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Examining the Efficacy of a Facebook-Mediated Intervention to Increase Steps per Day in College Freshmen

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EXAMINING THE EFFICACY OF A FACEBOOK-MEDIATED INTERVENTION TO INCREASE STEPS PER DAY IN COLLEGE FRESHMEN

by

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ABSTRACT
EXAMINING THE EFFICACY OF A FACEBOOK-MEDIATED INTERVENTION TO INCREASE STEPS PER DAY IN COLLEGE FRESHMENT

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During the transition from high school to college, physical activity levels tend to decrease. Given the numerous benefits of regular physical activity, it is essential to encourage college students to develop the habit of being regularly active. The internet is one tool that has been used to deliver physical activity interventions to this population but is hindered by low participant engagement and high monetary cost of development. Social media is an internet entity that can be used to deliver a physical activity intervention that facilitates higher participant engagement and reduces cost. The purpose of this study was to compare the efficacy of an intervention using social media to increase physical activity to an intervention that does not utilize social media in a sample of female college freshmen. Fifty-three insufficiently active female freshmen completed this 8-week, randomized pre-post intervention. Physical activity was measured using steps/day gleaned from a pedometer. Participants were randomized to one of two intervention arms: a walking intervention (WI) group and a walking intervention + Facebook (WI+FB) group. Participants in the WI group (n=26) received educational information on physical activity, a pedometer, step goals, logs to track steps/day, and weekly contact (email) from an intervention leader. Participants in the WI+FB group

(n=27) received this same intervention; however, instead of weekly emails, these participants received weekly messages through Facebook. In addition, these participants were enrolled in a Facebook group with seven other participants where they were asked to post information about their steps/day and provide feedback to one another. A mixed effects ANOVA was used to analyze change in steps/day and if this change was different between groups. Results demonstrated that women in both intervention arms significantly increased steps/day ($p < .05$). However, women in the WI+FB group increased physical activity by 7,293 steps/day, a significantly greater increase ($p < .05$) than the increase among women in the WI group (4,422 steps/day). These results demonstrate the large potential of a physical activity intervention using social media. Women enrolled in this intervention increased walking by approximately 3.5 miles/day which, if maintained, will have a pronounced impact on their future health.

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CHAPTER I: INTRODUCTION

Background

Physical activity has numerous health benefits that include but are not limited to a reduced risk of cardiovascular disease, type 2 diabetes, hypertension, dyslipidemia, depression, and some cancers (Powell, Paluch, & Blair, 2011). Despite these benefits and the overall promotion of regular physical activity by government, private agencies, and research teams, approximately 25% of adults in the U.S. engage in no moderate or vigorous physical activity (Centers for Disease Control and Prevention, CDC, 2012). A particular life transition when adults begin to decrease physical activity is the shift from high school to college (Wengreen & Moncur, 2009). Additionally, a large percentage of inactive college students continue to be inactive after graduation (Calfas, Sallis, Lovato, & Campbell, 1996). Researchers have implemented numerous intervention strategies to promote increases in physical activity among college students including goal-setting, self-regulation of progress toward these goals, regular contact with participants from an intervention leader, educational components, and social support. Recently, researchers have turned to the internet as a means of delivering such interventions given the benefit internet-based interventions provide to reach a large number of people at any time and place (Eiben & Lissner, 2006; Greene et al., 2012; Grim, Hortz, & Petosa, 2011; Magoc et al., 2011; Wadsworth & Hallam, 2010). Within these studies, authors did find significant changes in physical activity behavior among college students; however, the degree of change varied. Despite the benefit of using the internet to deliver a physical activity intervention and the success those interventions have found to increase physical

activity, there remain some limitations such as keeping participants engaged (logging into the site and using intervention materials), developing an active online social support network, and the monetary cost of website development and maintenance (Lewis, Williams, Neighbors, Jakicic, & Marcus, 2008). To ameliorate these limitations, researchers recently have examined the use of a social media websites such as Facebook as a means of delivering a physical activity intervention because social media sites do not require development and maintenance, are visited daily by members, and provide a dynamic, online social support network.

Social media is an internet entity designed to keep friends connected. These websites offer the potential to implement the benefits of internet-based physical activity interventions (i.e. widespread use, accessibility at any time and place, and online social networks) while addressing limitations of these types of interventions (participant engagement and cost). Facebook is currently the most popular social media site. Behind Google.com, Facebook is the second most visited website in the world (Alexia, 2010) and now has over 1 billion users (Internet World Stats, n.d.), over half of whom are mobile users (have access on their smart phones, tablets, or other mobile device). Individuals who use Facebook visit the site very regularly. The average Facebook user creates 90 new pieces of content per month, indicating that the average user logs into the site at least three times per day (Lukes, 2010). This login rate is seven times more often than the average number of logins found in internet-based physical activity interventions (Davies et al., 2012). Therefore, by delivering a physical activity intervention through social media (e.g., Facebook), researchers may be able to increase participant engagement given that users already visit the site regularly. In addition, social media websites such as

Facebook provide an active online social network. Individuals who are friends on the site or are part of the same group within the site can comment on each other's information in addition to posting their own. Finally, the fact that Facebook is already in existence also decreases the monetary cost of website development and maintenance. Given the potential benefits of using social media websites like Facebook, these types of websites may serve as an effective medium to deliver a physical activity intervention. Authors have recently begun to explore this option. However, there is very limited research examining the use of social media to deliver a physical activity intervention with just one study currently published (Cavallo et al., 2012). Thus, there remains a need to examine if a physical activity intervention using social media is effective to increase physical activity.

Research Question

Is a physical activity intervention using social media effective to increase physical activity behavior in female college freshmen?

Statement of Purpose

The primary purpose of this study was to compare the efficacy of an intervention using social media to increase physical activity to an intervention that does not utilize social media in a sample of female college freshmen. The secondary purpose of this investigation was to compare the efficacy an intervention using social media to improve psychosocial variables including stage of change, social support, decisional balance and

self-efficacy related to physical activity to an intervention that does not utilize social media in a sample of female college freshmen.

Specific Aims

To address these purposes, the following aims were developed to compared the efficacy of an 8-week physical activity intervention using social media and one not utilizing social media to:

(1) Increase steps/day between baseline and the final week (week 8) in female freshmen.

Hypothesis 1: Female freshmen enrolled in an 8-week physical activity intervention using social media will increase steps/day significantly more than female freshmen receiving the same intervention delivered through e-mail.

(2) Increase motivation to change physical activity, increase perceived benefits and decrease perceived drawbacks of physical activity, increase perceived social support to be physically active, and increase self-efficacy to be physically active between baseline and the final week (week 8) in female freshmen

Hypothesis 2-5: Female freshmen enrolled in an 8-week physical activity intervention using social media will increase motivation to change physical activity, increase perceived benefits of physical activity, decrease perceived drawbacks of physical activity, and increase perceived social support and self-efficacy to be physically active significantly more than female freshmen receiving a physical activity intervention delivered through e-mail.

Limitations & Delimitations

Because this study included a sample of female freshman living in dormitories who use Facebook, results can only be generalized to this population. However, this population was selected based on their heavy use of Facebook as well as overall low levels of physical activity. This study was limited to freshmen living in dormitories to control for variations in the lifestyle of students in different grade levels and different living situations (e.g. on-campus versus off-campus living). This study was also limited to female students given that the relationship between social support and physical activity differs between men and women (King et al., 1992; Troped & Saunders, 1998). Additionally, physical activity can be accumulated in numerous forms, and this study included an analysis of steps/day. Thus, results from this study are only comparable to other studies using this method of assessing physical activity. Finally, this study included the use of Facebook, the most popular social media website. However, it should be noted that Facebook may not exist in the future; albeit, social media websites will likely remain a part of society.

Assumptions

Assumptions were made when conducting this study. Specifically, it was assumed that all participants provided honest information regarding their steps/day as well as honest responses to questions surrounding motivation to change physical activity, perceived benefits and drawbacks of physical activity, and perceived social support and self-efficacy for physical activity.

Significance

Scientific

Although the internet provides a unique way to deliver physical activity interventions to a large number of individuals, there are numerous drawbacks to internet-based physical activity interventions. These drawbacks include low levels of participant engagement (frequency of site visits and intervention usage), issues maintaining an active online social network, and high monetary costs of intervention website development and maintenance (Davies et al., 2012; Lewis et al., 2008). Facebook offers an option for delivering physical activity interventions allowing researchers to potentially improve the efficacy of internet-based physical activity interventions by addressing the limitations of these interventions. To date, the authors are aware of only one published study examining the impact of an intervention using social media to increase physical activity in college women (Cavallo et al., 2012). Cavalo et al. (2012) found an intervention using social media and self-regulation of physical activity to be no more or less effective than an education-only intervention. However, this study leaves a number of gaps. The current study built on this research by addressing these gaps. Specifically, this study provides data on the specific impact of using social media to facilitate social support for physical activity from peers and an intervention leader on a valid and reliable measure of physical activity. This intervention separated the effect of social media from effects of self-regulation of physical activity. Also, educational information surrounding physical activity was incorporated into the social media site (Facebook) rather than requiring participants to visit a separate website. Given the success of this intervention above and beyond an intervention using goal-setting, self-monitoring, educational information, and

regular contact, future researchers can test this type of intervention on larger, more diverse populations.

Practical

Physical activity has numerous benefits. However, a large percentage of college students are not accumulating enough physical activity to reap these benefits. Because these individuals will likely carry health behaviors into adulthood, interventions are needed to promote increases in physical activity for inactive college students. This type of physical activity intervention using social media can reach an enormous number of individuals on a regular basis, providing them with a dynamic, online social support network, without the added cost of creating an individual website. Because social media websites like Facebook are used heavily, especially among younger populations, interventions using social media may also have the potential to promote increases in physical activity not only in young adults but also in children and adolescents.

To provide an adequate background in support of the importance of the present study, a review of the pertinent literature has been conducted. This review is presented in the following chapter.

CHAPTER II: LITERATURE REVIEW

Physical Activity and Health

Regular physical activity, defined as bodily movement raising energy expenditure above a resting level (Casperson et al., 1985), has numerous health benefits (Powell et al., 2011). These benefits include a reduction in risk of hypertension, coronary heart disease, stroke, type 2 diabetes, breast and colon cancer, and depression. In addition, regular physical activity can improve functional ability and bone health as well as aid in weight control. The importance of physical activity is so well-recognized that a lack of physical activity (physical inactivity) is now viewed as the fourth leading risk factor for global mortality. According to estimates, 3.2 million deaths each year are attributable to physical inactivity (World Health Organization, WHO, 2010). Pertaining to the U.S., recent investigation estimates that physical inactivity causes 6.7% of the burden of disease from coronary heart disease, 8.3% from type 2 diabetes, as well as 12.4% and 12.0% from breast and colon cancer, respectively (Lee et al., 2012). Given the many consequences of inactivity and the health benefits of regular physical activity, it is important for individuals to accumulate enough physical activity to reap these benefits.

To obtain the benefits of regular physical activity, research has demonstrated that individuals should accumulate a minimum of 150 minutes of moderate-intensity physical activity or 75 minutes of vigorous-intensity physical activity each week (U.S. Department of Health and Human Services, USDHH, 1996). These recommendations can be met through a variety of modes of activity, the most common of which is walking. Accumulating 30 minutes of walking at a moderate pace, one that elevates heart rate to at

least 50% of maximal heart rate, on five days of the week would allow individuals to reach current physical activity recommendations. However, prevalence data on physical activity demonstrate that a large percentage of the population is not reaching these recommendations.

Prevalence of Meeting Physical Activity Recommendations

It is estimated that 30% of the world population and nearly half of the U.S. population are not reaching recommended levels of physical activity (WHO, 2010). Children tend to have higher levels of physical activity than adults, and a key point during the lifespan when many individuals experience significant decreases in physical activity behavior is the transition from high school to college (Wengreen & Moncur, 2009). On average, 40 - 50% of college students do not meet current physical activity recommendations, with activity levels being the highest during freshman year and decreasing throughout college (Leslie, Fotheringham, Veitch, & Owen, 2000; Stone, Strikwerda-Brown, & Gregg, 2002; Wallace, Buckworth, Kirby, & Sherman, 2000). For instance, in a study of 159 college freshmen, Wengreen & Moncur (2009) found that the percentage of students who reported participating in vigorous physical activity on most days of the week went from 44.7% upon entering college to only 21.4% after the first semester of college. Decreases in physical activity during this major life transition may have a life-long impact given that young adults create new habits that will likely prevail into adulthood (Lenz, 2001).

College students do tend to retain their physical activity habits into adulthood (Calfas et al., 1996). In a longitudinal study of college seniors, Calfas et al. (1996) found

that 85% of individuals who exercised regularly as seniors in college remained physically active five years after graduating. Additionally, 81% of individuals who were inactive as seniors in college were also inactive five years after graduating. Given these data, researchers have recognized the need to find ways to promote increases in physical activity among college students. Without intervention, inactive young adults will likely continue to be inactive through their adult life and risk incurring the many health detriments related to physical inactivity (Lee et al., 2012). By examining previous research on physical activity interventions in college students, one can determine the factors resulting in the greatest increases in physical activity for this population as well as the gaps in the literature that warrant future study.

Effective Elements of Physical Activity Interventions

Several interventions have been successful in increasing physical activity among college students. The elements included in these interventions can shed light on the strategies that should be employed in future studies. Key elements that appear to be related to intervention success include goal-setting (Martens, Buscemi, Smith, & Murphy, 2012), self-regulation of progress toward these goals (Wadsworth & Hallam, 2010), regular contact with participants (Eiben & Lissner, 2006), educational components (Eiben & Lissner, 2006; Greene et al., 2012; Magoc, Tomaka, & Bridges-Arzaga, 2011; Martens et al., 2012; Wadsworth & Hallam, 2010), and social support (Buckworth, 2001; Leslie, Owen, Salmon, Bauman, & Sallis, 1999).

Goal-Setting

Goal-setting is the act of establishing specific, measurable, time-sensitive goals and is a common practice within physical activity literature (Davies et al., 2012). Goals for physical activity can be individually-tailored (e.g. increasing steps/day by 10% of the previous week) or general (e.g. accumulating 10,000 steps/day) and typically focus on the duration and/or frequency of a specific type of activity. Goal-setting has been established as an important component of successful physical activity interventions in college students (Martens et al., 2012). Among a group of 70 college students, those students randomized to receive a physical activity intervention were able to meet with intervention leaders to set individually-tailored goals pertaining to both moderate and vigorous physical activity. Compared to students just receiving educational materials surrounding physical activity, participants in the goals-setting intervention attained a 5-fold increase in vigorous physical activity, from 12 to 60 minutes per week. Thus, participants in this intervention were much closer to reaching the recommended amount of physical activity (75 minutes per week of vigorous physical activity; USDHH, 1996) at the end of the intervention than they were at the beginning. These findings demonstrate that future interventions should include goal setting as a strategy to increase physical activity.

Self-Regulation

Self-regulation is the process of evaluating one's own behavior, and according to theory, is essential for an individual to implement changes to a health behavior (Kanfer, 1970). Prior research has demonstrated that self-regulation is a modifiable factor related to increases in physical activity in adults (Müller-Riemenschneider, Reinhold, Nocon, &

Willich, 2008). Research indicates that self-regulation is also related to physical activity among college women (Wadsworth & Hallam, 2010). In a sample of 91 college women, researchers employed a 6-week intervention that included web-based information on the Social Cognitive Theory: self-regulation, self-efficacy, and outcome expectancy (Wadsworth & Hollom, 2010). Change in these psychosocial variables was measured before and after the intervention along with self-reported frequency of moderate physical activity. On average, participants increased the number of days they completed 30 minutes or more of moderate physical activity form 2.3 days per week to 3.1 days per week. However, the only Social Cognitive Theory variable that significantly predicted change in physical activity was self-regulation, predicting 26.4% of the variance. Thus, it appears that self-regulation is an important component of physical activity interventions.

Self-regulation of physical activity can be done through a variety of methods: diaries, logs, mobile devices, GPS, and physical activity monitors including pedometers. Pedometers, in particular, have been shown to be a popular and effective tool for self-regulation of physical activity (Bravata et al., 2007; Jackson & Howton, 2008; Richardson et al., 2008). The effectiveness of pedometers is due to the immediate, objective, quantitative feedback it provides to the individual. In general, research on the use of pedometers to self-regulate physical activity in interventions targeting adults has been positive (Bravata et al., 2007; Richardson et al., 2008; Tully & Cupples, 2011). A recent intervention in 326 college students, including the use of pedometers for self-regulation of physical activity, resulted in significant increases in physical activity (Jackson & Howton, 2008). Within this 12-week intervention, students monitoring their activity with pedometers increased average steps/day from just over 7,000 at baseline to

nearly 10,000 steps/day at the end of the intervention (Jackson & Howton, 2008). Finally, Tully & Cupples (2011) enrolled eight college students in an intervention where they wore a pedometer and tracked daily steps in a log. These women significantly increased physical activity from 8,824 to 12,636 steps/day. Based on these findings, it is evident that self-regulation is a key component of physical activity interventions in college students, and pedometers are an effective means for college students to employ self-regulation strategies.

Regular Contact from Intervention Leaders

Research on individuals across the lifespan indicates that regular contact from an intervention leader during physical activity interventions is strongly related to the success of the intervention (Vandelanotte, Spathonis, Eakin, & Owen, 2007). Contact can be in the form of in-person meetings, telephone calls, e-mails, or other forms of online communication (website modules, chat sessions, or guidance from an online intervention leader). An examination of the literature indicates that having more than five contacts with participants during an intervention is related to higher levels of success within physical activity interventions. Specifically, among interventions with five or fewer contacts occurring over four to 10 weeks (Hagerman, Walker, & Pullen, 2005; Kosma, Cardinal, & McCubbin, 2005; Leslie, Marshall, Owen, & Bauman, 2005; McKay, King, Eakin, Seeley, & Glasgow, 2001; Woolf et al., 2006), only one intervention resulted in significant increases in physical activity. On the contrary, among interventions ranging from eight weeks to six months that included more than five contacts, 78% had a positive impact on physical activity with the average increase reaching approximately 30 minutes

of moderate physical activity per week (Glasgow, Boles, McKay, Feil, & Barrere, 2003; Harvey-Berino et al., 2002; Harvey-Berino, Pintauro, Buzzell, & Gold, 2004; Napolitano et al., 2003; Plotnikoff, McCargar, Wilson, & Loucaides, 2005; Rovniak, Hovell, Wojcik, Winnett, & Martinez-Donate, 2005; Spittaels, De Bourdeaudhuji, Brug, & Vandelanotte, 2007; Tate, Wing, & Winnet, 2001; Tate, Jackvoney, & Wing, 2003). Adding to this evidence, Schneider, van Osch, Schulz, Kremers, & de Vries (2012) found that adults (n=1,790) receiving e-mail reminders within a physical activity intervention were 29 times as likely to complete the intervention compared to the participants (n=1,658) not receiving e-mail reminders. Taken together, it is clear that regular contact is a pivotal component of physical activity interventions in adults and should be incorporated into future studies.

Regular contact with participants also appears to be a potential key component among physical activity interventions targeting college students. Eiben & Lissner (2006) analyzed the efficacy of a 12-month randomized-controlled trial among 40 college women (18-29 years old) that included the use of educational information on physical activity as well as continuous (number of contacts not specified) contact including telephone, e-mail, group sessions, special interest lectures, and 'booster' visits with dietitians from the intervention leaders. Results demonstrated that individuals enrolled in the physical activity intervention increased energy expenditure through physical activity by 1,464 kcals per week (Eiben & Lissner, 2006) while individuals randomized to the control condition (delayed intervention) increased energy expenditure by only 200 kcals per week. However, because the effect of regular contact and educational components were not analyzed separately, it cannot be determined if one component is more

important than the other. Findings from prior studies among adults demonstrate the importance of regular contact, and this importance may also be extended to interventions in college students.

Educational Components

Educational components within physical activity interventions include one or more of the following: information on the benefits of physical activity, the amount of physical activity required to accrue these benefits, tips on ways to increase physical activity, types of physical activity to do, and locations that promote physical activity. Educational components can be delivered in a variety of ways including face-to-face meetings, mailings, e-mails, telephone calls, text messages, and posts to an internet discussion board. Like goal-setting, self-regulation, and regular contact with participants, educational components appear to be positively related to the success of physical activity interventions (Davies et al., 2012). Five recent interventions that showed success in increasing physical activity in college students included educational components (Eiben & Lissner, 2006; Greene et al., 2012; Magoc et al., 2011; Martens et al., 2012; Wadsworth & Hallam, 2010). Although the majority of these interventions combined educational components with other intervention tools, Green et al., (2012) employed a 12-week intervention specifically focusing on educational strategies. These authors delivered an intervention promoting increases in physical activity to 1,689 college students that included 10 online lessons covering healthy eating and physical activity. On average, students taking part in the intervention increased physical activity by 270 metabolic equivalent minutes per week. This increase in activity would be equivalent to

a 67.5 minute per week increase in moderate physical activity (at 4 metabolic equivalents) which would move these students closer to reaching physical activity recommendations depending on their initial physical activity level. Given these findings, future physical activity interventions may benefit from the inclusion of educational components.

Social Support

Social support is the support one feels from others (e.g. family, friends, peers) and is a well-established correlate of physical activity in adults (Ståhl et al., 2001; Trost, Owen, Bauman, Sallis & Brown, 2002) as well as specifically among college students (Buckworth, 2001; Leslie et al., 1999). In a study including 3,342 adults from six different countries, Ståhl et al. (2001) examined predictors of physical activity behavior. These authors found that the strongest, independent predictor of physical activity was perceived social support. Individuals who perceived social support of physical activity to be low were twice as likely to be sedentary compared to individuals how perceived their social support for physical activity to be high.

When focusing on college students, the same relationship is present. In a study examining predictors of physical inactivity in 2,729 college students, 47% of female students and 32% of male students were insufficiently active. Social support from both family and friends was a significant, independent predictor of insufficient activity among these students (Leslie et al., 1999). In a separate investigation of college students and social support, Buckworth (2001) found that perceived social support from family and friends was significantly different depending on the students' readiness to change

physical activity. For example, students who were regularly active had higher levels of perceived social support compared to individuals who were thinking of making a change or actively starting to make a change.

In addition to the relationship between social support and physical activity, social support networks appear to positively impact adherence to physical activity intervention (Richardson et al., 2010). Richardson et al. (2010) compared adherence among 324 adults enrolled in an intervention that included an online community where participants received feedback from other participants including encouragement, empathy, and useful information to adults enrolled in an intervention without an online community. Over the 16-week interventions, 79% of participants completed the intervention with an online community while only 66% of participants completed the intervention lacking an online community. Given these findings and the established relationship between social support and physical activity, it is evident that social support networks are key components within physical activity interventions.

Transtheoretical Model of Behavior Change

Research indicates that it is beneficial to incorporate theories of behavior change when designing and implementing an intervention to promote changes in health behavior (Rhodes & Nigg, 2011). In addition, more extensive application of theoretical constructs may be related to larger effects on physical activity (Webb, Joseph, Yardley, & Michie, 2010). Two commonly employed theories in interventions promoting increases in physical activity are the Transtheoretical Model of Behavior Change and the Social Cognitive Theory (Marcus et al., 2006). Despite similar rates of effectiveness among

interventions applying these two theories, the Transtheoretical Model of Behavior Change has a stronger body of literature validating its use within physical activity interventions (Rhodes & Nigg, 2011).

The Transtheoretical Model of Behavior Change is a classic theory of health behavior change (Prochaska & DiClemente, 1982). This model was originally developed around the behavior of smoking but has since been extended to numerous additional health behaviors including physical activity. There are four constructs included in this theory that can be applied to physical activity: stages of change, processes of change, decisional balance, and self-efficacy.

Stages of Change

According to this model, individuals progress through five stages as they change a behavior: pre-contemplation, contemplation, preparation, action, and maintenance. Pre-contemplation is a stage where an individual is not considering making a change to his or her behavior. This may be due to the fact that he or she has no desire to change, or he or she may not see a need to change. When considering physical activity, this would include individuals who are currently not thinking about increasing their physical activity behavior, perhaps because they do not know the benefits of physical activity, they currently do not have motivation to change, or they wrongly perceive that they are currently meeting physical activity recommendations. Contemplation is the second stage within this model and is the stage where individuals are considering making a change to their behavior but are not yet fully committed. For physical activity, this could be an individual who knows that he or she is not meeting physical activity recommendations, is

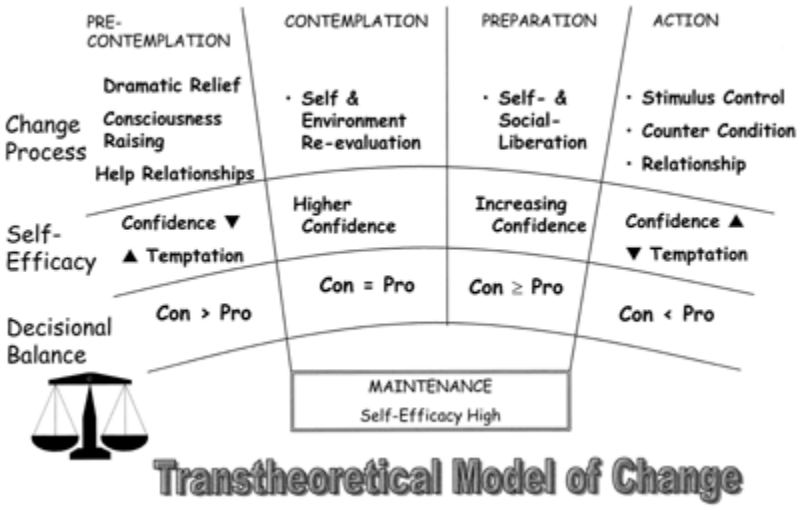
considering increasing activity, but is not yet fully committed to this change. Preparation is the third stage of this model where individuals are committed to making a change to a particular behavior and are preparing to do so within the next month. Regarding physical activity, an example of a person in the preparation stage would be someone who is currently planning a physical activity regimen. Action, the fourth stage in this model, is the stage where individuals are actively making changes to their respective behavior. Pertaining to physical activity, this could be someone who is currently attempting to accumulate 150 minutes of moderate physical activity per week (the recommended amount needed for health benefits; USDHH, 1996). The final stage is maintenance. This stage is one where individuals have maintained their current behavior for at least six months. An individual in this stage for physical activity would be someone who has been meeting physical activity recommendations for at least six months. The use of these five stages of change allows researchers a better understanding of levels of motivation to change health behaviors such as physical activity level.

Previous research has been conducted examining stage of change prevalence in college students (Braithwaite, McDaniel, & Reed, 2003; Dannecker, Hausenblas, Connaughton, & Lovins, 2003; Wallace & Buckworth, 2003). Overall, 10 to 15% of college students reported being in pre-contemplation, 25 to 30% of students were in contemplation, and 15 to 20% were in preparation for physical activity. These data further indicate the importance of physical activity interventions to provide these individuals with the additional tools needed to progress toward behavior change.

Processes of Change

Embedded within the five stages of change are processes of change that individuals experience through their progression of behavior change. There are 10 processes of change proposed by Prochaska & DiClemente (1983). The general agreement is that individuals experience or use particular processes of change during the progression from one stage to another (Figure 1).

Figure 1. Transtheoretical Model of Behavior Change (Edwards, Jones, & Belton, 1999)



The first process of change is consciousness-raising. Consciousness-raising is a process where an individual's awareness of the need for behavior change is heightened through feedback and/or education. This process of change is often used during the transition from pre-contemplation to contemplation. When considering physical activity behavior, this process of change may include providing individuals with feedback on

their current physical activity level and/or educating them on the benefits of regular physical activity.

Dramatic relief is the process of change where an individual is encouraged to experience emotions (that may, for instance, include fear) surrounding a particular behavior. Dramatic relief is thought to be used primarily in the progression from pre-contemplation to contemplation. Within a physical activity intervention, it may be useful to inform individuals about the many negative health ramifications related to lack of physical activity. For example, participants could be informed of the fact that physical inactivity is now considered the fourth leading risk factor for global mortality (WHO, 2010), in order to evoke an emotional response and help move them toward thinking about making a change in their physical activity level.

Two additional processes of change include self-re-evaluation and environmental re-evaluation, both of which are thought to be used in the progression from contemplation to preparation. Self-re-evaluation is the process of re-assessing one's own beliefs and priorities surrounding a health behavior. Environmental re-evaluation is appraising how the particular health behavior affects one's physical and social environment. With regard to physical activity, an individual may re-evaluate his or her priorities, as far as health and well-being, when considering increasing physical activity as well as re-evaluate how his or her lack of physical activity affects individuals and the environment. For instance, a man may re-consider how his lack of physical activity promotes inactivity among his family, which may move him from contemplating increasing physical activity to preparing to do so.

Self-liberation and social liberation are processes of change thought to be most prominent in the progression from preparation to action. Self-liberation is the act of making a firm choice to change one's behavior, and social liberation is the acceptance of the alternatives available in one's social surroundings to aid in that choice to change. Pertaining to physical activity, this would be the point where an individual officially decides to change his or her physical activity habits and accepts that there are many opportunities and options to aid in this change. These two processes of change are somewhat difficult to target with regard to an intervention, but it can be helpful to provide individuals with information (e.g. local facilities that are available or running groups) to help them in moving through these processes of change (Carr et al., 2011).

The final four processes of change, including reinforcement management, stimulus control, counter-conditioning, and helping relationships, are thought to primarily occur during the action stage of change and toward the progression to maintenance. Reinforcement management is the process that includes managing how individuals reward themselves when reaching a goal or how they react when not reaching a goal. For physical activity, like any behavior change, rewards can be set at particular landmark goals (e.g. reaching 10,000 steps/day for two straight weeks). Rewards can include such things as buying oneself something nice or treating oneself to a massage. Stimulus control is a process by which individuals avoid situations or settings where they are tempted to practice an unhealthy behavior. With regard to physical activity, this would be situations where an individual is tempted to sit for long periods of time such as getting engrossed in a TV show marathon or searching the internet for several hours. Counter-conditioning, closely related to stimulus control, is the process of changing how one

responds to situations or scenarios related to a behavior. For example, rather than turning on the TV, an individual may decide to go for a walk. These processes of change can be targeted in a physical activity intervention by providing individuals with suggested rewards, strategies to control stimuli of inactivity, and alternative options that include physical activity to select in various scenarios. The final process of change, helping relationships, is one that includes support from individuals in a person's social environment. These individuals may be family members, peers, physicians, or counselors. This process of change is often examined as a measure of social support, and within the physical activity realm, has been shown to be one of the strongest predictors of physical activity behavior.

The 10 processes of change are key components within the Transtheoretical Model of Behavior Change as they aid an individual in the progression through the stages of change. Despite the fact that some of these processes are experienced on a personal level (self and environmental re-evaluation and self and social liberation), several processes of change (consciousness-raising, dramatic relief, reinforcement management, stimulus control, counter-conditioning, and helping relationships) can be targeted within physical activity interventions. By employing strategies to encourage individuals to use these processes, interventions will increase the chance of successfully moving individuals through the stages of change towards maintaining a health behavior.

Decisional Balance

A third dimension of the Transtheoretical Model of Behavior Change is decisional balance. Decisional balance is the ratio between the perceived benefits and the perceived

drawbacks or barriers to changing a behavior (Janis & Mann, 1977). In the pre-contemplation and contemplation stages, the perceived drawbacks of changing a behavior typically outweigh the perceived benefits. However, as one progresses from contemplation to preparation, there is an increase in the perceived benefits in changing a behavior and a subsequent decrease in the perceived barriers. For progression of behavior change in physical activity, perceived benefits continue to increase as an individual progresses through the stages, and perceived drawbacks continue to decrease (Marshall, Stuart, & Biddle, 2001). This shift in decisional balance aids in the official decision to change a behavior.

With regard to physical activity behavior, there are very common perceived barriers. For example, common perceived barriers to physical activity among college students include time available to be active (Buckworth, 2001) and weather conditions accompanying seasonal changes (Calfas et al., 2000). These barriers can be targeted in interventions by providing individuals with advice and tools to aid in overcoming time and weather constraints. For example, information can be given to participants on ways to fit physical activity into a busy schedule.

Like processes of change, decisional balance is a key component within the Transtheoretical Model of Behavior Change. Facilitating a change in perception of benefits and drawbacks of physical activity will help move individuals through the stages of change toward maintaining regular physical activity. Thus, physical activity interventions should include strategies that increase awareness of the benefits of physical activity while reducing commonly-perceived drawbacks.

Self-Efficacy

The final dimension of the Transtheoretical Model of Behavior Change is self-efficacy. Self-efficacy is a person's confidence in his or her ability to change a behavior (Bandura, 1977). Self-efficacy is low when individuals are in the pre-contemplation and contemplation stages of change, and perceived temptation to revert back to the poor health behavior is high. However, as one progresses through the stages of change, self-efficacy steadily increases while perceived temptation steadily decreases with a cross in these factors typically occurring as an individual makes his or her way to the action stage of change.

Self-efficacy is influenced by four primary factors: previous experience, modeling of others' behaviors, feedback from others, and emotional state of the individual. With regard to physical activity, these factors each play a role in the choice to be active as well as what activities an individual will do. Previous experience of being physically active can increase a person's confidence in the ability to be physically active again. For example, someone who played a sport in high school may feel more confident in their ability to be regularly active as an adult. Seeing peers be physically active can also increase one's confidence and motivation to be active (Trost et al., 1997). For instance, a young woman who sees her friends or roommates be regularly active may feel more confident that she herself can be active as well. Feedback from others can be considered closely inter-linked with social support, and as previously discussed, this is a key sociological influence on physical activity behavior. An example of this social support would be a young adult who is more apt to be regularly active if he or she is encouraged to do so from peers. Finally, emotional state can also influence one's confidence to be

active, which is apparent within the commonly reported perceived barriers to physical activity- feeling too tired and lack of motivation. Thus, it is important to provide individuals with information on ways they can successfully increase physical activity to avoid a negative emotional state with regard to physical activity.

