increase in sedentary activity ($p < 0.0001$), as well as an increase in weekly alcohol beverages consumed (summer, 7.33; fall, 10.2; $p < 0.001$) (Pullman et al., 2009).

Male weight gains may also be associated with an increase in lean body mass (Silliman et al., 2004). Men select strength-training and competitive sports more than women, who normally chose aerobics as means of physical activity. Leslie et al. (1999) and Pinto and Marcus (1995) also reported these gender differences. Resistance exercise may elevate an individual's metabolic rate for 48-56 hours post-exercise (Herring et al., 1992; Melby et al., 1993). This increase in metabolic rate with resistance training may contribute to men's positive change in body composition, compared to women.

Gender Differences in Physiological Responses

There are not only differences in physical activity behaviors that occur between men and women, but also differences in physiological responses that may have an affect on physical activity and body composition. Previous research has discovered short-term and long-term mechanisms that affect stability of body mass and body composition. Long-term energy intake and expenditure becomes matched to stabilize body composition. Most of these studies have been conducted in animal populations, but are considered resourceful when examining humans. In animals, a 10-15% caloric restriction or weight loss leads to compensatory increases in food intake and decreased basal metabolic rate until intake and expenditure is regulated (Borer & Kooli, 1975; Borer & Kelch, 1978; Mitchel & Keeseey, 1977). It should be noted that individuals have different energy plateaus determined by genetics that can be justified through this mechanism. Genetic set points of energy needs affect energy conservation, food availability, and physical activity (Bouchard, 1994).

Exercise anorexia has been identified in males more often than females. Intense exercise has been shown to suppress food consumption and increase fat loss in men (Katch et al, 1979; Nance et. al, 1977). Other animal studies have established that females more often accurately compensate for exercise energy expenditure by increasing food intake post-exercise (Nance et al., 1977). In lean women, high intensity exercise leads to an increase pleasure from food and no decrease in hunger (King et. al, 1996). Other research has produced similar results; it has been shown that several days of exercise at different intensities produce accurate compensation for energy expenditure (Woo & Pi-Sunyer, 1985). Short-term coupling of energy expenditure mechanisms that control intake

are looser in men than women (Blundell & King, 1999; Hubert et al., 1998; King 1999; King et al., 1997a).

This close coupling of energy expenditure and intake in women is necessary for fertility. A threshold fatness level of 22% is necessary for maintenance of menstruation, however depending on the population and their level of physical activity this threshold may be different (FAO, 1957; Frisch & McArthur, 1974). Research suggests that this correlation is contingent on the availability of 99,000 calories in 11kg of body, which is enough to provide 80,000 calories for full-term pregnancy (FAO, 1957). The coupling mechanism of energy expenditure and intake in women is controlled by a women's need for sufficient energy to sustain pregnancy. These physiological responses can explain differentiation in body composition and physical activity between men and women. Specifically, women's resistance to decrease body mass and composition through increased energy expenditure.

Accelerometry

Physical activity can be assessed through self-reported questionnaires such as the International Physical Activity Questionnaire (Craig et al., 2003), or measured using accelerometers. Often times, studies done on physical activity and weight gain in college students use self-reported measures. This is a convenient but less accurate measurement. Participants who self-report data tend to give the socially desirable answer; often times, weight is under-reported in women and physical activity is over-reported (Downs et al., 2014). Most college students want to increase their amount of physical activity but when they are incorrectly reporting their data they often believe they are meeting requirements.

In one such study, Downs and colleagues found that participants self-reported engaging in 66.14 minutes of moderate physical activity per day, but according to their accelerometer data they only engaged in 19.90 minutes of moderate physical activity per day. Based on this data, 66.7% of participants were meeting physical activity requirements according to self-reported values but in reality only 33.8% were meeting these requirements (Downs et al., 2014). More and more research is using accelerometry to get accurate, quantifiable results. Using accelerometry in this study allowed for better understanding of how much physical activity participants are actually getting, as well as, how often participants are actually meeting physical activity requirements.

The Health Belief Model

The Health Belief Model (HBM) is a theoretical framework used to understand health-related behaviors (Champion & Skinner, 2008). This model was designed by a group of social psychologists in the 1950s, and later updated in the 1980s, to explain why people were not participating in disease screenings (Green & Kreuter, 2005). This model has since been revised to include general health motivation. HBM is now used as the theoretical framework for designing health behavior interventions (Champion & Skinner, 2008).

The Health Belief Model is composed of six constructs that work together to predict why individuals make or don't make behavior change. These constructs include: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy. Earlier model contained only the first five constructs. Recently, self-efficacy or an individual's confidence in being successful in reaching a

goal was included in the HBM to aid in changing habitual negative behaviors, such as smoking, over-eating, and sedentary behavior (Von Ah, Ebert, Ngamvitroj, Parj, & Kang, 2004).

For the purpose of this study, only two constructs of the HBM were utilized: perceived barriers and perceived benefits. Based on the theoretical framework, the likelihood that an individual will engage in physical activity will depend on the negative aspects on physical activity being lower than the perceived benefits an individual will receive from engaging in this health-behavior. Previous research shows that by increasing perceived benefits to physical activity, perceived barriers will decrease (Kennedy et al., 1998).

Perceived Physical Activity Barriers/Benefits

Since there is a trend among the college-aged population of increased inactivity and weight gain, it is important to understand how and why these two variables are related. Often times, during a student's transition to adulthood they face many obstacles that can hinder their physical activity. It is also important to understand what some of these barriers may be and ways that they can be substituted for physical activity benefits to promote lifelong physical activity. Paffenbarger et al. (1986) examined almost 17,000 college alumni and found decreased rates of mortality as high as 49% in those who maintained physical activity from college into their 70-80's. Researchers can examine the factors that influence physical activity adherence in undergraduate students to promote physical activity as a lifestyle, even after college.

When addressing specific perceived barriers and benefits that are associated with physical activity, it is important to first define these terms. Perceived barriers are associated with the obstacles that occur when trying to perform a specific task. These barriers can deal with unavailability, expense, time, difficulty, and inconvenience. Perceived barriers cannot only decrease commitment to physical activity programs but they can also prevent an individual from starting a new activity (Pender, 1996). Perceived benefits are positive reinforcements to a behavior. The individual needs an understanding, either from past experience or peer experience, for motivation. In order for an individual to invest time and effort into a behavior they have to perceive high achievement from the outcome (Pender, 1996).

Based on these definitions, it is important to examine what specific benefits and barriers affect the college population based on the Exercise Benefits and Barriers Scale (EBBS), as well as noting the differences between men and women. In Grubbs & Carter (2002), perceived benefits and barriers to exercise were assessed using the EBBS in 147 college-age students (18-24 years old). Of this population, 69% were “regular” exercisers and 31% were not, 82% of the overall population was females. Based on the survey data, the most impactful benefits to exercise were physical performance and appearance. The most substantial barrier associated with exercise was physical exertion. It is interesting to note that the participants who engaged in physical activity regularly perceived significantly more benefits to exercise than those non-exercisers. Broken down by sex, 92% of the male participants were categorized as exercisers, while only 63% of females were, although they consisted of a larger portion of the data sample (Grubbs & Carter, 2002). Silliman and colleagues (2004) found that the participant’s main reason for

physical activity was “health.” Women’s benefits to physical activity included weight management and stress reduction, while men chose physical activity for enjoyment and strength gains (Silliman et al., 2004). Women and men both understand the health benefits of physical activity, but women tend to engage in physical activity for its psychological and body image benefits more often than men (Myer and Roth, 1997). Since men stated enjoyment as a reason for physical activity, it may be easier for them to adhere to a physical activity program. The differences in benefits and barriers to physical activity between men and women may impact the percent of regular exercisers. Men engage in physical activity more frequently and at a greater intensity than women and chose strength training and competitive sports more than women (Silliman et al., 2004). These findings are consistent with gender differences seen by Leslie et al. (1999) and Pinto and Marcus (1995).

