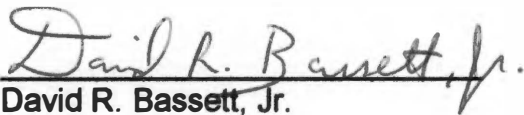


To the Graduate Council:

I am submitting herewith a dissertation written by Cherilyn N. Hultquist entitled "Adherence to the 10,000 Steps per Day Recommendation: An Examination of Researcher Contact, Self-Efficacy, Social Support, and Perceived Barriers." I have examined the final paper copy of this dissertation for form and content and recommend that it be accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, with a major in Education.


Dixie L. Thompson, Major Professor

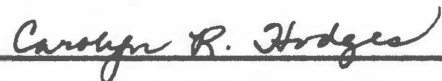
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I am submitting herewith a dissertation written by Christine M. Hurdless entitled
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We have read this dissertation and
recommend its acceptance.

David R. Bassett, Jr.

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Vice Provost and Dean of the
Graduate School

**Adherence to the 10,000 Steps per Day Recommendation:
An Examination of Researcher Contact, Self-Efficacy, Social Support, and
Perceived Barriers**

**A Dissertation
Presented for the
Doctor of Philosophy
Degree
The University of Tennessee, Knoxville**

**Cherilyn N. Hultquist
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Abstract

The purpose of this study was to determine if length of contact with a fitness professional impacts adherence, physical characteristics, exercise self-efficacy, feelings of social support, and perceived barriers during a walking intervention utilizing the 10,000 steps per day recommendation. A secondary purpose of this study was to document the specific strategies that previously inactive women use to successfully build walking into their day. Participants were 55 previously inactive women (45.6 ± 5.8 y) who were randomly assigned to either 4-weeks or 12-weeks of weekly contact with a researcher. Group assignment had no effect on any variable of interest ($p > 0.05$). Overall, participants were more active compared to baseline, saw improvements to body mass, body fat percentage, body mass index (BMI), and waist and hip circumference ($p < 0.001$). There was an overall decrease in perceived barriers at weeks 4, 12, and 24 ($p < 0.001$). Self-efficacy and perceived social support increased at weeks 4 and 12 ($p < 0.001$), but returned to baseline by week 24. Participants were also divided into adherers (averaged ≥ 9500 steps/day) and non-adherers. Adherers had lower perceived barriers compared to non-adherers at week 24 ($p < 0.001$). Adherers also had higher exercise self-efficacy at week 24 compared to non-adherers ($p < 0.001$). Perceived social support was similar among adherers and non-adherers. Adherers also had a significant decrease in body mass and BMI compared to baseline ($p < 0.001$) while the non-adherers saw no change. Strategies that participants used to increase steps included purposeful walking, making every step count, and constant self-monitoring. This

study addressed several aspects of social cognitive theory and found that it may be important to increase levels of exercise self-efficacy and decrease perceived barriers in order to see adherence with a daily walking program. The role that social support plays is still not understood and it was not associated with exercise behavior in this sample. Four weeks of contact was just as effective as 12 weeks for influencing adherence, hence, the minimum amount of time needed with a fitness professional remains unknown.

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Chapter 1

Introduction

Recent statistics indicate that the majority of U.S. adults, 54.1%, do not regularly engage in physical activity at even the minimum recommended level (63). Further, the prevalence of no leisure-time physical activity is approximately 23.7% for U.S. adults, and slightly higher for women at 25.9% (34). These statistics are a continued concern for health practitioners as physical inactivity is linked to several negative health conditions including coronary heart disease, type 2 diabetes, hypertension and osteoporosis (79). Other statistics place poor diet and physical inactivity as the second leading cause of preventable death in the United States, with approximately 365,000 deaths every year attributed to this combination of factors (46, 47). With physical inactivity as a major health risk factor for U.S. adults, health care professionals are attempting to identify effective physical activity programs that yield long-term adherence.

Over the years, a number of agencies have made recommendations for appropriate levels of physical activity. The American College of Sports Medicine (ACSM), the Centers for Disease Control and Prevention (CDC), and the U.S. Surgeon General currently recommend accumulating at least 30 minutes of moderate-intensity physical activity on most, preferably all, days of the week (56, 79). This activity can be achieved in one continuous bout or in several shorter bouts. The goal of this public health recommendation is to increase physical

activity, among sedentary individuals, in an effort to yield health benefits (37, 38, 54).

An alternative approach to increasing physical activity is through pedometer-based walking programs such as the goal of achieving 10,000 steps per day. Several studies have found that individuals who accumulate 10,000 steps per day are likely to meet the ACSM-CDC physical activity recommendation, thus there are similarities between the pedometer-based program and the standard physical activity recommendation (31, 36, 84). The use of pedometers to track daily step accumulation, when given a daily step goal, may also serve as an external environmental cue to help increase daily walking (19). An important difference between these two recommendations is that the ACSM-CDC recommendation requires activity to be at least moderate-intensity, and the 10,000 steps per day recommendation does not have an intensity requirement although walking is typically a moderate-intensity activity. Also, some individuals may accumulate 10,000 steps per day through occupational requirements or lifestyle, making this pedometer-based recommendation inadequate for some. Another difference is that the 10,000 steps per day program focuses on activity every day, not just most days.

The 10,000 steps per day recommendation has been shown to increase daily walking in previously sedentary populations (31, 36), but exactly how successful walkers build in their steps is still unknown. A preliminary study by Croteau (12) identified several strategies that were preferred by 34 participants for increasing lifestyle physical activity in a pedometer-based intervention. The

most popular strategy was work-related walking, such as going on an errand or to a meeting, with 64.7% of the total sample preferring this method. Other popular methods included walking before and after work, parking farther away, and walking the dog. Since these preliminary data were not conclusive, additional investigations of how one might consistently build steps into his or her day in order to achieve a daily step goal are needed.

In addition to developing effective recommendations to increase leisure-time physical activity and decrease risk factors for disease, health and fitness professionals should also consider psychosocial factors important in maintaining an active lifestyle. These factors include but are not limited to social support for physical activity, overcoming barriers to being physically active, and psychological variables that may influence long-term exercise behavior (Appendix A).

Increasing daily physical activity for a sedentary population requires a change in exercise behavior. To maximize a behavior change, health and fitness professionals should consider designing interventions based on a behavior change theory (17). Social cognitive theory, developed by Albert Bandura, suggests that human behavior is a function of an interaction between environmental, behavioral, and cognitive factors (3). When social cognitive theory is applied to exercise behavior, one variable that has received much attention is exercise self-efficacy, which is defined as the belief that one can successfully engage in exercise behaviors under challenging circumstances (15, 23). Exercise self-efficacy has emerged as an important variable when initiating, predicting,

and manipulating exercise behavior. In fact several studies have shown that past exercise adherence and self-efficacy are significant predictors of future exercise participation (39, 41, 43, 51, 52). Self-efficacy is a dynamic variable that can increase or decrease through mastery experiences, social modeling, verbal persuasion, or physical and/or emotional states. Another premise of social cognitive theory is that of outcome expectations, which is a belief in the likely consequence that an action will produce (3). Even though self-efficacy and outcome expectations are both a part of social cognitive theory, self-efficacy is often cited as the variable that can influence the magnitude of behavior change (39, 40, 43, 51, 52).

Social support is another psychological variable that may influence exercise behavior. While several definitions are found in the literature, it generally refers to the supportive ways that different people behave in the social environment (27). Social support can come in many forms including instrumental, informational, emotional, or appraisal (20). Verbal persuasion and social modeling, from social cognitive theory, may also be classified as types of social support as they are supportive mechanisms within the social environment. When promoting physical activity to an individual, a health and fitness professional may have an opportunity to offer all types of support, but informational and appraisal support may emerge more often in a variety of settings. While different forms of social support exist, it generally has a positive association with exercise behavior, particularly for women (49, 71).

Perceived barriers to physical activity may also influence a person's exercise behavior. A consensus on the impact of perceived barriers and meeting current physical activity recommendations has yet to be reached. While some studies have found that individuals who perceive more barriers to being active do not exercise as much as those who perceive fewer barriers (7, 53), other investigations have not found a relationship (55, 83). In a survey of rural women, there was a significant relationship between reporting more barriers and not meeting the ACSM/CDC recommendation (53). Additionally, women tend to report more barriers to physical activity than men, making it an important factor to consider for physical activity interventions that target females (7). In terms of social cognitive theory, perceived barriers could negatively influence exercise behavior due to an individual's reduced exercise self-efficacy.

Exercise initiation for sedentary individuals is the first challenge that health and fitness professionals face but adherence to physical activity is a separate, although related, issue. According to Dishman (16), approximately half of new exercisers drop out within 3 to 6 months after beginning an exercise program, making this a crucial time for health and fitness professionals to make a positive impact on a new exerciser. There is no guideline for the length of time that a person needs to be in contact with a fitness professional to enhance adherence, but to maximize resources, professionals should take an efficient approach when designing an intervention.

While several studies have shown that accumulating 10,000 steps per day can be an effective physical activity recommendation and has similarities with the

ACSM-CDC recommendation, little is known about what makes certain people adhere to this lifestyle-based recommendation and why others do not adhere as well. The 10,000 steps per day recommendation has received a great deal of positive attention, but little is known about the true effects that this recommendation has on exercise behavior within the first 6 months of initiation. If this approach can enhance exercise self-efficacy along with increasing daily physical activity, it should be considered a viable recommendation for sedentary individuals. Additionally, if a short intervention with accountability is as effective as a longer intervention with accountability, health and fitness professionals can put efforts into creating short-term interventions. If pedometer-based programs are to be fully embraced by health and fitness professionals, more information needs to be gathered regarding their effect on exercise self-efficacy, how adherers build steps into their day, if social support plays a role in adherence, and whether the amount of contact with a health and fitness professional has an influence on exercise behavior within the first 6 months of initiating this pedometer-based recommendation.