Self-efficacy is a pivotal piece of the Transtheoretical Model of Behavior Change. Future physical activity interventions should include strategies that target the modifiable factors that influence self-efficacy including modeling others' behaviors, feedback from others, and emotional state. By targeting these factors, the change of successfully increasing physical activity will be improved as individuals within the intervention will be more likely to progress through the stages of change toward maintaining regular physical activity.

Despite the fact that there is a larger set of literature supporting the use of the Transtheoretical Model of Behavior Change to target physical activity (Rhodes & Nigg, 2011), the majority of studies applying theories of behavior change to physical activity in college students have utilized the Social Cognitive Theory. However, little to no change resulted in Social Cognitive constructs (Magoc et al., 2011; Wadsworth & Hallam, 2010). To date, many researchers have used the Transtheoretical Model to guide physical activity interventions among adults. However, very few studies have used this theory to elicit changes in physical activity in college-aged adults. In 2008, Kim examined the efficacy of an eight-week intervention grounded in the full Transtheoretical Model of Behavior Change among 265 college students. Intervention participants were asked to attend intervention seminars twice a week including educational lectures, group work, videos, and self-study materials all targeting aspects of the Transtheoretical Model of

Behavior Change. This intervention was successful in increasing the percentage of individuals reporting regular physical activity from 32 - 51%. In a follow-up analysis, Kim (2008) found a significant interaction ($p < .05$) between change in physical activity within the intervention and all constructs of the Transtheoretical Model of Behavior Change.

Based on prior interventions promoting increases in physical activity among college students, it is evident that, to maximize the chance of success, future physical activity interventions should include goal-setting, self-regulation, regular contact with participants, educational components, and thorough application of the Transtheoretical Model of Behavior Change (Prochaska & DiClemente, 1983). Recently, researchers have turned to using the internet to deliver physical activity interventions given the numerous benefits of this medium (Eiben & Lissner, 2006; Greene et al., 2012; Magoc et al., 2011; Wadsworth & Hallam, 2010).

Internet-Based Physical Activity Interventions in College Students

Using the internet as a mode to deliver a physical activity intervention has a number of benefits. These benefits include widespread, frequent use and accessibility to the internet at any time and place (with mobile access), and allowing researchers to reach a large number of people on a regular basis. In addition, the internet has the benefit of offering the ability to create online social networks that can promote social support for physical activity.

By using the internet to deliver a physical activity intervention, intervention leaders can easily and regularly reach a large number of people. From 2000 to 2011,

internet use worldwide grew by over 500% (Internet Usage Statistics, n.d.), in part due to the prevalence and reduced cost of home computers as well as the popularity and prevalence of mobile devices. According to the most recent statistics on internet use, 96% of young adults (18 – 29 years old) use the internet (PEW Internet & American Life Project, 2012), 77% of whom go online daily. This heavy internet use presents an ideal mode of delivery for an intervention targeting health behavior change in young adults.

The fact that participants can access intervention information and materials at their own convenience is an additional benefit of interventions delivered over the internet. College students are faced with an array of factors (classes, work, studying, etc.) that can cause difficulties making time for physical activity. The internet is available 24 hours per day, seven days per week, giving college students the ability to access intervention materials when their schedules permit. This will allow such an intervention to reach college students regardless of their schedules and also may reduce the potential of enrolled individuals withdrawing participation based on time constraints.

The internet can be accessed by phones, tablets, and other mobile devices, which also provides a benefit for delivering physical activity interventions over this medium. According the most recent statistics, a higher percentage of young adults own a laptop (75%) than a desktop computer (51%; PEW Internet & American Life Project, 2012), and 20% of young adults in the U.S. own a tablet. Additionally, 66% of young adults (age 18-29 years) own a smart phone (with access to the internet). The mobile internet access available to the majority of U.S. adults presents an advantage to interventions delivered over the internet. With mobile access, participants will be able to access the intervention tools not only at any time but also at any place further increasing the convenience of

internet-based interventions. Given these benefits, several researchers have recognized the potential efficacy of using the internet to deliver physical activity interventions among college students.

A small number of studies have examined the efficacy of internet-based physical activity interventions in college undergraduates (Eiben & Lissner, 2006; Greene et al., 2012; Magoc et al., 2011; Wadsworth & Hallam, 2010). Despite varying durations (ranging from six weeks to 12 months) and employing several different intervention strategies, all of these interventions were successful in increasing physical activity among the students studied albeit to varying degrees.

Greene et al. (2012) examined the efficacy of an education-based internet intervention that targeted physical activity and healthy eating. These authors employed a 3-month randomized-controlled trial that included 10 online lessons focusing on physical activity and healthy eating among a sample of 1,689 college students from eight different universities. At baseline, participants in the control group and the intervention group did not significantly differ with regard to self-reported physical activity. Participants made changes to their physical activity level throughout the study and retained an increased physical activity level 15 months from the start of the study. The increase in physical activity seen in this study was 270 metabolic equivalent (MET) minutes per week ($p < 0.05$), which would equate to approximately 68 minutes per week of moderate physical activity at 4 METs or approximately 39 minutes per week of vigorous physical activity at 7 METs.

Eiben & Lissner (2006) also examined the efficacy of an internet-based intervention targeting physical activity and other health behaviors. These authors

employed a 12-month, internet-based intervention targeting physical activity as well as dietary behaviors and weight control among 40 college women. The intervention included support packages for three health behaviors: physical activity, diet, and weight control. Participants had the choice of accessing this information at their own convenience. Participants in the intervention also received regular contact (frequency not specified) from intervention leaders via phone calls, e-mails and occasional in-person meetings where they created personalized strategies to develop healthy behaviors. Participants in the intervention increased physical activity energy expenditure by 1,465 kcals per week while the participants in the control condition only increased self-reported physical activity energy expenditure by 200 kcals per week. This increase in physical activity energy expenditure averages 209 kcals per day. When considering the average body mass of women in this study (79.6 kg), this would equal a 37-minute increase in moderate physical activity (at 4 METs) per day for these women or a 19-minute increase in vigorous physical activity (at 7 METs) per day (ACSM, 2010). Taken together, these studies indicate that internet-based interventions targeting physical activity and other health behaviors in college students can result in moderate to large increases in physical activity that can be retained one or more years after beginning the intervention.

Magoc et al. (2011) employed an internet-based intervention grounded in the Social Cognitive Theory (Bandura, 1976) that included seven online educational lessons as well as strategies to promote goal-setting, self-monitoring physical activity (with a pedometer), self-efficacy, barriers to physical activity, and social support. Each lesson included information on the purpose and importance of the lesson as well as information on the lesson's topic (e.g., barriers) and an assignment for students to complete (e.g.,

create a list of one's perceived barriers to being physically active and develop strategies to overcome these barriers). Students assigned the control condition were given a basic "tip" sheet on physical activity and access to online physical activity logs. Participants enrolled in the intervention significantly increased the number of days they self-reported accumulating 30 minutes or more of moderate physical activity from 1.2 days to 2.9 days while participants in the control condition did not change time spent in moderate physical activity. In addition, participants in the intervention significantly increased the number of days they self-reported accumulating 20 minutes or more of vigorous physical activity from 1.2 days to 2.1 days, and participants in the control condition did not change time spent in vigorous physical activity.

Wadsworth & Hallam (2010) also implemented an intervention grounded in the Social Cognitive Theory that included educational information, goal-setting, self-monitoring, and social support. However, participants within this 6-month intervention had access to an e-counselor, computer-mediated exercise materials, and received 10 e-mails (weekly for the first 6 weeks and monthly thereafter) from the e-counselor. These e-mails included further educational information (e.g., advice on how to overcome barriers to physical activity and suggestions for exercise regimens) and reminders to use the materials. The e-counselor also responded to any questions intervention participants posed. Social support was targeted through access to a website containing discussion boards, exercise information and suggestions, sample workouts, and community events promoting physical activity. Participants in this intervention significantly increased the number of days per week they accumulated at least 30 minutes of moderate physical activity from 2.3 days to 3.1 days. For both of the interventions employed by Magoc et

al. (2011) and Wadsworth & Hallam (2010), participants did not reach physical activity recommendations but did move closer to doing so as a result of the intervention. Therefore, these interventions were successful to increase physical activity, but improvements can be made to result in larger increases, allowing participants to reach physical activity recommendations.

Findings from these four prior studies indicate that, although there was a wide range in the increase in physical activity among this set of literature, it is clear that internet-based physical activity interventions can be effective among college students. These results are promising given the many benefits of using the internet to deliver physical activity interventions that can be extended to future interventions. There are, however, a number of drawbacks of delivering physical activity interventions over the internet. Addressing these limitations in future interventions may allow for greater improvements in physical activity.

Limitations of Internet-Based Physical Activity Interventions

Internet-based physical activity interventions often suffer from two key drawbacks. First, these types of interventions lead to issues with a lack of participant engagement (logins and/or use of internet materials; Norman et al. 2007). Second, there are often high monetary costs associated with developing and maintaining an intervention website (Lewis et al., 2008). These limitations can prevent the implementation and success of internet-based physical activity interventions.

Intervention engagement, specifically the number of logins to the intervention website and use of the intervention materials, is often low or decreases over time within

internet-based interventions (Norman et al., 2007). Individuals enrolled in an internet-based physical activity intervention must log into the intervention website in order to engage in the intervention. This is likely one main reason why participants tend to reduce their engagement with the intervention website over the course of the intervention (Norman et al., 2007). Some participants end up dropping out of the intervention altogether. This reduction in logins presents an issue given that several research studies demonstrate that the level of engagement or interaction in the intervention is directly related to increases in physical activity (Donkin et al., 2011; Kelders, Van Gemert-Pijnen, Werkman, Nijland, & Sedel, 2011; Norman et al., 2007; Van Genugten et al., 2012). In a study of 163 adults, regression analysis demonstrated that the higher the number of logins to an intervention website, the greater the increase in physical activity ($t = 3.39$, $p < .01$) during a 12-month intervention (Lewis et al., 2008). These data indicate that interventions delivered through the internet must implement strategies to maintain participant engagement in order to maximize potential effects on increasing physical activity.

A second drawback to internet-based physical activity interventions is that successful interventions have proven to be costly. The monetary cost of developing and maintaining an internet-based intervention website can be very high. In a study analyzing the cost of intervention website development, Lewis et al. (2010) calculated the cost of web development for a physical activity intervention to be $109,564. Given this rate, estimated monthly cost per person for an online intervention targeting physical activity ($122.52) is similar to that found in the cost-analysis of a face-to-face physical activity intervention ($146.33/month; Elley et al., 2004). These high costs may prohibit

researchers' abilities to develop and implement internet-based physical activity interventions. Thus, there remains a need to find ways to reduce these high monetary costs of interventions promoting increases in physical activity while also retaining the ability to deliver these interventions online.

It is evident that the internet as a means of delivering physical activity interventions offers many benefits. These benefits include the ability to reach a large number of people on a regular basis at a time and place of their convenience while also allowing for the creation of online social networks. Although many researchers have turned to this method of intervention delivery and have found moderate rates of success, there are two major drawbacks. Intervention engagement (number of logins and use of intervention materials) decreases over time. In addition, internet-based interventions can be costly due to the need to create and maintain the intervention website. Future research is warranted to develop internet-based physical activity interventions that can maintain participant engagement and reduce costs.

Physical Activity Interventions using Social Media

Social media websites such as Facebook are readily-available internet resources that have the potential to be successful delivery modes for internet-based physical activity interventions. Social media websites are websites where individuals can keep in touch with friends, family, colleagues, and acquaintances. The most popular social media website is Facebook which was founded in 2004. In 2010, Facebook was the second most visited website in the world, behind Goolge.com (Alexia, 2010) and now has over 1 billion active users. Over half of these users access the website from a mobile device

(Internet World Stats, n.d.). To become a member of this social media site, individuals must register using a valid email address and then create a profile which can include personal interests, photos, educational background, and other personal information. Members of Facebook can make their profile public or private (only visible to those individuals they have established as "friends"). Communication between individuals on Facebook can be private through Facebook messages or public through posts to an individual's profile "wall" (a public messaging board). Members of Facebook can also create "groups" based on common interests or join groups already in existence. These groups can be public (visible by anyone on Facebook) or private (only accessible to invited members of the group). Members of a Facebook group can post information to the public discussion board as well as comment on other individuals' posts to the discussion board. Finally, members of the group can simply "like" what others post to the discussion board by clicking a "Like Button," a feature added in 2010. The unique, interactive features of Facebook allow for regular contact with participants and the implementation of an online social network, two key aspects related to successful interventions.

The average Facebook user creates 90 new pieces of content per month indicating that the average user logs into the site at least three times per day (Lukes, 2010). This frequency of use is seven times higher than login frequency seen in conventional internet based interventions where the average number of logins is three times per week (Davies et al., 2012). Thus, Facebook allows for frequent contact with participants which research has indicated is an important factor within physical activity interventions.

Social networks have also been shown to be a vital part of physical activity interventions. Inherent within Facebook is the ability to form groups based on common interests, thereby allowing for the creation of social support networks within this social media website. These groups can be formed around any topic including physical activity and can provide support at any time of the day. A group formed through a physical activity intervention can be used to provide peer support or support from the group leader/facilitator. Support from the group facilitator can include encouragement to be active, advice on ways to increase physical activity, or answers to questions posted regarding physical activity. Support from peers can include comments on others' posts to provide peer feedback or clicks on the "Like Button" to show support for another individual's post. Given these features, a Facebook-mediated physical activity intervention has the potential to facilitate strong social support for physical activity through an online social network.

In addition to providing the means of implementing regular contact as well as an online social network, Facebook can also address participant engagement, a documented challenge of standard internet-based physical activity interventions. The use of Facebook to deliver a physical activity intervention has the potential to result in high levels of participant engagement as defined by number of logins to the intervention website and use of intervention materials. As stated earlier, the average user will log into Facebook an average of three times per day (Alexa, 2010). If participants are currently Facebook users (which screening can ensure), they will have the option of viewing and using intervention materials once they log into their Facebook page. Thus, because the

intervention will be embedded within a website that individuals already visit several times per day, participant engagement may be more easily maintained.

Providing reminders to use intervention materials throughout physical activity interventions has been shown to improve the efficacy of the intervention (Schneider et al., 2012). Facebook has two features that provide reminders to use intervention materials: alerts and tags. Whenever new material is added to the physical activity Facebook group, enrolled group members receive an "alert" on their Facebook homepage. Participants can also be directly "tagged" in a post by another participant and will receive an additional alert when this occurs. These features offer the opportunity to remind members of the group to log into the group page, and these reminders will increase the likelihood that participants receive and view the intervention materials.

The use of Facebook as a mode for intervention delivery will likely cost less than the development of a physical activity intervention website (Lewis et al., 2010). Since Facebook is already in existence and many of the Facebook features can be used to support a physical activity interventions, there will be little to no funds needed to create a website for the physical activity intervention. The main cost of a Facebook physical activity intervention will be the labor needed to create and maintain the page. Therefore, the cost of a Facebook-mediated physical activity intervention will likely be lower than the $123 per participant average cost of internet-based physical activity interventions (Lewis et al., 2010).

Research examining the use of social media websites such as Facebook to promote healthy behavior change is in its infancy. To date, Facebook has been used as a mode of intervention for health behaviors outside of physical activity including food

safety, sexual health, and weight loss with many interventions demonstrating efficacy with respect to their targeted health behavior compared to a control condition (Bramlett & Harrison, 2012; Bull, Levine, Black, Schmiege, & Santelli, 2012; Napolitano, Hayes, Bennett, Ives, & Foster, 2012). Control conditions in these studies ranged from a group receiving a standardized lecture on the targeted health behavior (Bramlet & Harris, 2012) to a group enrolled in a separate Facebook group promoting exchange of information on a topic unrelated to the targeted health behavior (i.e., news-related stories; Bull et al., 2012). Only one intervention has been published examining the efficacy of a Facebook-mediated physical activity intervention (Cavallo et al., 2012). Cavallo et al. (2012) conducted a randomized-controlled trial using a sample of 134 female undergraduate Facebook users comparing social support and self-reported physical activity between participants randomized to a 12-week, social network physical activity intervention and participants in an education-only intervention. The social media group had access to an online physical activity education website (Internet Support for Healthy Associations Promoting Exercise, INSHAPE). Within this website, participants could set physical activity goals, track daily physical activity, and receive feedback (charts) regarding their progress. In addition, participants in the social media intervention were asked to enroll in a Facebook group that included all other social media intervention participants. A member of the research team was also enrolled in this group whose role was to encourage participation, post links to news stories related to physical activity, and answer questions related to physical activity. The researcher did not provide direct social support such as positive feedback to intervention participants in the Facebook group. Participants in the education-only intervention only had access to educational information on the INSHAPE

website and received e-mails (frequency not specified) throughout the intervention that included links to the same physical activity news stories posted to the Facebook group.

On average, participants in the social media group logged into the INSHAPE website every two weeks, while participants in the education-only group logged into the INSHAPE website an average of twice over the 12-week intervention. Participants in the social media group reported visiting the Facebook page at least 2-3 times per month, but logins declined over the course of the intervention. Results demonstrated that both groups within this study significantly increased social support and physical activity. Individuals in the Facebook group increased energy expenditure through physical activity by 749 kcals per week (from 1,646 kcals per week at baseline to 2,395 kcals per week at the end of the intervention) while those in the education-only group increased physical activity energy expenditure by 543 kcals per week (from 1,706 to 2,249 kcals per week). However, this difference in change in physical activity between the two groups did not reach significance. Therefore, the authors concluded that the components of the Facebook intervention were no more or less effective to increase physical activity than an intervention including just educational materials.

A number of limitations in the study by Cavallo et al. (2012) were highlighted by the authors, limitations that may have led to the lack of differences in changes in physical activity between groups. These limitations include the use of self-report tool to assess physical activity (International Physical Activity Questionnaire, IPAQ) and the inability to separate the potential effect of self-regulation and enrollment in the Facebook group on change in physical activity.

Self-reported physical activity can be a useful tool for assessing physical activity, but it is not without limitations. Self-report tools for assessing physical activity are easy-to-use, inexpensive and can be delivered over the internet. However, these physical activity measures can be plagued by human error such as poor recall or misperception of physical activity intensity (Prince et al., 2008). Results from an examination of the relationship between self-reported and objectively-measured physical activity demonstrate only low-to-moderate correlation between these two physical activity assessment tools. The IPAQ has been shown to be moderately correlated with objectively-measured vigorous physical activity (r = .49) and poorly correlated with objectively-measured moderate physical activity (r = .27; Kim, Park, Kang, 2012). Thus, future studies examining the efficacy of a Facebook-mediated physical activity intervention may benefit from using objective tools to assess physical activity that reduce the risk of human error and the potential for false conclusions based on this error.

Self-regulation and social support are independently and collectively related to the success of physical activity interventions (Richardson et al., 2010; Wadsworth & Hallam, 2010). Both of these psychological factors were incorporated into the Facebook physical activity intervention published by Cavallo et al. (2012). However, the design of the study did not allow for identification of the individual effect of either of these psychological factors on the change in physical activity. Therefore, the individual contribution of social support from a Facebook group during a physical activity intervention remains to be determined.

An additional limitation within study by Cavallo et al. (2012), one that was not cited by the authors, is the fact that educational information was not delivered through the

Facebook group but rather, through a separate physical activity website. Given that logins to the educational website averaged only 2-3 times per month in this study (Cavallo et al., 2012), the understanding and application of the educational information to increase their physical activity behavior may have been impacted. Further investigation is needed examining if intervention engagement (e.g., logins) can be increased by incorporating educational materials into the Facebook group rather than via a separate website.

We performed an exploratory pilot study to gain insight into satisfaction and to obtain advice on future directions for a Facebook-mediated physical activity intervention. For this pilot study, a small number of regularly-active, young adults between the ages of 23 and 30 years (N = 10, 9 females, 1 male) were enrolled in a Facebook group called "Be Active!" These individuals were asked to post their daily exercise on the group's page and provide encouragement to other participants in the group. An intervention leader was also enrolled who posted her physical activity and provided encouragement to participants such as posting comments (e.g., "Nice job!") on participants' physical activity posts. Eight of the 10 enrolled participants actively took part in the group (i.e., posted physical activity at least once per week). The intervention leader actively participated in this group for two months and then withdrew participation but remained a member. After the withdrawal of the intervention leader, six participants continued to actively participate for two weeks, after which participation (posting to the group page) of all group members except one halted. One participant posted an additional two times one month later but halted participation after these posts. These findings indicate that a physical activity intervention delivered through Facebook can successfully engage

participants but may suffer from attrition once the intervention leader becomes less visible.

Twelve months after the creation of this group, all members were sent a Facebook message and asked questions regarding their experience in the physical activity Facebook group, including enjoyment, motivation, likes, dislikes, and ways to improve the experience, A total of six participants provided responses to these questions. All six of these participants reported enjoying their experience with the Facebook group. Five of six participants reported that the group motivated them to increase their physical activity level with two participants particularly citing the fact that the group was motivating if they were not feeling like being active. One person reported that it did not motivate her because she was already regularly active. Participants liked the variety of activities others did, and awareness of these other activities increased their motivation to try new things. In addition, one participant reported liking the encouragement and social support from individuals in the group, and another participant reported enjoying the fact that she felt accountable for her activity. This participant stated, "I liked being accountable for my actions- if I didn't post in a while, I would feel guilty when everyone else had posted their physical activity." Two participants did not like feeling bad or inadequate when some members reported high volumes of exercise, such as running 12 miles or taking two exercise classes in a day. Another participant did not like it when participants eventually stopped posting on the group site. All six participants offered suggestions for future Facebook physical activity groups. These suggestions included grouping individuals together based on activity level or personal interests and encouraging members to be active together. In addition, four participants suggested adding more unique features than

just posting the amount of activity participants did. Specific suggestions included a greater level of interaction between the intervention leader and more tips and advice surrounding physical activity. Given this feedback, future interventions delivered through Facebook should group similar individuals to avoid negative experiences and include an intervention leader who actively provides social support to participants and monitors participant engagement.

Based on the limited research that has been conducted examining the efficacy of Facebook-mediated physical activity interventions and incorporating what can be learned from internet-based physical activity interventions, there remain gaps in the literature warranting further investigation. The impact of a Facebook group providing social support for physical activity on an objective measure of physical activity in college students must be examined. Cavallo et al. (2012) examined the efficacy of a physical activity intervention including a Facebook group but used a self-report measure of physical activity, the validity of which can be impacted by human error. In addition, the design used by Cavallo et al. (2012) did not allow these authors the ability to separate the effect of the Facebook group from the potential effect of self-regulation on physical activity. Thus, further investigation is needed to examine the specific impact of using social media (e.g., Facebook), outside of any other potential influences, on physical activity in college students. Future interventions should also examine if the inclusion of educational information within the social media website rather than a separate website improves gains in physical activity as well as participant engagement (logins and intervention usage). Cavallo et al. (2012) implemented a Facebook group as part of their physical activity intervention, but educational information was delivered separately

through the INSHAPE website rather than via the Facebook group. Finally, based on feedback gleaned from a small pilot study, additional research is needed examining an intervention with a Facebook group that includes an intervention leader who provides social support and monitors participant engagement. Given these gaps in the literature, it is clear that additional research is needed examining the efficacy of a Facebook-mediated physical activity intervention in college students.

Summary

A large percentage of college students are not regularly active, and research suggests that they will continue to be inactive into adulthood. This presents an imminent need to increase physical activity in college students and develop physical activity habits that will continue into later life. There is evidence that internet-based physical activity interventions can successfully increase physical activity in this population, but there are inherent drawbacks to using the internet as an intervention medium. Specifically, participant engagement (number of logins and usage of intervention materials/tools) remains an issue in these types of interventions, and there is often a high monetary cost to developing and maintaining intervention websites. Social media websites offer a means to ameliorate these drawbacks. However, very little research has been conducted examining the efficacy a physical activity intervention using social media. Thus, it is the purpose of this dissertation to assess the efficacy of an intervention to increase physical activity level using social media in college students.

CHAPTER III: RESEARCH METHODOLOGY

Introduction

Because of decreases in physical activity during college and the lasting life-habits that are formed during this time, researchers have recognized the need to intervene during this life transition and attempt to increase physical activity levels. Like physical activity interventions in adults, some interventions promoting increases in physical activity in college students are now delivered over the internet. Although there are a number of benefits to this mode of intervention delivery, there are also drawbacks. Social media offers a medium to capitalize on the benefits (i.e. regular contact with a large number of participants and an online social network) while ameliorating the primary drawbacks (i.e. participant engagement and cost of intervention website development and maintenance). Results from a recently published intervention using social media (Facebook) to promote increases in physical activity in college students indicate that this type of intervention is effective to increase physical activity in college students but is not significantly more effective than an online, education-only intervention (Cavallo et al., 2012). However, methodological and design limitations in this study suggest caution when interpreting these results. Namely, these authors used a self-report measure of physical activity (the IPAQ), one that can be impacted by human error. Additionally, based on the design of this study, the effect of enrollment in a Facebook group could not be separated from the potential effect of tracking one's physical activity. Finally, educational components were delivered through a separate website from the social media website, one that was visited only 2-3 times per month. Thus, there is a need to examine the efficacy of an

intervention to increase objectively-assessed physical activity using social media in college students.

Purpose

The primary purpose of this study was to compare the efficacy of an intervention using social media to increase physical activity to an intervention that does not utilize social media in a sample of female college freshmen. The secondary purpose of this investigation was to compare the efficacy an intervention using social media to improve psychosocial variables related to physical activity to an intervention that does not utilize social media in a sample of female college freshmen.

Specific Aims

To address these purposes, the following aims were developed to compared the efficacy of an 8-week physical activity intervention using social media and one not utilizing social media to:

(1) Increase steps/day between baseline and the final week (week 8).

Hypothesis 1: Female freshmen enrolled in an 8-week physical activity intervention using social media will increase steps/day significantly more than female freshmen receiving the same intervention without social media.

(2) Increase motivation to change physical activity, increase perceived benefits and decrease perceived drawbacks of physical activity, increase perceived social

support to be physically active, and increase self-efficacy to be physically active between baseline and the final week (week 8)

Hypothesis 2-5: Female freshmen enrolled in an 8-week physical activity intervention using social media will increase motivation to change physical activity, increase perceived benefits of physical activity, decrease perceived drawbacks of physical activity, and increase perceived social support and self-efficacy to be physically active significantly more than female freshmen receiving a physical activity intervention without social media.

Participants

The participants in this study included currently enrolled female freshman at a large, urban university in the Midwestern U.S. A power analysis, based on the results of Tully & Cupples (2011) was conducted to determine the number of participants needed to complete the study. Tully & Cupples (2011) was selected for this analysis given the similarities of the participants, design, and methodology to this proposed intervention. Based on the results of the power analysis, it was determined that 52 total participants, 26 per intervention arm, were needed to reach a power of 80% at an alpha level of 0.05 and assuming 20% attrition.

To address the specific aims of the study, the following inclusion and exclusion criteria were applied when screening participants:

Inclusion Criteria:

- Female freshmen living in dormitories;

- Current Facebook users;
- Less than 7,500 steps/day at baseline (Tudor-Locke, Hatano, Pangrazi, & Kang, 2008; Winett et al., 2012);
- In the Pre-contemplation, Contemplation, or Preparation Stage of Change as assessed by the Physical Activity Stages of Change questionnaire (Marcus, Rossi, Selby, Niaura, & Abrams, 1992)

This study was limited to freshmen living in the dormitories to control for the potential differences in environmental and social influences among students of different grade levels and those living off-campus. Also, the influence of social support on physical activity differs between men and women, and therefore, this study included only women (King et al., 1992; Troped & Saunders, 1998). In addition, because Facebook was used as a medium for intervention delivery, individuals were asked on a screening form if they were current Facebook users. Authors of previous studies examining internet-based interventions promoting increases in physical activity have advised future researchers to specifically target individuals with low baseline physical activity levels (Vandelanotte et al., 2007). Not only are these individuals in the greatest need of and could benefit the most from increases in physical activity (Lee & Skerrett, 2001), but internet-based interventions promoting increases in physical activity have been more effective among sedentary individuals. A study examining steps/day in college students found that students averaged 11,474 ± 2,979 (Behrens & Dinger, 2005). Thus, a baseline physical activity level of less than 7,500 steps/day (Tudor-Locke et al., 2012) was required for inclusion. Baseline physical activity level was assessed with a sealed

pedometer for one week prior to enrollment in the study. Finally, to avoid enrolling individuals who regularly engage in non-ambulatory activities such as cycling or swimming, only those who were in the Pre-contemplation, Contemplation, or Preparation stage based on responses to the Physical Activity Stages of Change questionnaire (Marcus et al., 1992; Appendix A) were included in this study.

Exclusion Criteria:

- Medium or high risk based on American College of Sports Medicine risk assessment;
- Use of an assistive walking device;
- Limitations to walking;

Because this study examined the efficacy of an intervention to increase physical activity, exclusion criteria focused on ensuring safe participation that can be accurately assessed with the tools used in this study. To ensure safe participation, individuals at medium or high risk for cardiovascular disease based on risk assessment (ACSM, 2010) were excluded from participation. Because pedometers have been shown to lack accuracy when assessing walking behavior in individuals who use an assistive walking device, or limp/shuffle while walking (Cyarto, Myers, & Tudor-Locke, 2004), volunteers who presented with these devices or had any limitations to walking were excluded from participation.

Recruitment

Recruitment for this study occurred through face-to-face contact and electronic postings and advertisements. Specifically, face-to-face recruitment occurred through announcements in large university classes. In addition, e-mail announcements were sent to all university freshmen (Appendix B). This study was promoted as a one examining the efficacy of a physical activity intervention.

Protection of Human Subjects

To ensure protection of participants, all study procedures were approved by the Institutional Review Board at the University of Wisconsin-Milwaukee. Participation in this study did not begin until participants read and signed the informed consent documents. There were two informed consent documents: one for participation in the baseline physical activity assessment which was part of the screening process for this study (ICD-Screening, Appendix C) and one for participation in the intervention (ICD-Intervention, Appendix D).

Study Design

This study was an 8-week, randomized pre-post intervention examining if the addition of social media (a Facebook group) improves the efficacy of a walking intervention that includes previously-established effective intervention elements (i.e., goal-setting, self-regulation, regular contact from an intervention leader, and educational materials on physical activity). The intervention using social media (Walking

Intervention + Facebook) included all components of the comparison intervention (Walking Intervention) which were a pedometer, weekly step goals, educational information, and weekly messages from the intervention leader. However, in addition, participants in the Walking Intervention + Facebook group were enrolled in a private Facebook group that included other intervention participants of the Walking Intervention + Facebook and the intervention leader. Steps taken per day, motivation to change physical activity, perceived benefits and drawbacks to physical activity, perceived social support regarding physical activity, and self-efficacy to be active were measured before and at the end of the intervention (week 8), and change in these variables within both groups were assessed and compared.

Procedures

This study included a screening meeting and two visits where measures were taken, one before the start of the intervention, and one after the completion of the intervention. The screening visit took place in the Physical Activity & Health Research Laboratory or in a place of convenience for the potential participant. Both visits where measures were taken took place in the Physical Activity & Health Research Laboratory.

A total of 128 female freshmen demonstrated initial interest in this study. Of these individuals, 31 women did not respond to follow-up e-mails to schedule a screening meeting, and two students decided that the time commitment was too great for them to participate.

Screening Meeting

Potential participants were asked to respond to questions on a screening form (Appendix E). Questions on this form were designed to verify that potential participants met inclusion criteria and were not excluded for any reason outlined previously. Specifically, these questions determined if participants were female freshmen living in the dormitories who currently used Facebook and who did not have any limitations to walking. In addition, this questionnaire determined the students' risk of cardiovascular disease.

A total of 97 female students were screened for participation, and of these women, 13 did not meet inclusion criteria: six students did not live in the dormitories, one student did not currently use Facebook, one student was not a freshman, and 5 students were in the action or maintenance stage of change. After completion of the screening form, if volunteers qualified and were still interested in participating in this study, an informed consent document (ICD-screening, Appendix C) was completed. This document described the remaining screening process which included a 7-day physical activity assessment and completion of the Physical Activity Stages of Change (SOC) questionnaire (Appendix A). Additionally, this form briefly explained the procedures that followed the screening process in this study.

The physical activity assessment consisted of the participant wearing a sealed pedometer (Omron HJ-303) on their right hip for seven consecutive days, during waking hours. Research has demonstrated that feedback from a pedometer can alter behavior and increase the number of steps taken per day (Bravata et al., 2007; Richardson et al., 2008). Therefore, because a true baseline estimate of daily physical activity was needed, the

pedometer was sealed to blind participants from the feedback on the pedometer. After completion of this week of monitoring, participants met with research staff at the Physical Activity & Health Research Laboratory for Visit 1.