Previous research shows a strong correlation between physical activity benefits and regular physical activity (Grubbs & Carter, 2002; Kennedy, DeVoe, Skov, & Short-DeGraff, 1998). Implementing a physical activity intervention may have a positive impact on perceived benefits and barriers seen in the individual. In a master’s thesis done by Pippin (2013), students enrolled in the intervention course were required to participate in twelve weeks of physical activity. The intervention and control group were both given the EBBS questionnaire at the beginning and end of the twelve-week period. All of the participants in this study were consistently engaging in physical activity 1-2 days per week at baseline. Based on pre- and post-test scores, those who were already engaging in physical activity had high-perceived benefits to exercise. Both groups significantly decreased their barriers, but also their benefits to exercise. Researchers presumed these

decreases in benefits to be illegitimate due to the fact that those who were already engaging in physical activity understand the benefits to physical activity more than those who were not (Pippin, 2013). Although these decreases in perceived benefits were found, it is important to note that with an intervention the participants were able to also decrease their perceived barriers to physical activity.

Summary

Understanding the perceived benefits and barriers to physical activity and how they differentiate between men and women is key. It is also important to address these concepts when implementing a physical activity program by highlighting the benefits and dismissing the barriers. Once individuals start to engage in physical activity regularly the barriers tend to decrease (Grubbs & Carter, 2002). Several studies describe the benefits and barriers to physical activity but only a few experimental studies have been conducted on the changes that occur before and after a physical activity intervention. Since women and men both gain weight during college, but men are more likely to engage in physical activity than women there is a need for experimental studies on college women (Talbot et al., 2000). Implementing an experimental study on college women can help health professionals understand the impact a physical activity intervention can have on physical activity, as well as benefits and barriers. College women are subject to change throughout their college career. Developing healthy diet and physical activity habits are important for longevity. Findings from physical activity interventions such as this can help eliminate common barriers to physical activity in women and create policies for college campuses to promote physical activity in all populations. As Wallace et al. (2000) stated, colleges

serve as a crucial setting to overcome barriers to healthy habits and implement effective interventions (Wallace et al., 2000).

CHAPTER III

METHOD

Participants and Design

Data were collected from August 2014 until December 2014 at the University of North Dakota (UND). The participants in this study were fifty college-aged women. Fifteen of these participants were enrolled in two seven-week undergraduate Basic Instructional Programming (BIP) courses: Kinesiology 108A Fitness and Conditioning Beginning Aerobics (n=6) and Kinesiology 108M Fitness and Conditioning Beginning Women's Conditioning (n=9). These courses took place during the first and second half of the semester, thus, data were collected in two waves. The other thirty-five participants were enrolled in the undergraduate PHE 101: Introduction to Public Health course in the fall semester of 2014, these participants served as the control group and data was collected at the first half of the semester. Participants were a convenience sample chosen based on enrollment in the above courses. However, fliers for enrollment in the BIP courses were hung up around the UND campus. The UND Student Involvement Office also sent out a recruitment email for BIP course enrollment to all sororities on campus. Each group provided written and verbal consent. The participants in the BIP courses received college credit for their enrollment in the courses and participants in the PHE 101 course received extra credit for their participation. The Institutional Review Board at the University of North Dakota gave approval before the start of this study.

Measures

General Demographics- A general assessment of the participant's age and academic year were assessed for this study. All participants in this study were women.

Exercise Benefits/Barriers Scale (EBBS)- Perceived benefits and barriers to physical activity were assessed using the Exercise Benefits/Barriers Scale (EBBS). This was a 43-item self-reported questionnaire that asked about the importance of different benefits and barriers to physical activity. Perceived benefits included 29 items broken down in five subscales: life enhancement, physical performance, psychological outlook, social interaction, and preventative health. The perceived barriers included 14 items broken down in four subscales, which included: exercise milieu, time expenditure, physical exertion, and family discouragement. All answers were scored in a 4-point Likert-type scale, where 1 = "strongly disagree" and 4 = "strongly agree." Internal consistency of the benefits and barriers portions for the EBBS are 0.95 and 0.86 respectively, test re-test reliability is 0.89 and 0.77 (Gyuresik, et al., 2006).

SenseWear Pro Armband Accelerometer- Actual quantifiable measures of physical activity were done using the SenseWear Pro Armband (Body Media, Pittsburg, PA). This device, used to measure energy expenditure during physical activity, was worn on the non-dominant arm over the triceps muscle. Total energy expenditure and active energy expenditure are measured in kcals per minute. For treadmill walking, the interclass correlation coefficient between energy expenditure from indirect calorimetry and the SenseWear Pro Armband is 0.87 (Jakicic, et al., 2004). Physical activity was

quantified by the average Kcals, steps taken, and minutes of moderate-vigorous physical activity over a three-day period: two weekdays and one weekend day.

Weight- Participant's weight was assessed on a digital scale (Seca Corp, Model 770, Hamburg, Germany) in kilograms rounded to the nearest tenth. The participant did not wear shoes for weighing and all heavy clothing was removed. Each participant was weighed twice, if weight varied by more than 0.1 kg, a third weight was taken. The closest two weights were averaged for the recorded value.

Height- Height was collected using a portable stadiometer (Seca Corp, Model 214, Hamburg Germany), also measured with the participant's shoes removed. They were instructed to stand under the device with their heels on the ground and their upper body relaxed. Height was measured in centimeters, to the nearest millimeter. Two height measurements were taken for each participant, within 5 mm of each other. If height varies by more than 5 mm than a third was taken and the closest two measurements were averaged for the recorded height.

Waist & Hip Circumference- To measure waist circumference the tape measure was placed at the level of the lowest floating rib. The participant stood still with their arms at their sides and was instructed to take a normal breath; the measurement was taken at the end of expiration. For hip circumference, the measuring tape was positioned around the hips at the level of the symphysis pubis and the greatest gluteal protuberance. Waist and hip circumference was measured to the nearest centimeter. These measures were both taken three times, averaging the two closest of each for the recorded values of waist and hip circumference (Dobblesteyn, 2001).

Body Composition: Bod Pod- Body composition was assessed using the Bod Pod (Life Measurement, Inc, Concord, CA). The Bod Pod uses the whole-body air-displacement plethysmography (ADP) laboratory technique to measure body volume and determine body density. Percentage body fat was estimated using the Brozek equation and fat mass and fat-free mass were also reported in kilograms. This technique is quick, comfortable, generalizable, and non-invasive (Fields, Goran, & McCrory, 2002). ADP works to measure the volume of the individual by indirectly measuring the volume of air he/she displaces inside an enclosed chamber (Fields, Goran, & McCrory, 2002). Individuals receiving this assessment were asked to wear minimal clothing (spandex swimming suit or compression shorts/sports bra) and a swim cap to reduce isothermal air. The individual was then instructed to sit still in the chamber with their hands on their lap and breath normally. Two trials were taken unless there was discrepancy between trials, then a third trial was done. Bod Pod has been considered a reliable and valid tool for measuring ADP clinically. Research comparing the Bod Pod to hydrostatic weighing and the gold-standard dual-energy X-ray absorptiometry (DXA), has shown the average mean differences in body fat percentage to be <1% (Fields, Goran, McCrory, 2002).