Purpose

The purpose of this study was to determine if length of contact with a fitness professional impacts adherence, physical characteristics, exercise self-efficacy, feelings of social support, and perceived barriers during the first 6 months of a physical activity intervention utilizing the 10,000 steps per day recommendation.

A secondary purpose of this study was to document the specific strategies that previously inactive women use to successfully build 10,000 steps into their day.

Hypotheses

It was hypothesized that there would be no group difference for step volume or physical characteristics 12 weeks or 24 weeks after being exposed to a fitness professional for either 4-weeks or 12-weeks. It was also hypothesized that the 10,000 steps per day physical activity recommendation would significantly increase exercise self-efficacy during the intervention but there would be no difference between groups. Finally, there would be a significant difference at week 24 between adherers and non-adherers for physical characteristics, exercise self-efficacy, perceived social support, and perceived barriers to exercise. It was expected the women who successfully adhered to the 10,000 steps per day recommendation would use specific strategies to increase their daily steps, and planned, purposeful exercise would be a common theme.

Chapter 2

Review of Literature

Physical Inactivity Epidemic

Despite the variety of physical activity recommendations, current statistics for physical inactivity indicate that the prevalence of no leisure-time physical activity is approximately 23.7% for U.S. adults (34). The prevalence of no leisure-time physical activity for women is even higher at 25.9% (34). These statistics are alarming because physical inactivity is linked to several negative health conditions including coronary heart disease, type 2 diabetes, hypertension and osteoporosis (79). While these disease states are not caused exclusively by a sedentary lifestyle, inactive individuals are at a higher risk of occurrence. On a positive note, landmark research has shown a strong inverse relationship between physical activity and several disease states as well as all-cause mortality (6, 37, 38). Despite the known benefits of living an active life, health and fitness professionals struggle to find ways to get people to initiate and then maintain a physical activity program.

Current Physical Activity Recommendations

When designing a physical activity intervention for sedentary people, several factors should be considered, starting with which physical activity recommendation to use. The American College of Sports Medicine (ACSM), Centers for Disease Control and Prevention (CDC) and the U.S. Surgeon General currently recommend at least 30 minutes of moderate-intensity physical activity on most, preferably all, days of the week (56, 79). This recommendation

aims to increase physical activity, thereby lowering disease risk in sedentary adults. In 1996, the Surgeon General's report (79) supplied a large amount of information that supported the 30-minute recommendation. This 1996 report gave emphasis to moderate-intensity physical activities that considered personal preferences, individual abilities and circumstances in an effort to encourage sedentary people to make physical activity part of daily life. Some major conclusions of the report included that everyone, regardless of age or gender, benefits from regular physical activity, and that moderate amounts of physical activity on most, preferably all, days of the week can yield significant health benefits (79). While empirical evidence supports 30 minutes of physical activity on most days to produce health benefits, controversy still exists about the best way to convey this positive message to the general public.

Pedometer-based Recommendations

An alternative physical activity recommendation that has received recent attention is that of achieving 10,000 steps per day. The 10,000 steps per day recommendation has distinct features, such as the use of pedometers to quantify ambulatory activity and having every step count. Several studies have equated accumulating 10,000 steps per day to the ACSM-CDC recommendation (31, 36, 84). A study by Wilde et al. (84) found that 32 inactive women accumulated approximately 10,000 steps per day when given the instruction to walk for an additional 30 minutes above normal daily activity. Participants accumulated an average of 7220 steps per day when no purposeful walking was performed and an average of 10,030 steps per day when 30 minutes of walking occurred. For

this group of inactive women, purposeful walking was required to accumulate 10,000 steps per day, which suggests that the goal of accumulating 10,000 steps per day would require extra activity for sedentary people.

In an observational study, LeMasurier and colleagues (36) found that individuals who accumulated 10,000 steps per day were more likely to meet the ACSM/CDC physical activity recommendation compared to those who did not accumulate as many steps. An intervention involving previously inactive women found no difference in step volume between women told to walk 10,000 steps per day and those told to take a brisk 30 minute walk on days when respective recommendations were achieved (31).

A unique aspect of a pedometer-based intervention is the ability to have constant feedback on progress toward a daily step goal. A study by Rooney et al. (60) examined the role that a pedometer played in increasing daily physical activity for 400 women told to accumulate 10,000 steps per day. Women were encouraged to keep a physical activity log and completed a follow-up survey after 8 weeks. The researchers found that 56% of the women set daily step goals and these women reported an increase in energy, weight loss, and less stress. Women who chose to keep a log were more likely to set a step goal and these goals were often in excess of 10,000 steps per day. Additionally, the women who reported wearing the pedometer every day were more aware of their daily activity and believed the pedometer made them more active. This study suggested that goal setting and self-monitoring are two important aspects of a pedometer-based recommendation.

In a qualitative analysis of the experiences of women in a minimal contact pedometer-based intervention, Heesch et al. (26) found that wearing a pedometer helped women set goals and motivated them to be more active. The information for this examination was obtained through a focus group of women who had participated in a 6-week pedometer-based intervention. The intervention consisted of two meetings with a researcher, an orientation and a follow-up appointment. The focus group also identified intervention strategies that they said would have been helpful. These suggestions included offering tips for staying active when barriers were present, ideas for places to walk in the community, help with setting individual goals, and feedback about progress. This intervention, although brief, suggests that minimal contact with fitness professional coupled with the use of a pedometer may increase physical activity in the short-term.

10,000 Steps per Day and Health Benefits

Daily step accumulation also has an influence on one's health status. A study by Chan et al. (9) found that steps per day were inversely correlated to body mass index ($r = -0.4005$, $p < 0.001$) and waist circumference ($r = -0.2140$, $p = 0.0383$) in a sample of 158 women. These cross-sectional data were collected at worksites where the jobs were mainly sedentary and participants wore a sealed Yamax SW-200 pedometer for 3 consecutive days. The average step count was 7230 ± 3447 indicating a fairly sedentary sample. These data were among the first to identify a relationship between body composition and average steps per day.

In a study specifically designed to examine the relationship between walking and body composition, Thompson et al. (73) found a significant correlation between average steps per day and body fat percentage, body mass index (BMI), waist circumference, hip circumference, and waist-to-hip ratio in middle-aged women. Participants included eighty women aged 40 to 66 years who followed their normal physical activity patterns while wearing a pedometer for seven consecutive days. The participants were placed into the following categories: inactive (<6000 steps/day), somewhat active (6000-9999 steps/day), or regularly active ($\geq 10,000$ steps/day). The researchers found that the women who were regularly active had significantly lower ($p < 0.05$) body fat percentages along with lower waist and hip circumferences compared to the less active women (73). The regularly active women were also the only group to be classified as “normal weight” according to their average BMI. These findings are important as they show an unmistakable inverse association between daily accumulated steps and body composition variables in middle-aged women (73).

Whitt and colleagues (81) examined the physical activity patterns in African-American women and whether they were meeting the ACSM-CDC recommendation. Eight days of physical activity data were collected over two separate 4-day periods. The subjects wore an accelerometer and a pedometer and kept activity logs while going about their normal routine. Only 5% of the 55 women in this study accumulated ≥ 30 minutes of physical activity on at least 5 days. While not the main focus of this investigation, an analysis of pedometer determined walking revealed that those with a lower BMI ($< 25.0 \text{ kg}\cdot\text{m}^{-2}$) had a

higher average step count (9997 steps/day) compared to those with a higher BMI (25.0-29.9 kg·m⁻² = 7595 steps/day; ≥ 30.0 kg·m⁻² = 6210 steps/day). These data suggest a relationship between body composition variables and accumulated steps per day in African-American women.

A study by Hornbuckle et al. (29) specifically examined the relationship between daily step accumulation and body composition variables in a sample of African-American women. Participants, whose ages ranged from 40 to 62 years, wore a pedometer for 7 consecutive days following one day of body composition testing. Participants also completed a 3-day diet record which allowed the researchers to control for caloric intake. Consistent with Thompson et al. (73) and Whitt et al. (81), this study found a significant difference ($p < 0.05$) between the least active women and the most active women for BMI, body fat percentage, and waist and hip circumference (29). A unique aspect of this investigation was the ability to adjust analyses based on daily caloric intake (29). Finally, a study by Krumm et al. (35) investigated the association between daily steps and body composition variables, including trunk adiposity, in post-menopausal women. Ninety-three women aged 50 to 75.9 years wore a pedometer for 14 consecutive days while going about their normal daily routines and completed a 3-day diet record. Again, the most active women had significantly lower ($p < 0.05$) BMI values, body fat percentage, waist and hip circumferences, and trunk fat compared to the less active women after controlling for caloric intake (35). This study was also the first to include a measure of trunk fat, a known risk factor for disease, and relate it back to steps per day. This mounting evidence suggests

that the accumulation of steps throughout the day is related to favorable body composition for women of varying ages and ethnicities.

Recent studies have also shown that accumulating 10,000 steps per day can improve health risk factors such as hypertension and glucose tolerance (32, 48, 72). A study by Moreau et al. (48) found that a 24-week pedometer-based walking program significantly lowered systolic blood pressure and mean arterial blood pressure. Participants were 24 post-menopausal women with borderline to stage 1 hypertension defined as systolic blood pressure of 130-159 mmHg and/or diastolic blood pressure of 85-99 mmHg. Women were randomly assigned to either an exercise group (N=15) or a control group (N=24). The exercise group was given a target number of steps to accumulate each day that would lead to meeting the ACSM-CDC recommendation of roughly two miles of walking above baseline activity (56). At baseline, the exercise group averaged approximately 5400 steps per day and increased average steps to approximately 9700 during the intervention. The control group maintained their normal activity while wearing a pedometer. A significant decrease (-11 mmHg) in systolic blood pressure was observed for the exercise group along with a 1.3 kg decrease in body mass. This study demonstrated that an increase in daily step accumulation can decrease systolic blood pressure in previously inactive, post-menopausal, hypertensive women (48).