Visit 1

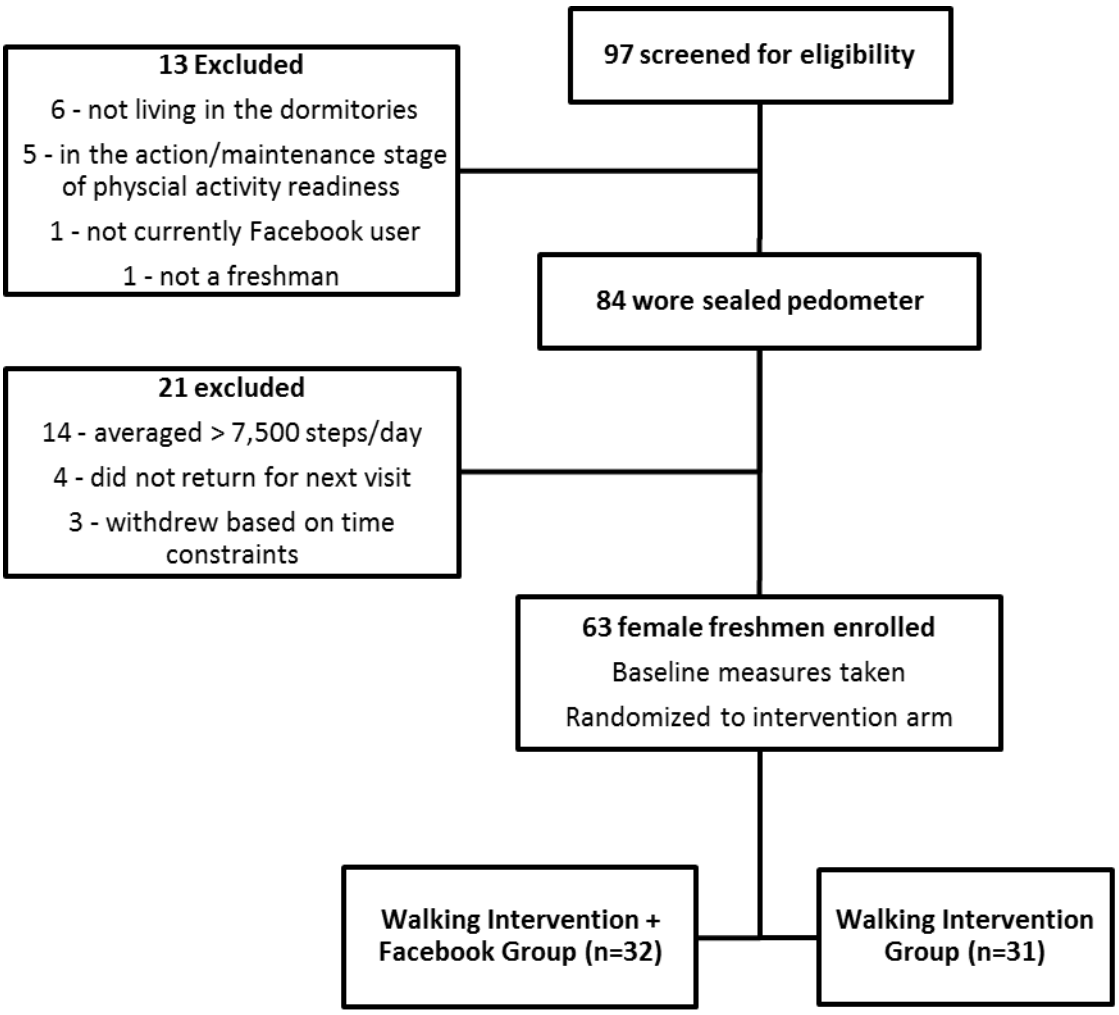
During Visit 1, average daily steps from the 7-day monitoring period were calculated. From this, final determination of inclusion was decided. A total of 84 female freshmen wore the sealed pedometer for one week (Figure 2). Four participants did not return to the laboratory for their next meeting, and three students decided to withdraw participation based on time constraints. In addition, 14 women accumulated > 7,500 steps/day and thus, did not qualify for further participation at this point in the study. Participants who do not qualify for this study based on steps/day were given feedback on their physical activity level as well as a pamphlet with educational information surrounding regular physical activity (Appendix F).

The remaining 63 women who qualified for this study were asked to complete a second informed consent (ICD- Intervention; Appendix D) that explained, in detail, the remaining study procedures. After signing this consent form, participants were asked to complete six questionnaires including a Health History Questionnaire (Appendix G), the Processes of Change questionnaire for physical activity (Appendix H; Marcus et al., 1992), the Social Support for Physical Activity Scale (Appendix I; Sallis, Grossman, Pinski, Patterson, & Nader, 1987), the Decisional Balance questionnaire for physical activity (Appendix J; Marcus, Rakowski, & Rossi, 1992), the Confidence (Self Efficacy)

questionnaire for physical activity (Appendix K; Marcus, Selby, Niaura, Rossi, 1992), and the Facebook Intensity Scale (Appendix L; Ellison, Steinfield, & Lampe, 2007).

After completion of these questionnaires, anthropometric measures including height, weight, and waist and hip circumference were taken. Once all measures were completed, participants were randomized (using adaptive randomization) into one of two groups: a Walking Intervention group or a Walking Intervention + Facebook group. For adaptive randomization, the variables upon which randomization depended included baseline steps/day, age, body mass index, and scores on the Social Support for Physical Activity Scale, the Decisional Balance questionnaire, the Confidence (Self-Efficacy) questionnaire, and the Facebook Intensity questionnaire.

Figure 2. Protocol Flow



Intervention Arms

Walking Intervention + Facebook

The individuals randomized into the Walking Intervention + Facebook group received feedback on their baseline physical activity level, an educational packet about regular physical activity (Appendix F), a pedometer, eight paper logs to record daily steps (Appendix M), and a weekly personalized step goal of increasing steps/day by 10% each week. This goal was based on the steps participants accumulated in the previous week, and there was a ceiling (or maximal recommendation) set at 15,000 steps/day. Each week of the intervention, each participant received a personal Facebook message from the intervention leader requesting the participant to report their average steps/day for the previous week. Based on this value, participants received an additional Facebook message with feedback as well as their step goal for the following week (calculated as 10% greater than their average the week before). The following messages were used for feedback and were the same for all participants throughout the eight weeks:

If participants reached their step goal:

(1) "Nice Job! Keep it up!"

(2) "Great work! Try to hit your goal next week too!"

(3) "Congratulations! You're doing great!"

(4) "All right! Keep up the great work!"

(5) "Well done! Keep making us and yourself proud!"

(6) "You are making great progress! Way to go!"

(7) "You are doing so well! Way to get your steps in!"

(8) "Way to meet your goal in the last week! You did great!"

- If step-goal was met 2 weeks in a row, the following phrase will be substituted "You've met your goal 2 weeks in a row! Consider treating yourself to a massage or a trip to the mall!"

If participants did not reach their step goal:

(1) "You were __steps away from your goal! Try again next week!"

(2) "Keep trying to reach your goal! You were just __ steps away!"

(3) "You were __ steps away from your goal! Take a look at the educational information from this week and previous weeks' Facebook posts to help you get to your goal! You can do it!"

(4) "Good effort! Keep trying to reach your goal!"

(5) "I know you did not reach your goal this week, but I also know you can next week! You can do it!"

(6) "Keep up the hard work to reach your goal! Try re-evaluating ways you can get more steps into your day!"

(7) "That's okay! Next week is another change to try to reach your goal!"

(8) "Although the intervention is now complete, keep trying to fit steps into your day!" (last week of intervention only)

Individuals in this group were also asked to enroll in a Facebook group created by the researcher to deliver the physical activity intervention. This Facebook group included eight other participants as well as the intervention leader. The total of eight participants was selected based on prior research investigating optimal groups size which is seven plus or minus two (Miller, 1956). There was a total of four Facebook groups, all

receiving identical information from the intervention leader. Participants enrolled in these Facebook groups were encouraged to report their ways in which they accumulated steps on the group's page. They were also asked to provide feedback and encouragement to fellow participants as often as possible. Finally, the intervention leader added weekly posts to each group's Facebook page (Appendix N) that were grounded in the Transtheoretical Model of Behavior Change (Prochaska & DiClemente, 1982).

Based on prior research including qualitative data on the use of Facebook to deliver part of a physical activity intervention, it appears that individuals prefer not to have people outside the intervention enrolled in the Facebook group (Munson & Consolvo, 2012). This is because these individuals fear they will bore others with their posts or sound as though they are boasting about their activity. Therefore, the Facebook groups for this intervention were private.

Walking Intervention

The individuals randomized into the Walking Intervention group received feedback on their physical activity level as well as an informational packet about regular physical activity (Appendix F). In addition, given the well-documented success of interventions using self-monitoring of steps/day with a pedometer (Bravata et al., 2007; Richardson et al., 2008; Tully & Cupples, 2011), individuals in this group received a pedometer, eight paper logs to track their steps/day, and a weekly personalized goal of increasing steps/day by 10% each week. This goal was based on the steps participants accumulated in the previous week, and there was a ceiling set at 15,000 steps/day. Finally, because regular contact with an intervention leader has also been shown to

positively impact physical activity levels (Davies et al., 2012), individuals in this group were contacted each week. However, instead of the Facebook message used for the Walking Intervention + Facebook, this contact was in the form of e-mails. These e-mails requested the participant to report their average steps/day for the previous week. Based on this value, participants received an e-mail with feedback as well as their step goal for the following week (calculated as 10% greater than their average the week before). These messages were the same as those used for the Walking Intervention + Facebook group.

The following aspects of the Trantheoretical Model of Behavior Change (Prochaska & DiClemente, 1983) were addressed within both intervention groups:

Processes of Change

- Consciousness-Raising: To increase individuals' awareness that there is a need to change their current physical activity level, individuals were given feedback on their current physical activity status (based on steps/day) upon completion of their baseline week of monitoring. Participants were also informed that research on physical activity promotes a goal to accumulate a minimum of 10,000 steps/day. This was done to raise their awareness that they were not currently meeting physical activity recommendations. This strategy was employed during Visit 1.

- Dramatic Relief: Participants were provided with information on the risks of physical inactivity. For example, in an attempt to evoke an emotional response,

participants were told that physical inactivity is now considered the fourth leading risk factor for mortality (WHO, 2010). This strategy occurred during Visit 1.

- Reinforcement Management: When participants reached their step goals for two consecutive weeks, they were encouraged (through their regular, weekly customized Facebook or email communication) to treat themselves with something such as a massage or a trip to the mall.

- Stimulus Control: Educational information was delivered weekly to all participants (as Facebook posts for the Walking Intervention + Facebook group and as e-mails to the Walking Intervention group) that included information regarding ways to avoid situations where individuals sit for long periods (Appendix N).

- Counter Conditioning: Educational information was delivered weekly to all participants (as Facebook posts for the Walking Intervention + Facebook group and as e-mails to the Walking Intervention group) which included advice on ways to increase steps (Appendix N).

Because the two processes of change, self-re-evaluation and environmental re-evaluation, are difficult to encourage through strategies, they were not targeted within this intervention. The processes of change of self-liberation and social liberation are completed on a personal level and were not directly targeted within this intervention.

Decisional Balance

With regard to Decisional Balance (Janis & Mann, 1977), participants received an informational packet on the benefits of physical activity (Appendix F) after receiving feedback of their baseline steps/day on Visit 1. These benefits were reinforced through weekly posts to the Walking Intervention + Facebook by the lead researcher. According to prior research, the most commonly reported barriers to regular physical activity among college students are lack of time and bad weather related to seasonal changes (Calfas et al., 2000). Thus, educational information was delivered weekly to all participants (as Facebook posts for the Walking Intervention + Facebook group and as e-mails to the Walking Intervention group) which included information on ways to overcome these barriers (Appendix N).

Additional Strategies

In addition to the strategies employed that are grounded in the Transtheoretical Model of Behavior Change, strategies found to be successful in prior physical activity interventions were implemented. Specifically, participants reported daily steps and received feedback and encouragement from other participants.

The following aspects of the Transtheoretical Model of Behavior Change were targeted in the Walking Intervention + Facebook group only:

Process of Change for Walking Intervention + Facebook Group Only

- Helping Relationships: The Facebook group served as a social support network from peers and the intervention leader to encourage increases in steps/day. Participants were encouraged to provide encouragement to other participants within the Facebook group.

Self-Efficacy for Walking Intervention + Facebook Group Only

Self-efficacy (Bandura, 1977) is determined by four factors, three of which can be targeted within this intervention. These factors are: previous experience, modeling of others' behaviors, feedback from others, and emotional state of the individual. Previous experience is a non-modifiable factor. However, the Facebook group was used as a way for participants to see the steps/day that others are accumulating and how they are accumulating these steps which provided the opportunity for modeling to occur. Additionally, feedback from the lead researcher and other participants was provided through this site which may, in turn, have improved the emotional state of the individual.

<u>Additional Strategies for Walking Intervention + Facebook Group Only</u>

Participants were encouraged to report information on their steps and how they accumulated steps on a daily basis to the Facebook group (Theory of Planned Behavior; Ajzen, 1991). If participants did not post to the group over a course of five days, the lead researcher sent them a message reminding them to do so. Participants were also asked to provide feedback and encouragement to one another.

Visit 2

Upon completion of the 8-week intervention, all participants met with study staff at the Physical Activity & Health Research Laboratory for a follow-up visit, Visit 2. During Visit 2, participants returned their physical activity logs. Also, participants were asked to complete all surveys completed on Visit 1 with the exception of the Health History Questionnaire (Appendix G). Participants were also asked to complete the Physical Activity Stages of Change questionnaire (Appendix A) again. In addition, all measures taken on Visit 1 were taken during Visit 2 including height, weight, waist and hip circumference. Walking Intervention + Facebook participants were informed that they could remain a part of the Facebook group promoting physical activity, or they could be removed from the group. Participants in the Walking Intervention group were given the option to join the Facebook group at this time. However, all participants were notified that the lead researcher would no longer be a member of the group. At the end of Visit 2, participants were given a full report on all physiological measures taken on Visits 1 and 2.

Measures

Primary Outcomes

The primary outcome variable of this investigation was steps/day. Steps/day were objectively assessed using a spring-loaded pedometer (Yamax SW-200). The pedometer was worn (clipped onto the waistband on the right hip) throughout the duration of the 8-week intervention during all waking hours, except while showering or swimming.

Average steps/day were calculated by the intervention leader for the baseline monitoring week and for week eight of the intervention. Thus, the outcome measure was average steps/day assessed at baseline (during the screening procedures) and average steps/day during the final week of the intervention.

There have been a number of studies demonstrating the validity of the spring loaded pedometer to detect steps taken among adults when walking (Le Masurier & Tudor-Locke, 2003). Some authors have demonstrated that the peizo-electric pedometer has stronger validity than the spring-loaded pedometer in overweight and obese adults (Doyle, Dennison, Green, Corona, & Kimball 2006), in children (Nakae, Oshima, & Ishii, 2008), and in adults (Melanson et al., 2004; Steeves et al., 2011). However, within a recent study comparing the spring-loaded pedometer to the peizo-electric pedometer in a sample of young adults, Giannakidou et al. (2012) found that the peizo-electric pedometer only had better validity than the spring-loaded pedometer at the walking speed of 54 m/min (2 mph). Within all other walking speeds tested (67 m/min, 80 m/min, 94 m/min, and 107 m/min, the spring-loaded pedometer was equally valid compared to the peizo-electric pedometer. We can also take a closer look at the studies claiming greater validity of the peizo-electric pedometers than the spring-loaded pedometers in adults (Melanson et al., 2004; Steeves et al., 2011). The walking speeds tested by Steeves et al. (2011) were 2, 3, and 4 mph. For 3 and 4 mph, the validity of the spring-loaded pedometer and the peizo-electric pedometer did not significantly differ. Melanson et al. (2004) also found no difference in the validity between the peizo-electric pedometer and the spring-loaded pedometer at a walking speed of 3 mph. Both types of pedometers had accuracies exceeding 96% when compared to counted steps. Within both of these

studies, the peizo-electric pedometer had greater validity for the ≤2 mph walking speeds. However, given the age of the population within our study, it is highly unlikely that students will be walking at 2 mph during their day. Rather, this is a walking speed that may be seen in older adults with low-to-moderate functional ability.

When examining the reliability of the spring-loaded pedometer, Steeves et al. (2011) found that, within five trials of 100 steps, the number of steps recorded by this pedometer (YAMAX SW-200) did not significantly differ between trials. Thus, given that the spring-loaded pedometer has good inter-reliability and appears to be equally valid for walking speeds likely to be seen in young adults (2.5 to 4 mph), this pedometer was selected for use within the current study.

Secondary Outcomes

Secondary outcomes for this study included Physical Activity Stage of Change, Social Support, Decisional Balance, and Self-Efficacy with regard to physical activity. Although a measure of steps/day is just one form of physical activity, it is the aim of this investigation to assess change in psychosocial variables of the Transtheoretical Model of Behavior Change with regard to physical activity in general. This practice is common within physical activity literature (Kim, 2008).

Physical Activity Stage of Change

Stage of Change for physical activity was assessed using the Physical Activity Stages of Change questionnaire (Appendix A) developed by Marcus et al. (1992) on a sample of over 1,100 adults. This questionnaire contains four items to which individuals

respond with a "yes" or "no." The first two items inquire if an individual is currently or plans to become physically active, defined as activities including walking briskly, jogging, bicycling, swimming, or similar activities. The second two items ask if an individual is currently or plans to become regularly physically active which is defined as a total of 30 minutes or more on at least 5 days per week. Using responses to these questions, participants were placed into one of the five Stages of Change. Research has demonstrated that this questionnaire has strong validity (Marcus & Simkin, 1993) and reliability (Marcus et al., 1992).

Social Support for Physical Activity

Social support for physical activity was assessed using the Social Support for Physical Activity Scale (Appendix I) (Sallis et al., 1987). This questionnaire includes 13 items asking how often members of one's family and friends (which are assessed separately) have done the described action in the previous three months. For example, an item from this questionnaire states: "Gave me encouragement to stick with my activity program." Responses are ranked on a 5-point Likert-type scale ranging from "none" to "very often." The authors of this questionnaire state that family should take into account individuals living in one's household. However, because this sample consisted of young adults attending college, many of whom will have roommates that are not family members, family was designated as those individuals who are related by blood or through marriage.

This survey was scored by first, as instructed by the authors, inverting responses to questions 7 and 8 as they are negatively worded (e.g., "Complained about the time I

spend doing physical activity"). Then, an average was calculated based on responses to all 13 items pertaining to family and to friends, separately. Higher scores indicate a higher perceived social support for physical activity. Prior research has demonstrated that this questionnaire has strong internal consistency ranging from an α of 84 to .91 (Wallace et al., 2000).

Physical Activity Decisional Balance

Decisional balance with regard to physical activity was assessed using the Decisional Balance questionnaire created by Marcus et al. (1992; Appendix J). This questionnaire measures the perceived benefits and barriers to being physically active using 16 items. Ten items pertain to the pros of physical activity, and six items pertain to the cons of physical activity. Participants were asked to respond with how important they perceive each of these 16 statements when thinking about physical activity. An example of a statement on this questionnaire is: "Regular physical activity would help me relieve tension." Responses are a on a 5-point Likert-type scale ranging from "not at all important" to "extremely important." The score for this survey was calculated by first determining the average of the items pertaining to pros as well as the average pertaining to cons. Then, the average for the cons was subtracted from the pros to yield an overall score. A positive score indicates the perception of more pros than cons, whereas a negative score indicates more perceived cons than pros. This questionnaire has been shown have good internal consistency (α = .79 for pros and α = .95 for cons; Marcus et al., 1992).

Physical Activity Self-Efficacy

Self-efficacy for physical activity was assessed using the Confidence (Self-Efficacy) questionnaire developed by Marcus et al. (1992; Appendix K). This is a 5-item questionnaire asking individuals how confident they feel to be active in five different situations (e.g., "When I am on vacation"). Responses are on a 5-point Likert-type scale ranging from "not at all confident" to "extremely confident."

A score for this survey was created by calculating the average for the five responses. Higher scores represent higher levels of self-efficacy with regard to stepping activity. Prior studies have demonstrated that this questionnaire has high internal consistency ($\alpha = 0.76$) and test-retest reliability (.90; Marcus et al., 1992).

Descriptive Measures

Additional variables were assessed and used as descriptive variables and/or tested as confounding or mediating variables for change in primary and secondary outcome variables. These included general information from a health history questionnaire, use of processes of change, baseline Facebook usage, anthropometric variables, and Facebook intervention engagement. In addition, data on steps/day for each week of the intervention were collected.

Health History Questionnaire

A health history and demographic questionnaire was used to obtain information surrounding personal and family health history as well as basic demographic information.

This information included age, ethnicity, major, number of credits taking, employment status, and hours per week spent exercising.

Physical Activity Processes of Change

Processes of change with regard to physical activity was assessed using the Processes of Change questionnaire (Appendix H) developed by Marcus et al. (1992). This questionnaire contains 40 items, four items for each of the 10 Processes of Change (e.g., Consciousness-Raising, Self Liberation, and Reinforcement Management). Each item is an example of a particular incidence, and individuals were asked to report how frequently these incidences occur on a 5-point Likert-type scale ranging from "never" to "repeatedly." For example, an item pertaining to Reinforcement Management is: "I reward myself when I am physically active." Averages were calculated for the responses to each of the four items pertaining to each Process of Change, resulting in 10 scores. Higher scores indicate greater use of the particular Process of Change. Prior research has shown that this questionnaire has high internal consistency ($\alpha = .83$; Marcus et al., 1992) in a sample of adults and young adults.

Baseline Facebook Usage

Facebook usage was assessed using the Facebook Intensity Scale (Ellison et al., 2007; Appendix L). For this questionnaire, individuals responded with how much they disagree or agree (Likert scale from 1 to 5) with six statements surrounding Facebook use. For example, participants ranked how strongly they agree (1 = strongly disagree; 5 =

strongly agree) with the statement: "Facebook has become part of my daily routine." An average score was calculated based on the numbered responses to each of these six items to provide an overall score. This questionnaire also includes two additional questions that can be open-ended or answered with a specified range or values. For this study, these questions were left open-ended. These questions asked participants to approximate the total number of Facebook friends they have and how much time per day they spent actively using Facebook. Responses to these items were not included in the total score but were used as separate numerical indicators of Facebook usage. Research has demonstrated that the Facebook Intensity Scale has strong internal consistency (Cronbach's alpha = .83) in a sample of college students (Ellison et al., 2007).

Anthropometric Measures

Using standard procedures (Lohman, 1997), height was measured using a stadiometer (Continental Scale Corporation, Bridgeview, IL), and body mass was measured using a physician's balance beam scale (Detecto 339, Web City, MO). From these measures, body mass index (BMI) was calculated by dividing body mass in kilograms by height in meters, squared. A BMI of <18.5 kg/m^2 was considered underweight, 18.5 to 24.9 kg/m^2 was considered normal, 25.0 to 29.9 kg/m^2 was considered overweight, and a value of $\geq$ 30 kg/m^2 was considered obese (NHLBI, 1998). Using a standard measuring tape and standardized procedures (American College of Sports Medicine, 2010), waist circumference was taken at the narrowest part of the torso between the iliac crest and the most inferior rip, and hip circumference was taken at the

widest part of the hips. Both waist and hip circumference were measured twice, and waist-to-hip ratio was calculated based on the average of these measures.

Facebook Intervention Engagement

Facebook intervention engagement was assessed by tracking the number of posts individuals in the Walking Intervention + Facebook group made during the 8-week intervention. These posts were separated into the following distinct categories (i.e., posts did not overlap in category): posted steps, posted how they accumulated steps, posted other information regarding physical activity, posted something else unrelated to physical activity, commented on someone else's post (or "liked" their post), or responded to a comment from someone else. These variables were also summed to provide an overall total number of "posts" during the intervention.

Statistical Analysis

Descriptive statistics (mean and standard deviation) were conducted for steps/day during each week of the intervention, scores social support, decisional balance, and self-efficacy as well as height, body mass, BMI, waist and hip circumference. For stage of change for physical activity, the percentage of women in each stage of change was calculated by dividing the number of women in that stage by the total number of women in the intervention arm. Before conducting statistical analyses of change in steps/day, stage of change, social support, decisional balance, and self-efficacy, statistical tests for skew were performed on these variables within both groups at baseline and 8-weeks. No significant skew was found. Independent t-tests were used to examine if there were

differences in hours worked per week, hours exercised per week, number of credits taken, or anthropometric variables at baseline. To analyze if there were significant changes for either group at 8-weeks on primary and secondary outcome variables, and if these changes differed by the independent variable (group assignment), mixed effects ANOVAs were conducted. The dependent variables were steps/day, stage of change score, social support score, decisional balance score, and self-efficacy score. The null hypothesis for this study was that all variables would not differ between baseline and 8-weeks for the Walking Intervention + Facebook (WI+FB) group and the Walking Intervention group.

In addition to examining the effect of the intervention on steps/day, the potential predictors of change in physical activity were also examined for women in each group. To do this, two multiple regression analyses were conducted (one for each intervention arm) where change in steps/day was the dependent variable. For the WI+FB group, the following variables were included as predictor variables and entered simultaneously: number of times participants posted to the Facebook group (intervention engagement), number of intervention e-mail responses (intervention adherence), baseline steps/day, and baseline score on the Facebook Intensity scale. For the WI group, only intervention adherence and baseline steps/day were entered as predictor variables. All analyses were completed using SPSS 18.0 for Windows (Chicago, IL). Significance was set at an alpha level of $p < 0.05$.

CHAPTER IV: RESULTS

Introduction

The primary purpose of this study was to compare the efficacy of an intervention using social media to increase physical activity to an intervention that does not utilize social media in a sample of female college freshmen. The secondary purpose of this investigation was to compare the efficacy an intervention using social media to improve psychosocial variables related to physical activity to an intervention that does not utilize social media in a sample of female college freshmen.

To address these purposes, the following aims were developed to compared the efficacy of an 8-week physical activity intervention using social media and one not utilizing social media to:

(1) Increase steps/day between baseline and the final week (week 8) in female freshmen.

Hypothesis 1: Female freshmen enrolled in an 8-week physical activity intervention using social media will increase steps/day significantly more than female freshmen receiving the same intervention without social media.

(2) Increase motivation to change physical activity, increase perceived benefits and decrease perceived drawbacks of physical activity, increase perceived social support to be physically active, and increase self-efficacy to be physically active between baseline and the final week (week 8) in female freshmen

Hypothesis 2-5: Female freshmen enrolled in an 8-week physical activity intervention using social media will increase motivation to change physical activity, increase perceived benefits of physical activity, decrease perceived

drawbacks of physical activity, and increase perceived social support and self-efficacy to be physically active significantly more than female freshmen receiving a physical activity intervention without social media.

Participant Characteristics

A total of 53 female full-time college freshmen (18.6 ± 0.7 years; 77.8% White, 9.3% Black, 7.4% Asian, and 5.6% Hispanic) from the same large, urban institution completed this study. Twenty-five of the 53 women in this study (47.2%) worked an average of 12.0 ± 6.0 hours per week in addition to attending school full-time. Seventeen women (32.1%) in this study were enrolled in a health-related major (e.g., nursing, kinesiology, pre-medicine), 10 (18.9%) were enrolled in a science-related major (e.g., biochemistry), five women (9.4%) were enrolled in a business or communication major (e.g., business and marketing), four women (7.5%) were pursuing a degree in social work, four (7.5%) in education, two (3.8%) in criminal justice, and one (1.9%) in film. Eleven women (20.8%) were undecided on a major. The average number of credits taken by the students in this study was 15 ± 2. In addition, 41 of the women in this study (71.9%) reported that they exercised averaging 4.9 ± 3.9 hours per week. Demographic variables that may impact the amount of walking individuals accumulate including, reported number of hours worked per week, hours exercised per week, and number of credits taken by women in the Walking Intervention (WI) group and women in the Walking Intervention + Facebook (WI+FB) group did not significantly differ ($t_{(2,51)}$ =.33 ,p > .05). Twenty-seven women (50%) were single, six women (11%) were casually

dating, and 21 women (39%) were in a committed relationship. Only two women in this study (4%) currently smoked, and 20 women (37%) reported that they drink alcohol.

On average, women in this study had used Facebook for 4.6 ± 1.2 years and reported spending an average of 1.8 ± 2.7 hours per day on Facebook. Participants' average score on the Facebook Intensity Scale was 3.6 ± 0.9. In addition, women in this study reported having an average of 648 ± 407 Facebook friends. There were no significant differences between groups among Facebook variables ($p > 0.05$).

Descriptive pre- and post-intervention anthropometric data are depicted in Table 1. Women in the WI group and the WI+FB group did not differ on anthropometric measures at baseline. At the start of the intervention, based on calculated BMI from measured height and weight, 40 of the women in this sample (76%) were of normal weight, eight (15%) were overweight, and five (9%) were obese (National Heart, Blood, and Lung Institute, 2013). In addition, the women in this study had an average waist circumference within the acceptable range (NHLBI, 2013). At the completion of the intervention, only one woman had a change in weight status based on BMI, moving from normal weight to overweight. There were no significant changes in anthropometric variables for women in the WI group. Women in the WI+FB group had a significantly decreased waist circumference ($t_{(2,24)} = 3.25$,$p = 0.003$) by 1.1 cm and waist-to-hip ratio ($t_{(2,24)} = 2.75$,$p = 0.011$) by 0.1 at the completion of the intervention compared to baseline.

A total of 10 women dropped out during the intervention, five women from the WI group and five women from the WI+FB group. Baseline characteristics for these participants are represented in Table 2. On average, these women were overweight based

on BMI and accumulated fewer steps at baseline than women who completed the intervention.

Table 1. Descriptive Anthropometric Data (M±SD) of Participants who Completed the Intervention (N = 53).

	Baseline		Week 8	
	WI (n = 26)	WI+FB (n = 27)	WI (n = 26)	WI+FB (n = 27)
Height (m)	1.66 ± .06	1.66 ± .07	1.65 ± .07	1.65 ± .06
Body Weight (kg)	65.8 ± 12.7	63.7 ± 11.1	65.6 ± 12.8	61.6 ± 16.4
Body Mass Index (kg/m^2)	24.0 ± 4.6	23.1 ± 2.9	23.9 ± 4.5	22.4 ± 5.3
Waist Circumference (cm)	74.4 ± 11.5	72.6 ± 6.6	73.8 ± 11.6	71.5 ± 6.5*
Hip Circumference (cm)	101.1 ± 8.2	99.6 ± 7.2	100.9 ± 8.2	99.5 ± 6.5
Waist:Hip Ratio	.73 ± .07	.73 ± .04	.73 ± .07	.72 ± .04*

Note: * Indicates a significant difference ($p < 0.05$) from baseline.

Table 2. Baseline Data (M±SD) of Participants who Dropped Out of Intervention (N = 10).

	WI (n = 5)	WI+FB (n = 5)
Height (m)	1.69 ± .06	1.62 ± .06
Body Weight (kg)	75.4 ± 19.6	76.1 ± 29.7
Body Mass Index (kg/m^2)	26.1 ± 4.8	28.5 ± 8.8
Waist Circumference (cm)	82.3 ± 16.4	84.7 ± 22.3
Hip Circumference (cm)	106.7 ± 11.2	105.5 ± 17.6
Waist:Hip Ratio	.77 ± .07	.79 ± .07
Steps/day	5,351 ± 2,304	4,625 ± 653

Aim 1: Effect of Intervention on Steps/day

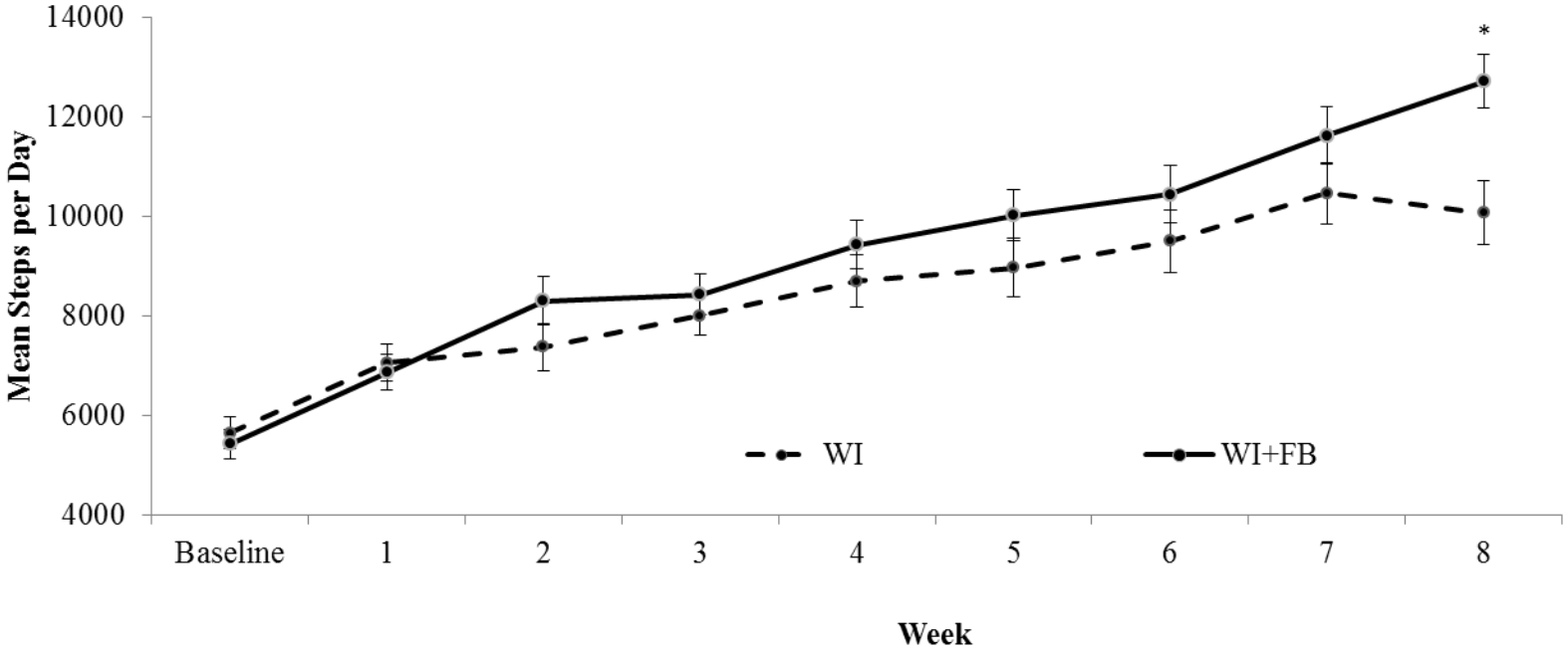
The first aim of this study was to examine if a social media-delivered PA intervention is more effective to increase steps/day than an e-mail-delivered PA intervention. It was hypothesized that female freshmen enrolled in an 8-week physical activity intervention delivered via social media that included an online social network would increase steps/day significantly more than female freshmen receiving an e-mail mediated PA intervention without an online social network. Results support this hypothesis. There were no significant differences in baseline steps/day between groups ($t_{(2,51)}$ =.51 ,p > .05; Table 3). Based on results from a mixed effects ANOVA, women in both groups significantly increased steps/day from the previous week with the exception of weeks 5 and 7. Comparing baseline to the final week of the intervention, there was a significant time effect ($F_{(51,1)}$ = 209.4, p < .001, η = .80, power = 100%) indicating that steps/day increased significantly for all participants. In addition, there was also a significant overall interaction effect for time, indicating that the groups were increasing their steps/day in different ways ($F_{(51,1)}$ = 10.80, p = 0.002, η = .18, power = 89.7%). Examining change over time, it is clear that women in the WI+FB group increased their steps/day to a greater degree than women in the WI group (Figure 3). Upon testing the between-subject effect for group, there was a significant difference ($F_{(51,1)}$ = 4.14, p = 0.047, η = .08, power = 51.5%) demonstrating that, by week 8, women in the WI+FB had increased steps/day to a significantly greater degree than women in the WI group (Figure 3).