Procedures

Participants were assessed twice over a seven-week period. Participants who were enrolled in the physical activity courses and undergraduate general requirement course were given a questionnaire about benefits/barriers to physical activity at the first session. Participants were also assessed for their height, weight, hip and waist circumferences, and body composition via Bod Pod (Life Measurement, Inc, Concord, CA). Participants

were given a SenseWear Pro Armband (Body Media, Pittsburgh, PA). The participants were instructed to wear the accelerometer on the tricep of their non-dominant arm. They wore the accelerometer for three consecutive days, including one weekend day. At the end of these three days they reported back to class with their accelerometers to be analyzed.

Physical Activity Intervention- Over the course of the seven-week period the physical activity courses met for a total of 150 minutes, two or three days per week depending on the course. The participants met at the same time for each session and were instructed to wear athletic clothing and running shoes. At the start of each session there was a brief discussion highlighting behavior change strategies targeting specific benefits and barriers. These discussions included handouts from the researcher and a dialogue led by the participants on topics such as physical activity goals, habits, and programming that was tailored to the specific benefit or barrier indicated by the researcher. The participants then engaged in a physical activity protocol designed and carried out by the researcher that included cardiovascular training, resistance training, and flexibility training broken up over the rest of the session. Each physical activity segment correlated with the discussion that occurred at the start of the session. A qualified, trained researcher who held national certifications in Group Fitness and a Bachelor of Science degree in Exercise Science led each session to ensure the quality of the intervention.

A brief description of the physical activity intervention is shown in Table 1, the entire intervention protocol is located in Appendix H.

Table 1: Physical Activity Intervention Description

Weekly Theme	Physical Activity Session	Procedures
Week 1: Pre-test	1: Consent form, PAR-Q, EBBS, height, weight, hip & waist circumference 2: Body composition (Bod Pod)	-Participants were measured based on procedures outlined in Chapter 3: Method
Week 2: Barrier: Location	1: Park workout 2: "At home" workout	-Reasons for not working out -Alternatives to going to the gym -Locate trails/bike paths on campus/ in community
Week 3: Benefit: Social Cohesion	1: Partner workout 2: Group workout	-Solo vs. partner/group workouts -Benefits of working out with a partner or group -Workout designed to work together
Week 4: Barrier: Time	1: Tabata workout 2: High intensity interval training	-Identify time constraints -Discuss time management -Learn short-duration workout routines (Tabata/HIIT)
Week 5: Benefit: Physical Performance	1: Aerobic training 2: Resistance training	-Endurance vs. resistance training -Proper programming for both - Health benefits to both -AHA/ACSM guidelines to physical activity
Week 6: Barrier: Physical Exhaustion Benefit: Lifelong Skill	1: Intensity via heart rate 2: Created own workout	-Difference between physical discomfort and injury -Signs of overtraining -Using heart rate to gage intensity of workout -Design a balanced physical activity plan -Make long-term and short-term goals based on S.M.A.R.T goal setting
Week 7: Post-test	1: Consent form, PAR-Q, EBBS, height, weight, hip & waist circumference 2: Body composition (Bod Pod)	-Participants were measured based on procedures outlined in Chapter 3: Method

**EBBS: Exercise Barriers & Benefits Scale Questionnaire*

**Week 6 was combined due to lack of time in 7-week schedule*

At the end of the seven-week course all participants from both groups again completed the questionnaire about perceived benefits and barriers to physical activity. Both groups also wore their accelerometers for another three consecutive days, including one weekend day to analyze their physical activity levels. Participant's height, weight, waist and hip circumference, and body composition via Bod Pod were again measured.

Data Analysis

This study examined the specific barriers and benefits to physical activity, as well as participant's accelerometer-based physical activity, and body composition. Change scores were computed for all variables. An analysis of the pre- to post-changes in overall barriers and benefits, physical activity, and body composition was conducted using an Analysis of Covariance (ANCOVA), alpha value of 0.05. ANCOVA was used to measure differences in the means between the group who received physical activity and the group that did not receive physical activity while controlling for baseline differences between groups.

CHAPTER IV

RESULTS

Participant Characteristics

A total of 50 women participated in this study. Participants in the physical activity intervention (n=15) had a mean age of 21.93 years and were primarily juniors in college. Of the 15 women in the physical activity intervention, 14 completed a pre-test Bod Pod analysis: the mean body fat percentage was $28.88 \pm 5.39\%$. Participants in the control (n=35) had a mean age of 19.8 years and were also primarily juniors in college. Based on the pre-test Bod Pod analysis, 11 women completed the assessment with a mean body fat percentage of $20.98 \pm 9.89\%$. Although this study investigated barriers and benefits in undergraduate courses, enrollment by graduate students could not be controlled for. Graduate students enrolled in undergraduate courses do not receive credit in their major program. Overall, there was no difference between groups at baseline for body fat percentage, fat percentage, fat mass, fat-free mass, total energy expenditure (kcal), average steps, sedentary time (minutes), vigorous-intensity physical activity (minutes), life enhancement benefit subscale, physical performance benefit subscale, psychological outlook benefit subscale, social interaction benefit subscale, preventive health benefit subscale, exercise milieu barrier subscale, time expenditure barrier subscale, physical exertion barrier subscale, and family discouragement barrier subscale ($p>0.05$). There was, however a difference between moderate-intensity physical activity (intervention =

196.0 minutes; control = 159.1 minutes, $p=0.03$) and moderate-vigorous physical activity (intervention=216.0 minutes; control=166.8 minutes, $p=0.01$).

The participant characteristics can be found in Table 2.

Table 2: Participant Characteristics		
	Control (n=35)	Intervention (n=15)
Mean Age, SD	19.8 (1.8)	21.9 (3.1)
Academic Year: n (%)		
Freshman	9 (25.7%)	1 (6.7%)
Sophomore	8 (22.9%)	3 (20.0%)
Junior	10 (28.6%)	6 (40.0%)
Senior	8 (22.9%)	4 (26.7%)
Graduate		1 (6.7%)
Fat Mass (%)	n=11	n=14
Risky (<15%)	2 (18.2%)	0 (0%)
Ultra Lean (15-18%)	3 (27.3%)	1 (7.1%)
Lean (19-22%)	1 (9.1%)	1 (7.1%)
Mod. Lean (23-30%)	2 (18.2%)	5 (35.7%)
Excess Fat (31-40%)	3 (27.3%)	7 (50.0%)
Mean Height (cm), SD	n=23	n=15
	163.7 (4.9)	166.4 (9.4)
Mean Weight (kg), SD	n=23	n=15
	61.9 (11.0)	67.9 (21.3)
Mean Physical Activity (mins), SD	n=19	n=15
Moderate to Vigorous	166.8 (67.8)	216.0 (141.1)

The overall purpose of this study was to examine changes in perceived benefits and barriers based on the Exercise Benefits and Barriers Scale (EBBS). Table 3 illustrates the change between groups for the EBBS subscales. The EBBS is broken into 9 subscales

(5 benefit and 4 barrier subscales). Overall, there was no statistically significant difference in subscales between the groups. However, the intervention group showed a trend in the physical performance benefit subscale compared to control (control = -0.7; intervention = 0.13, $p = 0.07$).