Swartz and colleagues (72) investigated the effects of the 10,000 steps per day recommendation on glucose tolerance in overweight women at risk for type 2 diabetes. Eighteen inactive, overweight women with a family history of

type 2 diabetes completed a 4-week control period during which they did not change their physical activity. This period was followed by an 8-week physical activity intervention when subjects were advised to accumulate 10,000 steps per day. The average steps per day increased from an average of 4972 steps per day during the control period to an average of 9213 steps per day during the physical activity intervention. An 11% decrease in two-hour plasma glucose levels, a decrease in systolic blood pressure from 136 mmHg to 130 mmHg, and a decrease in diastolic blood pressure from 89 mmHg to 83 mmHg were associated with the increase in physical activity. Swartz et al. concluded that accumulating 10,000 steps per day was effective at improving glucose tolerance and lowering blood pressure in prediabetic women (72).

A recent study by Schneider et al. (64) examined the effects of adhering to the 10,000 steps per day recommendation over 36 weeks on body composition, resting blood pressure, and fasting lipid profile on sedentary, overweight or obese adults. Fifty-six participants met all inclusion criteria including a body mass index between 25 and 45 kg·m⁻², no orthopedic limitations to walking, not taking any weight loss medication, body mass was stable for at least 3 months, and average baseline activity $\leq$ 7300 steps per day. The intervention consisted of prescribing 7000 steps per day during week 1 and progressing participants up to 10,000 steps per day by week 4. Adherence to the recommendation was defined as averaging $\geq$ 9500 steps per day from week 4 to 36. Thirty-eight participants completed the intervention and 19 adhered to the recommendation. The participants who completed the intervention had significant improvements for

steps per day and high-density lipoproteins. A comparison of adherers and non-adherers revealed that adherers experienced significant improvement in body composition and anthropometric measures. This study shows that the 10,000 steps per day recommendation can positively impact body composition variables in an overweight and inactive population making it a viable recommendation when weight loss is a goal.

The Reliability and Validity of Pedometers

In recent years, pedometers have become an acceptable method to objectively quantify walking. They are typically worn on the belt or waistband at the midline of the thigh and respond to vertical accelerations of the hip during gait cycles. While pedometers do not measure all types of physical activity, they have been shown to be accurate for measuring walking which is the most common type of physical activity (14, 65, 66). Pedometers are small and easy to use putting little burden on the participant, which makes it a useful and practical measurement tool for quantifying ambulatory physical activity (77). While large samples may still rely on some self-report methods for data collection of physical activity, pedometers may offer more accuracy when measuring physical activity in the form of walking.

When selecting a device to measure daily physical activity for research purposes, it must be both reliable and valid. Several studies have determined that the use of pedometers is both reliable and valid for quantifying ambulation (4, 5, 14, 65, 75). Until recently, a variety of both direct and indirect methods have been used to measure physical activity. These methods include but are not

limited to self-report methods, including logs, surveys or questionnaires, and laboratory measures such as calorimetry, anthropometric measures and various fitness assessments. In an examination of the relationship between questionnaires and pedometer-measured physical activity, Bassett et al. (5) used both methods on a sample of 48 men and 48 women between the ages of 25 and 70 years. After the questionnaire was administered, participants were given a pedometer to wear for seven days during all waking hours, except during sports or recreation. This allowed daily walking, outside of organized activities, to be quantified. Bassett et al. (5) found that the questionnaires resulted in an underestimation of physical activity, with daily walking under-estimated by 16%. The correlation between pedometer measured steps per day and the questionnaire was low, but statistically significant, for both men and women with $r = 0.346$ ($p = 0.02$) and $r = 0.481$ ($p = 0.001$), respectively. This study showed that while questionnaires may be an appropriate measure of physical activity for large samples, a more direct and objective measure of daily walking can be obtained from pedometers.

In terms of reliability and validity, an early study by Bassett et al. (4) examined the accuracy of five pedometers for measuring distance walked. Participants wore five different pedometers during three different walking conditions including outdoor sidewalk walking, walking on an outdoor rubberized track, and treadmill walking at different speeds. Steps were simultaneously counted by a researcher using a hand-tally counter. One finding was no significant difference in pedometer accuracy on different walking surfaces for

step accumulation. Additionally, pedometers were more accurate at intermediate speeds (80 m/min) compared to an underestimation of steps at slower and faster speeds (54 m/min and 107 m/min respectively).

A more recent study by Crouter et al. (14) examined the accuracy and reliability of 10 electronic pedometers for measuring steps taken, distance traveled, and kilocalories expended at various treadmill walking speeds. Participants included five males and five females who had their stride length measured prior to testing. They then walked on a treadmill at speeds of 54, 67, 80, 94, and 107 meters per minute for five minutes each while wearing one of the ten pedometers. Pedometers were tested on both the right and left sides. An investigator simultaneously tallied actual steps with a hand counter. Results revealed that six models, including the NL-2000 pedometer, were most accurate at speeds of 80 meters per minute or higher had mean values within $\pm 1\%$ of actual steps taken.

Schneider et al. (66) investigated the accuracy and reliability of the same 10 pedometers as Crouter et al. (14) over a 400 meter walk. Ten male and ten female participants walked at their own pace for 400 meters while wearing two pedometers of the same model on the waistband or belt at the mid-line of the thigh. The actual steps taken were determined by a researcher walking behind the participant using a hand-tally counter. The New Lifestyles NL-2000, the Kenz Lifecorder and the Yamax Digi-walker SW-701 were the three pedometers that were the most accurate in counting steps. The values recorded by the pedometers were within $\pm 3\%$ of the actual steps taken, 95% of the time. The

reliability per model of these three pedometers was high with an intra-class correlation of > 0.99 . With such accuracy for a self-selected walking pace, it was concluded that these three pedometers should be considered for research studies (66).

Schneider et al. (65) also examined the accuracy of pedometers to measure free-living physical activity. The main objective of this study was to compare the step values of 13 pedometers over a 24-hour period against the Yamax SW-200, a criterion pedometer which had performed well in previous validation studies (14, 66). The participants wore the criterion pedometer on their left side and a comparison pedometer on their right side for a 24-hour period. Of the 13 pedometers tested, 5 pedometers, including the New Lifestyles NL-2000, yielded mean values that were not significantly different from the criterion. Among those 5 pedometers, the NL-2000 had results closest to the steps measured with the criterion pedometer. The researchers concluded that it is an acceptable device for most physical activity research purposes (65).

Crouter et al. (13) examined whether elevated body mass index (BMI), which may result in pedometer tilt, had an effect of pedometer performance. A spring-levered pedometer, the Yamax Digiwalker SW-200 (SW-200), and a piezo-electric pedometer, the New Lifestyles NL-2000 (NL-2000) were tested during treadmill walking and over a 24-hour period in 40 overweight and obese participants. With the SW-200 worn on the right side and the NL-2000 worn simultaneously on the left side, an investigator hand tallied actual steps while participants walked at various speeds on a treadmill. Subsequently, 36

participants wore the pedometers in the same manner for a 24-hour period.

Results were that the SW-200 became less accurate with increasing BMI, increasing pedometer tilt and increasing waist circumference. The NL-2000 was not affected by these variables suggesting that a piezo-electric pedometer may be more accurate for overweight and obese study participants.

Since pedometers have been found to be reliable and accurate for walking (14, 65, 66), they are a solution for a low cost, objective monitoring tool of daily physical activity (5). These studies have led to the conclusion that pedometers are an acceptable way to track an individual's steps per day (65), and are generally considered a practical alternative for measuring physical activity (76).

Social Cognitive Theory

In the exercise psychology literature, several models and theories exist that describe ways to change or enhance exercise behavior. These models are useful for practitioners who prefer a systematic way to design interventions and interpret their results. Social cognitive theory is one such theory that was developed by Albert Bandura (3). This theory suggests that human behavior is a function of an interaction between environmental, behavioral, and cognitive factors, where the focus is on changing a belief which will lead to a change in behavior. Social cognitive theory also proposes that these factors interact to influence a person's sense of self-efficacy, where self-efficacy refers to the conviction that one can successfully execute the behavior required to produce a certain outcome (3). Further, self-efficacy can increase or decrease through mastery experiences, social modeling, verbal persuasion, or physical and/or

emotional states. Mastery experiences refer to past experiences with a particular situation and are extremely important within social cognitive theory. This theory suggests that an individual's past experience is the most influential and reliable source of self-efficacy information. Based on this theory, an exerciser's past experience with physical activity will likely have a strong influence on future exercise behavior. Social modeling is described as vicarious experiences, in which someone else successfully models a skill or behavior. In terms of exercise, social modeling can come from anyone who the exerciser perceives as having comparable capabilities for physical activity. Verbal persuasion is typically encouragement from a person with credibility or status for the situation at hand, such as a health and fitness professional or a medical doctor. Finally, physical and emotional states might lead to altered levels of arousal, which may affect behavior. Examples of these are an increase in heart rate due to exercise (physical) or simply "feeling good" after exercise (emotional).

Another premise of social cognitive theory is that a person must value the outcomes or consequences that he or she believes will occur as a result of performing a specific behavior or action (3). Outcomes may be classified as having immediate benefits, such as feeling energized following physical activity, or long-term benefits, such as reducing risk factors for disease as a result of being physically active. Because these expected outcomes are filtered through a person's perceptions of being able to perform the behavior, self-efficacy is the single most important variable within social cognitive theory which determines the magnitude of behavior change (3).

Exercise Self-Efficacy

With self-efficacy defined as the conviction that one can successfully execute the behavior required to produce a certain outcome (3), exercise self-efficacy is fittingly defined as the belief that one can successfully engage in exercise behaviors under challenging circumstances (15, 23). Exercise self-efficacy indicates the degree of confidence an individual has in his or her ability to be physically active (18). It takes into consideration a number of challenging and different circumstances that individuals may face when trying to exercise. Among the psychological variables that have been examined, exercise self-efficacy is the strongest and most consistent predictor of exercise behavior according to a review by Sherwood et al. (68). The reviewers also found that individuals with greater exercise self-efficacy were more likely to adhere to an exercise program to the point that the exercise became habitual (68).