Table 3. Average Steps/day (M±SD) for each Intervention Week by Group

	WI (n=26)	WI+FB (n=27)
Baseline	5,642 ± 1,651	5,419 ± 1,538
Week 1	7,056 ± 1,865	6,865 ± 1,846
Week 2	7,371 ± 2,317	8,301 ± 2,388
Week 3	8,007 ± 1,998	8,427 ± 2,030
Week 4	8,690 ± 2,624	9,423 ± 2,400
Week 5	8,962 ± 2,922	10,016 ± 2,594
Week 6	9,498 ± 3,049	10,443 ± 2,833
Week 7	10,456 ± 3,017	11,619 ± 2,813
Week 8	10,064 ± 3,316*	12,712 ± 2,720*§

Note: WI: Walking Intervention; WI+FB: Walking Intervention + Facebook. * indicates significant difference ($p < .05$) from baseline; § indicates significant difference ($p < .05$) between groups.

Figure 3. Mean Weekly Steps/day by Intervention Group



Note: WI: Walking Intervention; WI+FB: Walking Intervention + Facebook; * indicates significant difference ($p < 0.05$) between groups. Projected increases are based on increases of 10% each week starting from baseline

Predictors of Change in Physical Activity for WI+FB Participants

Four factors were tested as potential predictors of change in physical activity: intervention adherence, intervention engagement, baseline physical activity levels, and score on the Facebook Intensity score. Intervention adherence was measured as the number of messages participants responded to throughout the intervention and thus the number of step goals they received. Intervention engagement was measured by tracking the total number of posts participants made to the Facebook group throughout the intervention. Finally, baseline steps/day and baseline score on the Facebook Intensity scale were tested as predictors of change in physical activity.

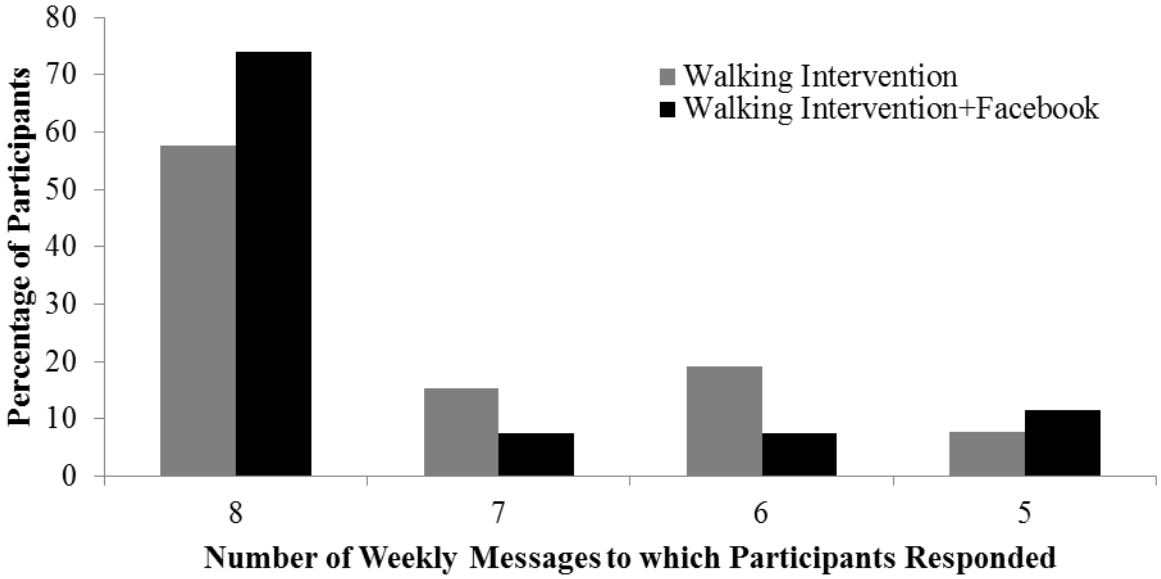
Intervention Adherence

Intervention adherence was quantified as the number of weekly e-mails to which participants responded. Among the 27 participants in the WI+FB group, 20 women (74.1%) responded to all weekly messages and thus received feedback and their new step goal for each week of the intervention (Figure 4). At baseline, these participants averaged 5,473 ± 1,651 steps/day and increased to 12,847 ± 2,745 at week 8. Two participants (7.4%) responded to six of seven messages, receiving feedback and step goals for all but one week of the 8-week intervention. At baseline, these participants averaged 4,665 ± 829 steps/day and increased to 10,780 ± 172 at week 8. Two participants (7.4%) responded to five of seven messages and thus received feedback and step-goals for six of the eight weeks of the intervention. These individual accumulated 6,343 ± 1,414 steps/day at baseline and 13,819 ± 2,111 during week 8 of the intervention. Finally, within the WI+FB group, three women (11.5%) responded to four of seven

messages and received feedback and step goals for five weeks within the 8-week intervention. These women averaged 4,947 ± 1,317 steps/day during the baseline week and increased to 10,432 ± 4,082 steps/day in the final week (week 8) of the intervention.

Among participants in the WI group (n=26), 15 women (57.7%) responded to all weekly e-mails and thus received feedback and their step goal for each week of the 8-week intervention (Figure 4). Women who responded to all e-mails accumulated an average of 5,671 ± 1,522 steps/day at baseline and increased to 10,451 ± 2,909 steps/day during week 8 of the intervention, an average increase of 4,867 ± 2,385 steps/day. Four women (15.4%) in the WI group responded to all but one e-mail, receiving feedback and a step goal for seven of the eight intervention weeks. These women averaged 6,634 ± 949 steps/day at baseline and increased to 11,343 ± 6,049 steps/day during the final week of the intervention, an average increase of 4,979 ± 5,137 steps/day. Five women (19.2%) responded to all but two weekly e-mails and thus received feedback and a step goal for six of eight weeks of the intervention. On average, these women accumulated 4,829 ± 2,469 steps/day at baseline and 8,648 ± 2,122 steps/day during week 8 of the intervention, an average increase of 3,189 ± 3,324 steps/day. Finally, two women in the WI group (7.7%) responded to four of seven e-mails and received feedback and a step goal for five of eight weeks of the intervention. Average baseline steps/day among these women was 6,011 ± 1,719 and increased to 8,343 ± 1,247 steps/day during the final week of the intervention, an average increase of 2,333 ± 472 steps/day.

Figure 4. Rates of Receiving Step Goals by Group



Intervention Engagement for the WI+FB Group

Intervention engagement was quantified as the number and type of posts to the Facebook group page. There was a total of 196 posts to the Facebook group pages with a range of 6 to 32 total posts per participant. On average, participants made 7.1 ± 4.5 total posts to the Facebook group. During week 1 of the intervention, there were 46 posts to the Facebook group. This number decreased to 30 during week 2 and continued to decrease throughout the intervention as demonstrated in Figure 5. The vast majority of these posts (35.7%) were reports of how steps were accumulated and "likes" to other members' posts (53.6%; Table 4).

Examples of posts of how steps were accumulated include:

I was way behind on my goal last night so I started walking laps around my floor.

Don't underestimate Zumba fitness and going to the mall. On Wednesday I got a little over 13 thousand steps.

I've realized taking walks really does add up and even if you don't think it's doing a whole lot, it really is. Plus, it's enjoyable and nice to get outside!

I took a zumba class the other day, it was fun and added almost 8000 steps to my day.

I take the bus to work and I get so many steps just from walking to the bus stop and back on my way home. So you can get more steps if you take the bus to bayshore or the grocery store :)

As I become more conscious of how many steps I take, I have also encouraged the people around me to also take the long route, and enjoy walks outside when it's nice out. It makes the numbers get bigger so much more easily!

I started taking the longer routes to class and never take the elevator, adds on more than you think!

Figure 5. Facebook Posts per Week among WI+FB Participants (n=27).

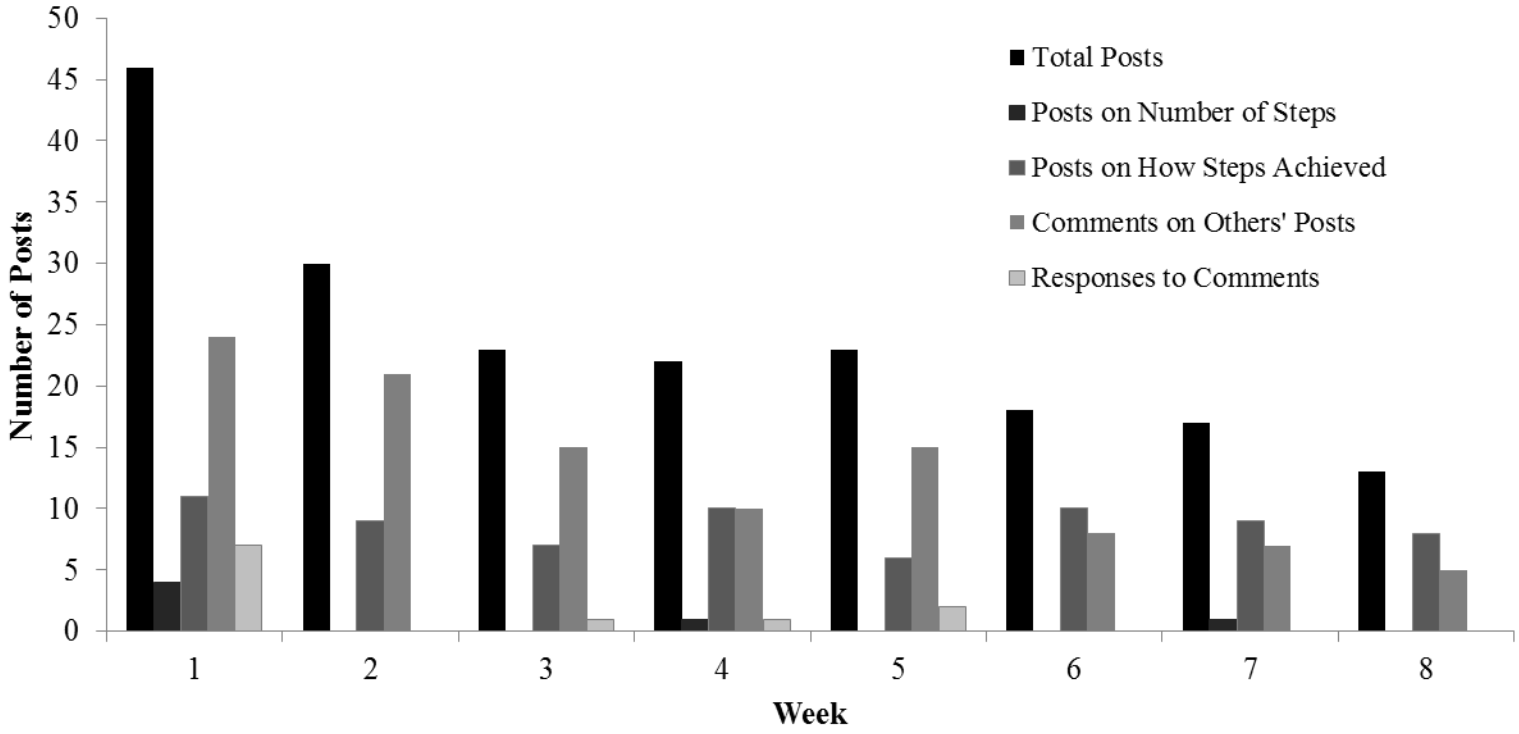


Table 4. Quantity and Types of Posts to Facebook Group (n=27).

	Week							
Post	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Number of steps	4 (8.7)	0 (0.0)	0 (0.0)	1 (4.5)	0 (0.0)	0 (0.0)	1 (5.9)	0 (0.0)
How steps achieved	11 (23.9)	9 (30.0)	7 (30.4)	10 (45.5)	6 (26.1)	10 (55.6)	9 (52.9)	8 (61.5)
Commented on other's post	24 (52.2)	21 (60.0)	15 (65.2)	10 (45.5)	15 (65.2)	8 (44.4)	7 (41.2)	5 (38.5)
Responded to comment	7 (15.2)	0 (0.0)	1 (4.3)	1 (4.5)	2 (8.7)	0 (0.0)	0 (0.0)	0 (0.0)
Total	46	30	23	22	23	18	17	13

Note: Values represent total posts in each category. Values in parentheses are percentages of total posts within each category.

Results of a multiple linear regression demonstrate that, among the variables included in the model, the only predictor of change in steps/day for women in the WI+FB group was baseline physical activity level (Table 5). Baseline steps/day was also a significant predictor of increases in steps/day for women in the WI group (Table 6). More specifically, the lower the baseline physical activity level, the greater increases in steps/day as a result of the intervention. Among women in the WI+FB group, adherence to the intervention, number of posts to the Facebook group, and score on the Facebook Intensity scale did not significantly predict change in steps/day. Among women in the WI group, adherence to the intervention did not predict change in steps/day (Table 6).

Table 5. Predictors of Change in Steps/day for WI+FB Group (n=27).

	Percent Increase in Steps/Day				
	B	**Std. Error**	**β**	**t**	***p***
Intervention Adherence	-.277	.188	-.225	-1.472	.156
Intervention Engagement	-.003	.020	-.024	-.0165	.871
Baseline Step/Day	-.001	.000	-.733	-5.089	.000
Facebook Intensity Score	-.045	.226	-.030	-0.199	.844

Full model statistics R^2 =.494, $F_{(21,4)}$ =7.091, p = .001.

Table 6. Predictors of Change in Steps/day for WI Group (n=26).

	Percent Increase in Steps/Day				
	B	**Std. Error**	**β**	**t**	***p***
Intervention Adherence	-.057	.097	-.102	-0.590	.562
Baseline Step/Day	.000	.000	-.610	-3.533	.002

Full model statistics R^2 =.317, $F_{(21,2)}$ =6.333, p = .007.

Summary

Overall, both groups significantly increased their steps/day from baseline to the completion of the intervention. However, the women enrolled in the WI+FB group increased their steps/day significantly more than women in the WI group. Baseline physical activity level was the only significant predictor of change in steps/day while adherence to the intervention, engagement in the Facebook intervention, and baseline score on the Facebook Intensity score were not significant predictors of improvements in physical activity.

Aim 2: Effect of Intervention on Psychosocial Variables

The second aim of this study was to examine if a social media-delivered physical activity intervention, one that includes an online social network, is more effective to increase motivation to change physical activity, increase perceived social support for physical activity, increase perceived benefits of physical activity and decrease perceived drawbacks, and increase self-efficacy to be physically active. It was hypothesized that female freshmen enrolled in an 8-week physical activity intervention delivered via social media would increase motivation to change physical activity more than women enrolled in an intervention delivered through e-mail. Based on results from testing the differences between proportions, this hypothesis was supported. It was also hypothesized that female freshmen enrolled in an 8-week physical activity intervention delivered via social media would increase perceived social support for physical activity, increase perceived benefits of physical activity, decrease perceived drawbacks of physical activity, and increase self-efficacy to be physical activity more than female freshmen receiving a physical

activity intervention delivered via e-mail. Based on results from mixed-model ANOVAs, this hypothesis was not supported.

Stage of Change

At baseline, the majority of women in the WI group (76.9%) and WI+FB group (81.5%) were in the preparation stage of change indicating that they were preparing to make a change to their physical activity level within the next month (Table 7). The percentage of women in the preparation stage did not differ between groups at baseline ($z = 0.41$, $p < .01$). Results support the hypothesis that significantly more female freshmen enrolled in an 8-week physical activity intervention using social media will increase motivation to change physical activity than female freshmen receiving a physical activity intervention without social media. At the completion of the intervention, the majority of women in the WI group (61.5%) and the WI+FB group (50.0%) were in the action stage of change. However, there remained two women in the contemplation stage of change within the WI group, while all women in the WI+FB group resided in either preparation or action at the completion of the intervention. This shift in the percentage of women in the action stage was significant ($p < .01$) for both groups (WI: $z = 4.81$, $p < .01$; WI+FB: $z = 4.35$, $p < .01$); albeit significant between group differences were not present ($z = -0.71$; $p < .01$). However, when combining women in the preparation and action stage of change and testing the differences between these two proportions, there was a significant difference in the percentage of women in these stages between the WI group and the WI+FB group ($z = 2.12$; $p < .05$) indicating that the WI+FB intervention arm had a greater effect on women's progression through stages of change for physical activity.

Table 7. Stage of Change at Baseline and Week 8 for WI (n=26) and WI+FB (n=27) Participants

	WI Baseline	WI Week 8	WI+FB Baseline	WI+FB Week 8
Pre-Contemplation	2 (7.7)	0 (0.0)	2 (7.4)	0 (0.0)
Contemplation	4 (15.4)	4 (15.4)	3 (11.1)	0 (0.0)
Preparation	20 (76.9)	6 (23.1)	22 (81.5)	13 (48.1)
Action	0 (0.0)	16 (61.5)	0 (0.0)	14 (51.9)

Note: WI: Walking Intervention; WI+FB: Walking Intervention + Facebook Values in parentheses are percentages of totals in columns.

Social Support for Physical Activity

At baseline, perceived social support from both family and friends did not significantly differ between groups (Family: $t_{(2,51)} = -0.95$ $p > .05$; Friends: $t_{(2,51)} = -0.43$ $p > .05$; Table 8). At the start of the intervention, 27 of the women in this study (50%) had low perceived social support from family, and 28 (51.9%) had what is considered low perceived social support from friends (Leslie et al., 1999). That is, these women reported that family and/or friends never, rarely, or only sometimes supported their efforts to be physically active. Results from the mixed effects ANOVA failed to support the hypothesis that female freshmen enrolled in an 8-week physical activity intervention using social media will increase perceived social support significantly more than female freshmen receiving a physical activity intervention without social media. Perceived social support from family and friends did not significantly change from baseline to week 8 of the intervention for either group (family = $F_{(50,1)}$=0.34, p=.565,η=.01; friends = $F_{(50,1)}$=3.36, p=.073,η=.06).

Table 8. Social Support, Decisional Balance, and Self-Efficacy at Baseline and at Week 8.

Dependent Variable	Group	Baseline M±SD	Week 8 M±SD
Social Support Family	WI	2.74 ± 0.69	2.76 ± 0.66
	WI+FB	2.93 ± 0.76	3.02 ± 0.56
Social Support Friends	WI	2.89 ± 0.90	3.08 ± 0.75
	WI+FB	3.00 ± 0.90	3.22 ± 0.62
Decisional Balance Pros	WI	4.09 ± 0.80	3.95 ± 0.98
	WI+FB	3.91 ± 0.71	4.19 ± 0.66
Decisional Balance Cons	WI	2.15 ± 0.61	2.39 ± 0.79
	WI+FB	2.27 ± 0.73	2.41 ± 0.74
Decisional Balance Score	WI	1.93 ± 0.99	1.56 ± 1.30
	WI+FB	1.64 ± 0.92	1.78 ± 1.02
Self-Efficacy	WI	2.88 ± 0.66	2.95 ± 0.75
	WI+FB	2.97 ± 0.74	3.03 ± 0.68

WI: Walking Intervention n=26; WI+ FB: Walking Intervention+Facebook, n=27.

Decisional Balance

At baseline, perceived benefits and barriers did not differ between groups (Benefits: $t_{(2,51)} = 0.86$; $p > .05$; Barriers: $t_{(2,51)} = -0.64$; $p > .05$; Table 8). The vast majority of women in this study (92.6%) perceived more benefits than barriers to physical activity (i.e. had a decisional balance score above zero). Results from the mixed effects ANOVA did not support the hypothesis that female freshmen enrolled in an 8-week physical activity intervention using social media will increase perceived benefits of physical activity and decrease perceived drawbacks of physical activity significantly more than female freshmen receiving a physical activity intervention without social media. There were no significant time or between-group effects for perceived pros of physical activity, perceived cons of physical activity, and the balance between pros and cons of physical activity. However, a significant interaction effect ($p = .012$) was observed for perceived pros of physical activity. While women in the WI group experienced a decrease in perceived pros of physical activity, women in the WI+FB group had an increase in perceived pros of physical activity upon completion of the intervention.

Self-Efficacy

Baseline self-efficacy scores did not significantly differ between groups ($t_{(2,51)} = -0.48$; $p > .05$; Table 8). Among the women in this sample, 31 women (57.4%) had low self-efficacy to be active (i.e. a self-efficacy score of less than 3; Leslie et al., 1999). That is, on average, these women had only low to moderate confidence that they could be

active in five different situations. Results from the mixed effects ANOVA again did not support the hypothesis that female freshmen enrolled in an 8-week physical activity intervention using social media will increase self-efficacy to be active significantly more than female freshmen receiving a physical activity intervention without social media. No significant changes in self-efficacy occurred for either group as a result of the intervention.

Processes of Change

Hypotheses were not developed for processes of change before and after the intervention. However, several effects within the 10 processes of change were seen (Table 9). There was a significant time effect ($p = .002$) for consciousness raising. Women in both groups utilized consciousness raising strategies significantly more at the end of the intervention compared to baseline. A significant time effect was also observed for social liberation ($p = .001$), self-liberation ($p = .001$), stimulus control ($p < .001$), counter-conditioning ($p < .001$), reinforcement management ($p = .006$), and helping relationships ($p = .013$). Women in both groups significantly increased their use of these processes of change from baseline to week 8 of the intervention. Finally, a significant interaction effect ($p = .025$) was observed for self-re-evaluation. While women in the WI group decreased their use of self-re-evaluation, women in the WI+FB group increased their use of self-re-evaluation. No significant changes ($p > .05$) were seen for use of dramatic relief and environmental re-evaluation.

Table 9. Processes of Change Scores at Baseline and at Week 8.

Dependent Variable	Group	Baseline M±SD	Week 8 M±SD
POC Conciousness-Raising	WI	3.31 ± 1.10	3.52 ± 1.04
	WI+FB	3.34 ± 0.94	3.86 ± 0.98
POC Dramatic Relief	WI	2.89 ± 0.72	2.92 ± 0.85
	WI+FB	2.48 ± 0.95	2.75 ± 1.03
POC Environmental Re-evaluation	WI	3.37 ± 0.90	3.54 ± 0.75
	WI+FB	3.27 ± 0.84	4.39 ± 0.54
POC Self Re-evaluation	WI	4.23 ± 0.95	4.20 ± 0.89
	WI+FB	3.97 ± 0.77	4.39 ± 0.54
POC Social Liberation	WI	2.86 ± 0.70	3.26 ± 0.84
	WI+FB	2.92 ± 0.70	3.24 ± 0.78
POC Self Liberation	WI	3.96 ± 0.79	4.19 ± 0.68
	WI+FB	3.84 ± 0.55	4.29 ± 0.51
POC Stimulus Control	WI	2.49 ± 0.80	2.94 ± 1.00
	WI+FB	2.34 ± 0.62	2.93 ± 0.95
POC Counter Conditioning	WI	3.39 ± 0.96	3.68 ± 0.83
	WI+FB	3.36 ± 0.88	3.81 ± 0.84
POC Reinforcement Management	WI	3.62 ± 0.92	3.84 ± 0.82
	WI+FB	3.34 ± 0.53	3.68 ± 0.73
POC Helping Relationships	WI	3.08 ± 1.01	3.52 ± 0.76
	WI+FB	2.97 ± 0.90	3.20 ± 0.76

WI: Walking Intervention n=26; WI+ FB: Walking Intervention+Facebook, n=27.
POC: Process of Change

Summary

In general, results supported few hypothesis surrounding changes in psychosocial variables related to physical activity. There were significant shifts in motivation to increase physical activity; albeit, no significant changes were seen within either intervention arm in perceived social support to be active, perceived benefits and barriers to be physically active, and self-efficacy to be active. There were, however, significant changes within both groups in the use of various processes of change including consciousness raising, social liberation, self-liberation, stimulus control, counter-conditioning, reinforcement management, and helping relationships. Thus, both the Walking Intervention and Walking Intervention + Facebook impacted motivation to change and the processes related to progression through stages of motivational readiness for physical activity but did not have an impact on other psychosocial variables related to physical activity including social support, decisional balance, and self-efficacy.

Chapter Summary

On average, women in both the WI and WI+FB groups significantly increased steps/day from baseline to the final week of the intervention. However, while women in the WI group had average increases in steps/day of 4,422, women in the WI+FB group had significantly greater increases physical activity, increasing steps/day by 7,293. Although there were varying degrees of adherence to the intervention, this factor did not predict change in physical activity within either intervention arm. In addition, despite a wide range in engagement in the Walking Intervention + Facebook (i.e. posts to the

Facebook page), this factor was also not predictive of change in steps/day among women enrolled in this intervention arm. Baseline physical activity level (steps/day), however, was a significant predictor in change in steps/day within both groups. Lower levels of baseline physical activity resulted in larger increases in steps/day as a result of the intervention.

Both the Walking Intervention and the Walking Intervention + Facebook were effective to increase motivation to change physical activity; albeit, results indicate that the intervention using social media may be more effective than the intervention without social media. In addition, women within both intervention arm significantly increased their use of several processes of change that are important when progressing through the stages of motivational readiness. Neither intervention arm, however, had a significant impact on perceived social support, perceived benefits and barriers, or perceived self-efficacy related to physical activity.

Results from this investigation demonstrate that the walking intervention that included a Facebook component was effective to increase physical activity in female college freshmen, more so than a walking intervention that does not have a social media component. Additionally, women who have the lowest levels of physical activity at baseline may benefit the most from this type of intervention.

CHAPTER V: DISCUSSION

Introduction

Insufficient levels of physical activity have been a challenge to the health of developed countries for decades. The high school to college transition is a period in the life course when physical activity levels tend to decrease and then remain low into adulthood (Wengreen & Moncur, 2009). These low activity levels can result in an elevated risk of chronic disease (Lee et al., 2012). Thus, many researchers have focused on increasing physical activity levels in college students using face-to-face, mail, and telephone interventions (Dishman & Buckworth, 1996). While these interventions have demonstrated success (Marcus et al., 2006), they are limited in the number of participants that can be reached, high cost, personnel demand, and staff expertise. In an effort to address some of these limitations, researchers have started to deliver interventions through the internet (Eiben & Lissner, 2006; Greene et al., 2012; Grim et al., 2011; Magoc et al., 2011; Wadsworth & Hallam, 2010). Although these interventions have been successful in promoting physical activity and can reach larger numbers of individuals, the cost of delivering these interventions remains high, and engagement within these interventions (logins and use of intervention materials) is often low.

In an attempt to increase participant engagement within internet-based physical activity interventions, researchers have begun to explore integrating elements of social media. However, this research has found that delivering part of a physical activity intervention through social media was no more effective than educational information (Cavallo et al., 2012). Currently, no published study has delivered an entire physical activity intervention through an inexpensive, widely-used social media website, and thus,

the efficacy of such an intervention remains unknown. To address this gap in the literature, this study was designed to examine the efficacy of a physical activity intervention that uses social media to increase steps/day in a sample of female college freshmen. In addition, to gain a better understanding of potential factors related to the success of this intervention, the impact of this intervention on psychosocial variables (motivation to change, social support, decisional balance, and self-efficacy) related to physical activity were also studied.

Results of the present investigation demonstrated that a physical activity intervention, delivered via email, which included goal setting, self-monitoring with a pedometer, educational information, and weekly contact from an intervention leader was effective at increasing steps/day among previously inactive college women by approximately two miles of walking per day. However, delivering this intervention via a popular, widely used social media site (Facebook) was more effective to increase steps/day than delivering this intervention via e-mail, increasing physical activity by approximately three and a half miles of walking per day. Within both intervention arms (e-mail and Facebook), baseline steps/day was predictive of changes in steps/day. That is, the lower the physical activity at the start of the intervention, the greater the improvement in steps/day. Adherence to the intervention (defined as the number of weekly goals participants received) did not predict change in steps/day among either intervention arm. Within the social media-delivered intervention, neither engagement within the intervention (number of posts to the Facebook group) nor baseline level of Facebook usage predicted change in steps/day.

Examination of the psychosocial variables within this study revealed that women in both intervention arms had significant increases in motivation to change physical activity. However, the social media-delivered intervention had a stronger influence on motivation to change physical activity behavior than the intervention delivered via e-mail. Neither intervention arm was effective to improve perceived social support, decisional balance, or self-efficacy surrounding physical activity.

The success of this social media-delivered intervention to increase physical activity is encouraging. An intervention delivered through social media can address limitations in previously published internet-delivered physical activity interventions. That is, this type of physical activity intervention can be delivered to large numbers of people at a relatively low monetary cost through an internet entity that individuals already visit several times per day.

Change in Physical Activity

Current recommendations state that adults should accumulate 150 minutes/week of moderate physical activity, 75 minutes/week of vigorous physical activity, or a combination of the two to obtain the health benefits of regular physical activity (U.S. Department of Health and Human Services, USDHHS, 1996). Because pedometers are widely used by both researchers and the general public to quantify physical activity, recommendations have also been developed surrounding how many steps/day to accumulate (10,000 steps/day; Tudor-Locke et al., 2008). On average, only 40-50% of college students are meeting these recommended levels of physical activity (Leslie et al., 2000; Stone et al., 2002; Wallace et al., 2000). Because physical activity levels and habits

in college tend to continue into adulthood (Calfas et al., 1996), there is a need to increase physical activity levels in this population. Many intervention strategies have been successful to increase physical activity among college students; albeit, the current study is the first to examine the efficacy of a physical activity intervention delivered entirely through a social media website.

A physical activity intervention delivered via e-mail (Walking Intervention; WI) was used as a comparison group within this investigation. Participants in the WI group increased physical activity by 90.8%, an increase that is both clinically and statistically significant. Throughout the course of the intervention, participants continuously increased their steps/day, resulting in a final physical activity level 4,422 steps/day greater than at baseline, or over two additional miles of walking on a daily basis (Moreau et al., 2001). Further, while the women in this group were classified as "insufficiently active" at baseline (5642 steps/day), by the conclusion of the intervention, a total of 14 of the 26 women in this group (53.8%) were classified as "active," accumulating >10,000 steps/day (Tudor-Lock et al., 2009). These changes in physical activity are important given the numerous benefits of regular physical activity including a reduction in risk of premature mortality and non-communicable diseases including heart disease, type 2 diabetes, obesity, some forms of cancer, osteoporosis, and depression (CDC, 2012).

The degree of change in physical activity within the current investigation is greater than changes observed in some published studies (Jackson & Howton, 2008; Wadsworth & Hallam, 2010) but less than the success found in others (Eiben & Lissner, 2006; Magoc et al., 2011). However, the different results between this study and previous studies may be due to key differences in study design including baseline

physical activity level of participants, physical activity assessment tool, and intensity of the intervention (e.g. number of contacts with the intervention leader).

The increases in physical activity within the current study were larger than those seen in two prior internet-based physical activity interventions targeting college students (Jackson & Howton, 2008; Wadsworth & Hallam, 2010). Jackson & Howton (2008) examined the efficacy of a physical activity intervention among 236 college freshmen and sophomores enrolled in an introductory health and wellness course. As part of their course, students were given information (education) on the recommended steps/day (10,000 steps/day) and were asked to wear a pedometer for 12 weeks, to set step goals for themselves (goal setting), and to track their steps/day (self-monitoring). On average, students increased their physical activity from approximately 7,000 to 9,500 steps/day, an increase of 35%.

Wadsworth & Hallam (2010) also employed an internet-based physical activity intervention in college students (n=91) that resulted in smaller increases in physical activity than the current investigation. Within their 6-week intervention, Wadsworth & Hallam (2010) delivered weekly e-mails and provided participants with access to an e-counselor, computer-mediated exercise materials, and a website with information on goal-setting, time management, building social support and self-efficacy, and managing outcome expectancies. The students increased physical activity by 35%, going from accumulating 30 minutes of moderate physical activity on 2.3 days per week to doing so on 3.1 days per week.

The smaller changes in physical activity seen within these two prior investigations compared to the current study may be due to several key differences in intervention and

study design, including baseline physical activity level, amount and quality of contact with the intervention leader, and method of monitoring and assessing physical activity level. Research has demonstrated that, when a participant begins an intervention with a low baseline physical activity level, he or she tends to increase physical activity to a greater extent than someone starting the intervention with a higher physical activity level (Vandelanotte et al., 2007). This phenomenon may have contributed to the smaller increase in steps/day seen in Jackson & Howton (2008), where baseline steps/day were higher compared with the baseline steps/day of women in the current study. In addition, contact from an intervention leader differed between the current study and the study conducted by Jackson & Howton (2008). Although participants enrolled in the intervention by Jackson & Howton (2008) met with the intervention leader in a class setting, this contact was not focused on the intervention (e.g. contain tips on increasing physical activity), and this may have impacted the degree of success of the intervention.

Another factor to consider is that physical activity was quantified in the current study using a pedometer, a step-counter that provides immediate feedback to the person wearing this device. Contrarily, Wadsworth & Hallam (2010) quantified physical activity as the number of days participants self-reported accumulating 30 minutes or more of moderate physical activity. Thus, participants did not receive a tool to self-monitor physical activity. In addition, when quantifying physical activity as designated portions of time (e.g. 30 minute periods), large amounts of physical activity may not be "counted" in results. For example, some participants in the study by Wadsworth & Hallam (2010) may have increased their physical activity to 25 minutes per day, but this would not have been represented in the results because it did not reach the required 30 minute bout.

Overall, comparing the results of the current study to two prior investigations on an internet-based physical activity intervention, certain strategies employed in the current study may have resulted in larger increases in physical activity. These strategies include targeting insufficiently active individuals, weekly contact from an intervention leader providing tips to become more active, and the use of a pedometer to quantify physical activity and allow participants to self-monitor physical activity.