Table 3: Changes in EBBS subscales between intervention and control		
	Intervention	Control
Benefit Subscales:		
Life Enhancement	0.05	0.04
Physical Performance	0.13	-0.07
Psychological Outlook	0.13	0.01
Social Interaction	0.12	0.01
Preventative Health	0.12	0.19
Barrier Subscales:		
Exercise Milieu	-0.06	0.06
Time Expenditure	0.16	0.09
Physical Exertion	-0.16	0.11
Family Discouragement	-0.04	-0.18

* $p < 0.05$

To evaluate our secondary aim, we examined changes in accelerometer-based physical activity. Table 4 illustrates the change in physical activity between the two groups. Total energy expenditure (TEE) in kcals, average steps, and moderate-vigorous physical activity (MVPA) in minutes were all evaluated. There was no significant difference in total energy expenditure or minutes engaged in moderate-vigorous physical activity between groups, however there was a significant difference in average steps between groups (control = -10.22; intervention = -2295.53, $p = 0.04$).

Table 4: Changes in physical activity between intervention and control			
Condition	TEE (kcals)	Avg. Steps	MVPA (minutes)
Control	51.56	-10.22*	14.11
Intervention	48.33	-2295.53*	-57.73

* $p \leq 0.05$

Last, Table 5 illustrates the change in body composition between the two groups. There was no significant difference between groups when comparing changes in body fat percentage ($p > 0.05$). However, there was a significant difference in fat-free mass. The women in the intervention group increased fat-free mass compared to a loss of fat-free mass in the control group (-2.5kg, $p = 0.03$). However, there was no significant difference in fat mass between groups ($p > 0.05$).

Table 5: Changes in body composition between intervention and control

Condition	Body Fat (%)	Fat-Free Mass (kg)	Fat Mass (kg)
Control	2.22	-2.48*	2.30
Intervention	-0.30	0.49*	-0.66

* $p \leq 0.05$

CHAPTER V

DISCUSSION

The transition to college is a crucial time in a young adult's life. College students face an abundance of freedom and the ability to make their own choices. One important decision is to regularly participate in physical activity. Common barriers to physical activity may hinder an individual's decision to make healthy behavior choices, such as physical activity. Identifying barriers that affect specific populations is key to reversing habitual behaviors that negatively affect health. This is important because many adult health behaviors are established during early adulthood (Buckworth & Nigg, 2004).

Physical activity is important in the maintenance of a healthy lifestyle. Physical activity reduces the risk of chronic diseases including diabetes, hypertension, depression, cancer, and obesity (Warburton, Nicol, & Bredin, 2006). Even though physical activity is important for longevity, young adults are not meeting AHA/ACSM recommendations for physical activity. Only 22% and 33.6% of adults engage in moderate-intensity and vigorous-intensity respectively (American College Health Association, 2014). Across the board young adults are not meeting recommendations; however, college-age women tend to be less physically active than men (Talbot, et al., 2000).

The primary objective of the present study was to investigate whether a physical activity intervention highlighting common barriers and benefits would decrease barriers, increase benefits, and influence physical activity and body composition. The purpose of

this study was to examine the common benefits and barriers that influence physical activity in college-age women. Although, our study was not successful at increasing benefits and decreasing barriers to physical activity, it is important to understand whether a behavior change intervention was effective at increasing benefits to physical activity, and thus long-term physical activity.

To our knowledge, this is the first study using a physical activity intervention based on the Health Belief Model to target behavior change through specific benefits and barriers in college-age women. Contrary to our hypothesis, there was no change in perceived benefits and barriers in the physical activity intervention compared to control. Several studies have examined changes in perceived benefits and barriers following a physical activity intervention (Schultz, 2004; Kennedy et al., 1998). Results from these studies provide inconclusive evidence as to how to increase physical activity in college-aged women. Specifically, Schultz and colleagues (2004) showed increases in physical activity, but only mothers, and not daughters, decreased barriers (Schultz, 2004). When assessing changes in the benefit and barrier subscales, there were no changes (Schultz, 2004). These results are similar to our findings, in which we did not decrease barrier subscales; however, both studies were of short duration with a small sample size. A more intensive intervention may be necessary to reduce barriers in college populations. This is supported through Kennedy and colleagues' (1998) findings, where they saw significant increases in benefits and decreases in barriers following a long-duration physical activity intervention in minority women (Kennedy et al., 1998).

The secondary aim of this study was to examine whether women in the physical activity intervention would have positive changes in body composition and increase total energy expenditure. In the present study, the use of the Health Belief Model framework to create a physical activity intervention exploiting specific benefits and barriers while objectively measuring changes in energy expenditure and body composition, to our knowledge, is the first of its kind.

Results from the present study showed women in the physical activity intervention increased fat-free mass (0.49 kg), compared to a decrease in fat-free mass in control (-2.5 kg; $p=0.03$). To date there are no other similar studies that have measured changes in body composition between intervention and control groups. Previous research has analyzed the effect of physical activity on body composition in diverse populations (Trapp et al., 2008, Donnelly et al., 2003, Girandola, 1976). This research supports our findings: increases in physical activity will elicit positive changes in body composition. More specifically, Trapp and colleagues (2008) and Girandola (1976) saw decreases in fat mass in women following an exercise intervention (Trapp et al., 2008 & Girandola, 1976). Donnelly and colleagues (2003) saw decreases in fat mass, but also increases in fat-free mass (Donnelly et al., 2003). All of the above studies were of long-term duration, which may make it easier to see changes in body composition. The significant increase in fat-free mass in the present study is an important finding because of the relatively short duration of the intervention compared to previous research. Also, previous research has shown changes in body composition but significant increases in fat-free mass have been under reported. Thus, while we did not see changes in benefits and barriers, our short-

term intervention was effective at behavior change resulting in improved body composition.

The increase in fat-free mass in the present study is a significant finding when looking at energy balance over time. Energy balance is the ratio between energy intake and energy expenditure (Hall et al., 2012). This is an important factor in weight maintenance. Individuals who have positive energy balance over time, energy intake outweighs energy expenditure, will be at greater risk for weight gain (Sparti et al., 1997). The largest component of energy expenditure is resting metabolic rate (Sparti et al., 1997). Resting metabolic rate is defined as the rate of energy expenditure at rest (Sparti et al., 1997). Resting metabolic rate is strongly associated with fat-free mass; 70-80% of resting metabolic rate is controlled for by fat-free mass (Sparti et al., 1997). Individuals who have a higher percentage of fat-free mass will have a higher resting metabolic rate. This may favor energy balance and weight management over time.

The secondary aim of the present study also evaluated whether a physical activity intervention would increase total energy expenditure in women. We found that there was no change in total energy expenditure between groups. However, both groups had a significant decrease in average steps with a larger decrease coming from the intervention group (control = -10.22; intervention = -2295.53, $p=0.04$). At the start of this study, both groups were meeting physical activity recommendations of 150 minutes of moderate-intensity physical activity per week. This may explain why we did not see changes in overall energy expenditure between the groups. To our knowledge there are no other studies similar to this design that have objectively measured energy expenditure as a part

of a college-age physical activity intervention in women. Previous studies have used a physical activity intervention to overcome barriers, but have not measured changes in physical activity (Kennedy et al., 1998 & Pippin, 2013). Kennedy and colleagues (1998) measured physical activity adherence, through completion of physical activity intervention sessions (Kennedy et al., 1998). Pippin (2013), an unpublished Master thesis, also examined perceived barriers and benefits and physical activity adherence following a physical activity intervention compared to control (Pippin, 2013). Kennedy and colleagues (1998) implemented a successful intervention; the women had an 84% adherence rate and also significantly increased benefits and decreased barriers (Kennedy et al., 1998). Pippin (2013) did not implement a structured physical activity intervention, and only assumed adherence of participants (Pippin, 2013). Although these studies did not objectively measure energy expenditure like the present study, they explain that increases in EBBS scores coincide with increases in physical activity. Previous research shows a strong correlation between physical activity benefits and regular physical activity (Grubbs & Carter, 2002; Kennedy, DeVoe, Skov, & Short-DeGraff, 1998). This could explain why the present study saw no change in both physical activity and EBBS subscales.