Early research in this area revealed that, for previously sedentary adult females, exercise self-efficacy was higher for “good attenders” compared to the women who did not adhere as well (43). Fifty-eight women participated in an 8-week aerobic exercise program. Self-efficacy for exercise was assessed with McAuley's Exercise Self-Efficacy Scale (ESES). Adherence was assessed approximately 2 months after a structured 8-week physical activity intervention. It was found that women who exercised on a more regular basis perceived themselves to be more capable of exercising in the face of barriers (43). While this early study had some notable limitations such as length of follow-up, it clearly

identified self-efficacy as an important component of early adherence to exercise programs in previously sedentary women.

Oman and King conducted a randomized trial to investigate the effects of self-efficacy and previous exercise participation rates on adoption and maintenance of exercise participation (52). They also looked at changes in exercise self-efficacy over time and how these changes may be related to exercise participation. To assess exercise behavior, participants completed exercise logs and participation rates were based on the amount of exercise completed relative to each subject's prescription. Exercise self-efficacy was measured with McAuley's 14-item Exercise Self-Efficacy Scale (ESES) (40). Measures were taken at baseline and at 1 year. The researchers found that baseline self-efficacy significantly predicted early exercise adherence (months 1-6), but not later adherence (months 7-12). Changes in self-efficacy were unrelated to changes in exercise adherence. However, adherence change during months 1-6 predicted exercise behavior at 1 year, suggesting that exercise self-efficacy plays a role in exercise adoption while long-term adherence is associated with behavior changes during exercise adoption (52). This is consistent with social cognitive theory which suggests that self-efficacy plays a role in adopting a behavior and mastery experiences may have an influence over future behavior.

A recent study by Wilbur and colleagues (82) examined the role of self-efficacy for overcoming barriers to exercise in women following the intervention phase of a 24-week, home-based walking program. The investigators found that

exercise self-efficacy measured at the end of the intervention was a predictor of walking during the maintenance phase. They also found that baseline measures of exercise self-efficacy did not predict exercise adherence during the maintenance phase. It was the improved self-efficacy from baseline to the end of the intervention that influenced long-term adherence. This study supports targeting exercise self-efficacy as an outcome variable in future physical activity interventions designed to yield long-term adherence to exercise.

Another study by D'Alonzo et al. (15) assessed the effectiveness of a 16-week supervised physical activity intervention for Black and Hispanic college-age women (n=44) for enhancing exercise self-efficacy. The program was designed to increase the women's exercise self-efficacy through planned physical activity sessions. These sessions were based on social cognitive theory and provided feedback regarding mastery experiences, modeling of appropriate exercise behaviors, positive verbal feedback, and positive self-monitoring of physiological states such as maintaining an appropriate heart rate. At the conclusion of the intervention women were classified as "high attenders" or "low attenders" based on actual program attendance. Exercise self-efficacy was measured with the 12-item Self-Efficacy for Exercise Habits Survey (SEEHS) and exercise benefits and barriers were measured with the 43-item Exercise Benefits Barriers Scale (EBBS). Higher scores on the EBBS indicates more benefits and fewer barriers were perceived as the items associated with barriers were reverse scored; therefore, higher scores on both scales were favorable. These measures were taken pre- and post-intervention. An investigator was present at all exercise

sessions and provided immediate self-efficacy-enhancing feedback regarding performance. There was a significant difference between groups for exercise self-efficacy ($p < 0.001$) and perceived benefits and barriers ($p = 0.004$) at the completion of the exercise program, with “high attenders” having greater scores on the Self-Efficacy for Exercise Habits Survey (SEEHS) and the Exercise Benefits Barriers Scale (EBBS). While the researchers were successful in increasing scores for exercise self-efficacy and perceived benefits and barriers, it is important to point out that the “high attenders” averaged only 1.3 exercise sessions per week which is well below the ACSM recommendation for moderate or vigorous activity (most days of the week and 3-5 days/week, respectively).

Self-efficacy for exercise is related to many factors according to recent research by Fallon et al. (22). This study examined the correlates of self-efficacy for physical activity in African American women aged 20 to 50 years ($n=892$). These data were derived from the Women and Physical Activity Survey (WPA) which assessed socio-demographic characteristics as well as the personal, social, and physical environment influences on physical activity. One limitation to this study was that only one item was used to assess exercise self-efficacy. Women were asked “How confident are you that you could exercise more if you wanted to?” Possible responses were “very confident,” “somewhat confident,” or “not at all confident.” Since only 20 women reported “not at all confident,” they were combined with the women who responded “somewhat confident.” For further statistical analyses women were considered as having low self-efficacy ($n=310$) or high self-efficacy ($n=582$) for exercise. The results of the survey

revealed that women with high self-efficacy for physical activity reported significantly fewer social constraints, more positive perceptions of physically active women, and a more positive sense of community. High self-efficacy for physical activity was also significantly correlated with being in better health and meeting current physical activity guidelines (22). While the cross-sectional design of this study does not reveal causation, it does help to identify characteristics of women who may benefit from an intervention that targets both exercise self-efficacy and physical activity.

Sharma et al. (67) had similar findings when they examined the extent to which social support and self-efficacy were related to duration of weekly leisure-time physical activity in a sample of 240 African American women. To measure self-efficacy for performing moderate-intensity physical activity, an adaptation of Gonzalez and colleagues' Global Self-Efficacy for Physical Activity Survey (GSEPA) was used (25). A 7-day physical activity recall was used to determine minutes spent in moderate-intensity leisure time physical activity. These data revealed that self-efficacy for physical activity was a significant predictor of minutes spent in moderate-intensity physical activity (67). These results further support that exercise self-efficacy is an important factor in determining exercise behavior.

When promoting physical activity, health and fitness professionals should not ignore factors that influence exercise self-efficacy. McAuley et al. (45) found that self-efficacy for exercise could be significantly altered by the type of feedback that a participant received following a submaximal exercise test. The

investigators found that participants who were given positive, yet bogus, feedback had greater exercise efficacy compared to a group that was given negative bogus feedback. Extending on McAuley's design, Jerome et al. (33) replicated the previous study and yielded similar results. Since positive feedback yields greater exercise self-efficacy which can result in better exercise adherence, incorporating positive feedback into a physical activity intervention may lead to greater adherence.

When deciding on outcome variables, McAuley et al. (44) suggest that exercise self-efficacy should be targeted as an independent outcome variable in physical activity interventions. Because self-efficacy has an independent and strong influence on future behavior, the implications of such research may be particularly important for sedentary individuals who may not have a history of physical activity.

Consistent with social cognitive theory, exercise self-efficacy can best be enhanced by mastery experiences of exercise, social modeling of proper exercise behaviors, positive and reinforcing verbal persuasion, and minimizing negative physiological reactions. For mastery experiences to happen, physical activity recommendations should be tailored to an individual's needs and abilities. Social modeling would include learning exercise behaviors by observing others such as an exercise leader, fitness professional, or competent exercise partner. Verbal persuasion should consist of positive feedback from a fitness professional, practitioner, or other individuals in a supporting role. Finally,

negative physiological reactions can be minimized through proper physical assessments followed by appropriate physical activity recommendations.

Outcome and Efficacy Expectations

Social cognitive theory also addresses the difference between efficacy expectations and outcome expectations. Efficacy expectations have been described as an individual's beliefs in his or her capabilities to carry out necessary actions to fulfill a situational need, or the confidence that one has in his or her ability to perform certain behaviors (3). An outcome expectation is a belief in the likely consequence that these actions will produce (3). Bandura further suggests that people view specific outcomes as being contingent on the adequacy of their performance and therefore rely on self-efficacy expectations when deciding whether to pursue an action (2).

The main difference between an efficacy expectation and an outcome expectation is that an outcome expectation is the consequence of an act, not the expectation of the act itself. The influence of these two factors on each other remains equivocal. When examining the factors that predict exercise behavior, outcome expectations should not be disregarded. For example, the positive outcomes of exercise are well documented: yet if someone does not have a strong efficacy expectation toward exercise she/he may never engage in that behavior. On the other hand, if the positive outcomes are compelling to an individual, such as improving health variables, outcome expectations may be enough for an individual to initiate physical activity behavior even if her/his efficacy expectations remain low initially.

In a review of the outcome expectancy construct in physical activity research, Williams et al. (85) found that several theories, including self-efficacy theory and the theory of planned behavior, varied in their labeling and conceptualization of outcome expectations but all included expected outcomes of behavior. When examining the benefits and barriers of physical activity, the authors point out that although perceived benefits of physical activity are the same as positive outcomes, perceived barriers to physical activity are not the same as negative outcome expectancies (85). For example, an exerciser might have a positive outcome expectancy of weight loss, which is also a benefit. This same exerciser might have a negative outcome expectancy of sweating too much, which is not a barrier. An example of a barrier to exercise would be lack of time, which is not a negative outcome expectancy. The reviewers concluded that more research is needed on the role of outcome expectations for exercise in order to design appropriate and effective physical activity interventions (85).

A study by Resnick et al. (58) examined the factors that influenced exercise behavior in older adults. Investigators conducted a one-time health interview with 187 older adults, which included a measure of self-efficacy expectations and outcome expectations related to exercise. Self-efficacy expectations were measured using a modified version of McAuley's Barriers Specific to Self-Efficacy Scale (BSSE) (40), and outcome expectations were measured using the Expected Outcomes for Habitual Exercise Scale (EOHE) (70). The Expected Outcomes for Habitual Exercise Scale (EOHE) is a 12-item measure based on descriptive epidemiological studies that asks participants to

agree or disagree with expected positive outcomes of exercise such as staying in shape, good health, and psychological well-being. Item responses are based on a 5-point Likert scale. The researchers also identified individuals that participated in at least 20 minutes of physical activity 3 days per week over the previous 3 months. Seventy-one of the 187 participants reported such activity and there was a significant difference between exercisers and non-exercisers for self-efficacy expectations and outcome expectations ($p < 0.05$). This research suggests that for older adults, efficacy expectations are related to adherence to a regular physical activity program.