Some prior studies had interventions that were more successful at increasing physical activity than the current study (Eiben & Lissner, 2006; Magoc et al., 2011). Eiben & Lissner (2006) provided 40 female college students with specific goals based on their current physical activity level (tailored goal-setting) and provided regular contact (frequency not provided) to participants that included e-mails, telephone calls, and occasional group sessions. As a result of the intervention, women increased their physical activity (measured via self-reported time spent in physical activity at work, commuting, and during leisure) by 1,464 kcals per week, a 105% increase. Magoc et al. (2011) also employed an internet-based physical activity intervention that had a larger effect than the current investigation. In a study including 104 college students, Magoc et al. (2011) employed an intervention that required an initial one-on-one meeting with students followed by access to an intervention website with seven lesson plans. These lessons included the following topics: self-monitoring, goal-setting, self-efficacy, barriers to physical activity, social support, reinforcement management, and outcome expectations. Participants in this intervention increased the number of days they accumulated at least 30 minutes of moderate physical activity from 1.2 days to 2.9 days per week, a 142% increase.

Although these changes in physical activity are somewhat different, in this case, slightly higher, than those seen in the current study, key differences in study design may help explain these differences. Again, the quantity and/or quality of contact with an intervention leader as well as the tool used to quantify physical activity may explain these differing results. Prior studies indicate that the intensity of a physical activity intervention (number of contacts, type of contacts) is related to the effect of the intervention (Vandelanotte et al., 2007). Although frequency was not specified, participants in the intervention employed by Eiben & Lissner (2006) received telephone calls from an intervention leader and attended group sessions with intervention staff. The quality of this contact is greater than the quality of contact in the current investigations (message over the internet), this could account for the larger increase in physical activity level compared with the current study (Vandelanotte et al., 2007). The larger increases in physical activity seen within the study by Magoc et al. (2011) may be due to the way in which physical activity was assessed. Magoc et al. (2011) quantified physical activity as the number of days participants accumulated at least 30 minutes of physical activity. When using any form of physical activity assessment tool, it is important to interpret the meaning of change in physical activity. Although participants in the study by Magoc et al. (2011) had greater percentage increases in physical activity than participants in the current study, they still fell short of meeting physical activity recommendations by the end of the intervention. Contrarily, participants in the current study were meeting the physical activity recommendations by the completion of the intervention.

Taking findings from the current study and previous investigations together, it is clear that there are components of a physical activity intervention that contribute to its

success, including baseline physical activity level of the participants, physical activity monitoring and assessment tool, and the quality and quantity of participant contact with the intervention leader. Including these factors in an intervention to increase physical activity levels will increase the likelihood of success.

While the WI resulted in both clinically and statistically significant increases in physical activity, significantly larger increases in physical activity were seen when the physical activity intervention was delivered through social media. The women in the Walking Intervention+Facebook (WI+FB) group increased physical activity by 155% (from 5,419 to 12,712 steps/day). After completion of the 8-week intervention, participants in the WI+FB group increased physical activity by an average of 2,619 steps/day more than women in the WI group. This difference would equate to approximately an additional 1.3 miles of walking per day or about 26 minutes of walking (at a 3 mph pace; Moreau et al., 2001). This finding is not only statistically significant, but also has clinical significance. First, like the women in the WI group, women in the WI+FB successfully moved from "insufficiently active" to "highly active" and thus are reducing their risk of premature death and chronic disease (CDC, 2012). Additionally, based on data from the Women's Health Initiative including over 73,000 women, there appears to be a dose-response relationship between energy expended through walking and reduced risk of cardiovascular disease (Manson et al., 2002), Type 2 Diabetes (Hu et al., 1999), breast cancer (Rockhill et al., 1999), and colon cancer (Martinez et al., 1997). Thus, it can be postulated that all women in the present study decreased their risk of cardiovascular disease after completion of the intervention; however, the women in the

WI+FB group decreased their risk of cardiovascular disease, type 2 diabetes, breast cancer, and colon cancer to a greater extent that women in the WI.

Only one other published study has included the use of social media to deliver a physical activity intervention, and found less success in changing physical activity levels, than the current study. Cavallo et al. (2012) examined the change in physical activity over 12 weeks among 134 female students in response to two intervention arms, one that was partially delivered through social media (Facebook), and a comparison group where participants had access to a website that provided educational information surrounding physical activity. Both groups significantly increased the number of kcals expended per week calculated by the Paffenbarger Physical Activity questionnaire (Paffenbarger, Blair, Lee, & Hyde, 1993). This questionnaire asks participants about the time they spend in sedentary, light, moderate, and vigorous activities during a typical 24-hour day. The comparison group increased kcals per week by 543 kcals per week (32% increase) while the intervention group increased kcals by 749 kcals per week (46% increase). These increases, although statistically significant, are much lower than those seen in the current study. Specifically, the increase in physical activity from baseline to the completion of the intervention for the WI of the current study was 4,422 steps/day while the increase in physical activity in the WI+FB group was 7,293 steps/day. Even if this walking was done at a very slow pace (2.5 mph), women in the walking intervention increased kcals per day by 225 kcal per day (1,575 kcals per week), over twice as much as the intervention group. Women in the WI+FB group increased kcals per day by 330 kcals, over three times that of the intervention group of the Cavallo et al (2012) study. (2,310 kcals per week; Ainsworth et al., 2011). There are a few key differences between the

current study and Cavallo et al. (2012), which could have contributed to the discrepant results, including the measurement tool used to assess physical activity, the method of intervention delivery, and the group sizes used within the interventions.

Research has shown that the physical activity assessment tool can influence physical activity measurement (Prince et al., 2008). Physical activity can be measured objectively (e.g. pedometer) or subjectively (e.g. self-report), and studies have research demonstrates that these two forms of assessment are only moderately correlated with one another due to human error and misperception of actual physical activity level. While the current study utilized a pedometer to objectively assess physical activity (step/day), Cavallo et al. (2012) used self-reported time spent in sedentary, light, moderate, and vigorous physical activity. Thus, the different physical activity measures used in the current study and the study by Cavallo et al. (2012) may have led to differing results.

It has been well-established that the method of delivery of a physical activity intervention can influence the success of the intervention (Marcus et al., 2006). The study by Cavallo et al. (2012) utilized a unique intervention delivery system-delivering part of the intervention through a website, part through email, and part through social media. Specifically, participants enrolled in the intervention by Cavallo et al. (2012) were still required to visit a separate website to obtain the educational information as well as goal-setting and self-monitoring tools, while social support was delivered through social media. This type of intervention design and delivery may have hindered engagement in the intervention as participants were required to visit a separate website, other than one they visit regularly (Facebook) to use intervention tools and strategies. Within the intervention by Cavallo et al. (2012), participants logged into the website

containing educational information and goal-setting/self-monitoring tools, just once every two weeks. Contrarily, within the present study, where all facets of the intervention were delivered via Facebook, participants received weekly goals and educational information.

Finally, intervention group size has been shown to influence the success of an intervention. Studies have shown that an ideal group size to facilitate social support is five to nine individuals (Miller, 1956). Groups that are larger than this size risk overloading individuals with information (e.g. if someone has to sort through over 20 posts to the group page), while groups that are smaller than five individuals may risk not supplying sufficient levels of social support (e.g. if only two individuals post regularly). In total, 64 students were enrolled in one Facebook group promoting physical activity within the study by Cavallo et al. (2012). Thus, within the current study, Facebook groups were limited to eight participants and the intervention leader which may have facilitated greater success within the intervention.

The current study adds to the small body of literature examining the efficacy of a physical activity intervention delivered through social media. Previous studies have demonstrated the efficacy of internet-based physical activity interventions among college students, but these interventions can be costly and hampered by low levels of engagement among participants. Unlike the intervention by Cavallo et al. (2012), where only part of the intervention was delivered via social media, the current study demonstrates that a physical activity intervention delivered entirely through social media can increase physical activity among college students to a significantly greater extent than an intervention delivered through e-mail. The question remains as to why this type of intervention was more effective than an e-mail-delivered intervention.

Factors Influencing Change in Physical Activity

The current intervention was successful at increasing physical activity among participants in both intervention arms, with a larger increase among the women enrolled in the Facebook intervention. In order to understand the success of this intervention, exploration of factors that contributed to the success of this intervention is warranted. Previous research has indicated that baseline physical activity levels, adherence to the intervention, social support, and the frequency of intervention reminders influence the success of a physical activity intervention (Schneider et al., 2012; Vandelanotte et al., 2007; Van Genugten et al., 2012;). Further, it was hypothesized that baseline level of Facebook use and engagement in the Facebook intervention group may contribute to the success of the interventions. Therefore, these factors were explored as potential contributors to the success of this intervention.

Baseline Physical Activity Level

Prior research demonstrates that baseline physical activity level is an important factor within physical activity interventions (Vandelanotte et al., 2007). Interventions that have targeted inactive or insufficiently active individuals have resulted in larger increases in physical activity than interventions not specifically targeting inactive individuals. We previously speculated that the larger effects seen in the current study compared to some prior studies may be due to the fact that women in this study were specifically recruited for their low levels of physical activity (<7,500 steps/day) while women in other studies were more active at baseline. Analyses conducted on women in the current study confirm this speculation and demonstrate that baseline physical activity

level was predictive of change in steps/day throughout the intervention for women in both groups. That is, the lower participants' physical activity at baseline, the greater increases in physical activity by the completion of the intervention. These results confirm prior research demonstrating that individuals with the lowest levels of physical activity tend to increase activity the most during a physical activity intervention (Lee & Skerrett, 2001). These findings support the idea that inactive or insufficiently active individuals should be specifically targeted because they have the greatest need for increases in physical activity to promote good health, and they will have the largest increases in physical activity upon completion of an intervention.

Intervention Adherence and Engagement

Intervention adherence and engagement are important within physical activity interventions and have been shown to be related to their success (Donkin et al., 2011; Kelders et al., 2011; Van Genugten et al., 2012). Adherence can be defined in different ways; some authors have defined adherence as attendance at a particular number of exercise classes (Garmendia et al., 2013) while others have defined adherence as the number of days participants successfully self-monitored their behavior (Carter, Burley, Nykjaer, & Cade, 2013). In the current study, adherence was defined as the number of weekly goals participants received throughout the intervention. A primary strategy used within the current study is goal-setting (10% increase in steps/day each week) and self-monitoring using a pedometer. However, if participants did not respond to weekly e-mails sent form the intervention leader, they would not receive their weekly goal. The majority of women in this study (66%) responded to all intervention e-mails and thus

received step goals for each week of the intervention. Approximately one quarter of the women in this study responded to all but one or two intervention messages, and only five of the 53 women in this study responded to just four of seven intervention messages. These rates of intervention adherence are higher than those seen with previous research examining the efficacy of an e-mail intervention targeting women (Dunton & Robertson, 2008). In their study of 156 women, participants enrolled in the e-mail intervention significantly increased walking, while women in placed on a wait-list did not change walking behavior. Women in the intervention opened 7.4 of the weekly e-mails during the 10-week intervention and only 23% of participants opened all weekly e-mails (Dunton & Robertson, 2008). These authors did not, however, test if intervention adherence was predictive of change in physical activity. Upon testing this relationship in the current study, it was discovered that adherence did not predict change in steps/day. Given these findings, there are a number of possible explanations. First, there may be a threshold for intervention adherence, beyond which, further increases in steps/day were not seen. However this threshold has not yet been defined for intervention adherence in previous research. It is also possible, however, that other intervention tools were effective to increase physical activity. That is, even if women did not receive their weekly goal, they were still self-monitoring with a pedometer and receiving social support from peers.

Engagement in the intervention delivered through social media was also examined as a potential influence on increases in step/day. Engagement was defined as the number of "posts" each participant logged throughout the intervention. The engagement or postings of participants in this study averaged 7.1 ± 4.5 posts and was higher than

previously published research using social media to increase physical activity (Cavallo et al., 2012) albeit lower than general Facebook use (Lukes, 2010). As seen in other studies (Norman et al., 2007), participants' posts decreased throughout the intervention. Results from this analysis demonstrate that, although there was a wide range in the number of posts made by individuals in this intervention (from 6 to 32), this factor did not influence actual change in steps/day from baseline to week 8 of the intervention. From these findings, it appears that engagement within a Facebook group does not predict increases in physical activity among college women. Despite these findings, something to consider is that posts to the Facebook group were not the only form of engagement in this intervention. Participants may have visited the group but not have posted. However, an objective measure of how many times an individual visits a group page is currently not available.

Baseline Facebook Usage

It can be theorized that women who use Facebook more frequently may be more likely to succeed in a physical activity intervention delivered through Facebook because of the potential increased frequency with which they will receive intervention information. In the current study, the baseline frequency of Facebook use among participants enrolled in the Facebook-delivered intervention was not a predictor of change in steps/day. Baseline Facebook usage was assessed using participants' scores on the Facebook Intensity scale. This scale has been used in previous research examining the efficacy of a physical activity intervention delivered through Facebook (Cavallo et al., 2012). This questionnaire asks participants how strongly they agree or disagree with six

statements (e.g. “Facebook is a part of my everyday life”; Ellison et al., 2007). The results of this study are in concordance with previous studies that also examined the influence of the baseline Facebook Intensity scale score on success within a physical activity intervention (Cavallo et al., 2012). These findings suggest that, although college students utilize Facebook to varying degrees, this may not impact the success of physical activity interventions delivered via Facebook. There is also the potential that certain aspects of Facebook usage that are pertinent to a physical activity intervention, such as the willingness to participate in a Facebook common interest (physical activity) group, were not adequately assessed using the Facebook Intensity scale. However, this scale is currently the only tool available to assess Facebook use; thus, further research may benefit the field by developing valid and reliable tools to assess Facebook usage within a physical activity intervention setting.

Although both intervention groups had significant increases in physical activity, the group enrolled in the intervention delivered via Facebook increased steps/day significantly more than participants in the e-mail-delivered intervention. Upon statistical tests of several factors that may have resulted in this change, the reason(s) that the intervention using social media had greater success than the intervention delivered through email had more success has yet to be determined. Two innate differences between the interventions must also be considered as potential influences of change in physical activity: social support and reminders (Facebook alerts).

Social Support

Research has demonstrated that social support is a significant predictor of change in physical activity among both adults (Ståhl et al., 2001) and college students (Leslie et al., 1999). A potential explanation for the larger increases in physical activity among women in the WI+FB group is the fact that this group had an online, peer-based social support network. The WI group had no formal social support provided as part of this study. Having a social support network and seeing others post may partially explain why women in the WI+FB group increased steps/day more than women in the WI group. When examining perceived social support before and after the intervention, there were no changes for either group in perceived support from family or friends. This is not surprising given that social support within the intervention was coming from strangers individuals had met on the internet through Facebook. Currently, a validated survey assessing change in online social support is not available. Previous studies evaluating the impact of an internet-based physical activity intervention in 104 college students demonstrated no change in social support using the same scale (Social Support for Physical Activity Scale, Sallis et al., 1987) as the current study, despite an increase in physical activity (Magoc et al., 2011).

Cavallo et al. (2012) also examined perceived social support before and after a physical activity intervention using social media in a larger sample of college students (N = 134) and found that that companionship social support significantly increased (by 11%) among participants in an intervention using social media. However, Cavallo et al. (2012) utilized a scale that had been adapted from the Social Influence on Physical Activity Questionnaire (Chogahara, 1999) and found increases in social support for physical

activity within both intervention arms. Because these authors had adapted the social support scale to focus on online social support, they may have been able to more accurately assess the types of social support that accompany social media-based or internet-based interventions. It should be noted that this modified scale has not been validated and psychometric properties are not available on the scale. Therefore, caution should be used when interpreting results.

Taking the findings in the current study together with previous studies, the question as to whether or not a physical activity intervention using social media can increase social support in college students and if this increase influences changes in actual physical activity level is left unanswered. It remains unknown if social support from online peers is influential in changing physical activity levels. Future studies using tools to assess changes in online social support throughout internet-based physical activity interventions are needed to fully elucidate the potential influence of social support on change in physical activity.

Frequency of Reminders

Reminders (such as messages or alerts) can come from intervention leaders or fellow participants, and research suggests that reminders from intervention leaders or fellow participants are strongly related to the success within physical activity interventions (Schneider et al., 2012). Women in the WI+FB group received more frequent reminders of the physical activity intervention via Facebook compared to the WI group that did not receive reminders on Facebook. Reminders within the WI+FB group were delivered in two different ways- when participants had a message from the

intervention leader or when a fellow participant posted to the Facebook group. When participants had a Facebook message from the intervention leader, she would receive an alert on her Facebook homepage. Additionally, whenever a participant would post, all other participants would receive an alert of that post on their Facebook homepage. While Facebook messages from the intervention leader were sent on a weekly basis, and therefore were consistent between groups and across the 8-week intervention (women in the WI group received e-mails with the same scripted messages), the number of posts to the Facebook groups from fellow participants declined throughout the intervention (Intervention week one: 46 posts; Intervention week eight: 13 posts). Despite this fact, participants in the WI+FB received a minimum of three additional reminders (posts) per week compared to the WI group. Thus, this difference may explain the increased efficacy of the intervention delivered via Facebook compared to the e-mail-delivered intervention.

In addition to potential predictors of change in physical activity, changes in psychosocial factors related to physical activity were also examined within this investigation to gain a better understanding of potential contributors of the effect of the intervention on steps/day. Specifically, the current investigation included an examination of shifts in motivation to change physical activity, use of processes of change surrounding physical activity, perceived benefits and drawbacks of being active, and self-efficacy to be physically active before and after the 8-week intervention.

Motivation to Change Physical Activity

Motivational readiness is an important factor surrounding any behavior change such as increasing physical activity levels (Prochaska & DiClemente, 1982). Theoretically, individuals must go through a series of stages of motivational readiness to successfully change a behavior. Previous studies examining motivational readiness to change physical activity demonstrate that, on average, 10-15% of college students reside in pre-contemplation (not considering changing physical activity), 25-30% of students reside in contemplation (considering making a change), and 15-20% of students reside in preparation (preparing to make a change within the next 30 days; Braithwaite et al., 2003; Dannecker et al., 2003; Wallace & Buckworth, 2003). This leaves 35-50% of students who are actively making changes to their physical activity or have been regularly active for six months or more. Within the present examination, recruitment was limited to only those individuals who were in the pre-contemplation, contemplation, or preparation stage of change. Overall, 7.5% of participants were in pre-contemplation, 13.2% of participants were in contemplation, and 79.3% were in preparation. The low percentage of individuals in pre-contemplation is not surprising given the fact that this study was promoted as one seeking to increase individuals' physical activity level. Thus, students not currently interested in changing their physical activity level were unlikely to show interest in this study. Similarly, the high percentage of students in the preparation stage was also expected given that these individuals are more likely to enroll in a physical activity intervention in their attempts to become more physically active.

Results from the current study demonstrate that women within both intervention arms had significant changes in motivational readiness to change physical activity by the

completion of the intervention. At baseline, no women in either group was taking actions toward being regularly active, but at the completion of the intervention, 61.5% of women in the WI group and 50% of women in the action stage of change. These findings are in line with previous research among college students (Lieber et al., 2012). Specifically, among 892 women who completed a 12-week internet-based physical activity intervention, there was a significant shift in stage of change. By the completion of the 12-week intervention, a greater percentage of women (25.3% versus 12.3% at baseline) were in the action stage of change for physical activity. Taken together, it appears that a physical activity intervention among college students can increase motivation to change physical activity, and this increase in motivation parallels increases in actual physical activity.

However, findings from the current study also suggest that a physical activity intervention delivered through social media and including an online social support network may be more effective to increase the motivational readiness of women to be physically active. That is, at the completion of the intervention, all of the women within the WI+FB were taking steps toward becoming regularly active (i.e. were in the Preparation or Action stage of change) while 15.4% of the women in the WI were still only contemplating making a change to their activity level (i.e. in the Contemplation stage of change). Because a physical activity intervention delivered through social media appears to increase motivation to change physical activity to a greater extent than an e-mail-delivered physical activity intervention, larger increases in actual physical activity are also likely to result from a physical activity intervention delivered through social media.

Processes of Change

Progression through the stages of motivational readiness is dependent on several processes of change. These processes include raising awareness of the need to change a behavior (consciousness-raising), expressing feelings about the behavior (dramatic relief), considering how the behavior affects oneself (self re-evaluation) as well as one's physical and social environment (environmental re-evaluation), committing to changing the behavior (self-liberation), avoiding situations that promote the behavior (stimulus control), becoming aware of alternatives (social liberation) and substituting these alternatives for the behavior (counter-conditioning), rewarding oneself for making changes (reinforcement management), and using the support of others (helping relationships; Prochaska & DiClemente, 1983). When examining these processes of change within the current investigation, results indicate that women in both intervention arms significantly increased their use of several processes of change including consciousness raising, social-liberation, self-liberation, stimulus control, counter-conditioning, reinforcement management, and helping relationships. However, these results should be interpreted with caution due to inadequate power (ranging from 7 to 79%) to adequately assess potential between-group differences.

Prior research indicates that individuals use particular processes of change more heavily depending on the stage in which they reside (Prochaska & DiClemente, 1983). Specifically, when individuals are moving from contemplation to preparation, they are more likely to use the five cognitive-affective stages: consciousness-raising, dramatic relief, self re-evaluation, environmental re-evaluation, and social liberation (Prochaska et al., 1992). In the current study, however, participants increased the use of just two of

these five processes of change. Contrarily, participants increased the use of all of the behavioral processes of change: self-liberation, stimulus control, counter conditioning, reinforcement management, and helping relationships. These findings are in concordance with a prior examination of the efficacy of a physical activity intervention among 150 adults (Lewis et al., 2006). Lewis et al. (2006) also found that the use of behavioral processes significantly increased throughout a successful physical activity intervention. However, these authors did not see any significant changes in the use of cognitive-affective processes of change. Based on previous studies, behavioral processes are used more often when individuals progress from preparation to action (Rosen, 2000). When examining the stage of change in which the majority of participants in this study resided at baseline (preparation), these increases in use of certain processes of change is in line with what is theoretically expected.

The increases in the use of particular stages of change within this intervention demonstrate the potential efficacy of certain strategies employed. Participants were given continual feedback from their pedometer which may have led to an increased awareness of their level of physical activity (consciousness-raising). In addition, women in this study significantly increased their physical activity level which indicates that they did, in fact, make a choice to become more active (self-liberation), and results from statistical analysis as well as types of posts to the Facebook group (e.g., reporting the taking the stairs) indicate that these women may have started to recognize alternatives within their environment that promoted physical activity (social liberation). Another strategy employed within this study was goal-setting. The fact that women increased the use of reinforcement management indicates that the women in this study improved their ability

to react to accomplishing or falling short of these goals (reinforcement management). The increased use of stimulus control indicates that women in this study were becoming more adept at avoiding situations promoting sedentary behavior and instead selecting situations where physical activity is promoted. Lastly, the fact that women in both groups increased their use of helping relationships indicates that these women were experiencing increased support to be active from individuals in their environment. Helping relationships is very similar to perceived social support, which did not change for women in either group within this study. However, a key difference between the two measures of support may explain why helping relationships increased while perceived social support from friends and family did not. The Social Support for Physical Activity scale exclusively asks participants to consider family and friends while the Processes of Change questionnaire asks participants if they have an individual who supports their efforts to be active. Results show that women in this study felt increased support from individuals in their environment, but these individuals were new acquaintances (i.e. the intervention leader and fellow participants) rather than actual friends.

These changes in use of processes of change, combined with findings on shifts in motivational readiness to change, indicate that the strategies used within the two intervention arms in the current study (includes goal-setting, self-monitoring, educational information, and weekly contact from an intervention leader) were successful to aid participants in the progression through stages and processes of motivational readiness to change physical activity. However, future studies on examining increases in use of processes of change among larger, more diverse samples are warranted to gain a better

understanding of the potential added benefit of delivering a physical activity intervention through Facebook.

Perceived Benefits and Barriers to Physical Activity

Research demonstrates that perceived benefits and barriers to changing physical activity are related to actual physical activity level (Buckworth, 2001; Calfas et al., 2000). The most commonly reported perceived benefits to physical activity are feeling increased energy and reducing body weight while the most commonly reported barriers to physical activity among college students is lack of time (Buckworth, 2001). At the start of the intervention, women in both the WI and WI+FB group perceived more benefits than drawbacks to physical activity, but there were not significant differences between the groups on these variables. There were no significant changes for perceived benefits, perceived drawbacks, or the balance between benefits and drawbacks within either group at the completion of the intervention. However, sufficient power was not reached to detect change in perceived pros (power = 16.1%), perceived cons (power = 37.5%), or the balance between pros and cons (11.5%). Despite this fact, the majority of research demonstrates little change in decisional balance over the course of an internet-based physical activity intervention in college students (Franko et al., 2008; Magoc et al., 2011; Mailey et al., 2010; Wadsworth & Hallam, 2010). The general lack of change in decisional balance related to physical activity is interesting considering the fact that many women in this study and others progressed from one stage of motivational readiness to change physical activity to the next stage. Theoretically, as one progresses through these stages, perceived benefits of physical activity continue to increase while perceived

drawbacks continue to decrease (Prochaska & DiClemente, 1982). Despite the lack of effect of time on perceived benefits of physical activity, as would be expected within the Transtheoretical Model of Behavior Change, there was a significant interaction effect within the analyses. That is, while women in the WI+FB group increased perceived benefits of physical activity from baseline to week 8 of the intervention, women in the WI group had a slight decrease in perceived benefits of physical activity. Again, these findings indicate that something is occurring regarding decisional balance among participants, but further investigation is warranted.

Self-Efficacy for Physical Activity

An individual's confidence to be active (self-efficacy) is a key factor related to her actual physical activity level (Kim, 2008). Prior to the start of the intervention, women in both groups of this study had comparable levels of self-efficacy for physical activity to prior research examining inactive women. In their study of 584 women, Leslie (1999) found that 63.9% of participants had low self-efficacy. That is, the majority of these women felt only moderately or not at all confident that they could be active in various situations. Similarly, the majority of women in the current investigation (57.4%) had what would be considered low self-efficacy to be active. Results of this study show that neither intervention arm was effective to increase average levels of self-efficacy. However, again, adequate power was not reached to detect change in self-efficacy over time (power = 8.7%) or differences in change between groups (power = 5.4%). Despite issues with power, other previous studies examining the effect of a physical activity intervention among college students also demonstrated no change in self-efficacy

(Wadsworth & Hallam, 2010; Magoc et al., 2011). Wadsworth & Hallam (2010) examined self-efficacy among 45 college students before and after an intervention that included weekly e-mails, access to a website that allowed goal-setting and self-monitoring, and access to an e-counselor who was available to answer questions. These authors found no intervention effect on self-efficacy to be physically active. Similarly, Magoc et al. (2011) also found no change in self-efficacy to be physically active among 104 college students following an intervention that encompassed goal-setting, self-monitoring, and educational information. Findings from prior research in this area indicate that internet-based physical activity intervention, including interventions using social media, may not be effective to change college women's confidence to be active in various situations. However, results from the current study should be interpreted with caution due to insufficient power, and thus, further investigation is needed.

Overall, several factors were examined as potential influences on change in physical activity with only baseline physical activity level predicting change in steps/day. The level of adherence and engagement in the intervention as well as individuals' frequency of using Facebook at baseline were not predictive of change in physical activity. The question as to why the intervention delivered through Facebook was more successful than the intervention delivered through e-mail remains unanswered. Key differences in these interventions may being to explain the increased efficacy of delivering a physical activity intervention through Facebook. Specifically, participants in the intervention delivered through Facebook received many more reminders than participants receiving the intervention via e-mail. Currently, quantifying the number or reminders participants received through Facebook is not possible leaving in question

whether or not this factor results in the added efficacy of a physical activity intervention delivered through Facebook. Participants in the intervention delivered through Facebook also had access to an online social support network; participants in the intervention delivered through e-mail did not. Upon testing differences in changes in social support, no changes were seen in either group. However, a valid and reliable questionnaire assessing change in online social support is not yet available, again leaving in question whether or not this factor was responsible for the added benefit of the intervention delivered through Facebook.

Based on results, change in physical activity coincided with increased motivation to change physical activity. When progressing through the stages of motivational readiness to change physical activity, findings demonstrate that participants increased the use of several processes of change. However, other commonly-examined psychosocial factors that may be related to change in steps/day (decisional balance and self-efficacy) also did not change throughout the intervention, but again, adequate power was not reached for these variables. Thus, the true reason for changes in physical activity and differences in change between the two intervention arms remains unclear. Future studies containing larger, more diverse samples sizes may allow for further insight into predictors of change in physical activity during interventions.

Limitations

Several limitations must be considered when interpreting the results of this study. First, this study is limited in its scope because only female college freshmen living in on-campus dormitories were included in this sample. However, this population was

specifically targeted for a number of reasons. First, freshmen year is a time when physical activity levels tend to decline, and thus these students are in particular need of intervention. Second, this study was limited to women to eliminate sex as a confounding variable. For example, there is the risk that individuals may post false information about activity to impress members of the opposite sex or may feel too shy to post information given the presence of members of the opposite sex. Therefore, the results from this investigation can only be generalized to this population.

An additional limitation within this study is the time-frame within which data collection took place. Intervention enrollment began in February in the upper Midwest (average temperature of 30 degrees) and continued into the first week of May. Thus, there is the potential that seasonal changes promoted increases in physical activity (Calfas et al., 2000). However, women in both groups experienced these seasonal changes, and thus, the difference between the groups with regard to changes in steps/day cannot be explained by these seasonal changes. In addition, of note is the fact that the vast majority of participants completed this intervention by the month of April when temperatures averaged 50 degrees.

The measures used to assess secondary variables within this study must be considered as well when addressing limitations. Because research examining the efficacy of using internet resources to deliver physical activity interventions is relatively new, valid and reliable tools to assess psychosocial variables surrounding physical activity within an online setting are currently unavailable. This is particularly relevant when considering social support for physical activity. The measure utilized within this study did not assess perceived social support from online peers which is likely what changed

within this intervention. Studies are warranted to develop and validate such a measure for future use examining change in social support during an internet-based physical activity intervention.

Finally, a limitation within this study is the fact that there was face-to-face contact between participants and the intervention leader during baseline and post intervention assessments. The benefit of using social media to deliver and facilitate a physical activity intervention is that a large number of people can be reached over a wide range of locations. Thus, researchers have called for the need to examine internet-based physical activity interventions that do not include or require face-to-face contact between participants and intervention leaders (Marcus et al., 2009). For the purpose of this study, face-to-face contact was necessary to assess change as a result of the intervention. However, if this intervention were to be delivered widely to individuals in the general public without the need for objective assessments, this face-to-face contact would no longer be necessary.

Scientific Implications

Research has demonstrated that approximately 45% of college students are not meeting physical activity recommendations (Leslie et al., 2000; Stone et al., 2002; Wallace et al., 2000) and that physical activity habits developed in college extend into adulthood (Wengreen & Moncur, 2009). Although several researchers have examined if an internet-based intervention can successfully increase physical activity in college students, just one intervention has examined the efficacy of an intervention delivered using social media. The current study extends this research and demonstrates that an

intervention that uses goal-setting, self-monitoring, educational information, and weekly contact from an intervention leader can increase physical activity in a sample of female college freshmen, taking them from being insufficiently active (based on steps/day) to obtaining the recommended amount of activity. Further, when this intervention is delivered using social media, significantly greater increases in physical activity (equating to about 1.5 miles/day of walking) can be obtained. The added success of this physical activity intervention using social media is meaningful when considering the health benefits of physical activity and the dose-response relationship between physical activity and a number of diseases. In addition to this, a physical activity intervention using social media has the potential to reach very large numbers of people on a regular basis and be embedded in a website that is already visited several times per day.

Future Directions

This study is the second study to investigate the efficacy of a physical activity intervention using social media. Thus, further investigations are warranted to expand on the findings within this investigation. First, given the specific population used within this study, future research examining larger, more diverse samples is advised including men, younger and older individuals, as well as individuals with chronic disease who can benefit from increasing physical activity. Although female college freshmen are in need of increasing physical activity, this need extends to all men as well as people of all ages. A second future direction is to examine the efficacy of an intervention using social media on a different objective measure of physical activity. A pedometer was used for this study, and thus, only quantity of ambulatory physical activity can be assessed. However,

many studies on walking and health indicate that speed of walking is important (Hu et al., 2000; Kushi et al., 1997). Other physical activity monitors are available that can provide information on the efficacy of this type of intervention to increase activities of various modes and intensities, something the pedometer cannot assess.

Future interventions examining the efficacy of a physical activity intervention using social media may also benefit by examining the effect of this intervention within groups of actual friends or among groups of individuals with common goals (e.g. weight loss or increasing energy). The vast majority of women in this study were not friends prior to the intervention and did not meet in person throughout the intervention. Thus, they were merely members of the same interest group. There is the potential that employing this type of intervention in a sample of individuals who are actual friends may find increased success. Finally, the large increase in usage of various commercially-available activity monitors that have a social media component or the ability to be tied to a social media website (e.g. FitBit, Nike Fuel Band) warrants the need to examine the social media component of these types of monitors on physical activity levels.

Although changes in physical activity were seen within this study, the question remains as to what causes these changes. The only significant predictor of increases in physical activity within the current study was baseline steps/day. Future studies are warranted to further examine not only if physical activity intervention delivered through social media are successful but also why they are successful or unsuccessful.

Finally, this intervention was eight weeks in duration. Although changes were seen over this 8-week period, future studies are needed to examine the long-term effect of this intervention. The question remains if individuals who increase physical activity level

throughout this intervention continue to attain regular physical activity or resort to their previous, inactive lifestyle. The question also remains as to whether or not these individuals continue to utilize the Facebook group as a social support network once an intervention leader is not present.