The Health Belief Model was used in the present study as the theoretical framework to structure behavior change in college-age women. This framework was used to motivate women to engage in physical activity both inside and outside of the intervention. This approach worked to create a real-world setting for the participants. College students lead busy lives juggling academics, work, relationships, and personal wellbeing. Students have minimal time to create healthy behaviors, so teaching them to

overcome barriers in the real world is important. This intervention was quite short in duration and frequency (2 days a week), and used both educational and physical activity components to increase participant's desire to engage in physical activity outside of the intervention. Increasing benefits to physical activity and decreasing barriers would make it easier for women to meet physical activity recommendations post-intervention and increase lifelong engagement in physical activity.

Had the intervention been of long-term duration like Kennedy et al. (1998) or met more frequently during the week (Pippin 2013), who engaged in physical activity 4 days a week, there may have been a positive change in both physical activity engagement and benefits and barriers within the intervention (Kennedy et al., 1998 & Pippin, 2013). Had the present intervention been structured as a 5 day per week program, the women would not have had to overcome individual barriers to engage and meet recommendations for physical activity. While, it would have been ideal to increase physical activity to meet guidelines, this is not a sustainable model. At the conclusion of the 7-week intervention, participants would not have gained the skills necessary to continue effective physical activity habits on their own. Perhaps, a more intensive 5 day a week intervention would have been necessary to increase physical activity, and decrease barriers and increase benefits in the college-age women. However, a 5-day intervention is almost forcing women to be active, rather than help them to develop the skills necessary to continue this life-long behavior.

Strengths & Weaknesses

The present study was a small, pilot study with several strengths and weaknesses. Strengths included an experimental design utilizing a control group. Second, a trained researcher conducted all anthropometric measures, to avoid participant self-reporting. Body composition was measured with a reliable and valid clinical tool (Bod Pod) to ensure accuracy. Third, physical activity and sedentary behavior were objectively measured using accelerometers. Fourth, the physical activity intervention included a structured program including cardiovascular, resistance, and range of motion training. Last, the program was designed based on the Health Belief Model to initiate behavior change from specific benefits and barriers. Limitations to this study include a small sample size, specifically in the intervention group. Second, the length of the physical activity intervention may have also been too short to see any significant changes in perceived benefits or barriers. Third, the groups were not randomized. Last, this intervention was developed primarily for freshman students who had just previously begun their college experience. The majority of the population in this study were juniors who may have already fallen into a routine, which could have made developing a behavior change of increasing physical activity more difficult than would be seen in freshman.

Conclusion

In conclusion, there was not a statistically significance difference in perceived barriers and benefits in the physical activity intervention compared to the control. Physical performance, a benefit subscale to physical activity, showed a trend toward significance (control = -0.07; intervention =0.13, p=0.07). There was a statistically

significant increase in fat-free mass in the intervention women (0.49 kg) compared to a decrease of fat-free mass in control (-2.5kg; $p=0.03$). College-age women may have already adopted sedentary behaviors that negatively influence their perception of physical activity. This could potentially lead to chronic disease and overweight/obesity. Our findings suggest that a physical activity intervention has the ability to positively influence body composition, by increasing fat-free mass. Increasing fat-free mass through physical activity is an important factor when a large portion of college students continue to be overweight and obese. The results of this study could influence further physical activity intervention programs in a college population, both female and male. Future studies should look to increase the duration and frequency of the physical activity intervention to promote changes in benefits and barriers. Incorporating larger sample sizes could also increase the power of future studies. Future studies should include both males and females to identify specific barriers and benefits to increase the likelihood of lifelong physical activity. Future studies could impact policy changes on college campuses to incorporate mandatory freshman physical activity courses that correspond with the design of the current study.

APPENDICES

**APPENDIX A
INTERVENTION GROUP INFORMED CONSENT**

**THE UNIVERSITY OF NORTH DAKOTA
CONSENT TO PARTICIPATE IN RESEARCH**

TITLE: The Influence of a Physical Activity Intervention on Barriers & Benefits in Women

PROJECT DIRECTOR: Kathryn Lundberg

PHONE #: 701-777-2663

DEPARTMENT: Kinesiology & Public Health Education

STATEMENT OF RESEARCH

A person who is to participate in the research must give his or her informed consent to such participation. This consent must be based on the understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

WHAT IS THE PURPOSE OF THIS STUDY?

You are invited to be in a research study about the effect of an organized exercise program on perceived benefits and barriers to exercise in women because you are taking Kinesiology 108M Beginning Conditioning Women's Conditioning or Kinesiology 108A Beginning Conditioning Aerobics.

The purpose of this research study is to see if an organized exercise program has an effect on perceived benefits and barriers to exercise in women. With your help, we are hoping

to address some of these key benefits and barriers and increase the likelihood for women to engage in the recommended amount of physical activity.

HOW MANY PEOPLE WILL PARTICIPATE?

Approximately 20 women will take part in this study at the University of North Dakota.

HOW LONG WILL I BE IN THIS STUDY?

Your participation in this study will last 7 weeks. You will need to come to Room 307F of the Hyslop Sports Center for each class session, which will last 50 or 75-minutes, depending on the class requirement.

WHAT WILL HAPPEN DURING THIS STUDY?

1. During the first session, you will complete brief questionnaire on the perceived benefits and barriers to exercise.
2. You will then be outfitted with an accelerometer to measure your physical activity levels.
3. You will also have your height, weight, hip/waist circumference, and body composition measured in a private setting by a trained researcher. Body composition will be measured using a very precise tool called a Bod Pod®, conducted at the UND Wellness Center during a designated appointment time.
4. You will then complete a 7-week exercise program including range of motion, resistance training, and cardiovascular training. This program will also include a learning component, to address key benefits and barriers to exercise.
5. At the end of the 7 weeks, you will again complete the questionnaire, have your body composition reevaluated, and wear the accelerometer to measure physical activity.

For all questionnaires, you are free to skip any questions that you would prefer not to answer.

WHAT ARE THE RISKS OF THE STUDY?

There is a chance that you may feel uncomfortable while having your height, weight, hip/waist circumference, or body composition measured. Also, you may experience dizziness or get tired while exercising, but you may stop participating in the exercise at any time without penalization.

WHAT ARE THE BENEFITS OF THE STUDY?

Not all participants will benefit from this study. We hope that you enjoy the exercise program and learn some new ways to enjoy exercise on your own. Results from this study will allow researchers to understand whether an organized exercise program improves enjoyment and likelihood to participate in exercise.

ALTERNATIVES TO PARTICIPATING IN THIS STUDY

You will not receive alternative assignments for credit. You may chose to forgo completion of questionnaires and all body measurements without penalization, but will only receive college credit for completing the 8-week exercise program. If you chose to not participate in the exercise program you will be asked to withdraw from the course.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

You will not have any costs for being in this research study.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for being in this research study. However, you will receive college credit for participating in the course.

WHO IS FUNDING THE STUDY?

The University of North Dakota and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research.