Measuring Exercise Self-Efficacy

There are several valid and reliable measures of exercise self-efficacy that can be found in the literature. Some instruments assess exercise self-efficacy specific to a physical activity recommendation, some examine barriers to exercise, and others target exercise self-efficacy for specific populations such as women or older adults. While it might seem advantageous for researchers to have only a few measures of exercise self-efficacy, adaptable, reliable, and valid methods of measurement are necessary due to the dynamic and situation-specific nature of exercise self-efficacy. A few of the more common measures found in recent literature that are used as originally designed or adapted for a population of interest are the Barriers Specific Self-Efficacy Scale (BSSE) (39), the Exercise Self-Efficacy Scale (ESES) (40), the Self-Efficacy for Exercise Scale (SEE) (57), and the Physical Self-Efficacy Scale (PSE) (61).

The Barriers Specific Self-Efficacy Scale (BSSE) was designed by McAuley to assess participants' perceived capabilities to exercise in the face of commonly identified barriers to participation (39). The instrument was developed along the guidelines suggested by Bandura (3). Participants indicate their degree of confidence for each item on a 0% (no confidence at all) to 100% (complete confidence) scale. Total strength of this rating is determined by summing the confidence scores and dividing by the total number of items giving a possible range of 0 to 100%. Some barriers to exercise that are assessed include exercising when "weather was very bad," "felt pain or discomfort when exercising," "had to exercise alone," and "under personal stress of some kind." Tests have shown this to be a valid and reliable measure (39). This measure was originally composed of 13 items, although shorter and longer versions of the scale have been successfully utilized to predict exercise behavior in diverse populations such as women and older adults (42, 82).

McAuley also developed the Exercise Self-Efficacy Scale (ESES) to measure exercise self-efficacy. It was designed to investigate subjects' self-efficacy with respect to continued exercise participation in prescribed exercise regimens over incremental periods of time (40). Similar to the Barriers Specific Self-Efficacy Scale (BSSE), participants indicate their degree of confidence for each item on a 0% (no confidence at all) to 100% (complete confidence) scale. The confidence scores are summed and then divided by the total number of items giving a possible range of 0 to 100% for total strength of the measure. The statement on the original instrument was, "I am able to continue to exercise three

times per week at moderate intensity, for 40+ minutes without quitting for the next week.” The subsequent items on this instrument change the time aspect from “next week” to “next two weeks” and continue through 8 weeks (40). The strength of the exercise efficacy belief for engaging in an exercise behavior over time is determined by the score, with higher scores indicating greater exercise self-efficacy. This scale can be used with any physical activity recommendation, can examine different time aspects, and has been found to be valid and reliable (40).

The Self-Efficacy for Exercise Scale (SEES) is a revision of McAuley’s Self-Efficacy Barriers to Exercise (SEBE) measure (39) that was altered for an older population. Alterations involved removing items that were deemed non-relevant to the population at hand. These revisions were based on a previous exploratory study that identified what motivates older adults to exercise (59). The items removed included the impact of taking a vacation, issues associated with getting to the exercise location, feeling self-conscious about one’s appearance while exercising, and lack of encouragement from the leader. Items added were related to past exercise experiences, exercise goals, personality, and sensations associated with exercise. Resnick and Jenkins (57) tested the reliability and validity of this instrument with 187 older adults. Answers were based on a 0 to 10 format instead of 0 to 100, and all questions related back to being able to walk/exercise for 20 minutes three times per week. Consistent with McAuley’s original instrument (39), the score indicated the strength of efficacy expectations. To validate this scale, measures of current health status, demographic

information, exercise activity, and expectancy outcomes were assessed as well. Reliability and validity testing showed that the SEE is a reliable and valid measure for exercise self-efficacy for older adults (57).

The Physical Self-Efficacy Scale (PSES) (61) is a 22-item scale that requires participants to indicate the extent to which they believe each item reflects their own capabilities on a scale ranging from 1 (strongly disagree) to 6 (strongly agree). It is composed of two subscales. The 10-item Perceived Physical Ability subscale has a range of 10 to 60, and the 12-item Physical Self-Presentation Confidence subscale has a range from 12 to 72. The Perceived Physical Ability subscale assesses confidence in one's physical capabilities and the Physical Self-Presentation Confidence subscale assesses confidence in the presentation of physical skills. The two subscales can also be summed to produce an overall score with a range of 22 to 132, with higher scores indicating a stronger sense of physical self-efficacy. A battery of tests revealed that the Physical Self-Efficacy Scale (PSES), along with its subscales, are both valid and reliable (61).

Exercise Adherence

The issue of exercise adherence has been a long-term concern for health and fitness professionals. According to Anshel (1), adherence refers to the tendency of an individual to continue with a behavior once he or she has agreed to undertake that behavior. While adherence has been an outcome variable of interest in numerous physical activity studies over the years, the lack of a "gold standard" for measuring adherence makes it difficult to generalize findings. In a

review of exercise adherence (17), it was discovered that most physical activity interventions lacked a follow-up to the intervention, and when they did follow-up, activity levels typically decreased post-intervention. Additionally, most physical activity interventions were not based on a theoretical model of behavior change, which, according to Dishman, makes the results from these studies rather “uncompelling” (17).

While long-term adherence is a concern, the first hurdle that health and fitness professionals encounter is adherence within the first 6 months of exercise initiation. According to Dishman (16), about half of new exercisers drop out within 3 to 6 months after *initiating* an exercise program, making this the most sensitive time for a novice exerciser. Without a gold standard for length of physical activity interventions, an ideal amount of time for an intervention needs to be established, as well as what should occur during that time. While several pedometer-based walking interventions have effectively increased walking volume over varying lengths of time, there is still no consensus on the ideal amount of time an intervention should last (31, 32, 48, 60, 64, 69, 72, 84). Unfortunately, a review of literature failed to identify a study that directly examined whether there is a difference between lengths of intervention for adherence to a physical activity recommendation. With adherence as a dependent variable of interest, practitioners and participants would benefit from knowing if there is an ideal amount of time for an intervention that would maximize adherence over the first 6 months of participation.

In a review of quantitative literature about exercise adherence, White and colleagues (80) identified several factors that may contribute to adherence in women including enjoyment, shorter bouts of physical activity, home-based physical activity, program tailoring, and high level of self-efficacy. This review identified studies that lasted anywhere from 2 to 24 months and saw adherence rates between 20 and 98%. The reviewers also found that some factors that may enhance adherence are not completely understood including social support, exercise intensity, and using different modes of exercise. Another issue in the exercise adherence literature is the difficulty in comparing studies due to varying adherence definitions and intervention designs, including amount of contact with a researcher and time between intervention and follow-up.

A pedometer-based intervention by Sidman et al. (69) examined the difference between assigning 92 sedentary women a 10,000 steps per day goal or having the women set a personal daily step goal based on baseline steps and information about current public health recommendations. Participants were placed into four different cohorts based on weekly recruitment. Participants sent in log sheets for three weeks and had no contact with researchers during this time. A follow-up questionnaire was administered at the same time for all participants which was between 6 and 9 weeks after the intervention was completed, depending on cohort assignment. At the time of the follow-up, 34% of the women reported having discontinued physical activity 1 week after the intervention and 62% reported no physical activity at the time of the follow-up. Additionally, 77% of participants reported that they no longer wore their

pedometer. These data indicate that a short-term pedometer-based intervention with minimal researcher contact may not elicit a significant change in exercise behavior for the majority of participants.

In an investigation of a home-based walking program, Wilbur et al. (82) examined adherence 24-weeks after a 24-week physical activity intervention had taken place. Ninety women were assigned to take a 30-minute, moderate-intensity walk for at least 4 days per week. During the intervention participants met with a researcher every other week and received feedback about their activity logs. Of the 90 women who went through the entire intervention phase, 72 returned for follow-up 24-weeks later. Results showed that 64.6% of those who completed the maintenance phase adhered to their prescribed exercise for the entire 48-weeks. Adherence to walking during the intervention phase and self-efficacy scores following the intervention were significant predictors of walking during the maintenance phase in this sample. These results are consistent with social cognitive theory where mastery experiences may have affected exercise behavior over time.

Cox and colleagues (11) compared adherence over 18 months between a home-based and center-based exercise intervention. In this study, sedentary women between the ages of 40 and 65 years received an intervention where the center-based group attended supervised exercise sessions 3 times per week and the home-based group attended 10 training sessions in the first 5 weeks and then exercised 3 times per week at home. The exercise included walking along with some circuit training. The center-based group had greater adherence during

the first 6 months compared to the home-based group, 83.9% and 63% respectively ($p < 0.001$). After the initial 6 months all participants were on a home-based program. Adherence significantly declined for the center-based group from months 7 to 18 resulting in no difference between groups during that time. For months 7 to 12 the center-based group had an adherence rate of 66.8% while the home-based group had an adherence rate of 76.6%. For months 13 to 18 adherence rates were again similar between the center- and home-based groups (73.3% and 79.1%, respectively). This study suggests that short-term adherence may be affected by continued contact with a fitness professional and that adherence decreases when this contact discontinues, or that center-based programs simply provide more structure and home-based programs rely on the individual to be self-motivated to find time to exercise, which may reduce adherence.

Social Support

Another psychological variable that may influence exercise behavior is social support. A broad definition of this phenomenon is often found in the literature. One definition of social support refers to the supportive ways that different people behave in the social environment, or more simply stated, it is the helpful resources provided by another person (27). Social support for physical activity generally includes the resources provided by one's social network of family, friends, and health professionals, and it can come in many forms. Social support for physical activity can be instrumental, informational, emotional, or appraisal (20). Instrumental support is a tangible aid or service such as providing

transportation to a fitness facility. Informational support is giving advice, suggestions, and information such as telling someone about a community exercise program. Emotional support comes from empathy, love, trust, and caring and can come from inquiring about how someone's exercise program is going. Appraisal support refers to information that is useful for self-evaluation, and could be in the form of encouragement or reinforcement for adopting an exercise behavior (20).