Conclusion

Results from this study highlight the strong potential of an intervention using social media to increase physical activity in college freshmen. The current intervention was highly successful to increase physical activity among a sample of women and was delivered through an internet entity (Facebook) that is widely used and incorporated into the vast majority of individuals' daily lives. The increases in physical activity as a result from this intervention delivered through Facebook were very large, equating to an increase of 3.5 miles or walking per day. Women enrolled in the intervention delivered through Facebook went from being insufficiently active (accumulating just over 5,400 steps/day) to being highly active, more than doubling their steps/day to over 12,700 steps/day. If this type of increase were maintained, it has substantial potential to reduce risk of numerous chronic diseases including the number one cause of death in the U.S., heart disease (CDC, 2012). Given the success of this intervention, researchers, fitness professionals, and government agencies are encouraged to employ this type of intervention on a broader scale. However, because of the novelty of this type of intervention, further research is warranted to examine the efficacy of this intervention in larger, more diverse populations and to determine the reason an intervention delivered through Facebook is more effective than an intervention delivered through e-mail.

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APPENDICES

Appendix A: Physical Activity Stages of Change Questionnaire

ID:_____ Test #: _____ Date:_____

PHYSICAL ACTIVITY STAGES OF CHANGE

For each of the following questions, please circle Yes or No. Please be sure to read the questions carefully.

Physical activity or exercise includes activities such as walking briskly, jogging, bicycling, swimming, or any other activity in which the exertion is at least as intense as these activities.

	No	**Yes**
1. I am currently physically active.	0	1
2. I intend to become more physically active in the next 6 months.	0	1

For activity to be *regular*, it must add up to a *total* of 30 minutes or more per day and be done at least 5 days per week. For example, you could take one 30-minute walk or take three 10-minute walks for a daily total of 30 minutes.

	No	**Yes**
3. I currently engage in *regular* physical activity.	0	1
4. I have been *regularly* active for the past 6 months.	0	1

Appendix B: E-mail/In-Class Recruitment Script

E-mail/In-Class Recruitment Script

Hello! My name is Aubri Rote, and I am a doctoral student at UWM. I am currently completing my dissertation- a study examining the effectiveness of a Facebook-delivered physical activity intervention. If you would be willing to participate in this study, it would really help me out!

What will you get out of this study?

The study aim is to increase your physical activity level which has many health benefits including aiding in weight management and reducing your risk for a number of diseases (heart disease, type 2 diabetes, and some cancers).

Before I tell you more, to take part in this study, you must be a female freshman living in the Sandburg dorms, between the ages of 18 and 29, and a current Facebook user.

If you are interested, the first step is for us to get an idea of your current level of physical activity. For this, we will ask you to fill out a 4-question survey and wear a pedometer for one week. We will seal this pedometer, so you will not be able to see how many steps you take. We want this week to be a typical week for you.

After this week, we will meet you at a place of your convenience or have you come into the lab where we will collect the pedometer and make a final determination as to whether you qualify or not. At this point, you will find out how many steps per day you accumulated. If you do qualify, you will receive several tests of your overall health for free including: height, weight, waist and hip circumference. We will also ask you fill out 6 short surveys. Then, you will be randomly assigned to one of two groups, both aimed at increasing your physical activity. Regardless of the group you are in, you will receive a pedometer, a step goal for each week, logs to track you steps, and weekly messages from the intervention leader (me!). One group will involve Facebook, and the other group will not. The intervention will last 8 weeks. After the 8 weeks, we will ask you to come back to the lab for a final visit where we will ask you to complete the same measures we completed during your first lab visit.

Upon successful completion of the 8-week intervention, you will receive $20 worth of gift cards as a thank you for your time commitment. You'll have a choice between Amazon.com, itunes, or Subway. Also, after completing the intervention, you will get to keep the pedometer we give you for the intervention!

If this sounds like something that interests you (and I hope it does!), please let me know, and I can send you the screening form to complete. Then, we can get started! I hope to hear from you!

Kind Regards,
Aubri Rote
Physical Activity & Health Research Lab

Appendix C: Informed Consent Document-Screening

University of Wisconsin – Milwaukee
Consent to Participate in Research

Study Title: Eligibility screening for "Examining the efficacy of a walking intervention using social media in young adults"

Person Responsible for Research: Ann Swartz, Ph.D.

Study Description: The purpose of this study is to monitor baseline steps per day in order to screen for eligibility for a larger study that will examine the efficacy of a walking intervention using social media. Approximately 100 subjects will participate in this study. If you agree to participate, you will first be asked to complete a short, four-question survey. It is called Physical Activity Stages of Change. If you responses to this questionnaire allow you to qualify for the next step of the study, you will be asked to wear a physical activity monitor for seven consecutive days. This monitor will count your daily steps. However, this monitor will be sealed so that you cannot view output during the seven days. You will receive feedback on your activity after completing this one-week monitoring period. During these seven days, we ask that you go about your daily activities and not alter your activity level. After this week of monitoring, you will be asked to report to the Physical Activity & Health Research Laboratory where we will determine whether you are eligible for the walking intervention.

Based on your steps per day during this monitoring week, you may be asked to participate in this larger study examining the efficacy of a walking intervention using social media that will include two visits separated by an 8-week intervention promoting increases in walking followed by a 6-month and 12-month follow up.

Risks / Benefits: Risks that you may experience from participating are considered minimal. You may experience some frustration with not being able to view your steps per day during this week of monitoring. This precaution is being taken so that feedback from your pedometer will not affect your baseline steps per day. We want to assess your typical level of walking. Upon your return to the Physical Activity & Health Research Laboratory, we will go over your results with you. There will be no costs for participating. The benefits of participating include learning about your average steps per day at the end of the one-week period.

Confidentiality: Your information collected for this study is completely confidential and no individual participant will ever be identified with his/her research information. Data from this study will be saved on password protected computer for no longer than five years beyond the completion of the study. Only those individuals involved in the collection or analysis of the data will have access to the information. However, the Institutional Review Board at UW-Milwaukee or appropriate federal agencies like the Office for Human Research Protections may review this study's records.

Voluntary Participation: Your participation in this study is voluntary. You may choose not to take part in this study, or if you decide to take part, you can change your mind later and withdraw from the study. You are free to not answer study related questions or withdraw from study participation at any time. Your decision will not change any present or future relationships with the University of Wisconsin Milwaukee. There are no known alternatives available to participating in this research study other than not taking part.

Who do I contact for questions about the study: For more information about the study or study procedures, contact

Ann M. Swartz, Ph.D.
Associate Professor
Department of Human Movement Sciences
University of Wisconsin – Milwaukee
P.O. Box 413, Milwaukee, WI 53201
Telephone Number: (414) 229-4242

Who do I contact for questions about my rights or complaints towards my treatment as a research subject? Contact the UWM IRB at 414-229-3173 or irbinfo@uwm.edu.

Research Subject's Consent to Participate in Research:

To voluntarily agree to take part in this study, you must be 18 years of age or older. By signing the consent form, you are giving your consent to voluntarily participate in this research project.

_____
Printed Name of Subject/Legally Authorized Representative

_____ _____
Signature of Subject/Legally Authorized Representative Date

Appendix D: Informed Consent Document-Intervention

UNIVERSITY OF WISCONSIN – MILWAUKEE
CONSENT TO PARTICIPATE IN RESEARCH

1. GENERAL INFORMATION

Study title: Examining the efficacy of a walking intervention using social media in young adults

Person in Charge of Study:

Ann M. Swartz, Ph.D.
Associate Professor
Department of Human Movement Sciences
University of Wisconsin – Milwaukee

2. STUDY DESCRIPTION

Study description:
The primary purpose of this study is to examine the effectiveness of a Facebook intervention to increase steps per day. You will be one of 100 individuals (18-29 yrs) participating in this research study. Based on your responses to screening questions and your baseline steps per day, you are eligible to participate in this study. The study will be conducted over two visits (either at a place of your convenience or to the Physical Activity & Health Research Laboratory), separated by an 8-week intervention period. In addition, there will be a 6-month and 12-month follow up following the 8-week intervention. The first visit will last approximately 45 minutes. During the first visit, you will be asked to complete a questionnaire on your current and previous health history, as well as demographic information. You will be asked to complete five additional, short questionnaires and have your height, weight, waist and hip circumference measured. Finally, you will be randomized into one of two groups: a walking intervention group or a walking intervention plus Facebook group.

If you are randomized to the walking intervention group, you will be given feedback on your baseline steps per day, a pamphlet with advice on ways to increase walking, and a pedometer plus 8 weekly logs to track your steps as well as an individualized step goal. Finally, you will receive weekly e-mails from the intervention leader asking you to report your average steps per day up which you will receive feedback regarding this value. If you are randomized into the walking intervention plus Facebook group, you will be provided with all the same information and materials with the exception of the weekly e-mails. Instead, you will be asked to enroll in a Facebook group. You will receive weekly messages from the intervention leader asking you to report your average steps per day upon which you will receive feedback. In addition, we will ask that you post your steps per day each day and examples of how you accumulated steps. Also, we will encourage you to provide feedback to other participants in the Facebook intervention group.

After an 8-week period, we will meet with you at a place of your convenience or have you return to the Physical Activity and Health Research Laboratory to undergo the same tests that were completed during Visit 1 with the exception of the health history and demographic questionnaire. We will also ask you to complete the Physical Activity Stages of Change questionnaire. Research staff will go over results of all physical activity and health measures if you would like this information. This visit will take approximately 45 minutes. Six months and 12 months after the completion of the intervention, we will request that you wear a pedometer for one week and complete 5 surveys related to physical activity. Participation in the research study is completely voluntary, and you do not have to participate if you do not want to.

3. STUDY PROCEDURES

What will I be asked to do if I participate in the study?
This research study will consist of two visits (at a place of your convenience or to the Physical Activity and Health Research Laboratory of the University of Wisconsin-Milwaukee) separated by 8 weeks. There will also be a 6-month and 12-month follow-up.

Visit #1 (approximately 45 minutes in duration)

Demographic Measures
You will be asked to complete a questionnaire on your current and previous health status and demographic information. These measures will be completed in order to gather demographic information as well as necessary health information to double-check that you meet the inclusion/exclusion criteria for this study.

Questionnaires
You will be asked to complete five additional questionnaires that use a Likert scale which is a rating scale. The information from these questionnaires will allow for the assessment of various factors related to physical activity and Facebook usage. The first questionnaire will be used to assess your use of various strategies related to changing your physical activity. It is called Processes of Change. This is a 40-item questionnaire. You will be asked how often various events occur in your daily life. A second questionnaire will assess your percieved social support to be physically active. It is called Social Support for Physical Activity Scale. This questionnaire contains 13 items and assesses how often events occur. The third questionnaire contiains 16 items and will assess your percieved benefits and barriers to physical activity. It is called Decisional Balance. You will be asked to rank how important statements are to you. The fourth questionnaire called Confidence (Self-Efficacy) and will ask you to rank your level of confidence to be physically active in five different situtations. The final questionnaire will assess your Facebook usage. It is called the Facebook Intensity Scale. You will be asked how much you agree or disagree with six statements. This questionnaire also includes to open-ended questions asking about how many Facebook friends you have and how much time

you spent on Facebook in the previous week. It will take approximetly 15-20 minutes to complete these surveys, and it is important to take your time with the surveys and answer each question honestly and completely.

Baseline Measurements

We will measure your height, weight, and the distance around your waist and hips. Your height will be measured by having you stand as straight as possible, take a deep breath and hold this breath while we measure your standing height using a stadiometer. Your weight will be measured by having you stand on a scale while we adjust a balance beam scale. Waist and hip circumference will be measured using a tape measure. For waist circumference, we will measure the circumference of the narrowest part of your waist between your lowest rib and your hip bone. This measure will be taken twice. For hip circumference, we will measure the widest part of your hips. This measure will also be taken twice.

Group Assignment

Once surveys and measures are completed, you will be assigned to one of two groups, a walking intervention group or a walking intervention plus Facebook group. If you are randomized to the walking intervention group, you will be given feedback on your baseline steps per day, a pamphlet with advice on ways to increase walking, and a pedometer plus 8 weekly logs to track your steps as well as an individualized step goal. If you are randomized into the walking intervention plus Facebook group, you will be provided with all the same information and materials and also asked to log into your Facebook account and accept an invitation to join a Facebook walking intervention group.

Intervention

Walking Intervention Group: You will receive weekly e-mails from the intervention leader asking you to report your average steps per day up. Based on this value, you will receive feedback from the intervention leader. For example, if they meet their goal, they will receive positive feedback such as, "Nice job! Keep it up!" If they do not reach their goal, they will be encouraged to meet it in the next week with statements such as, "You were just __ steps away from your goal! Try again next week!" We ask that, if you are randomized to this group, you refrain from posting information about your physical activity to your personal Facebook account and refrain from using any other internet physical activity tools.

Walking intervention plus Facebook group: You will receive weekly Facebook messages from the intervention leader asking you to report your average steps per day upon which you will receive feedback. In addition, we will ask that you post your steps per day each day and examples of how you accumulated steps on the Facebook Intervention Group. When you log into the Facebook group to report your steps, we encourage you to provide a fellow member with some form of encouragement or provide the group as a whole

some form of motivational information with regard to walking. The material you post to Facebook will be used as quantitative (the number of times you post) and qualitative data (the type of information you post). However, these data will never be associated with your name when reporting results. All qualitative data taken from the site will be linked only the number we have given you. The lead researcher will also be a member of the Facebook group and will provide weekly educational information surrounding walking.

Follow-Up Visit (approximately 45 minutes in duration)

After the 8-week internvention, we will meet with you at a place of your convenience or have you report to the Physical Activity & Health Researcb Laboratory for a follow-up visit. During this visit, you will be asked to return your pedometer and your weekly logs.

You will be asked to complete the same questionnaires you completed during the first visit with the exception of the health history questionnaire. You will also be asked to complete the Physical Activity Stages of Change questionnaire again. In addition, the same measures will be taken including height, weight, waist and hip circumference. At the end of this visit, the researcher(s) will provide you with feedback on all the health variables that were collected if you would like this feedback.

At this point, if you are enrolled in the walking intervention plus Facebook group, you may continue to be a part of this group. It will not be disbanded. However, the lead researcher will no longer be a member of the group. If you are in the walking intervention group, you will have the option of enrolling in the Facebook group at this time.

6-Month Follow-Up Visit

Six months following the completion of the intervention, we will be contacting you to request that you wear a sealed pedometer. You will be able to pick up this pedometer at the Physical Activity & Health Research Laboratory, or we can bring the pedometer to you. We will also ask you to complete the same four pen and paper surveys surrounding physical activity that you completed during Visits 1 and 2, including the Processes of Change questionnaire for physical activity, the Social Support for Physical Activity Scale, the Decisional Balance questionnaire for physical activity, and the Confidence (Self Efficacy) questionnaire for physical activity. We will also ask you to complete the Physical Activity Stage of Change questionnaire. These questionnaires can be delivered by hand, or you can come to the Physical Activity & Health Research Laboratory to pick up the surveys. After this week of monitoring, we will ask that you return the pedometer to the laboratory, or we can pick it up at a place of your convenience. At this point, we will unseal the pedometer and provide you with feedback on your steps per day.

12-Month Follow-Up Visit

Twelve months following the completion of the intervention, we will be contacting you to request that you wear a sealed pedometer. You will be able to pick up this pedometer at the Physical Activity & Health Research Laboratory, or we can bring the pedometer to you. We will also ask you to complete the same four pen and paper surveys surrounding physical activity that you completed during Visits 1, 2, and for the 6-month follow-up, including the Processes of Change questionnaire for physical activity, the Social Support for Physical Activity Scale, the Decisional Balance questionnaire for physical activity, and the Confidence (Self Efficacy) questionnaire for physical activity. We will also ask you to complete the Physical Activity Stage of Change questionnaire. These questionnaires can be delivered by hand, or you can come to the Physical Activity & Health Research Laboratory to pick up the surveys. After this week of monitoring, we will ask that you return the pedometer to the laboratory, or we can pick it up at a place of your convenience. At this point, we will unseal the pedometer and provide you with feedback on your steps per day.

4. RISKS & MINIMIZING RISKS

What risks will I face by participating in this study?
You will face very minimal risks by participating in this research study. There is a risk of psychological stress when having your weight, height, waist and hip circumference measured. You will have the option of not receiving any of this information to reduce this risk of psychological stress. If you would like this information, we will fully explain and interpret all of your results.

There is also the risk of minor muscle soreness with increased physical activity. If this soreness reaches a point of extreme discomfort or if you feel that you have strained a muscle or ligament or experienced any other form of injury, we ask that you please report this to us immediately. If this occurs, we will either halt your participation in this study or re-assess your weekly step goals.

Facebook is an open forum for communication. Facebook will have the rights to access the information uploaded in the Facebook group, even though it is a "Private" group and Facebook retains all data as an independent entity even after the researchers are no longer monitoring the group. Electronic records on public websites may also be subject to open records requests. As an online participant in this research, there is always the risk of intrusion by outside agents, i.e., hacking, and therefore the possibility of being identified. You do not have to use your real name within the Facebook website, but if you do, your name will be visible by other research participants in the Facebook group.

It is completely up to you how much information you decide to share on the site with regard to you physical activity. We will make every effort to encourage participants to be respectful to each other during this intervention. However, there is the potential risk of someone saying something that you find offensive. The lead researcher will be a member of this group and will monitor the content posted within the Facebook group during the 8-

week intervention period. Because the lead researcher will not remain a member of the group after the intervention period, the content will no longer be monitored after the intervention period. If you find content offensive, please report it to the study staff immediately. We will ask the person who posted this content to remove it. If they refuse to do so, they will be asked to withdraw their participation in this study. There is also the risk that you may experience a reduced self-esteem when comparing your progress with the progress of others. We ask that, if you are feeling unhappy with your experience in the Facebook group, that you report this to us immediately.

As with any research study, there may be additional risks of participating that are unforeseeable or hard to predict.

5. BENEFITS

Will I receive any benefit from my participation in this study?
Yes, we will provide you with information on your steps per day as well as your height, weight, waist and hip circumference after completing the intervention, if you would like this information. The researcher will not provide any medical diagnosis as the result of the study.

Are subjects paid or given anything for being in the study?
Upon completion of the 8-week intervention, you will be given $20 worth of gift cards (you can choose Amazon.com, itunes, or Subway) as a token of our appreciation for your time commitment. You will also be allowed to keep the pedometer you were provided for the intervention if you complete the 8-week intervention.

6. STUDY COSTS

Will I be charged anything for participating in this study?
You will not be responsible for any of the cost associated with participating in this research study.

7. CONFIDENTIALITY

What happens to the information collected?
The information collected in this study is kept strictly confidential. Only the people directly involved in this study will have access to the information. However, the Institutional Review Board at UW-Milwaukee or appropriate federal agencies like the Office for Human Research Protections may review your records. Your name will never be associated with any of the information collected. Your name will be associated with an identification number which will not allow your information to be traced back to you. We may decide to present what we find to others, or publish our results in scientific journals or at scientific conferences. If this happens, your name will never be associated

with any of the data collected, and your identity will always remain strictly confidential. All research data is stored electronically on a password protected computer as well as in hard copy in a locked cabinet.

8. ALTERNATIVES

Are there alternatives to participating in the study?
There are no known alternatives available to you other than not taking part in this study.

9. VOLUNTARY PARTICIPATION & WITHDRAWAL

What happens if I decide not to be in this study?
Your participation in this study is entirely voluntary. You may choose not to take part in this study, or if you decide to take part, you can change your mind later and withdraw from the study. You are free to not answer questions or withdraw at any time. Your decision will not change any present or future relationships with the University of Wisconsin Milwaukee. The investigator may stop your participation in this study if she feels it is necessary to do so.

10. QUESTIONS

Who do I contact for questions about this study?
For more information about the study or the study procedures or treatments, or to withdraw from the study, contact:

Ann M. Swartz, Ph.D.
Associate Professor
Department of Human Movement Sciences
University of Wisconsin – Milwaukee
P.O. Box 413, Milwaukee, WI 53201
Telephone Number: (414) 229-4242

Who do I contact for questions about my rights or complaints towards my treatment as a research subject?
The Institutional Review Board may ask your name, but all complaints are kept in confidence.

Institutional Review Board
Human Research Protection Program
Department of University Safety and Assurances
University of Wisconsin – Milwaukee

P.O. Box 413
Milwaukee, WI 53201
(414) 229-3173
irbinfo@uwm.edu

11. SIGNATURES

Research Subject's Consent to Participate in Research:
To voluntarily agree to take part in this study, you must sign on the line below. If you choose to take part in this study, you may withdraw at any time. You are not giving up any of your legal rights by signing this form. Your signature below indicates that you have read or had read to you this entire consent form, including the risks and benefits, and have had all of your questions answered, and that you are a female freshman living in Sandburg Hall and 18-29 years of age.

_____
Printed Name of Subject/ Legally Authorized Representative

_____ _____
Signature of Subject/Legally Authorized Representative Date

Principal Investigator (or Designee)
I have given this research subject information on the study that is accurate and sufficient for the subject to fully understand the nature, risks and benefits of the study.

_____ _____
Printed Name of Person Obtaining Consent Role on Study

_____ _____
Signature of Person Obtaining Consent Date

Appendix E: Screening Form

UWM UNIVERSITY of WISCONSIN MILWAUKEE

Physical Activity & Health Research Lab

Department of Kinesiology
Enderis Hall, Rm. 434 (414)229-4392

Screening Form

Call log: Date/ Time Comment

_____

_____

Hello, my name is _____ and I am a_____ working with the Physical Activity & Health Research Laboratory at the University of Wisconsin-Milwaukee. You have indicated that you are interested in participating in physical activity research with our Lab. If you have a moment, please let me tell you about a study that we are currently working on. It is a study designed to examine the effectiveness of a Facebook intervention to increase your average step per day. Before I tell you about the study, do you mind if I ask you a few questions about yourself to determine if you qualify for the study.

1. Are you currently a member of Facebook? ☐ **Yes** ☐ No
2. Are you a female freshman living in Sandburg? ☐ **Yes** ☐ No
3. Do you currently have any limb amputations? ☐ Yes ☐ **No**
4. Are you currently pregnant, think you could be pregnant or nursing? ☐ Yes ☐ **No**
5. Have you had a barium or nuclear medical test within the past week? ☐ Yes ☐ **No**

RISK STRATIFICATION QUESTIONS	Yes	No
1. Do you have a family history of a heart attack, coronary artery disease, or sudden death (before 55 years in male first-degree relative such as father, brother OR before 65 years female first degree relative such as mother, sister)? If yes, which relative, and how old were they when the event occurred? _____ _____	☐	☐
2. Has anyone ever told you that you have high blood pressure? What is your blood pressure?_____ When was it last taken?_____	☐	☐
3. Has anyone ever told you that you have high cholesterol? What is your blood cholesterol level?_____ When was it last taken?_____	☐	☐
4. Has anyone ever told you that you have diabetes? What is your blood sugar level?_____	☐	☐

When was it last taken?_____

5. What is your current body weight?_____
   What is your current height?_____
   What is your current waist circumference?_____
   What is your current hip circumference?_____
6. What is your age?_____
   Are you male or female?_____
   Do you have any of the following:

Pain, discomfort in the chest, neck, jaw, arms, or other areas ☐ ☐
If yes, please explain
_____
_____

Shortness of breath at rest or with mild exertion ☐ ☐
If yes, please explain
_____
_____

Dizziness or lightheadedness ☐ ☐
If yes, please explain
_____
_____

Shortness of breath occurring at rest while lying down that is relieved by sitting up or standing or shortness of breath while sleeping ☐ ☐
If yes, please explain
_____
_____

Ankle swelling ☐ ☐
If yes, please explain
_____
_____

"Skipped heart beats" or a really fast heart rate (it may only occur occasionally) ☐ ☐
If yes, please explain
_____
_____

Pain that occurs in a muscle (pain does not go away during exercise, pain does not occur with sitting or standing, pain occurs daily, often described as a cramp, disappears 1 to 2 minutes after cessation of exercise) ☐ ☐
If yes, please explain
_____
_____

Known heart murmur ☐ ☐
If yes, please explain
_____
_____

Unusual fatigue or shortness of breath with usual activities ☐ ☐
If yes, please explain
_____
_____

*****They are eligible to participate if:**

- INDIVIDUAL ANSWERS "YES" TO QUESTIONS 1-2 AND "NO" TO QUESTIONS 3-5.
- THEY ARE CONSIDERED LOW RISK BASED ON RISK STRATIFICATION
- IS BETWEEN 18-29

IF THEY QUALIFY…

You are one of 100 women who are being asked to participate in this study at the University of Wisconsin-Milwaukee. This research study will consist of a baseline physical activity assessment, followed by two meetings separated by an 8-week intervention promoting increases in physical activity as well as a 6-month and 12-month follow up. Upon completion of the 8-week intervention, you will be given $20 worth of gift cards (you have a choice between Amazon.com, itunes, or Subway) as a token of our appreciation for your time commitment. In addition, you will be allowed to keep the pedometer we provided to you for the intervention.

Prior to any measures, the researcher(s) will go over an informed consent document with you in person. You will be asked to sign this form if you are willing to participate.

Baseline Eligibility Assessment: Before any laboratory visits, we will ask you to complete a baseline physical activity assessment (wearing a sealed pedometer for one week) as well as a short survey.

Visit 1:
On Visit 1, we will meet you at a place of your convenience or will have you come to the Physical Activity & Health Research Laboratory. We will ask you to provide us with some information on your current and previous health. Additionally, we will ask you to complete five pen and paper questionnaires. Next, measures of your body weight, standing height, and waist and hip circumference measures will be taken. Then, you will be assigned to one of two groups: a walking intervention group or a walking intervention plus Facebook group. Regardless of group assignment, you will receive feedback on your baseline steps per day, a pamphlet with information on physical activity, a pedometer, 8 weekly logs on which to record steps per day, and an individualized step goal. If you are assigned to the Facebook group, you will be asked to log into your Facebook account, and accept the invitation to the Facebook group sent to you by the lead researcher.

Intervention:
The intervention will last 8 weeks. If you are randomized into the walking intervention group, you will receive weekly e-mails from the intervention leader where you will be asked to report your average steps per week, and you will receive feedback on this value. If you are randomized into the walking intervention plus Facebook group, you will be enrolled in a Facebook group that will include all participants in this study group. This

group will be private from the public. Members of this group will receive weekly contact from the intervention leader through Facebook messages rather than e-mails. In addition, educational information will be posted with advice on how to accumulate more physical activity into daily life, and members of the group will be encouraged to post their steps accumulated, ways in which they accumulated steps, and encouragement to other members of the group on a daily basis.

Follow-Up Visit:
At the end of the 8-week intervention, we will meet with you at a place or your convenience or have you return to the Physical Activity & Health Research Laboratory. During this visit, you will be asked to complete all surveys you completed during Visit 1 with the exception of the health history questionnaire. We will also ask you to complete the Physical Activity Stages of Change questionnaire. In addition, all measures completed on Visit 1 will be completed during this follow-up visit including height, weight, waist and hip circumference. At the end of this visit, you will receive feedback on these measures of your health if you would like.

6-Month Follow-Up:
Six months following the completion of the intervention, we will be contacting you to request that you wear a sealed pedometer. You will be able to pick up this pedometer at the Physical Activity & Health Research Laboratory, or we can bring the pedometer to you. We will also ask you to complete the same five pen and paper surveys on physical activity you completed during Visits 1 and 2. We will also ask you to complete the Physical Activity Stages of Change questionnaire. These surveys can be delivered to you, or you can pick them up for the laboratory. After this week of monitoring, we will ask that you return the pedometer to the laboratory, or we can pick it up at a place of your convenience. At this point, we will unseal the pedometer and provide you with feedback on your steps per day.

12-Month Follow-Up:
Twelve months following the completion of the intervention, we will be contacting you to request that you wear a sealed pedometer. You will be able to pick up this pedometer at the Physical Activity & Health Research Laboratory, or we can bring the pedometer to you. We will also ask you to complete the same five pen and paper surveys on physical activity you completed during Visits 1, 2, and for the 6-month follow-up. We will also ask you to complete the Physical Activity Stages of Change questionnaire. These surveys can be delivered to you, or you can pick them up for the laboratory. After this week of monitoring, we will ask that you return the pedometer to the laboratory, or we can pick it up at a place of your convenience. At this point, we will unseal the pedometer and provide you with feedback on your steps per day.

Just a few more questions…

1. Is there any reason why you cannot complete this study?

□ Yes □ **No**

2. Do you have any medical conditions or vacations scheduled which would interfere with completion the study.

□ Yes □ **No**

Are you still interested? IF YES, SCHEDULE THEM FOR THE STUDY

IF THEY DO NOT QUALIFY…

Unfortunately, due to _____ you do not qualify to participate in this project at this time. If you would like to be contacted in the future for other studies taking place in the Physical Activity and Health Research Lab, I can keep your name on file. Would you like to hear about such studies in the future?

□ Yes □ **No**

Initials and date of person who filled out this form_____

Appendix F: Educational Pamphlet

This brochure sets out four steps to better health for Australian adults.

Together, guidelines 1–3 recommend the minimum amount of physical activity you need to do to enhance your health. They are not intended for high-level fitness, sports training or weight loss. **To achieve the best results, try to carry out all three guidelines and combine an active lifestyle with healthy eating.**

Guideline 4 is for those who are able, and wish, to achieve greater health and fitness benefits.

1 **Think of movement as an opportunity, not an inconvenience.**

2 **Be active every day in as many ways as you can.**

3 **Put together at least 30 minutes of moderate-intensity physical activity on most, preferably all, days.**

4 **If you can, also enjoy some regular, vigorous activity for extra health and fitness.**

Regular physical activity can:

* help prevent heart disease, stroke and high blood pressure;
* reduce the risk of developing type II diabetes and some cancers;
* help build and maintain healthy bones, muscles and joints reducing the risk of injury; and
* promote psychological well-being.

Guideline 1

THINK OF MOVEMENT AS AN OPPORTUNITY, NOT AN INCONVENIENCE.

Where any form of movement of the body is seen as an opportunity for improving health, not as a time-wasting inconvenience.

The need for movement

The human body was designed to move. Over hundreds of thousands of years of evolution, humans have been active in the process of survival; hunting, gathering, farming food, collecting fuel and building shelter.

But the technology of today has reduced much of the opportunity for human movement. Cars now reduce how much we walk. Machines and labour-saving devices carry out work for us both in the workplace and at home. Home entertainment such as TVs, videos, DVDs and computers, can keep us inactive for long periods.

The result is that human movement has been decreasing, but at the same time levels of obesity and other health problems have been increasing.

Changing the way we think about movement

We need to change our attitude toward physical activity if we are serious about our long-term health. If we view all movement as an opportunity, rather than an inconvenience, we will be taking a positive step towards better health and preventing illness. We can enjoy the benefits of modern technology without the negative health consequences.

Guideline 2

BE ACTIVE EVERY DAY IN AS MANY WAYS AS YOU CAN.

Make a habit of walking or cycling instead of using the car, or do things yourself instead of using labour-saving machines.

The increase in effort-saving technology in modern societies has coincided with increasingly busy lifestyles. So, we not only have less opportunity to be active, but seem to have less time. However, it is possible to regain some of the health benefits of regular movement by being more active in everyday life.

Being active in small ways throughout the day is likely to provide health benefits to almost everyone, no matter what your age, body weight, health condition or disability.

Ways to increase activity

Increases in daily activity can come from small changes made throughout your day – they all add up. It is important to remember that some activity is better than none, and more is better than a little.

To make a habit out of increasing activity in your day, you can:

* Walk or cycle instead of using the car.
* Park further away from your destination and walk the rest of the way.
* Walk or cycle to and from your tram/train station or bus stop, and get on and off at a stop that is further away.

* Take the stairs instead of the lift.
* Walk rather than rest on escalators or travelators.
* Work in the garden.
* Play with children in an active way.
* Walk or play with pets.
* Challenge family, friends and work colleagues to be active with you.

Guideline 3

PUT TOGETHER AT LEAST 30 MINUTES OF MODERATE-INTENSITY PHYSICAL ACTIVITY ON MOST, PREFERABLY ALL, DAYS.

You can accumulate your 30 minutes (or more) throughout the day by combining a few shorter sessions of activity of around 10 to 15 minutes each.

Moderate-intensity activity isn't hard!

Moderate-intensity activity will cause a slight, but noticeable, increase in your breathing and heart rate. A good example of moderate-intensity activity is brisk walking, that is at a pace where you are able to comfortably talk but not sing. Other examples include mowing the lawn, digging in the garden, or medium-paced swimming or cycling.

Moderate-intensity activity doesn't have to be continuous!

Research has shown that accumulated short bouts of moderate-intensity activity are just as effective as continuous activity at improving indicators of health such as blood pressure and blood cholesterol.

So you can:

* accumulate your 30 minutes or more throughout the day by combining a few shorter sessions of activity of around 10 to 15 minutes each; or
* do 30 minutes or more continuously.

Moderate-intensity activity should, however, be carried out for at least 10 minutes at a time without stopping.

For best results combine an active lifestyle with healthy eating

In general, this means eating a wide variety of nutritious foods including plenty of vegetables, legumes, fruits, breads and cereals (preferably wholegrain).

It also involves choosing foods that are low in fat (particularly saturated fat), salt and include only moderate amounts of sugars and foods containing added sugar. If you drink alcohol, limiting your intake is recommended. More information on healthy eating and the Dietary Guidelines for Australian Adults can be obtained from the Australian Government Department of Health and Ageing.

Guideline 4

IF YOU CAN, ALSO ENJOY SOME REGULAR, VIGOROUS ACTIVITY FOR EXTRA HEALTH AND FITNESS.

This guideline does not replace Guidelines 1-3. Rather, it adds an extra level for those who are able, and wish, to achieve greater health and fitness benefits.

Vigorous activity

Research has shown that people who participate in regular vigorous activity can get health and fitness benefits over and above the benefits they get from increasing daily movement or regular moderate-intensity activity. This includes extra protection against heart disease.

How hard is vigorous activity?

"Vigorous" implies activity that makes you "huff and puff", for example where talking in full sentences between breaths is difficult. Vigorous activity can come from sports such as football, squash, netball and basketball and activities such as aerobics, circuit training, speed walking, jogging, fast cycling or brisk rowing. For best results, this type of activity should be carried out for a minimum of around 30 minutes, three to four days a week.

Seeking medical advice

Although there's no age barrier to carrying out vigorous activity, medical advice is recommended for those who have been previously inactive, who have heart disease, have close relatives with heart disease, or who have other major health problems. Vigorous activity in pregnancy is not recommended without strict medical supervision.