CONFIDENTIALITY

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. Your study record may be reviewed by Government agencies, the UND Research Development and Compliance office, and the University of North Dakota Institutional Review Board.

Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. All paperwork with your name will be torn off and replaced with a coded ID, which will be used for participant identification. All data will be stored in the researcher's locked office. Only the primary researcher, Kathryn Lundberg, and her mentor, Dr. Tanis Hastmann, will have access to the data. All data and consent forms will be kept in a locked office for 3 years and then shredded with a paper shredder.

If we write a report or article about this study, we will describe the study results in a summarized manner so that you cannot be identified.

IS THIS STUDY VOLUNTARY?

Your participation is voluntary. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota.

If you decided to leave the study early, we ask that you call or discuss your withdrawal with the primary researcher in person. You will need to follow University of North Dakota rules for withdrawing from a course. If you decide to completely withdraw from the course after the specified date, you will receive no college credit and a W on your transcript.

In the rare case that the researcher believes you are no longer physical able to complete the study because of deteriorating health you may be asked to withdraw from the study.

CONTACTS AND QUESTIONS?

The researcher conducting this study is Kathryn Lundberg, under the advising of Dr. Tanis Hastmann. You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact Kathryn Lundberg at 701-777-2663 or Dr. Tanis Hastmann at 701-777-2994.

If you have questions regarding your rights as a research subject, you may contact The University of North Dakota Institutional Review Board at 701-777-4279.

- You may also call this number about any problems, complaints, or concerns you have about this research study.
- You may also call if you cannot reach research staff, or you wish to talk with someone who is independent of the research team.

- General information about being a research subject can be found by clicking “Information for Research Participants” on the web site:
<http://und.edu/research/resources/human-subjects/research-participants.cfm>

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Subject Name: _____

Signature of Subject

Date

I have discussed the above points with the subject or, where appropriate, with the subject’s legal authorized representative.

Signature of Person Who Obtained Consent

Date

**APPENDIX B
CONTROL GROUP INFORMED CONSENT**

**THE UNIVERSITY OF NORTH DAKOTA
CONSENT TO PARTICIPATE IN RESEARCH**

TITLE: The Influence of a Physical Activity Intervention on Barriers & Benefits in Women

PROJECT DIRECTOR: Kathryn Lundberg

PHONE #: 701-777-2663

DEPARTMENT: Kinesiology & Public Health Education

STATEMENT OF RESEARCH

A person who is to participate in the research must give his or her informed consent to such participation. This consent must be based on the understanding of the nature and risks of the research. This document provides information that is important for this understanding. Research projects include only subjects who choose to take part. Please take your time in making your decision as to whether to participate. If you have questions at any time, please ask.

WHAT IS THE PURPOSE OF THIS STUDY?

You are invited to be in a research study about the effect of an organized exercise program on perceived benefits and barriers to exercise in women because you are taking PHE 101 Introduction to Public Health course.

The purpose of this research study is to see if an organized exercise program has an effect on perceived benefits and barriers to exercise in women. With your help, we are hoping to address some of these key benefits and barriers and increase the likelihood for women to engage in the recommended amount of physical activity.

HOW MANY PEOPLE WILL PARTICIPATE?

Approximately 20 women will take part in this study at the University of North Dakota.

HOW LONG WILL I BE IN THIS STUDY?

Your participation in this study will last 7 weeks. You will meet in UND Education Room 113 during your required course hours.

WHAT WILL HAPPEN DURING THIS STUDY?

1. During the first session, you will complete brief questionnaire on the perceived benefits and barriers to exercise.
2. You will then be outfitted with an accelerometer to measure your physical activity levels.
3. You will also have your height, weight, hip/waist circumference, and body composition measured in a private setting by a trained researcher. Body composition will be measured using a very precise tool called a Bod Pod®, conducted at the UND Wellness Center during a designated appointment time.
4. At the end of the 7 weeks, you will again complete the questionnaire, have your body composition reevaluated, and wear the accelerometer to measure physical activity.

For all questionnaires, you are free to skip any questions that you would prefer not to answer.

WHAT ARE THE RISKS OF THE STUDY?

There is a chance that you may feel uncomfortable while having your height, weight, hip/waist circumference, or body composition measured. You may stop participating in the study at any time without penalization.

WHAT ARE THE BENEFITS OF THE STUDY?

Not all participants will benefit from this study. Results from this study will allow researchers to understand whether an organized exercise program improves enjoyment and likelihood to participate in exercise.

ALTERNATIVES TO PARTICIPATING IN THIS STUDY

If you chose not to participate in this study, you may earn extra credit in your PHE 101 Intro to Public Health course in other ways. Please ask your instructor, who will provide you with comparable assignments that you may chose to complete.

WILL IT COST ME ANYTHING TO BE IN THIS STUDY?

You will not have any costs for being in this research study.

WILL I BE PAID FOR PARTICIPATING?

You will not be paid for being in this research study. You will, however, receive extra credit from your instructor.

WHO IS FUNDING THE STUDY?

The University of North Dakota and the research team are receiving no payments from other agencies, organizations, or companies to conduct this research.

CONFIDENTIALITY

The records of this study will be kept private to the extent permitted by law. In any report about this study that might be published, you will not be identified. Your study record may be reviewed by Government agencies, the UND Research Development and Compliance office, and the University of North Dakota Institutional Review Board.

Any information that is obtained in this study and that can be identified with you will remain confidential and will be disclosed only with your permission or as required by law. All paperwork with your name will be torn off and replaced with a coded ID, which will be used for participant identification. All data will be stored in the researcher's locked office. Only the primary researcher, Kathryn Lundberg, and her mentor, Dr. Tanis Hastmann, will have access to the data. All data and consent forms will be kept in a locked office for 3 years and then shredded with a paper shredder.

If we write a report or article about this study, we will describe the study results in a summarized manner so that you cannot be identified.

IS THIS STUDY VOLUNTARY?

Your participation is voluntary. You may choose not to participate or you may discontinue your participation at any time without penalty or loss of benefits to which you are otherwise entitled. Your decision whether or not to participate will not affect your current or future relations with the University of North Dakota.

If you decided to leave the study early, we ask that you call or discuss your withdrawal with the primary researcher in person.

In the rare case that the researcher believes you are no longer physical able to complete the study because of deteriorating health you may be asked to withdraw from the study.

CONTACTS AND QUESTIONS?

The researcher conducting this study is Kathryn Lundberg, under the advising of Dr. Tanis Hastmann. You may ask any questions you have now. If you later have questions, concerns, or complaints about the research please contact Kathryn Lundberg at 701-777-2663 or Dr. Tanis Hastmann at 701-777-2994.

If you have questions regarding your rights as a research subject, you may contact The University of North Dakota Institutional Review Board at 701-777-4279.

- You may also call this number about any problems, complaints, or concerns you have about this research study.
- You may also call if you cannot reach research staff, or you wish to talk with someone who is independent of the research team.
- General information about being a research subject can be found by clicking “Information for Research Participants” on the web site:
<http://und.edu/research/resources/human-subjects/research-participants.cfm>

Your signature indicates that this research study has been explained to you, that your questions have been answered, and that you agree to take part in this study. You will receive a copy of this form.

Subject Name: _____

Signature of Subject

Date

I have discussed the above points with the subject or, where appropriate, with the subject's legal authorized representative.

Signature of Person Who Obtained Consent

Date

APPENDIX C
RECRUITMENT FLIER

WOMEN ONLY

BIP Class offered for Fall 2014: KIN 108M

- What? This fitness class is geared towards building total body strength & cardiovascular endurance.
- When? Fall semester M/W/F 8:00-8:50 am (8 week course).
- Why? Fun fitness environment only for women! Learn the tools to maintain lifelong fitness.