Social Support and Physical Activity

Social support is, in general, positively associated with physical activity, particularly for women. For example, a cross-sectional mailed survey of 2636 ethnically diverse women, aged 20 to 65 years, revealed that social support was associated with higher levels of sport and exercise participation (71). A qualitative study by Nies and colleagues (49) found that in a sample of 35 to 50 year-old European American women, social support was identified as the major factor that facilitated physical activity participation. Social support is not an all-or-nothing phenomenon; perceptions of social support are actually measured on a continuum. A cross-sectional study by Eyler et al. (20) examined the relationship of social support for physical activity in a sample of racially/ethnically diverse women. They found that women in medium and high support categories were much less likely to be sedentary than those with low or no support, and were more likely to accumulate at least 150 minutes per week of moderate-intensity physical activity. The researchers concluded that promoting social support from

friends and family as a component in physical activity interventions for sedentary women may be advantageous (20).

A study by Gabriele et al. (24) sought to better understand how social support, described as social influence, is related to physical activity behavior. In this study, social influence was divided into social encouragement and social constraint, to determine if these variables were differentially related to exercise motivation and exercise behavior. The investigators found that social encouragement was significantly correlated to exercise motivation and exercise behavior. Social encouragement measures assessed perceptions of encouragement from significant others to exercise, and included items such as “people important to me support my exercising” and “people important to me encourage me to exercise.” Social constraint measures assessed social expectations that make people feel obligated to exercise and included items such as “I feel pressure from other people to exercise” and “people will be disappointed in me if I quit exercising.” The differences between these two variables can be viewed as positive or negative social reinforcement, meaning that some people may exercise just to avoid negative social outcomes. In this study, social constraint was not significantly correlated to exercise behavior. Additionally, social encouragement was found to be a particularly important factor for exercisers that had not yet reached a stage of exercise maintenance (24). While this study included men, 64% of the participants were female which adds the body of literature surrounding women, social support, and exercise.

Additionally, the findings in this study were consistent with current trends that advocate positive approaches to health promotion.

Recently, Sharma and colleagues (67) examined the extent to which social support and self-efficacy were related to the duration of leisure-time physical activity in a sample of African American women. This cross-sectional study sought to determine which type of social support, from family or friends, was most important for African American women when engaging in physical activity. To measure frequency of family and friends' social support for physical activity, Sallis and colleagues' Social Support for Exercise Questionnaire (SSEQ) was used (62). For measuring importance of emotional, instrumental, informational and appraisal social support from family and friends, an 8-item scale was constructed. For the women in this study, the weekly mean number of minutes spent in moderate-intensity physical activity was 88.25, the median was 70 minutes, and the mode was 0 minutes which indicated that the majority of these women were sedentary. Daily means ranged from 9 minutes to 14 minutes. These data are consistent with the Behavioral Risk Factor Surveillance System (BRFSS) data which indicate that African Americans fall well below current physical activity recommendations. Frequency of social support was relatively low with means of 10.10 for family and 10.14 for friends on a possible scale of 0-36. "Importance of social support" scored 7.58 for family and 7.38 for friends, on a scale of 1-8. The role of social support appears to be rather important, but the perceived frequency of social support was rather low for the respondents. As for the 4 types of social support, emotional support was ranked

the highest in importance with a mean of 4.41 units on a scale of 0-8. The researchers used a stepwise regression model to identify possible predictors of leisure-time physical activity and found that only self-efficacy and frequency of friends' social support were significant predictors and accounted for 23.7% of the variance (67). This study clearly demonstrates that African American women perceive social support from friends as important when it comes to participating in physical activity.

Social support may also facilitate exercise adherence. An early study by Oman and Duncan (51) investigated the relationship between social support for exercise and adherence in a sample of women that were currently participating in either water aerobics or other group aerobics classes. Classes were available at least 3 times per week and women that attended at least 3 classes per week were considered 100% compliant. Over a 5-week period the researchers found that women attended an average of 74% of possible classes (3 classes/week for 5 weeks), 88% of the women reported that it was important for them to be in good physical condition and 75% indicated that their significant others also viewed exercise as important. In addition, 68% reported that the instructor was very important to their program attendance; the same number also indicated that other class members were important to their attendance as well (51). Based on these data, the authors suggested that social support from a woman's spouse or friends may enhance her exercise-related sense of control, commitment, and confidence. Also, these psychological factors may enhance the likelihood that a woman will adhere to an exercise program (51).

Studies that have included social support as part of an intervention to increase physical activity have generally found it to positively influence exercise behavior. Social support during an intervention can be delivered in several forms. The health and fitness professional will often serve as the authority figure who is qualified to deliver the intervention (informational) and to provide feedback (appraisal). While only a few studies have been done, the findings are promising. Calfas et al. (8) conducted an intervention in which participants were assigned to either an experimental group or a control group. The experimental group received physician-delivered, activity-specific informational support. The additional support positively influenced change in physical activity level in a group of 256 adults. The experimental group was more active and reported more social support compared to the control group. Another study by Toobert et al. (74) found that a group of post-menopausal women who received "enhancement of social support" significantly improved their physical activity level over 12 months, and social support was significantly higher at 12 months in the experimental group.

A more recent investigation by Nies et al. (50) used a telephone counseling intervention where sedentary women were encouraged to adopt and maintain a home-based walking program over a 24-week period. Participants in this study were assigned to an intervention group, an attention-control group, or control group. The intervention group received phone calls once a week for the first 8 weeks and then once every other week for the following 16 weeks. These supportive phone calls consisted of information on the benefits of exercise, social

support, and exercise efficacy. Women also reported the number of minutes they had walked since the previous phone call. The attention-control group received the same frequency of phone calls but was only asked to report minutes of walking. The control group was not contacted for 24 weeks. At baseline, all groups were encouraged to walk 90 minutes per week. After 24 weeks there were no differences between the attention-control group and the control group and they were collapsed into one group for further analyses. There was a significant difference for weekly minutes walked between the control groups and the intervention group suggesting that the extra support offered to the intervention group may have resulted in an increase in walking. Although research has shown a positive association between social support and physical activity, the specific domain of social support and the measurement of social support are not always clearly defined.

Measuring Social Support

While social support is frequently used in behavioral and social research, there is considerable variation in how social support is conceptualized and measured. A Social Support for Exercise Scale (SSES) developed by Sallis and colleagues (62) measures the amount of perceived social support that one has for participating in exercise. It consists of a list of things people do or say to someone who is trying to exercise regularly. Examples include, "During the past 3 months, my family or friends: exercised with me; offered to exercise with me; gave me helpful reminders to exercise; gave me encouragement to stick with my exercise program." Participants are asked to rate each statement for family

support and friends' support separately, rating each item twice. Items are scored on a Likert scale from 1 (none) to 5 (very often). This validated scale is one of the first and only measures of social support behaviors specific to exercise habit change (62).

Barriers to Exercise

Identifying and overcoming perceived barriers to exercise may be an important factor in long-term adherence. A study by Osuji et al. (53) found that barriers to physical activity was significantly associated with not meeting current public health recommendations in a sample of rural-dwelling women. The most frequently reported barriers in this sample were: too tired, lack of time, bad weather, no energy, and no motivation. Additionally, there was evidence of a dose-response relationship between amount of physical activity and number of perceived barriers.

Wilcox and colleagues (83) examined the determinants of physical activity for rural (n = 1242) and urban (n = 1096) woman. Results revealed that rural women were more sedentary than urban women and they also reported more perceived barriers to physical activity. Rural women identified caregiving duties as their main barrier while urban women reported lack of time as their main barrier. Rural women also reported more barriers than their urban counterparts. When combined, all participants identified lack of time and energy and caregiving responsibilities as the most frequent barriers. These data suggest that a home-based physical activity intervention, where physical activity can be accomplished

in multiple short bouts of exercise, may be appropriate for women regardless of where they live.

Despite the diversity that exists in the female population including socioeconomic status, ethnicity, and marital status, the common barriers to being active remain similar across groups. Eyler and colleagues (21) examined the determinants of exercise in a diverse sample of U.S. adult women. The most prominent barrier to exercise across the sample were family and caregiving responsibilities such as child care, spouse care, and household chores, which resulted in a lack of time to exercise. This multi-site, focus group project also identified environmental barriers including weather and lack of daylight as common barriers. Policy-driven barriers such as the cost associated with some physical activity and lack of child care were also common. With common perceived barriers across a diverse female sample, identifying intervention strategies specifically for women would be beneficial for health practioners.

How do People “Build” Steps into Their Day?

The 10,000 steps per day recommendation has been shown to increase daily walking (31, 36), but exactly how successful walkers build in their steps is still unknown. A preliminary study by Croteau (12) identified several strategies that were preferred by 34 participants (27 women, 7 men) for increasing lifestyle physical activity over an 8-week pedometer-based intervention. Participants selected 8-10 primary strategies at the beginning of the study and 5 strategies were chosen to focus on for each new week. The most popular strategy was work-related walking, such as going on an errand or to a meeting, with 64.7% of

the total sample preferring this method. Other popular methods included walking before and after work or on a lunch break, parking farther away, and walking the dog. One limitation of this study is that it was a small, homogenous sample therefore, results cannot be generalized for all pedometer-based interventions. However, these preliminary data certainly set the stage for examining how one might consistently build steps into her day in order to achieve a daily step goal.

In a study which examined walking volume during a one year follow-up, researchers found that the majority of previously inactive women given the 10,000 steps per day recommendation reported that they liked the recommendation (30). Many stated that the 10,000 steps per day goal was easy to achieve and that the pedometer made it easy to monitor walking throughout the day. The pedometer was also reported to be a motivating tool when it came to increasing daily physical activity. Additionally, several women commented that they liked that steps did not have to be achieved in a specified block of time and could be built into their day however they chose. With limited literature on how women successfully build steps into their day when, it is important to identify the strategies used by adherers vs. non-adherers in pedometer-based interventions.