Warm-up, cool-down, stretching and a gradual build-up from an inactive level are also recommended with vigorous activity, in line with most recommended fitness training programs.

For more information

www.healthyactive.gov.au

Other resources that you may find useful include:

Everyone wants to be more active. The problem is getting started.

Australia's Physical Activity Recommendations for 5-12 year olds

Australia's Physical Activity Recommendations for 12-18 year olds

Food for Health, Australian Dietary Guidelines for Adults, Children and Adolescents

Australian Guide to Healthy Eating

Each of these can be obtained by calling 1800 020 103 and asking for the PHD publications request line.

National Physical Activity Guidelines for Adults has been developed through extensive consultations with a wide range of experts in physical activity by the University of Western Australia and the Centre for Health Promotion and Research, Sydney, for the Australian Government Department of Health and Ageing (formerly the Commonwealth Department of Health and Aged Care).

GET HEALTHY. GET ACTIVE.

Building a healthy, active Australia.

Department of Health and Aged Care (1999)
National Physical Activity Guidelines for Adults, Canberra.
Reprinted 2005.

Appendix G: Health History Questionnaire

Physical Activity & Health Research Lab

PROJECT ID	HEALTH HISTORY AND DEMOGRAPHIC QUESTIONNAIRE	CURRENT DATE
_____		_____

Name: _____

Address: _____

City: _____ **ZipCode:** _____

Phone: _____ **Date of Birth:** _____ **Current Age:** _____

E-mail Address: _____ **Gender (circle one):** M F

How long have you been using Facebook: _____ **How often do you log into Facebook:** _____

For what do you use Facebook: _____

Do You Attend College? (circle one): Yes No **Year in College:** _____

If Yes, What University Do You Attend: _____

What is Your Intended Major: _____

Do You Work? (circle one): Yes No **Occupation:** _____

How Many Hours Per Week Do You Work On Average? _____

How many credits are you currently taking? _____ **What percentage of classes do you attend?** _____

Do You Exercise? Yes No **How Many Hours Per Week Do You Exercise?** _____

What Types of Exercise Do You Do? _____

Have You Recently Altered Your Exercise Habits For Any Reason? Y N

If So, Why? _____

Relationship Status (circle one): Single Casual Dating Committed Relationship
Married Divorced Widowed

Ethnicity (circle all that apply): White American Indian Asian Hispanic
Black / African American Native Hawaiian / Pacific Islander

Are you taking any prescription or over-the counter medication? (circle one) YES NO

If YES, please indicate the names, reasons, and how long you have been taking the medication below.

Name of Medication Reason for Taking For How Long?

_____

_____

Emergency Contact Information:

Name: _____

Relationship: _____ Phone: Work: _____ Home: _____

Personal Physician Name: _____ **Location:** _____

YOUR PAST HEALTH HISTORY

Circle any of the following medical conditions you have either been diagnosed with or have experienced.

Eating Disorders
Depression
Any heart problems
Blood Clots
High blood pressure
Cancer
Diabetes
Recurring leg pain
Liver or Kidney Disease
Any breathing or lung problems
Ankle swelling (not related to twisting)
Low back or joint problems

FAMILY HEALTH HISTORY

Circle any of the following medical conditions experienced by any immediate family and indicate who has/had the condition and when (brothers/sisters, children, parents).

Heart attacks
Stroke
High blood pressure
Early death
High cholesterol
Diabetes
Congenital heart defect
Eating Disorders
Heart operations
Depression
Other family illnesses _____

_____

YOUR PRESENT HEALTH (SIGNS & SYMPTOMS)

Circle any of the following signs and symptoms you are currently experiencing (within the last year).

Eating Disorder
Cough on exertion
Depression
Coughing of blood
Heart palpitations
Dizzy spells
Skipped heart beats
Frequent headaches
Chest pain / discomfort
Orthopedic / joint problems
Shortness of breath
Back Pain
Diabetes
Use of an assistive walking device

Have you been hospitalized in the last year?(circle one) Yes No

If YES, how many days were you in hospital? _____

YOUR PRESENT HEALTH (BEHAVIORS)

Do you currently smoke? (circle one) YES NO If YES, what? (circle) Cigarettes Cigars Pipe

How much per day: (circle one) < 0.5 pack 0.5 to 1 pack 1.5 to 2 packs >2 packs

If you have quit smoking, how old were you when you quit? ____ How many years did you smoke? _____

Do you drink alcoholic beverages? (circle one) YES NO If YES, how many beverages in 1 week? ____

Appendix H: Processes of Change

ID:_____ Test #: _____ Date:_____

Processes of Change

Physical activity or exercise includes activities such as walking briskly, jogging, bicycling, swimming, or any other physical activity in which the exertion is at least as intense as these activities.

The following experiences can affect the exercise habits of some people. Think of any similar experiences you may currently have or have had during the **past month**. Then rate how frequently the event occurs. Please circle the number that best describes your answer for each experience.

Scale

1. = never
2. = seldom
3. = occasionally
4. = often
5. = repeatedly

1. Instead of remaining inactive I engage in some physical activity. 1 2 3 4 5
2. I tell myself I am able to be physically active if I want to. 1 2 3 4 5
3. I put things around my home to remind me to be physically active. 1 2 3 4 5
4. I tell myself that if I try hard enough I can be physically active. 1 2 3 4 5
5. I recall information people have personally given me on the benefits of physical activity. 1 2 3 4 5
6. I make commitments to be physically active. 1 2 3 4 5
7. I reward myself when I am physically active. 1 2 3 4 5
8. I think about information from articles and advertisements on how to make physical activity a regular part of my life. 1 2 3 4 5
9. I keep things around my place of work that remind me to be physically active. 1 2 3 4 5
10. I find society changing in ways that make it easier to be physically active. 1 2 3 4 5
11. Warnings about the health hazards of inactivity affect me emotionally. 1 2 3 4 5
12. Dramatic portrayals of the evils of inactivity affect me emotionally. 1 2 3 4 5
13. I react emotionally to warnings about an inactive lifestyle. 1 2 3 4 5
14. I worry that inactivity can be harmful to my body. 1 2 3 4 5
15. I am considering the idea that regular physical activity would make me a healthier, happier person to be around. 1 2 3 4 5
16. I have someone I can depend on when I am having problems with physical activity. 1 2 3 4 5
17. I read articles about physical activity in an attempt to learn more about it. 1 2 3 4 5
18. I try to set realistic physical activity goals for myself rather than set myself up for failure by expecting too much. 1 2 3 4 5

19. I have a healthy friend who encourages me to be physically active when I don't feel up to it. 1 2 3 4 5
20. When I am physically active, I tell myself that I am being good to myself by taking care of my body. 1 2 3 4 5
21. The time I spend being physically active is my special time to relax and recover from the day's worries, not a task to get out of the way. 1 2 3 4 5
22. I am aware of more and more people encouraging me to be physically active these days. 1 2 3 4 5
23. I do something nice for myself for making efforts to be more physically active. 1 2 3 4 5
24. I have someone who points out my rationalizations for not being physically active. 1 2 3 4 5
25. I have someone who provides feedback about my physical activity. 1 2 3 4 5
26. I remove things that contribute to my inactivity. 1 2 3 4 5
27. I am the only one responsible for my health, and only I can decide whether or not I will be physically active. 1 2 3 4 5
28. I look for information related to physical activity. 1 2 3 4 5
29. I avoid spending long periods of time in environments that promote inactivity. 1 2 3 4 5
30. I feel that I would be a better role model for others if I were regularly physically active. 1 2 3 4 5
31. I think about the type of person I will be if I am physically active. 1 2 3 4 5
32. I notice that more businesses are encouraging their employees to be physically active by offering fitness courses and time off to work out. 1 2 3 4 5
33. I wonder how my inactivity affects those people who are close to me. 1 2 3 4 5
34. I realize that I might be able to influence others to be healthier if I would be more physically active. 1 2 3 4 5
35. I get frustrated with myself when I am not physically active. 1 2 3 4 5
36. I am aware that many health clubs now provide babysitting services to their mothers. 1 2 3 4 5
37. Some of my close friends might be more physically active if I would. 1 2 3 4 5
38. I consider the fact that I would feel more confident in myself if I were regularly physically active. 1 2 3 4 5
39. When I feel tired I make myself be physically active anyway because I know I will feel better afterward. 1 2 3 4 5
40. When I'm feeling tense, I find physical activity a great way to relieve my worries. 1 2 3 4 5

Appendix I: Social Support for Physical Activity Scale

ID:_____ Test #: _____ Date:_____

SOCIAL SUPPORT FOR PHYSICAL ACTIVITY SCALE

The following questions refer to social support for your physical activity.

The following is a list of things people might do or say to someone who is trying to do physical activity regularly. Please read and answer every question. If you are not physically active, then some of these questions may not apply to you.

Please rate each question *two times*. Under "Family", rate how often anyone living in your household has said or done what is described during the past three months. Under "Friends", rate how often your friends, acquaintances, or co-workers have said or done what is described during the past three months.

Please write one number from the following rating scale in each space:

1 = none
2 = rarely
3 = a few times
4 = often
5 = very often
0 = does not apply

		Family	**Friends**
1.	Did physical activities with me.	_____	_____
2.	Offered to do physical activities with me.	_____	_____
3.	Gave me helpful reminders to be physically active (i.e., "Are you going to do your activity tonight?")	_____	_____
4.	Gave me encouragement to stick with my activity program.	_____	_____
5.	Changed their schedule so we could do physical activities together.	_____	_____
6.	Discussed physical activity with me.	_____	_____
7.	Complained about the time I spend doing physical activity.	_____	_____
8.	Criticized me or made fun of me doing physical activities.	_____	_____
9.	Gave me rewards for being physically active (i.e., gave me something I liked).	_____	_____
10.	Planned for physical activities on recreational outings.	_____	_____
11.	Helped plan events around my physical activities.	_____	_____
12.	Asked me for ideas on how they can be more physically active.	_____	_____
13.	Talked about how much they like to do physical activity.	_____	_____

Appendix J: Decisional Balance

ID:_____ Test #: _____ Date:_____

DECISIONAL BALANCE

Physical activity or exercise includes activities such as walking briskly, jogging, bicycling, swimming, or any other physical activity in which the exertion is at least as intense as these activities.

Please rate how important each of these statements are in your decision of whether to be physically active. In each case, think about how you feel **right now**, not how you felt in the past or how you would like to feel.

Scale

1. = not at all important
2. = slightly important
3. = moderately important
4. = very important
5. = extremely important

1.	I would have more energy for my family and friends if I were regularly physically active.	1	2	3	4	5
2.	Regular physical activity would help me relieve tension.	1	2	3	4	5
3.	I think I would be too tired to do my daily work after being physically active.	1	2	3	4	5
4.	I would feel more confident if I were regularly physically active.	1	2	3	4	5
5.	I would sleep more soundly if I were regularly physically active.	1	2	3	4	5
6.	I would feel good about myself if I kept my commitment to be regularly physically active.	1	2	3	4	5
7.	I would find it difficult to find a physical activity that I enjoy and that is not affected by bad weather.	1	2	3	4	5
8.	I would like my body better if I were regularly physically active.	1	2	3	4	5
9.	It would be easier for me to perform routine physical tasks if I were regularly physically active.	1	2	3	4	5
10.	I would feel less stressed if I were regularly physically active.	1	2	3	4	5
11.	I feel uncomfortable when I am physically active because I get out of breath and my heart beats very fast.	1	2	3	4	5
12.	I would feel more comfortable with my body if I were regularly physically active.	1	2	3	4	5
13.	Regular physical activity would take too much of my time.	1	2	3	4	5

Please turn over

14. Regular physical activity would help me have a more positive outlook on life.	1	2	3	4	5
15. I would have less time for my family and friends if I were regularly physically active.	1	2	3	4	5
16. At the end of the day, I am too exhausted to be physically active.	1	2	3	4	5

Appendix K: Confidence (Self-Efficacy)

Confidence (Self-efficacy)

Physical activity or exercise includes activities such as walking briskly, jogging, bicycling, swimming, or any other activity in which the exertion is at least as intense as these activities.

Circle the number that indicates how confident you are that you could be physically active in each of the following situations:

Scale

1= not at all confident
2= slightly confident
3 = moderately confident
4 = very confident
5 = extremely confident

1. When I am tired 1 2 3 4 5
2. When I am in a bad mood 1 2 3 4 5
3. When I feel I don't have time 1 2 3 4 5
4. When I am on vacation 1 2 3 4 5
5. When it is raining or snowing 1 2 3 4 5

Appendix L: Facebook Intensity Scale

Facebook Intensity (FBI)

The Facebook Intensity scale is used to measure Facebook usage beyond simple measures of frequency and duration, incorporating emotional connectedness to the site and its integration into individuals' daily activities.

Please indicate how much you agree or disagree with the following statements.

1 = strongly disagree to 5 = strongly agree

	Strongly Agree				Strongly Agree
1. Facebook is part of my everyday activity.	1	2	3	4	5
2. I am proud to tell people I'm on Facebook.	1	2	3	4	5
3. Facebook has become part of my daily routine.	1	2	3	4	5
4. I feel out of touch when I haven't logged onto Facebook for a while.	1	2	3	4	5
5. I feel I am part of the Facebook community.	1	2	3	4	5
6. I would be sorry if Facebook shut down.	1	2	3	4	5

Please write a number for the following questions.

7. Approximately how many TOTAL Facebook friends do you have?

8. In the past week, on average, approximately how much time PER DAY have you spent actively using Facebook?

Reference: Ellison, N. B., Steinfield, C., & Lampe, C. (2007). The benefits of Facebook "friends:" Social capital and college students use of online social network sites. *Journal of Computer-Mediated Communication, 12*, 1143-1168.

Appendix M: Pedometer Log

Weekly Pedometer Log

Monday

Date: _____

Time on:_____ Time off:_____
Number of Steps:_____
Did you work? YES NO
Did you exercise? YES NO
If you exercised, what did you do? _____
For how long? _____

Tuesday

Date: _____

Time on:_____ Time off:_____
Number of Steps:_____
Did you work? YES NO
Did you exercise? YES NO
If you exercised, what did you do? _____
For how long? _____

Wednesday

Date: _____

Time on:_____ Time off:_____
Number of Steps:_____
Did you work? YES NO
Did you exercise? YES NO
If you exercised, what did you do? _____
For how long? _____

Thursday

Date: _____

Time on:_____ Time off:_____
Number of Steps:_____
Did you work? YES NO
Did you exercise? YES NO
If you exercised, what did you do? _____
For how long? _____

Friday

Date: _____

Time on:_____ Time off:_____
Number of Steps:_____
Did you work? YES NO
Did you exercise? YES NO
If you exercised, what did you do? _____
For how long? _____

Saturday

Date: _____

Time on:_____ Time off:_____
Number of Steps:_____
Did you work? YES NO
Did you exercise? YES NO
If you exercised, what did you do? _____
For how long? _____

Sunday

Date: _____

Time on:_____ Time off:_____
Number of Steps:_____
Did you work? YES NO
Did you exercise? YES NO
If you exercised, what did you do? _____
For how long? _____

Appendix N: Weekly Educational Messages

Intervention Weekly Posts:

Week 1:

Try going for a walk, even just a short one! Consider these options:

1. Start with a short 5-minute walk. Even with just 5 minutes, you can accumulate nearly 500 steps!

2. Try walking for 10 to 15 minutes. A short walk like this can increase your energy level and mood! Plus, you accumulate about 1,000 - 1,500 steps!

3. Even if you are not up for a vigorous workout, try a brisk walk on the treadmill for 30 minutes! Just like vigorous exercise, this amount of brisk walking still has lots of health benefits and can help with weight control!

Week 2:

You can fit activity into your day in surprising ways! Consider these options:

1. Check out this link to decide what is the best way to fit walking into your day: http://www.bostonglobe.com/business/2012/08/18/walking-for-exercise-easier-than-you-think/eUC6kV9SzSc4oCuZfZnJUK/story.html

2. Go for a short walk during commercial breaks of your favorite show! The average 60-minute TV show has about 14 minutes of commercials. That's 14 minutes of potential walking, even if it is just around your dorm room or walking in place!

3. Try watching your favorite show while walking on the treadmill! There are treadmills in Klotche as well as in the UWM dorms.

Week 3:

Walk for transportation! Consider these options:

1. Is there an errand or social gathering you can think of that you can walk to instead of take automobile transportation (car, bus, BOSS, cab)? Try it! You might find if enjoyable and want to do it more often!

2. Try ridding yourself of all automobile transportation (car, bus, BOSS, cab) for three full days! See how many more steps you get!

3. Really challenge yourself! Try ridding yourself of all automobile transportation (car, bus, BOSS, cab) for a whole week! See how long you can keep it going! You'll get a lot more steps into your day!

Week 4:

Keep your eyes peeled for opportunities to get steps into your day! Consider these options:

1. Try thinking of ways you can re-evaluate your daily routine to include more steps! Here is a website that may give you some ideas:

http://walking.about.com/u/ua/measure/How-To-Sneak-More-Walking-Steps-Into-Your-Day.htm

2. Instead of texting, facebooking messaging, or e-mailing a friend, go find them in person!

3. Take the stairs instead of the elevator! You'll be amazed at how many more steps you get!

Week 5:
Studying for classes is something all students must make time for. Try to find ways to fit activity into study time! Consider these options:

1. If you've been studying for a long period of time, break up your studying by taking a walk. You'll come back with more energy and re-focused!

2. Try doing part of your studying while walking! Sometimes pacing while reading notes can be helpful!

3. Try studying your notes while walking on the treadmill! This may take some practice, but give it a shot!

Week 6:
Replace sedentary choices with active ones! Consider these options:

1. Here a link to a list of ideas for walking activities at Livestrong.com. Try to pick which ones will work best for you!

   http://www.livestrong.com/article/526893-fun-ideas-for-walking-exercises/
2. Once per week, try to replace a sedentary activity with an active one! For instance, go to the mall rather than to a movie!

3. If you have a date or are just meeting up with a friend, instead of doing only sedentary activities, suggest going for a walk. Or, you can suggest an activity that requires walking such as checking out Milwaukee's local museums. They have great discounts for students!

Week 7:
Make your walking productive! Consider these options:

1. Try to re-evaluate your daily routine to incorporate walking. For instance, if you are on the phone, walk while you talk!

2. Maybe there is a new album you have been meaning to listen to! Load it on your phone or ipod and listen to it while you take a walk!

3. Try incorporating walking while you catch up with your friends, classmates, or roommates! Instead of sitting and talking, talk while taking a walk!

Week 8:

Make walking interesting! There are lots of places for walking in Milwaukee! Consider these options:

1. Here is a great link with various activities to do in Milwaukee! Pick the one that best suits you:

   http://city.milwaukee.gov/Local-Activities-Calendar
2. There are many parks near UWM! Here is a link to a map of Lake Park, voted the best public park in Milwaukee in 2012!

   http://county.milwaukee.gov/ImageLibrary/Groups/cntyParks/maps/Lake1.pdf
3. UWM offers many free classes to students! Through these classes, you can accumulate a lot of steps! Here is a link to UWM's Group-X website:

   https://www4.uwm.edu/recsports/group-x/

Appendix O: Institutional Review Board Approval Letter

UNIVERSITY of WISCONSIN
UWMILWAUKEE
Department of University Safety & Assurances

Jessica Rice, MPH
IRB Administrator
Institutional Review Board
Engelmann 270
P. O. Box 413
Milwaukee, WI 53201-0413
(414) 229-3182 *phone*
(414) 229-6729 *fax*
http://www.irb.uwm.edu
ricej@uwm.edu

New Study - Notice of IRB Full Board Approval

Date: November 19, 2012

To: Ann Swartz, PhD
Dept: Kinesiology

Cc: Aubrianne Rote
Nora Miller

IRB#: 13.135
Title: Examining the efficacy of a walking intervention using social media in young adults

After review of your research protocol by the University of Wisconsin – Milwaukee Institutional Review Board at a fully convened meeting held November 2, 2012, your protocol has been approved as minimal risk as governed by 45 CFR 46.

This protocol has been approved on **November 2, 2012** for one year. IRB approval will expire on **November 1, 2013**. If you plan to continue any research related activities (e.g., enrollment of subjects, study interventions, data analysis, etc.) past the date of IRB expiration, a continuation for IRB approval must be filed by the submission deadline. If the study is closed or completed before the IRB expiration date, please notify the IRB by completing and submitting the Continuing Review form found on the IRB website.

Unless specifically where the change is necessary to eliminate apparent immediate hazards to the subjects, any proposed changes to the protocol must be reviewed by the IRB before implementation. It is the principal investigator's responsibility to adhere to the policies and guidelines set forth by the UWM IRB and maintain proper documentation of its records and promptly report to the IRB any adverse events which require reporting.

It is the principal investigator's responsibility to adhere to UWM and UW System Policies, and any applicable state and federal laws governing activities the principal investigator may seek to employ (e.g., FERPA, Radiation Safety, UWM Data Security, UW System policy on Prizes, Awards and Gifts, state gambling laws, etc.) which are independent of IRB review/approval.

Contact the IRB office if you have any further questions. Thank you for your cooperation and best wishes for a successful project.

Respectfully,

Jessica P. Rice
IRB Administrator

Appendix P: Institutional Review Board Protocol Flow

IRBManager Protocol Form

Instructions: Each Section must be completed unless directed otherwise. Incomplete forms will delay the IRB review process and may be returned to you. Enter your information in the **colored boxes** or place an **"X"** in front of the appropriate response(s). If the question does not apply, write **"N/A."**

SECTION A: Title

A1. Full Study Title: Examining the efficacy of a walking intervention using social media in young adults

SECTION B: Study Duration

B1. What is the expected start date? *Data collection, screening, recruitment, enrollment, or consenting activities may not begin until IRB approval has been granted. Format: 07/05/2011*

1/1/2013

B2. What is the expected end date? *Expected end date should take into account data analysis, queries, and paper write-up. Format: 07/05/2014*

12/31/2014

SECTION C: Summary

C1. Write a brief descriptive summary of this study in Layman Terms (non-technical language):

The purpose of this study is to determine the efficacy of a walking intervention delivered through social media when compared to a usual care group in a sample of young women. The study will include one screening meeting and two visits at a place of the participants' convenience or to the Physical Activity & Health Research Laboratory as well as an 8-week intervention. There will also be a 6-month and 12-month follow up following this 8-week intervention. The first meeting will include obtaining consent to fill out a short survey and wear a sealed pedometer for one week. Visit 1 will include completion of a health history and demographic questionnaire and five additional questionnaires on Facebook usage and psychosocial factors related to physical activity such as motivation and perceived social support, self-efficacy and the benefits and drawbacks of physical activity. In addition, participants will have their height, weight, waist and hip circumference assessed. At the end of this visit, participants will be randomized into one of two groups: a walking intervention group or a walking intervention plus Facebook group. Participants in the walking intervention group will receive information on their current steps per day, a pamphlet with advice on ways to increase walking, a pedometer, 8 weekly logs on which to record steps per day, a tailored step goal for each week, and weekly e-mails to check the progress of reaching these goals. Participants in the walking intervention plus Facebook will receive the same information and materials. However, instead of using e-mail to contact participants, these individuals will be contacted through

Facebook messaging. They will also be asked to log into a Facebook group each day to report their daily steps, examples of how they reached their accumulated steps, and to provide encouragement to other participants. The Facebook Groups, each containing 8-9 participants, will be private and comprised of only those individuals enrolled in this study and a member of the study staff. After completion of the 8-week intervention, all participants will complete a second visit either at a place of their convenience or at[8] the Physical Activity & Health Research Laboratory. Visit 2 will consist of completion of five surveys on Facebook usage and factors related to physical activity that were completed on Visit 1 in addition to completion of the Physical Activity Stages of Change questionnaire and assessments of height, weight, waist and hip circumference. Following the 8-week intervention, there will be a 6-month and 12-month follow-up. Results from this study will provide insight into the immediate and long-term effectiveness of a walking intervention delivered through social media, as compared to the standard treatment aimed at increasing walking which includes providing feedback on physical activity, a goal to increase activity, a pedometer and logs to track steps per day, and regular contact with participants.

C2. Describe the purpose/objective and the significance of the research:

Physical activity which includes walking has numerous health benefits that include but are not limited to reduced risk of cardiovascular disease, type 2 diabetes, hypertension, dyslipidemia, and some cancers (CDC, 2011). Despite these benefits and the overall promotion of regular physical activity by government and non-government agencies, health care providers, and researchers, approximately 25% of adults in the U.S. engage in no physical activity (CDC, 2012). Researchers have recently turned to the internet as a means to promote physical activity, given its ability to reach a very large number of individuals on a regular basis (Davies et al., 2012).

Several studies have examined factors that are strongly related to the success of internet-based health behavior interventions. Lustria, Cortese, Noar, & Gluekauf (2009) cite four key factors related to the effectiveness of these interventions: personal and frequent information, regular contact with participants (Robroek et al., 2012), goal-setting, and tracking physical activity. In addition to these factors, Brouwer et al. (2011) suggest the importance of peer support as well as support from a knowledgeable counselor as a key to successful behavior change through internet-delivered interventions. Other authors have concluded that the factors that strongly influence the effectiveness of internet-based physical activity interventions are the frequency with which participant's login to the internet intervention (Donkin et al., 2011).

Facebook is a unique internet entity that can address all of the factors most strongly related to the efficacy of internet-based health behavior interventions (regular contact, frequent logins, peer support, tracking, goal-setting). Behind Google.com, Facebook is the second most visited website in the world (Alexia et al., 2010). The social media website, designed to keep people connected with friends, now has over 845 million users, half of whom are mobile users (have access on their smart phones). The average Facebook user creates 90 new pieces of content per month, indicating that the average user logs into the site at least three times per day (Lukes, 2010). The average number of logins to the internet-based

interventions reviewed by Davies et al. (2012) was three times per week. As Facebook has evolved over the years, there is now the ability to form what is known as "groups," where individuals enrolled in the group can post and share information on a shared webpage at any time. In addition, whenever new material is added to a group in which an individual is enrolled, he or she will receive an alert on his or her Facebook homepage. Also, individuals can be "tagged" in a post by someone else and will receive an alert. These features offer the opportunity to remind members of the group to track their physical activity behavior and visit the group if they have not done so in a while. Given the features of Facebook, this site can be a potential means to promote physical activity. Members of the site will not need to log into any additional websites for the walking intervention. Instead, the intervention will be embedded into a website that members visit several times per day. The formulation of a "group" can offer the potential for providing social support to increase walking and a place for an intervention "leader" to educational information surrounding walking. Research is limited examining the effectiveness of an internet-based walking intervention using Facebook. It is the purpose of this study to assess the efficacy of an intervention using Facebook to promote walking in young adults.

C3. Cite any relevant literature pertaining to the proposed research:

Alexa. (2010). Top Sites. Retrieved from http://www.alexa.com/topsites.

Brouwer, W., Willemieke, K., Crootzen, R., de Nooijer, J., de Vries, N.K….& Oenema, A. (2011). Which intervention characteristics are related to more exposure to internet-delivered healthy lifestyle promotion interventions? A systematic review. *Journal of Medical Internet Research, 13*(1), e2.

Centers for Disease Control and Prevention. (2012). Facts about physical activity. Retrieved from http://www.cdc.gov/physicalactivity/data/facts.html

Centers for Disease Control and Prevention. (2011). Physical activity and health: The benefits of physical activity. Retrieved from http://www.cdc.gov/physicalactivity/everyone/health/

Davies, C.A., Spence, J.C., Vandelanotte, C., Caperchione, C.M., & Mummery, W.K. (2012). Meta-analysis of internet-delivered interventions to increase physical activity levels. *International Journal of Behavioral Nutrition and Physical Activity, 9*(52), Advanced online publication. doi:10.1186/1479-5868-9-52.

Donkin, L., Christiensen, H., Naismith, S.L., Neal, B., Hickie, I.B., & Glozier, N. (2011). A systematic review of the impact of adherence on the effectiveness of e-therapies. *Journal of Medical Internet Research, 13*(3), e52.

Lukes, C.A. (2010). Social media. *American Association of Occupational Health Nurses, 58*(10), 415-417.

Lustria, M.L., Cortese, J., Noar, S.M., & Gluekauf, R.L. (2009). Computer-tailored health interventions delivered over the web: Review and analysis of key components. *Patient*

Education and Counseling, 74(2), 156-173.

Robroek, S.J.W., Lindeboom, D.E.M., Burdorf, A. (2012) Initial and sustained participation in an internet-delivered long-term worksite health promotion program on physical activity and nutrition. *Journal of Medical Internet Research, 14*(2), e43.

SECTION D: Subject Population

Section Notes…

- D1. If this study involves analysis of de-identified data only (i.e., no human subject interaction), IRB submission/review may not be necessary. Visit the Pre-Submission section in the IRB website for more information.

D1. Identify any population(s) that you will be specifically targeting for the study. Check all that apply: (Place an "X" in the column next to the name of the special population.)

	Not Applicable (e.g., de-identified datasets)		Institutionalized/ Nursing home residents recruited in the nursing home
X	UWM Students of PI or study staff		Diagnosable Psychological Disorder/Psychiatrically impaired
	Non-UWM students to be recruited in their educational setting, i.e. in class or at school		Decisionally/Cognitively Impaired
	UWM Staff or Faculty		Economically/Educationally Disadvantaged
	Pregnant Women/Neonates		Prisoners
	Minors under 18 and ARE NOT wards of the State		Non-English Speaking
	Minors under 18 and ARE wards of the State		Terminally ill
x	Other (Please identify): UWM students		

D2. Describe the subject group and enter the total number to be enrolled for each group. For example: teachers-50, students-200, parents-25, parent's children-25, student control-30, student experimental-30, medical charts-500, dataset of 1500, etc. Enter the total number of subjects below.

Describe subject group:	**Number:**
Students (some of whom could be enrolled in the PI's classes at UWM)	100

TOTAL # OF SUBJECTS:	100
TOTAL # OF SUBJECTS (If UWM is a collaborating site):	

D3. List any major inclusion and exclusion criteria (e.g., age, gender, health status/condition, ethnicity, location, English speaking, etc.) and state the justification for the inclusion and exclusion:

Inclusion Criteria

1. Female college freshmen aged 18 – 29 years old living in Sandburg Hall. Young adults are the heaviest users of social media websites such as Facebook (Chou, Hunt, Beckjord, Moser, & Hesse), and have high rates of inactivity (19%, CDC, 2008). Freshmen were selected in order to control for potential differences in lifestyles of students of different years in college. Social support for physical activity has differing influences for men and women (Gruber, 2008). In addition, individuals enrolled in a Facebook group of opposite sex may use the group page differently than they would if there are only individuals of the same sex. Finally, to control for environmental and living conditions that could impact walking behavior, this study will include participants living in Sandburg Hall.
2. Current Facebook user. Because Facebook will be used as a medium for intervention delivery, current Facebook use will be required for participation in this study.
3. Not accumulating regular physical activity, as defined as accumulating less than 7,500 steps per day (Tudor-Locke, Hatano, Pangrazi, & Kang, 2008). Authors of previous studies examining internet-based intervention promoting increases in physical activity have advised future researchers to specifically target individuals with low baseline activity levels (Vandelanotte et al., 2007). Not only are these individuals in the greatest need of increases in physical activity, but internet-based interventions promoting increases in physical activity appear to be more effective among sedentary individuals.

Exclusion Criteria ,

1. Cardiovascular, pulmonary, and metabolic disease and/or at moderate or high risk based on risk stratification. Because we are asking individuals to increase their steps per day, we will only enroll individuals free of cardiovascular, pulmonary, and metabolic disease and who are considered low risk based on risk stratification.
2. Use an assistive walking device or have current limitations to walking. Because the outcome measure of physical activity for this study is steps per day assessed using a pedometer, individuals who use an assistive walking device or have limitations to walking will be disqualified from participation in this study given that pedometer step counts may be inaccurate within these individuals.
3. In the "Action" or "Maintenance" Stage of Change based on results from the Physical Activity Stages of Change questionnaire (Appendix A). We are targeting individuals who are not currently engaging in regular physical activity for this study.

Center for Disease Control and Prevention. (2008). U.S. physical activity statistics. http://apps.nccd.cdc.gov/PASurveillance/DemoCompareResultV.asp?State=1&Cat=1&Ye

ar=2008&Go=GO.

Chou, W.S., Hunt, Y.M., Beckjord, E.B., Moser, R.P., & Hesse, B.W. (2009). Social media use in the United States: Implications for health communication. *Journal of Medical Internet Research, 11*(4), e48.

Gruber, K.J. (2008). Social support for exercise and dietary habits among college students. *Adolescence, 43*(171), 557-575.

Tudor-Locke, C., Hatano, Y., Pangrazi, R.P., & Kang, M. (2008). Revisiting "how many steps are enough?" *Medicine and Science in Sports and Exercise, 40*(Suppl 7), S537-S543.

Vandelanotte, C., Spathonis, K.M., Eakin, E.G., & Owen, N. (2007). Website-delivered physical activity interventions a review of the literature. *American journal of preventive medicine, 33*(1), 54 -64.

SECTION E: Informed Consent

Section Notes…

- E1. Make sure to attach any recruitment materials for IRB approval.
- E3. The privacy of the participants must be maintained throughout the consent process.

E1. Describe how the subjects will be recruited. (E.g., through flyers, beginning announcement for X class, referrals, random telephone sampling, etc.). If this study involves secondary analysis of data/charts/specimens only, provide information on the source of the data, whether the data is publicly available and whether the data contains direct or indirect identifiers.