NOT SURE WHAT TO DO
WITH YOUR WORKOUT?

SICK OF YOUR SAME
ROUTINE?



SIGN UP WITH A FRIEND & GET
IN SHAPE TOGETHER!

QUESTIONS? Please contact
class instructor:
kathryn.lundberg.
2@my.und.edu

Appendix D Physical Activity Readiness Questionnaire (PAR-Q)

Physical Activity Readiness
Questionnaire - PAR-Q
(revised 2002)

PAR-Q & YOU

(A Questionnaire for People Aged 15 to 69)

Regular physical activity is fun and healthy, and increasingly more people are starting to become more active every day. Being more active is very safe for most people. However, some people should check with their doctor before they start becoming much more physically active.

If you are planning to become much more physically active than you are now, start by answering the seven questions in the box below. If you are between the ages of 15 and 69, the PAR-Q will tell you if you should check with your doctor before you start. If you are over 69 years of age, and you are not used to being very active, check with your doctor.

Common sense is your best guide when you answer these questions. Please read the questions carefully and answer each one honestly: check YES or NO.

YES	NO	
<input type="checkbox"/>	<input type="checkbox"/>	1. Has your doctor ever said that you have a heart condition <u>and</u> that you should only do physical activity recommended by a doctor?
<input type="checkbox"/>	<input type="checkbox"/>	2. Do you feel pain in your chest when you do physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	3. In the past month, have you had chest pain when you were not doing physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	4. Do you lose your balance because of dizziness or do you ever lose consciousness?
<input type="checkbox"/>	<input type="checkbox"/>	5. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by a change in your physical activity?
<input type="checkbox"/>	<input type="checkbox"/>	6. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
<input type="checkbox"/>	<input type="checkbox"/>	7. Do you know of <u>any other reason</u> why you should not do physical activity?

**If
you
answered**

YES to one or more questions

Talk with your doctor by phone or in person BEFORE you start becoming much more physically active or BEFORE you have a fitness appraisal. Tell your doctor about the PAR-Q and which questions you answered YES.

- You may be able to do any activity you want — as long as you start slowly and build up gradually. Or, you may need to restrict your activities to those which are safe for you. Talk with your doctor about the kinds of activities you wish to participate in and follow his/her advice.
- Find out which community programs are safe and helpful for you.

NO to all questions

If you answered NO honestly to all PAR-Q questions, you can be reasonably sure that you can:

- start becoming much more physically active — begin slowly and build up gradually. This is the safest and easiest way to go.
- take part in a fitness appraisal — this is an excellent way to determine your basic fitness so that you can plan the best way for you to live actively. It is also highly recommended that you have your blood pressure evaluated. If your reading is over 144/94, talk with your doctor before you start becoming much more physically active.

DELAY BECOMING MUCH MORE ACTIVE:

- if you are not feeling well because of a temporary illness such as a cold or a fever — wait until you feel better; or
- if you are or may be pregnant — talk to your doctor before you start becoming more active.

PLEASE NOTE: If your health changes so that you then answer YES to any of the above questions, tell your fitness or health professional. Ask whether you should change your physical activity plan.

Informed Use of the PAR-Q: The Canadian Society for Exercise Physiology, Health Canada, and their agents assume no liability for persons who undertake physical activity, and if in doubt after completing this questionnaire, consult your doctor prior to physical activity.

No changes permitted. You are encouraged to photocopy the PAR-Q but only if you use the entire form.

NOTE: If the PAR-Q is being given to a person before he or she participates in a physical activity program or a fitness appraisal, this section may be used for legal or administrative purposes.

"I have read, understood and completed this questionnaire. Any questions I had were answered to my full satisfaction."

NAME _____

SIGNATURE _____

DATE _____

SIGNATURE OF PARENT
or GUARDIAN (for participants under the age of majority) _____

WITNESS _____

Note: This physical activity clearance is valid for a maximum of 12 months from the date it is completed and becomes invalid if your condition changes so that you would answer YES to any of the seven questions.



© Canadian Society for Exercise Physiology www.csep.ca/forms

Appendix E
Exercise Benefits and Barriers Scale Questionnaire

Participant Questionnaire

Participant Name: _____

Age: _____

This cover sheet will be torn off by the researchers so that your name will NOT be on the questionnaire.

INSTRUCTIONS:

Please read all of the instructions and questions carefully.

Do not put your name on any part of the questionnaire on the following pages.

Fill in the circle next to each question that indicates your best answer.

EXERCISE BENEFITS/BARRIERS SCALE

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

	Strongly Agree	Agree	Disagree	Strongly Disagree
1. I enjoy exercise	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
2. Exercise decreases feelings of stress and tension for me	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
3. Exercise improves my mental health.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
4. Exercising takes too much of my time.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
5. I will prevent heart attacks by exercising.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
6. Exercise tires me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
7. Exercise increases my muscle strength.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
8. Exercise gives me a sense of personal accomplishment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
9. Places for me to exercise are too far away.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
10. Exercising makes me feel relaxed.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
11. Exercising lets me have contact with friends and persons I enjoy.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
12. I am too embarrassed to exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
13. Exercising will keep me from having high blood pressure.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

14. It costs too much to exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
15. Exercising increases my level of physical fitness.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
16. Exercise facilities do not have convenient schedules for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
17. My muscle tone is improved with exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
18. Exercising improves functioning of my cardiovascular system.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
19. I am fatigued by exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
20. I have improved feelings of well being from exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
21. My spouse (or significant other) does not encourage exercising.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
22. Exercise increases my stamina.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
23. Exercise improves my flexibility.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
24. Exercise takes too much time from family relationships.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
25. My disposition is improved with exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
26. Exercising helps me sleep better at night.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
27. I will live longer if I exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
28. I think people in exercise clothes look funny.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

29. Exercise helps me decrease fatigue.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
30. Exercising is a good way for me to meet new people.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
31. My physical endurance is improved by exercising.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
32. Exercising improves my self-concept.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
33. My family members do not encourage me to exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
34. Exercising increases my mental alertness.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
35. Exercise allows me to carry out normal activities without becoming tired.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
36. Exercise improves the quality of my work.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
37. Exercise takes too much time from my family responsibilities.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
38. Exercise is good entertainment for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
39. Exercising increases my acceptance by others.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
40. Exercise is hard work for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
41. Exercise improves overall body functioning for me.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
42. There are too few places for me to exercise.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**43. Exercise improves the way my
body looks.**

Appendix F
Bod Pod® Data Collection Form

BOD POD® DATA COLLECTION
COVER SHEET

PARTICIPANT NAME: _____

This cover sheet will be torn off by the researchers so that your name will NOT be on the data sheet.

Instructions:

- Refrain from eating, drinking, exercising 3 hours prior to test
- Use restroom before testing
- Remove jewelry (if possible)
- Wear minimal, form-fitted clothing
 - Spandex swimsuit OR compression shorts and sports bra (no wire or padding)
- A swim cap will be provided

PARTICIPANT BOD POD® DATA COLLECTION SHEET

- Will receive a print out from the Bod Pod® with the appropriate data

Appendix G
Body Composition Data Collection Form

PARTICIPANT DATA COLLECTION
COVER SHEET

PARTICIPANT NAME: _____

This cover sheet will be torn off by the researchers so that your name will NOT be on the data sheet.