Chapter 3

Methods

Participants

Participants included healthy, non-smoking, sedentary women between the ages of 30 and 55 years. Potential participants were excluded if they reported cardiovascular, pulmonary, or metabolic disease, blood pressure $\geq 160/100$ mmHg, or had any orthopedic limitations to walking. Participants were included if average baseline steps were ≤ 7000 steps per day. All procedures were reviewed and approved by the Institutional Review Board (IRB) at the University of Tennessee. Prior to participation, each participant was informed of potential risks and benefits, and signed an informed consent form (Appendix B) approved by the University of Tennessee IRB.

Baseline Testing

Participants reported to the Applied Physiology Laboratory after an overnight fast and having refrained from exercise for twelve hours prior to testing. Upon arrival to the lab, participants were seated for at least 5 minutes prior to taking blood pressure. During this time all testing procedures were explained to the participant and an informed consent and a health history questionnaire (Appendix C) were completed. After the rest period, blood pressure measurements were taken on the right arm three times using a stethoscope and a mercury sphygmomanometer with two minutes between each trial (10). The average of the three trials was then used as the baseline resting blood pressure.

For body composition testing, all participants wore a lycra swimsuit and swimcap, and all jewelry was removed. Height was measured using a wall-mounted stadiometer (Seca Corporation, Columbia, MD). Body mass and body fat percentage were assessed using the Bod Pod® body composition system (Life Measurement Instruments, Concord, CA) and was performed according to the manufacturer's specifications. A female-specific equation, assuming a fat-free tissue density of $1.097 \text{ kg} \cdot \text{l}^{-1}$, was used to estimate percentage of body fat (28). Standing waist and hip circumference were measured in duplicate using a Gulick fiberglass measuring tape with a tension handle (Creative Health Products, Inc., Plymouth, MI), and mean values were reported. The waist measurement was taken at the narrowest part of the torso between the rib cage and the iliac crest, after normal expiration. Hip circumference was measured at the greatest gluteal protuberance while the subject stood with feet together. Body mass index (BMI) was calculated by dividing the weight in kilograms by the height in meters squared ($\text{kg} \cdot \text{m}^{-2}$).

Participants also completed three questionnaires that addressed exercise self-efficacy, social support for physical activity, and perceived barriers to exercise. The Barriers Specific Self-Efficacy Scale (Appendix D), designed by McAuley, assessed participants' perceived capabilities to exercise in the face of commonly identified barriers to participation (39). Participants indicated their degree of confidence for each item on a 0% (no confidence at all) to 100% (complete confidence) scale. Total strength of this rating was determined by summing the confidence scores and dividing by the total number of items giving

a possible range of 0 to 100%. The Social Support for Exercise Scale developed by Sallis and colleagues (62) measured the amount of perceived social support that participants had for participating in exercise (Appendix E). It consists of a list of things people may do or say to someone who is trying to exercise regularly. Participants were asked to rate each statement for family support and friends' support separately, rating each item twice. Items were scored on a Likert scale from 1 (none) to 5 (very often). The Barriers to Being Active Quiz was used to identify specific perceived barriers to exercise (Appendix F). Participants indicated how likely it would be for them to say or think specific statements regarding barriers to being active. Statements were rated on a 4-point scale from very likely to very unlikely. Barriers identified by this survey are lack of time, social influence, lack of energy, lack of willpower, fear of injury, lack of skill, and lack of resources. A score of 5 or more indicated an important barrier to overcome (78).

Baseline activity was determined by measuring daily steps for 7 consecutive days. Steps per day were measured using the New Lifestyles NL-2000 (New Lifestyles Inc., Kansas City, MO), which is known to be accurate in measuring steps over a 24-hour period (65). The pedometers were sealed so that participants were not able to see how many steps they were accumulating each day. Pedometer placement followed the manufacturer's recommendation which was standardized on the belt or waistband, in the midline of the thigh. Participants were instructed to wear the pedometer during all waking hours and to continue with their normal activity patterns for the 7-day baseline period. The

NL-2000 is capable of storing 7 days of activity; therefore, participants returned to the lab after one week so that steps per day could be recorded.

Physical Activity Intervention

All participants were given the PA recommendation to accumulate 10,000 steps per day. The physical activity intervention lasted for 24 weeks, and participants were randomly assigned to a 4-week or 12-week accountability group. The 4-week group met with the researcher once weekly for 4 weeks and the 12-week group met with the researcher weekly for the first 12 weeks of the intervention. These meetings were one-on-one with the researcher and were scheduled at a time convenient to each participant. Each participant was given an unsealed NL-2000 pedometer along with verbal instructions on how to operate it. Participants also received their first PA log at this time (Appendix G). Weekly logs consisted of recording daily step accumulation and how steps were incorporated into each day.

The weekly meetings consisted of a review of activity for the previous week, strategizing for the next week, providing informational handouts regarding various health and fitness topics, and answering participants' questions. The handouts consisted of a variety of topics regarding the benefits of physical activity and strategies to increase activity levels (Appendix H). The researcher individually reviewed each handout with each participant. After a participant completed the initial weekly meetings, she sent weekly activity logs to the researcher via e-mail or regular mail based on her preference. Stamped and self-

addressed envelopes were provided for participants who chose to return their logs by regular mail.

All baseline testing was repeated at week 4, week 12, and week 24. A questionnaire was also administered at week 24 asking participants to reflect on the past 24 weeks and give a summary of their experience.

Statistical Analyses

Statistical analyses were performed using SPSS for Windows version 14.0 (SPSS, Inc., Chicago, IL). The significance level was set at $p < 0.05$ for all tests. Descriptive statistics were calculated for all baseline measurements, and independent t-tests were used to compare the baseline characteristics of the two groups. A repeated measures analysis of variance (ANOVA) was used to compare steps per day, physical characteristics, self-efficacy, social support, and perceived barriers, at four time points and between groups. Pairwise comparisons with a Bonferroni adjustment were used to identify specific differences between groups.

Participants were also categorized as adherers or non-adherers based on whether or not they averaged ≥ 9500 steps per day throughout the intervention. These averages were calculated for every four weeks during the intervention. Chi square analyses were used to determine if group assignment had a relationship with adherence category. To determine if baseline measures of exercise self-efficacy, perceived social support, or perceived barriers predicted adherence, a logistic regression was run. A repeated measures ANOVA was used to compare physical characteristics, self-efficacy, social support, and perceived barriers over

time and between adherers and non-adherers. Pairwise comparisons with a Bonferroni adjustment were used to identify specific differences between adherers and non-adherers. If there was a time and group interaction independent t-tests were used to compare adherers and non-adherers at each time point. Chi square analyses were also used to compare responses of adherers and non-adherers to categorical questions from the exit questionnaire.

To analyze qualitative data from the exit questionnaire, data were transcribed and the researcher identified emergent themes from answers to open-ended questions. SPSS for Windows Text Analysis for Surveys, version 2.0 (SPSS, Inc., Chicago, IL) was used to confirm themes identified by the researcher. This software is a survey text coding application that provides an analysis of responses to open-ended questions. With this application, survey data is imported, key concepts are extracted, and responses are categorized. The “internal extractor engine” identifies and collects the key terms expressed in each open-ended question being analyzed. Patterns, which represent combinations of terms, are also extracted. The categories represent the main ideas and attitudes expressed by the respondents.

Chapter 4

Results

Seventy-six previously inactive women between the ages of 32 and 55 volunteered for this study. Sixty-two participants met all final inclusion criteria and began the physical activity intervention portion of the study. One participant discontinued the study due to a family emergency and six participants discontinued due to reported time constraints and did not return for testing. Results are reported on the remaining 55 participants, with 29 participants in the 12-week group and 26 participants in the 4-week group.

Comparison by Group Assignment

There were no significant differences between groups for baseline physical characteristics or baseline psychological variables ($p > 0.05$) (Table 1 and Table 2). Two participants from the 4-week group and one participant from the 12-week group discontinued wearing the pedometer and indicated that they were no longer attempting to follow the 10,000 steps per day recommendation or any other physical activity recommendation. Because these women did return for all testing, they were used for all analyses except for step data.

Repeated measures ANOVA was run for body composition and anthropometric variables. There was a time effect ($p < 0.001$), but no group effect and no group by time interaction ($p > 0.05$) for body mass, body fat percentage, BMI, waist circumference, and hip circumference. These data are reported in detail in the next section.

Table 1. Baseline characteristics of participants (mean $\pm$ SD).

Measure	4-week group (n = 26)	12-week group (n = 29)
Age (y)	47.5 $\pm$ 5.8	47.8 $\pm$ 5.8
Height (cm)	163.7 $\pm$ 6.8	164.1 $\pm$ 5.9
Body mass (kg)	83.7 $\pm$ 17.3	79.8 $\pm$ 14.3
BMI (kg·m ⁻²)	31.3 $\pm$ 6.5	29.5 $\pm$ 5.0
Waist circumference (cm)	92.8 $\pm$ 15.9	90.9 $\pm$ 12.4
Hip circumference (cm)	115.3 $\pm$ 13.1	110.8 $\pm$ 11.6
WHR	0.80 $\pm$ 0.08	0.82 $\pm$ 0.07
Body Fat (%)	44.4 $\pm$ 7.9	43.2 $\pm$ 6.9
SBP (mmHg)	117 $\pm$ 12	119 $\pm$ 13
DBP (mmHg)	75 $\pm$ 9	77 $\pm$ 9
Baseline steps (steps/day)	5176 $\pm$ 1202	5574 $\pm$ 1185

BMI = body mass index

WHR = waist to hip ratio

SBP = systolic blood pressure

DBP = diastolic blood pressure

4-week group = met weekly with researcher for first 4 weeks of intervention

12-week group = met weekly with researcher for first 12 weeks of intervention

Table 2. Baseline measures of psychological variables for participants (mean $\pm$ SD).