Recruitment for this study will occur through announcements made in large university classes, over e-mail, and on Facebook (Appendix B), as well as flyers (Appendix C) posted in various campus bulletins. Interested participants will be screened in person, via e-mail or over the telephone (Appendix D). For e-mail recruitment, the student researcher (Aubrianne Rote) will be the correspondent via e-mail and will be the only person with access to this e-mail account. An informed consent document-short form (Appendix E) will be covered in person with all interested individuals. As part of the screening process, participants will be asked to complete the Physical Activity Stages of Change questionnaire (Appendix A); only those who are categorized as "pre-contemplation," "contemplation," or "preparation" will be eligible to continue in the screening process for the study. If, after the SOC questionnaire, a volunteer is still eligible, he or she will be given a sealed pedometer to wear for seven consecutive days and will be instructed not to change their physical activity patterns during the monitoring week. Because previous research has demonstrated that self-monitoring with a pedometer can improve health behavior (Bravata et al., 2007; Richardson et al., 2008; Tully & Cupples, 2011), the pedometer will be sealed during this monitoring period. After the seven days of wearing the monitor, participants will be met at a place of their convenience or will report to the Physical Activity & Health Research Laboratory for Visit 1, where information from the pedometer will be used to determine eligibility. That is, individuals accumulating less than 7,500 steps per day, on average, will be enrolled in this study.

Bravata, D.M., Smith-Spangler, C., Sundaram, V., Gienger, A.L., Lin, N.,…Sirard, J.R.

(2007). Using pedometers to increase physical activity and improve health: a systematic review. *Journal of American Medical Association, 298*(19), 2296-2304.

Richardson, C.R., Newton, T.L., Abraham, J.L., Sen, A., Jimbo, M., Swartz, A.M. (2008). A meta-analysis of pedometer-based walking interventions and weight loss. *Annals of Family Medicine, 6*, 69-77.

Tully, M.A. & Cupples, M.E. (2011). UNISTEP (University Students Exercise and Physical Activity) study: A pilot study of the effects of accumulating 10,000 steps on health and fitness among university students. *Journal of Physical Activity and Health, 8*, 663-667.

E2. Describe the forms that will be used for each subject group (e.g., short version, combined parent/child consent form, child assent form, verbal script, information sheet): If data from failed eligibility screenings will be used as part of your "research data", then these individuals **are** considered research subjects and consent will need to be obtained. Copies of all forms should be attached for approval. If requesting to waive documentation (not collecting subject's signature) or to waive consent all together, state so and complete the "Waiver to Obtain-Document-Alter Consent" and attach:

A short version informed consent document (Appendix E) and a full version informed consent document (Appendix F) will be completed for all subjects who qualify and are interested in participating in the study.

E3. Describe who will obtain consent and where and when consent will be obtained. When appropriate (for higher risk and complex study activities), a process should be mentioned to assure that participants understand the information. For example, in addition to the signed consent form, describing the study procedures verbally or visually**:**

Research staff will obtain consent. Both the short version informed consent and the full version informed consent will be obtained in person in the Physical Activity & Health Research Laboratory (Enderis Hall, room 434), in a University of Wisconsin Milwaukee classroom, or in a place of convenience for the participant (e.g. dormitory cafeteria).

SECTION F: Data Collection and Design

Section Notes…

- F1. Reminder, all data collection instruments should be attached for IRB review.
- F1. The IRB welcomes the use of flowcharts and tables in the consent form for complex/ multiple study activities.

F1. In the table below, chronologically describe all study activities where human subjects are involved.

- In **column A**, give the activity a short name. E.g., Obtaining Dataset, Records Review, Recruiting, Consenting, Screening, Interview, Online Survey, Lab Visit 1, 4 Week Follow-Up, Debriefing, etc.
- In **column B**, describe in greater detail the activities (surveys, audiotaped interviews, tasks, etc.) research participants will be engaged in. Address where, how long, and when each activity takes place.
- In **column C,** describe any possible risks (e.g., physical, psychological, social, economic, legal, etc.) the subject may ***reasonably*** encounter. Describe the **safeguards** that will be put into place to minimize

possible risks (e.g., interviews are in a private location, data is anonymous, assigning pseudonyms, where data is stored, coded data, etc.) and what happens if the participant gets hurt or upset (e.g., referred to Norris Health Center, PI will stop the interview and assess, given referral, etc.).		
A. Activity Name:	**B. Activity Description:**	**C. Activity Risks and Safeguards:**
Initial screening to determine eligibility	Initial screening will take place in person, via e-mail or over the telephone. Specific questions will be used (Screening Form; Appendix D) to ensure that participants meet inclusion and exclusion criteria.	None
Short Version Informed Consent	Consent for wearing a pedometer for one week and completing a short survey (Informed Consent Short Version; Appendix E) will take place in person in the Physical Activity & Health Research Laboratory, in a classroom on the UWM campus, or in a place of convenience for the participant.	None
Stage of Change Survey and Physical Activity Monitoring Period to Determine Eligibility	Participants will be asked to complete the Physical Activity Stages of Change questionnaire (Appendix A) to determine whether they meet the eligibility criteria which includes classification in the "pre-contemplation," "contemplation," or "preparation." Responses to the Physical Activity Stages of Change questionnaire (Appendix A) will be scored to ensure that participants are not in the action or maintenance stage. If they are in the action or maintenance stage, they will no longer qualify at this point. Participants will be asked to wear a sealed pedometer during all waking hours for seven consecutive days to assess a baseline of average steps taken per day.	There is the risk of that participants may experience some frustration with not being able to view their steps per day during this week of monitoring. This precaution is being taken so that feedback from their pedometer will not affect their baseline physical activity level. We want to assess their typical activity level. During Visit 1, we will go over results from this monitoring week with participants.

Visit 1	This visit will take place at a place of convenience for the participant or in the Physical Activity & Health Research Laboratory. Participants will return their pedometers to the research staff, and average steps per day will be calculated. Final eligibility will be determined. If participants averaged less than 7,500 steps per day they qualify to participate. If they averaged 7,500 steps/day or more, they will not qualify to participate and will be given general information about the benefits of physical activity and ways to increase physical activity (Appendix G). Individuals who qualify for the study will then be consented for the remaining aspects of the study (Full Version Informed Consent Document; Appendix F). If participants choose to participate, they will be asked to complete a Health History Questionnaire (Appendix H), the Processes of Change questionnaire for physical activity (Appendix I), the Social Support for Physical Activity Scale (Appendix J), the Decisional Balance questionnaire for physical activity (Appendix K), the Confidence (Self Efficacy) questionnaire for physical activity (Appendix L), and the Facebook Intensity Scale (Appendix M). After completion of these questionnaires, anthropometric measures will be taken. These measures will include height, weight, waist and hip circumference. Once all measures have been completed, participants will be randomized into one of two groups: a walking intervention group or a walking intervention plus Facebook group. Randomization will occur through adaptive randomization, a software tool that can ensure that groups do not differ at baseline on specified variables. For this study, these variables will include scores on all	There is also the small potential for psychological risk associated with with any of the anthropometric measures. These measures will be completed in a private room. Feedback on the values of these measures will not be provided during this visit. However, if the participant does become upset after the anthropometric measurements, the researcher will answer any questions she has regarding the measures. If the participant remains visibly upset, the researcher will inform the participant that there are trained professionals at the Norris Health Center with whom they can meet if they need to. If participants are hurt during the study, they will be referred to Norris Health Center. All research staff are CPR certifiedand able to deal with emergencies, so proper response (911, etc.) will be followed.

	questionnaires completed on Visit 1 with the exception the health history questionnaire. The walking intervention plus Facebook group will receive a theoretically-based, 8-week, Facebook-delivered, intervention promoting increases in physical activity. The walking intervention plus Facebook group will receive feedback on their baseline steps per day relative to the amount that is recommended per day (10,000 steps per day; Tudor-Locke et al., 2008) as well as an educational pamphlet on physical activity (Appendix G). Baseline steps will be determined by their initial physical activity level determined during the eligibility screening. Specifically, the goal will be to increase average steps per day by 10% each week up to 12,500 steps per day at which point (Tudor-Locke et al., 2008), participants will be given the goal to maintain this level of steps per day. The step goals will be listed at the top the logs provided to participants (Appendix N). To track daily steps, participants will be given a pedometer. Participants will be asked to log into their Facebook account and accept the invitation to a Facebook group created by the researcher that will deliver the walking intervention. At this time, participants will be informed that it is expected that they are respectful to all members of the Facebook group, and if they are not, they will be asked to withdraw their membership. There will be six Facebook groups, each including 8-9 participants (four groups with 8, and two groups with 9). All groups will receive identical information from the intervention leader. The walking intervention group will receive feedback on their baseline steps per day relative to the amount that is recommended (10,000 steps per day) as well as an educational pamphlet on physical activity (Appendix G). Members in this group will	

	be given tailored step goals based on their initial physical activity level determined during the eligibility screening. Specifically, the goal will be to increase average steps per day by 10% each week. The step goals will be listed at the top the logs provided to participants (Appendix N). To track daily steps, participants will be given a pedometer. Participants will also be informed that they will be receiving weekly e-mails from the study staff requesting their average steps per day for each week and a second e-mail with feedback based on this value.	
Intervention	Walking Intervention Group: During the 8-week intervention, the walking intervention group will receive weekly e-mails from the intervention leader. In this e-mail, they will be asked to report average steps per day, and based on this value, feedback will be provided. For example, if they meet their goal, they will receive positive feedback such as, "Nice job! Keep it up!" If they do not reach their goal, they will be encouraged to meet it in the next week with statements such as, "You were just __ steps away from your goal! Try again next week!" After completion of an 8-week intervention period, participants will meet with research staff at a place of their convenience or at the Physical Activity & Health Research Laboratory for a follow-up visit, Visit 2. Walking Intervention plus Facebook Group: All individuals enrolled in the walking intervention plus Facebook group will have joined one of six research study group on Facebook during Visit 1. The lead researcher will also be enrolled in each group. Participants in the Facebook groups will be	There is the risk of minor muscle soreness with increased walking. If this soreness reaches a point of extreme discomfort or if participants experience any form of injury, we will ask that they report this to the study staff immediately. If this occurs, their participation in this study will be halted or their weekly goals will be re-evaluated. Facebook is a public forum for communication. However, the Facebook intervention "group" will be private, only including enrolled research participants and the intervention leader. When consented (Appendix F), participants will be informed that electronic

	contacted weekly through Facebook messaging. In this message, participants will be asked to report average daily steps, and they will receive feedback on this value from the intervention leader. For example, if they meet their goal, they will receive positive feedback such as, "Nice job! Keep it up!" If they do not reach their goal, they will be encouraged to meet it in the next week with statements such as, "You were just __ steps away from your goal! Try again next week!" These participants will also be encouraged to post their steps per day each day on the Facebook group page in which they are enrolled as well as ways they accumulated steps. They will also be encouraged to provide feedback on their Facebook group to other participants in their group. The information posted to the Facebook group will be collected as data for quantitative (number of times posted) and qualitative analysis (type of information posted). Finally, the lead researcher will provide weekly educational information grounded in the Processes of Change for the Transtheoretical Model of Behavior Change (Appendix O). If participants have not reported their daily steps for five consecutive days, the lead researcher will send them a message on Facebook reminding them to report their steps each day.	records on public websites may be subject to open records requests. Participants will also be informed during consent that there is not completely secure interaction online with the statement: "As an online participant in this research, there is always the risk of intrusion by outside agents, i.e., hacking, and therefore the possibility of being identified." During consent, participants will also be told that they do not have to use their real name within the Facebook group. However, if they do use their name, this information will be visible by other research participants in the Facebook group. Also, any information participants share regarding their physical activity is completely voluntary. We will make every effort to encourage participants to be respectful to each other during this intervention. However, there is the potential risk of someone saying something that a participant finds offensive. The lead researcher will be a member of this group and will monitor the content

		posted within the Facebook group. If content is deemed offensive, the person who posted this content will be asked to remove it. If they refuse to do so, they will be asked to withdraw their participation in this study. There is also the risk that participants may experience a reduced self-esteem when comparing their progress with the progress of others. We will ask that if participants are feeling unhappy with their experience in the Facebook group, they report this to the study staff immediately. This Facebook group will be private and not visible to the public or other Facebook "friends." However, there is the possibility that someone may hack into the Facebook group. Participants will be warned of this possibility and always given the option to withdraw from participation if they feel that their confidentiality has been breached.
8-Week Follow-Up Visit (Visit 2)	After completion of the 8- week intervention period, all participants will meet with study staff at a place of their convenience or at the Physical Activity & Health Research Lab for Visit 2. During this visit, participants will return their pedometers and physical activity logs. Also, participants will be asked to	There is the small potential for psychological risk associated with with any of the anthropometric measurements. These measures will be

	complete all surveys completed on Visit 1, including the Processes of Change questionnaire for physical activity (Appendix I), the Social Support for Physical Activity Scale (Appendix J), the Decisional Balance questionnaire for physical activity (Appendix K), the Confidence (Self Efficacy) questionnaire for physical activity (Appendix L), and the Facebook Intensity Scale (Appendix M) with the exception of the Health History Questionnaire (Appendix H). Participants will also be asked to complete the Physical Activity Stage of Change questionnaire (Appendix A). In addition, all measures taken on visit 1 will be taken during this visit, including height, weight, waist and hip circumference. Results from all measures taken will be provided to participants at the end of this visit if they would like it. Walking intervention plus Facebook group participants will be informed that they can remain a part of the Facebook group promoting physical activity, or they can remove themselves from the group. In addition, participants in the walking intervention group will be offered the ability to join one of the Facebook walking groups at this time. However, all participants will be informed that the lead researcher will no longer be a member of this group.	completed in a private room. Participants will be asked if they would like to receive feedback on these variables before feedback is provided. If the participant does become upset after the anthropometric measurements, the researcher will answer any questions she has regarding the measures. If the participant remains visibly upset, the researcher will inform the participant that there are trained professionals at the Norris Health Center with whom they can meet if they need to. If participants are hurt during the study, they will be referred to Norris Health Center. All research staff are CPR certified and able to deal with emergencies, so proper response (911, etc.) will be followed.
6-Month Follow-Up	Six months following the completion of the intervention, participants will be contacted to request that they wear a sealed pedometer. They will be able to pick up this pedometer at the Physical Activity & Health Research Laboratory, or a member of the research team can bring the pedometer to them. Participants will also be asked to complete the same four pen and paper surveys	There is the risk of that participants may experience some frustration with not being able to view their steps per day during this week of monitoring. This precaution is being taken so that feedback from

	surrounding physical activity that they completed during Visits 1 and 2, including the Processes of Change questionnaire for physical activity (Appendix I), the Social Support for Physical Activity Scale (Appendix J), the Decisional Balance questionnaire for physical activity (Appendix K), and the Confidence (Self Efficacy) questionnaire for physical activity (Appendix L). We will also ask participants to complete the Physical Activity Stage of Change questionnaire (Appendix A). These questionnaires can be delivered by hand, or participants can come to the Physical Activity & Health Research Laboratory to pick up the surveys. At the completion of the week of wearing the pedometer, participants will have the option of returning the pedometer to the Physical Activity & Health Research Laboratory, or a member of the laboratory will meet the participant at a place of his or her convenience to retrieve the pedometer. Upon receipt of the pedometer, the study staff will provide participants with feedback on their steps per day for the monitoring week.	their pedometer will not affect their baseline physical activity level. We want to assess their typical activity level. Upon receipt of the pedometer, the study staff will provide participants with feedback on their steps per day for the monitoring week.
12-Month Follow-Up	Twelve months following the completion of the intervention, participants will be contacted to request that they wear a sealed pedometer. They will be able to pick up this pedometer at the Physical Activity & Health Research Laboratory, or a member of the research team can bring the pedometer to them. Participants will also be asked to complete the same four pen and paper surveys surrounding physical activity that they completed during Visits 1 and 2, including the Processes of Change questionnaire for physical activity (Appendix I), the Social Support for Physical Activity Scale (Appendix J), the Decisional Balance questionnaire for physical activity (Appendix K), and the Confidence (Self Efficacy) questionnaire for physical activity (Appendix	There is the risk of that participants may experience some frustration with not being able to view their steps per day during this week of monitoring. This precaution is being taken so that feedback from their pedometer will not affect their baseline physical activity level. We want to assess their typical activity level. Upon receipt of the pedometer, the study staff will provide participants with feedback on their steps

	L). We will also ask participants to complete the Physical Activity Stage of Change questionnaire (Appendix A). These questionnaires can be delivered by hand, or participants can come to the Physical Activity & Health Research Laboratory to pick up the surveys. At the completion of the week of wearing the pedometer, participants will have the option of returning the pedometer to the Physical Activity & Health Research Laboratory, or a member of the laboratory will meet the participant at a place of his or her convenience to retrieve the pedometer. Upon receipt of the pedometer, the study staff will provide participants with feedback on their steps per day for the monitoring week.	per day for the monitoring week.

F2. Explain how the privacy and confidentiality of the participants' data will be maintained after study closure:

Participant's names will be stored only in association with general demographic data and kept in a locked area (Enderis 444) by the primary investigator in the Department of Kinesiology. All experimental data will be stored with a coded subject identification number. Participants will be given a number with which their information will be linked, and these data will be available for use by the primary investigator or student investigator. Data from the Facebook site will never be entered in accordance with

The link between the coded data and the identifying information of the individuals will be destroyed after the data is analyzed. The primary investigator will store all data no longer than five years beyond the completion of the study. Only those individuals involved in the collection or analysis of data will have access to the material.

F3. Explain how the data will be analyzed or studied (i.e. quantitatively or qualitatively) and how the data will be reported (i.e. aggregated, anonymously, pseudonyms for participants, etc.):

The data will be analyzed quantitatively and qualitatively and be reported anonymously. Data will be reported as means and standard deviations. Steps per day, questionnaire scores, and anthropometric measures will be examined if differences occurred using a two by two Analysis of Variance. Posts to the Facebook walking group will be analyzed quantitatively and qualitatively. Common themes will be determined and reported as summarized information or as examples of quoted remarks.

SECTION G: Benefits and Risk/Benefit Analysis

Section Notes…

- Do not include Incentives/ Compensations in this section.

G1. Describe any benefits to the individual participants. If there are no anticipated benefits to the subject directly, state so. Describe potential benefits to society (i.e., further knowledge to the area of study) or a specific group of individuals (i.e., teachers, foster children). Describe the ratio of risks to benefits.

All participants will receive health information regarding their body anthropometrics. In addition, participants will receive information regarding their steps per day.

The goal of this intervention is to increase steps per day. Research has demonstrated that increasing physical activity such as walking can reduce risk of cardiovascular disease, type 2 diabetes, hypertension, dyslipidemia, and some cancers (CDC, 2011). Physical activity such as walking can also reduce the risk of depression and anxiety as well as improve body image. Thus, if participants are successful with this intervention, benefits can be experienced on the individual level with regard to personal health as well as the societal level in reductions in health care costs.

In addition, results from this study will provide further knowledge to the area of physical activity interventions, and if successful, this type of intervention can be delivered on a larger scale to more diverse populations.

G2. Risks to research participants should be justified by the anticipated benefits to the participants or society. Provide your assessment of how the anticipated risks to participants and steps taken to minimize these risks, balance against anticipated benefits to the individual or to society.

Risks include psychological stress during health measures such as waist and hip circumference, minor muscle soreness or strains due to increases in steps per day, and/or negative experiences in the Facebook group. However, the potential benefits of this study outweigh the risks. Participants will receive information regarding their body anthropometrics and physical activity level, factors strongly related to overall health. With this information, participants will be able to assess their current health risks with regard to obesity and physical inactivity.

SECTION H: Subject Incentives/ Compensations

Section Notes…

- H2 & H3. The IRB recognizes the potential for undue influence and coercion when extra credit is offered. The UWM IRB, as also recommended by OHRP and APA Code of Ethics, agrees when extra credit is offered or required, prospective subjects should be given the choice of an equitable alternative. In instances where the researcher does not know whether extra credit will be accepted and its worth, such information should be conveyed to the subject in the recruitment materials and the consent form. For example, "The awarding of extra credit and its amount is dependent upon your instructor. Please contact your instructor before participating if you have any questions. If extra credit is awarded and you choose to not participate, the instructor will offer an equitable alternative."
- H4. If you intend to submit to the Travel Management Office for reimbursement purposes make sure you understand what each level of payment confidentiality means **(click here for additional information).**

H1. Does this study involve incentives or compensation to the subjects? For example cash, class extra credit, gift cards, or items.

[_x_] Yes
[__] No [SKIP THIS SECTION]

H2. Explain what (a) the item is, (b) the amount or approximate value of the item, and (c) when it will be given. For extra credit, state the number of credit hours and/or points. (e.g., $5 after completing each survey, subject will receive [item] even if they do not complete the procedure, extra credit will be award at the end of the semester)**:**

$20 worth of gift cards will be given after completing the 8-week intervention. Participants will have the option of gift cards to amazon.com, itunes, or Subway. In addition, participants will be allowed to keep the pedometer we give them for the intervention if they complete the intervention.

Extra credit will be given to students based on the discretion of professors.

H3. If extra credit is offered as compensation/incentive, an alternative activity (which can be another research study or class assignment) should be offered. The alternative activity (either class assignment or another research study) should be similar in the amount of time involved to complete and worth the same extra credit.

Alternative activities will be left to the discretion of professors.

H4. If cash or gift cards, select the appropriate confidentiality level for payments (see section notes):

[_x_] Level 1 indicates that confidentiality of the subjects is not a serious issue, e.g., providing a social security number or other identifying information for payment would not pose a serious risk to subjects.

- Choosing a Level 1 requires the researcher to maintain a record of the following: The payee's name, address, and social security number and the amount paid.
- When Level 1 is selected, a formal notice is not issued by the IRB and the Travel Management Office assumes Level 1.
- Level 1 payment information will be retained in the extramural account folder at UWM/Research Services and attached to the voucher in Accounts Payable. These are public documents, potentially open to public review.

[__] Level 2 indicates that confidentiality is an issue, but is not paramount to the study, e.g., the participant will be involved in a study researching sensitive, yet not illegal issues.

- Choosing a Level 2 requires the researcher to maintain a record of the following: A list of names, social security numbers, home addresses and amounts paid.
- When Level 2 is selected, a formal notice will be issued by the IRB.
- Level 2 payment information, including the names, are attached to the PIR and become part of the voucher in Accounts Payable. The records retained by Accounts Payable are not considered public record.

[__] Level 3 indicates that confidentiality of the subjects must be guaranteed. In this category, identifying information such as a social security number would put a subject at increased risk.

- Choosing a Level 3 requires the researcher to maintain a record of the following: research subject's name and corresponding coded identification. This will be the only record of payee names, and it will stay in the control of the PI.
- Payments are made to the research subjects by either personal check or cash.
- Gift cards are considered cash.
- If a cash payment is made, the PI must obtain signed receipts.

SECTION I: Deception/ Incomplete Disclosure (INSERT "NA" IF NOT APPLICABLE)
Section Notes… • If you cannot adequately state the true purpose of the study to the subject in the informed consent, deception/ incomplete disclosure is involved.

I1. Describe (a) what information will be withheld from the subject (b) why such deception/ incomplete disclosure is necessary, and (c) when the subjects will be debriefed about the deception/ incomplete disclosure.

NA

IMPORTANT – Make sure all sections are complete and attach this document to your IRBManager web submission in the Attachment Page (Y1).

Aubrianne E. Rote, Ph.D.
Curriculum Vita

1. GENERAL INFORMATION

Formal education

Doctorate of Philosophy (2013). University of Wisconsin-Milwaukee. College of Health Sciences, Milwaukee, Wisconsin. Concentration: Exercise Physiology. GPA: 3.93.

Master of Science (2010). University of Wisconsin-Milwaukee. Department of Human Movement Science, Milwaukee, Wisconsin. Concentration: Exercise Physiology. GPA: 3.96.

Bachelor of Science (2008). University of Wisconsin-Milwaukee. Department of Human Movement Sciences, Milwaukee, Wisconsin. Major: Kinesiology. GPA: 3.93.

Positions Held

Dissertation Fellow (Sept. 2012-May 2013)
Graduate School
University of Wisconsin-Milwaukee

Ad-Hoc Professor (Jan. 2013-July 2013)
KIN 330: Exercise Physiology
University of Wisconsin-Milwaukee

Co-Instructor (Sept. 2012-Dec. 2012)
KIN 330: Exercise Physiology
University of Wisconsin-Milwaukee

Research Assistant (Sept. 2008-Aug 2012)
Physical Activity & Health Research Laboratory
University of Wisconsin-Milwaukee

Ad-Hoc Professor (Jan. 2011-May 2011)
HMS 590: Body Image: Influences & Health-Related Implications
University of Wisconsin-Milwaukee
Teaching Assistant (Summer 2009 & 2010)
Exercise Physiology
University of Wisconsin-Milwaukee

2. TEACHING EXPERIENCE

KIN 330: Exercise Physiology (Summer 2013; Spring 2013)

KIN 330: Exercise Physiology (co-instructor) (Fall 2012).

HMS 590: Body Image: Influences & Health-Related Implications (Spring 2011).

HMS 330: Exercise Physiology Laboratory (Summer 2009 & 2010).

KIN 799: Physical Activity, Exercise, and Health Assessment (invited guest lecturer): Maximal Aerobic Exercise Testing (Fall 2012).

HMS 590: Body Image: Influences & Health-Related Implications (invited guest lecturer): Physical Activity and Body Image (Spring 2012)

HMS 330: Exercise Physiology (invited guest lecturer): Pulmonary Physiology (Fall 2011).

HMS 330: Exercise Physiology (invited guest lecturer): Body Composition (Su 2010).

3. RESEARCH/SCHOLARSHIP/PROFESSIONAL ACTIVITIES

Publications

Swartz, A.M., Tarima, S. Miller, N.E., Hart, T.L., Grimm, E.K., **Rote, A.E.**, & Strath, J.S. (2012). Prediction of body fat in older adults by time spent in sedentary behavior. *Journal of Aging and Physical Activity, 22*, 332-344.

Rote, A.E., Swartz, A.M., & Klos, L.A. (Accepted). Associations between lifestyle physical activity and body image among women. *Women & Health.*

Wheeler, L.A., Cashin, S.E., Klos, L.A., **Rote, A.E.,** Clasey, J.L., & Swartz, A.M. (Accepted). Validation of a hand-held bioelectrical impedance device for the assessment of body fat in young and old adults. *International Journal of Body Composition.*

Rote, A.E., Klos, L.A., & Swartz, A.M. (In Preparation). Perception matters: Examining factors related to under-estimation of weight status among women. *Obesity.*

Swartz, A.M., **Rote, A.E.,** Hart, T.L., Welch, W.A., & Strath, S.J. (In Preparation). Prompts to disrupt sitting time and increase physical activity at work. *American Journal of Preventive Medicine.*

National/International Presentations

Rote, A.E., Klos, L.A., Wheeler, L.A., Thielke, N.C., & Swartz, A.M. Comparing body fat distribution in women according to weight perception. *American College of Sports Medicine, National Meeting.* Indianapolis, IN. (May 29, 2013).

Swartz, A.M., **Rote, A.E.**, Hart, T.L., Thielke, N.C., & Strath, S.J. Evaluating prompts to disrupt sitting time at work: A pilot study. *American College of Sports Medicine, National Meeting.* Indianapolis, IN. (May 29, 2013).

Wheeler, L.A., Cashin, S.E., Klos, L.A., **Rote, A.E.**, Clasey, J.L., & Swartz, A.M. Validation of hand-held bioelectrical impedance analysis for the assessment of body fat in young and old adults. *American College of Sports Medicine, National Meeting*. Indianapolis, IN (May 31, 2013).

Strath, S.J., Lenz, E.K., Miller, N.E., Dondzila, C.J., **Rote, A.E.**, Tarmia, S.S., & Swartz, A.M. Efficacy of an individually-tailored, internet-mediated physical activity intervention in older adults: A randomized controlled trial. *American College of Sports Medicine, National Meeting.* Indianapolis, IN. (May 30, 2013).

Swartz, A.M., **Rote, A.E.,** Thielke, N., Welch, W.A. & S.J. Strath. (2013). Congruency of Motion Sensors to Detect Change following a Sedentary Behavior *Intervention. 3rd International Conference on Ambulatory Monitoring of Physical Activity and Movement*. Amherst, MA. (June 2013).

Rote, A.E., Klos, L.A., Wheeler, L.A., & Swartz, A.M. Many college women are not aware that they are over-fat or obese. *American College of Sports Medicine, National Meeting*. San Franciso, CA. (May 31, 2012).

Rote, A.E., Swartz, A.M., Strath, S.J., & Cashin, S.E. Over-estimation of time spent in moderate-intensity physical activity is related to obesity level among college women. *International Conference on Ambulatory Monitoring of Physical Activity and Movement.* Glasgow, Scotland. (June 2, 2011).

Rote, A.E., Swartz, A.M., Strath, S.J., Cashin, S.E., Miller, N.E., & Grimm, E.K. (2010). Obesity assessment method does not alter relationship with health-related quality of life in older women. *International Society for Behavioral Nutrition & Physical Activity.* Minneapolis, MN. (June 10, 2010).

Swartz A. M., Strath, S.J., Miller, N.E., Hart, T.L., Grimm, E.K., & **Rote, A.E.** Time spent in moderate intensity physical activity, but not sedentary behaviour is related to body fat in older adults. *3rd International Congress on Physical Activity and Public Health.* Toronto, Canada (May 6, 2010).

Rote, A.E., A.M. Swartz, S.E. Cashin, S.J. Strath, N.E. Miller, E.K. Grimm, K.P. Gennuso, C.J. Dondzila, & K.M. Sweere. Psychosocial factors influencing physical activity in older adults. *American College of Sports Medicine, National Meeting.* Seattle WA (May 27, 2009).

Grimm, E.K.,Strath, S.J., Swartz, A.M., Miller, N.E., Gennuso, K.P., **Rote, A.E.,** Dondzila, C.J. & Sweere, K.M. Objective measurement of sedentary and active behavior in older adults. *American College of Sports Medicine, National Meeting.* Seattle WA (May 29, 2009).

Local Presentations

Rote, A.E., Swartz, A.M., Klos, L.A., Brondino, M.J., Strath, & S.J., Harley, A.M., & Examining the efficacy of a physical activity intervention using social media in college freshmen. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee. (May 3, 2013).

Verstegen, M.R., **Rote, A.E.,** & Swartz, A.M. Self-efficacy does not predict physical activity in female college freshmen. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee. (April 15, 2013).

Rote, A.E., Klos, L.A., Wheeler, L.A., & Swartz, A.M. Many college women are not aware that they are over-fat or obese. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee (December 2, 2011).

Rote, A.E., Swartz, A.M., Strath, S.J., Cashin, S.E. Over-estimation of physical activity is related to obesity level among college women. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee. (April 15, 2011).

Rote, A.E., Swartz, A.M., Strath, S.J., Cashin, S.E., Miller, N.E. & Grimm, E.K. Obesity assessment method does not alter relationship with health-related quality of life in older women. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee. (April 16, 2010).

Squires, L.L., Swartz, A.M., Strath, S.J., Hart, T.L., Grimm, E.K. & **Rote, A.E.** Acute physiological response to disruption of sedentary behavior: preliminary results. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee. (April 16, 2010).

Squires, L.L., Swartz, A.M., Strath, S.J., Hart, T.L., Grimm, E.K. & **Rote, A.E.** Acute physiological response to disruption of sedentary behavior: preliminary results. *Undergraduate Research at the Rotunda.* University of Wisconsin System. (May 5, 2010).

Rote, A.E., Swartz, A.M., Cashin, S.E., Strath, S.J., Miller, N.E., Grimm, E.K. Gennuso, K.P., Dondzila, C.J. & Sweere, K.M. Psychosocial factors influencing physical activity in older adults. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee. (April 17, 2009).

Grimm, E.K., Strath, S.J., Swartz, A.M., Miller, N.E., Gennuso, K.P., **Rote, A.E.,** Dondzila, C.J. & Sweere, K.M. Objective measurement of sedentary and active behavior in older adults. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee. (April 17, 2009).

Minor Publications

Rote, A.E., Swartz, A.M., Cashin, S.E., Strath, S.J., Miller, N.E., Grimm, E.K., Gennuso, K.P., Dondzila, C.J. & Sweere, K.M. (2009). Psychosocial factors influencing physical activity in older adults. *Medicine and Science in Sports and Exercise.* 41:S290.

Grimm, E.K., S.J. Strath, A.M. Swartz, N.E. Miller, K.P. Gennuso, **A.E. Rote,** C.J. Dondzila, & K.M. Sweere. (2009). Objective measurement of sedentary and active behavior in older adults. *Medicine and Science in Sports and Exercise.* 41:S476.

Grants

Rote, A.E. & Swartz, A.M. Examining the efficacy of a Facebook-mediated intervention to increase steps per day in young adults. *UWM College of Health Sciences Student Research Grant.* $2,000. (Fall 2012-Spring 2013).

Rote, A.E. & Swartz, A.M. An examination of habitual physical activity, sedentary behaviors and body image in college women. *UWM College of Health Sciences Student Mentored Grant*. $500. (Fall 2009-Spring 2010).

Rote, A.E. & Grimm, E.K. Travel Grant. *Senate Appropriations Committee*. $1,229. (Fall 2009-Spring 2010).

Awards

UWM Dissertation Fellowship Award (Fall 2012-Spring 2013).

Research Assistantship. Clinical and Translational Science Institute Research Assistant Support Award. Clinical and Translational Science Institute of Southern Wisconsin. (2011-2012). (Swartz – Principle Investigator).

Best Student Presented Poster Short List. Over-estimation of time spent in moderate-intensity physical activity is related to obesity level among college women. *International Conference on Ambulatory Monitoring of Physical Activity and Movement.* (June 2, 2011).

Presenter Award. 1st Place. Over-estimation of physical activity is related to obesity level among college women. *College of Health Sciences Research Symposium*. University of Wisconsin-Milwaukee, (April 15, 2011).

Randall S. Lambrecht Honor Code Award. $2,000. (Fall 2010-Spring 2011).

Chancellor's Fellowship Award. $20,000. (Fall 2008-Spring-2009; Fall 2009-Spring 2010).

Human Movement Science Faculty & Alumni Scholarship. $1,000. (Fall 2009-Spring 2010).

Scholar-Athlete. University of Wisconsin-Milwaukee (2004 – 2008).

Service

President. *Human Movement Sciences Graduate Association* (Fall 2009- Spring 2011).

Member. *Black & Gold Committee* (Fall 2009- Spring 2011)

Certificates

CPR (Fall 2008 – Present)

First Aid (Fall 2008 – Present)