PARICIPANT BODY COMPOSITION DATA SHEET

Participant ID: _____

Date of Birth: _____ Date of Collection: _____

Left Handed or Right Handed

Weight (in kilograms to 0.1 kg):

- 1.) _____ kg
- 2.) _____ kg
- 3.) _____ kg

Height (in centimeters to 0.1 mm):

- 1.) _____ cm
- 2.) _____ cm
- 3.) _____ cm

Hip Circumference (in centimeters to 0.1 mm):

- 1.) _____ cm
- 2.) _____ cm
- 3.) _____ cm

Waist Circumference (in centimeters to 0.1 mm):

- 1.) _____ cm
- 2.) _____ cm
- 3.) _____ cm

Appendix H

Physical Activity Intervention Outline

The study's physical activity intervention is developed based on the theory of the Health Belief Model. This theory is based on six constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self efficacy. For this study, the most important constructs are the role of perceived benefits vs. perceived barriers. The benefits minus the barriers provide the path of action. Researchers will need to reduce barriers so that the women will take the recommended action to engage in regular exercise. This can be done through reassurance, correcting misperceptions, and giving incentive.

The study will examine 3 perceived barriers and 3 perceived benefits to physical activity over the 7-week intervention. Each week the researcher will highlight one barrier or benefit. There will be a learning component to each session that will take place during the first part of class. During this time, the researcher will discuss the topic. If it is a barrier they will work to limit it and if it is a benefit they will work to promote its importance. The learning component included research & educational handouts for the women to read and visualize the importance of the topics, as well as, have something they can revisit when the course is over. The hope of this approach was to serve as an educational tool to the women so that they understood the importance of reversing inactivity as a major health risk. We also hoped that this approach increased benefits to

physical activity and decreased the barriers in a way that the women would enjoy
physical activity and continue to engage in it after the conclusion of the intervention.

Physical Activity Intervention Protocol (cont.)

Week 1: Pre-testing: Anthropometric measurements, consent forms, surveys, accelerometers

Week 2: Location

- Tuesday: Gym Location: Barrier
 - What are some reasons for not working out?
 - Why do you not go to the gym?
 - Do you think the gym is too far away?
 - Do you know alternatives to getting physical activity in, besides going to the gym?
 - Do you use them?
 - Do you know of trails/bike paths on campus or in the community?
 - Greenway & UND trails maps
 - PARK WORKOUT (sheet attached)
- Thursday: Gym Location: Barrier (cont.)
 - Recall any alternatives for not getting to the gym?
 - Do you know how to set up your own workout?
 - Designed a workout as a class based on “At home workout brochure” provided
 - Discussed alternative calorie burning activities “12 ways to burn 500 calories” (sheet attached)
 - Completed a 3 day activity recall of when they wore the accelerometer

Week 3: Social Cohesion

- Tuesday: Partner Exercise: Benefit
 - Do you enjoy working out alone or with a friend?
 - How can partner exercise be beneficial?
 - Provides support, accountability, & structure
 - Exercise adherence: being accountable to a friend
 - Handed out 2 articles: “Don’t Go Alone-The Benefits of Group Exercise” and “ACSM Benefits of Group Exercise” to read and discuss next class
 - Completed Partner Workout (sheet attached)
- Thursday: Group Exercise: Benefit
 - Briefly discussed Tuesday’s class
 - Talked about 2 assigned articles

- Do you enjoy group exercise?
- Why is group fitness beneficial?
 - Motivation
 - Socialization
 - Commitment
 - Advice
 - Different experience levels
 - Technique & safety
 - Diet, exercise, and injury tips
- Examples of why group exercise or partner workouts are important
- Address that solo workouts are still good & have benefit
- Group workout (sheet attached)
 - Split the class into 2 groups
 - Had come up with a plan to complete all the exercises as quickly as possible
 - 1 group split everything equally and worked together
 - 2nd group split things un-evenly and did them at their own pace, but still helped each other when needed
 - Group who worked together completed workout first
 - We discussed this, and they said they felt like they needed to push themselves and work harder because the other team members were counting on them. Easier to complete when working together as a team. This helped readdress the benefit to partner or group collaboration and motivation

Week 4: Time

- Tuesday: No time: Barrier
 - Discuss why we have time constraints to working out
 - Need to lead balanced lifestyle
 - Can't only study & work, need to for ourselves and to relax, exercise
 - Exercise can recharge your brain to improve cognitive functioning at school
 - Living healthy-staying active
 - Don't need to just go to the gym
 - Incorporating PA into daily life is much more beneficial than just the gym
 - Tabata Workout (sheet attached)
 - Talked about how to design own Tabata workouts

- Short: 16 minute workout but still affective
- Thursday: No time (cont.): Barrier
 - Readdress topics from Tuesday
 - Talk about time management
 - Completed weekly time budget sheet (attached) to see where they are spending the most time or wasting time
 - Talked about scheduling your workout so you are more accountable to yourself
 - Making workouts enjoyable so you don't feel like exercise is a chore
 - More likely to schedule it
 - Walking/running the dog, playing at the park, active sports
 - 20-minute HIIT workout (attached)
 - Benefits of high intensity interval training

Week 5: Physical Performance

- Tuesday: Aerobic Training: Benefit
 - Do you know what aerobic exercise is?
 - Cardiovascular? (Knew what cardio was but not aerobic training)
 - What are some health benefits to cardio?
 - Heart & lung health, decrease diseases, obesity/overweight
 - What are ACSM's guidelines for cardiovascular physical activity?
 - 150 moderate/week, 75 vigorous/week
 - Look over "Aerobic Exercise" article (attached)
 - Aerobic Workout (sheet attached)
- Thursday: Resistance Training: Benefit
 - What do you know about resistance training?
 - What intimidates you about it/the weight room?
 - Do you use the weight floor on campus?
 - Typically what is your workout?
 - Free weights vs. machines
 - Show them circuit deck
 - Talk about programming
 - Endurance vs. strength vs. power
 - How many sets/reps

- When to increase weight
 - Resistance Training workout (sheet attached)
- F.I.I.T. Principle (attached 2 sheets)
- “4 myths of strength training” (sheet attached)

Week 6: Physically Exhaustion/Lifelong Skill

- Tuesday: Exercise makes me exhausted: Barrier
 - Understanding the difference between pain & working hard
 - Do they know the differences?
 - Muscle soreness or muscle strain (sheet attached)
 - Overtraining issues
 - Do know what overtraining is?
 - Information on overtraining (sheet attached)
 - Working out different heart rate zones
 - Know resting heart rate?
 - Max heart rate?
 - Why is it important to know or workout in different zones?
 - Calculate max HR
 - $220 - \text{age} = \text{max HR}$
 - Go over heart rate zones (attached sheet)
 - 60-70% (light), 70-80% (moderate), 80-90% (heavy)
 - Wear heart rate monitor during entire workout
 - Record resting HR, HR during warm-up, moderate/heavy exercise, and during cool-down
 - Talk about how they felt during each segment
 - Taught how to palpate heart rate in neck or wrist when there is not heart rate monitor available
 - Workout (sheet attached)
- Thursday: Balancing cardio/resistance/range of motion training: Benefit
 - Ask to write down current exercise plan
 - Make a new plan for a week/month
 - What are some things you learned about exercise you didn't know before?
 - Make 5 short-term and long-term fitness goals
 - S.M.A.R.T. training information (sheet attached)
 - Final Workout (sheet attached)

Week 7: Post-testing: Anthropometric measurements, consent forms, surveys, accelerometers

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