Measure	4-week Group (n = 28)	12-week Group (n = 29)
Exercise self-efficacy	53.2 $\pm$ 23.1	57.6 $\pm$ 26.0
Perceived social support	42.3 $\pm$ 13.1	44.7 $\pm$ 13.4
Perceived barriers to exercise	28.8 $\pm$ 9.1	28.1 $\pm$ 9.8
Exercise self-efficacy possible score range 0 to 100		
Perceived social support possible score range 16 to 80		
Perceived barriers to exercise possible score range 0 to 63		

Repeated measures ANOVA revealed a time effect but no group effect or group by time interaction for average steps per day during the intervention.

Paired comparisons revealed a significant increase in steps per day over baseline at each 4-week average ($p < 0.001$) (Figure 1). Average steps during weeks 1 through 12 were higher than during weeks 13 through 24. The only consecutive time points that differed from each other was a significant decrease in steps between weeks 9-12 and weeks 13-16 ($p = 0.003$).

Repeated measures ANOVA revealed a time effect but no group effect or group by time interaction for exercise self-efficacy. Paired comparisons found that there was a significant increase in exercise self-efficacy between baseline and weeks 4 and 12 ($p = 0.001$ and $p < 0.001$, respectively), with no difference between baseline and week 24 ($p = 0.285$) (Figure 2).

Repeated measures ANOVA revealed a time effect but no group effect or group by time interaction for perceived social support. Paired comparisons found that there was a significant increase in social support between baseline and

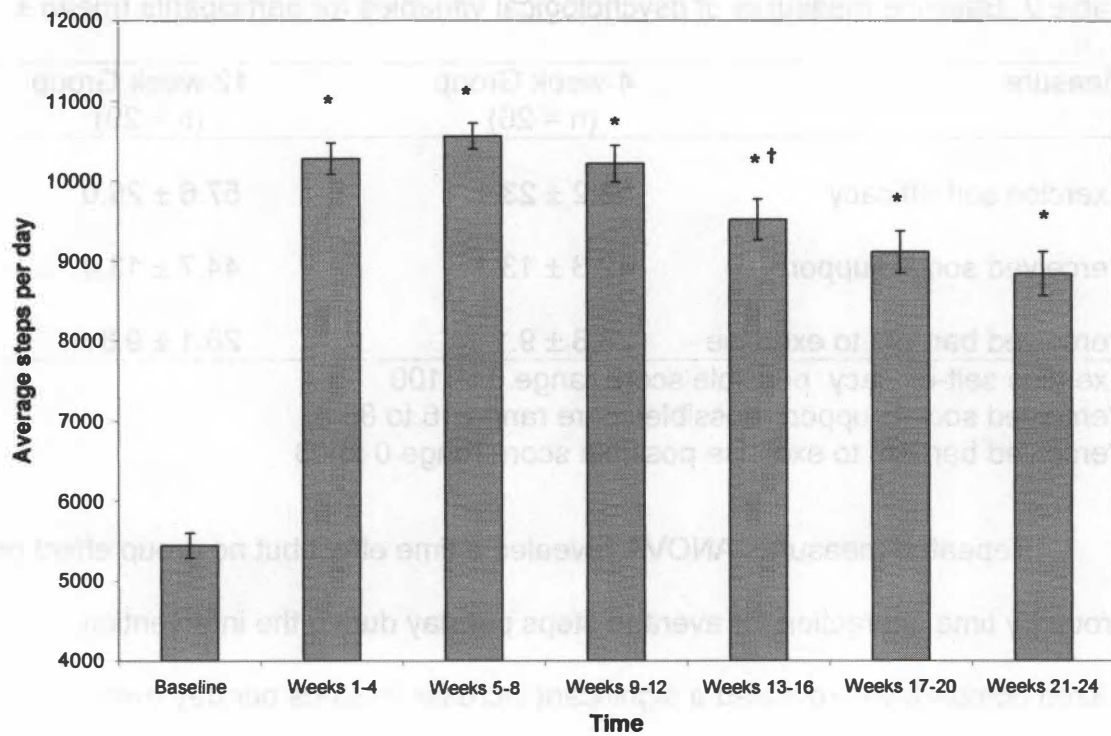


Figure 1. Average steps throughout the intervention (*Significantly different from baseline, †Significantly different from previous time point)

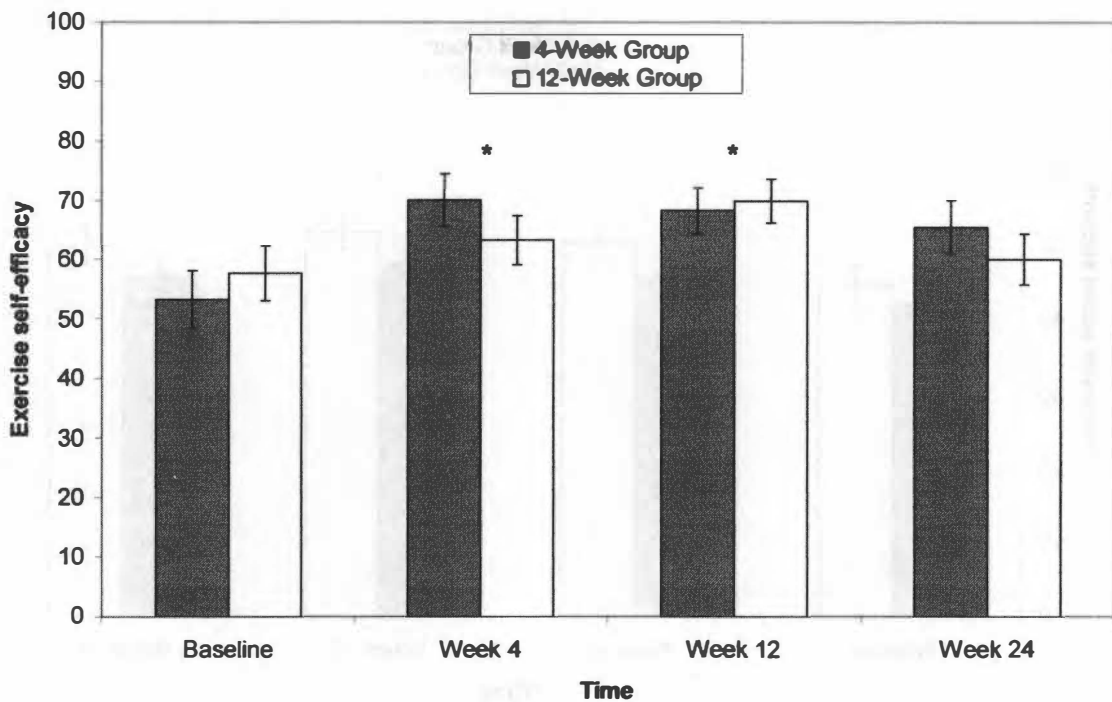


Figure 2. Overall exercise self-efficacy scores (*Significantly different from baseline)

weeks 4 and 12 ($p = 0.01$ and $p = 0.003$, respectively), with no difference between baseline and week 24 ($p = 0.146$) (Figure 3).

Repeated measures ANOVA revealed no group by time interaction and no group effect for perceived barriers to exercise. Paired comparisons found that there was a significant decrease in perceived barriers to exercise between baseline and weeks 4, 12, and 24 ($p < 0.001$) (Figure 4).

Comparison of Adherers and Non-adherers

To examine the impact of the 10,000 steps per day program on those who followed the recommendation, participants were divided into adherers ($n = 25$) and non-adherers ($n = 30$) with adherence defined as averaging ≥ 9500 steps per day throughout the intervention. A chi square analysis was used to determine

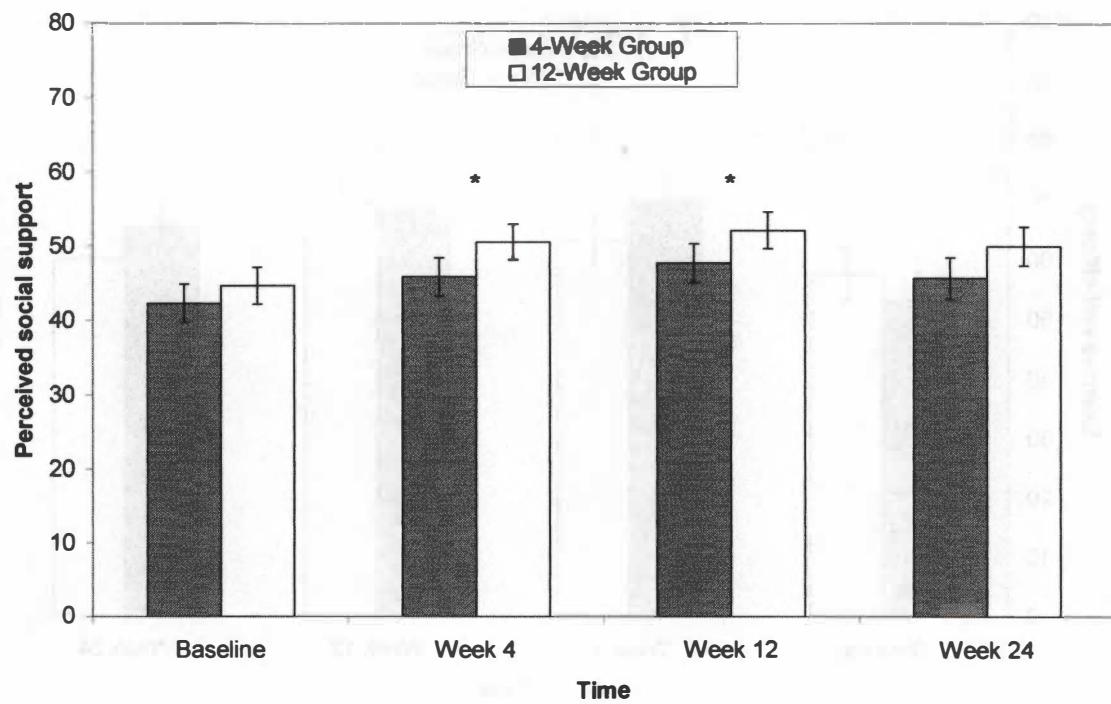


Figure 3. Overall perceived social support scores (*Significantly different from baseline)

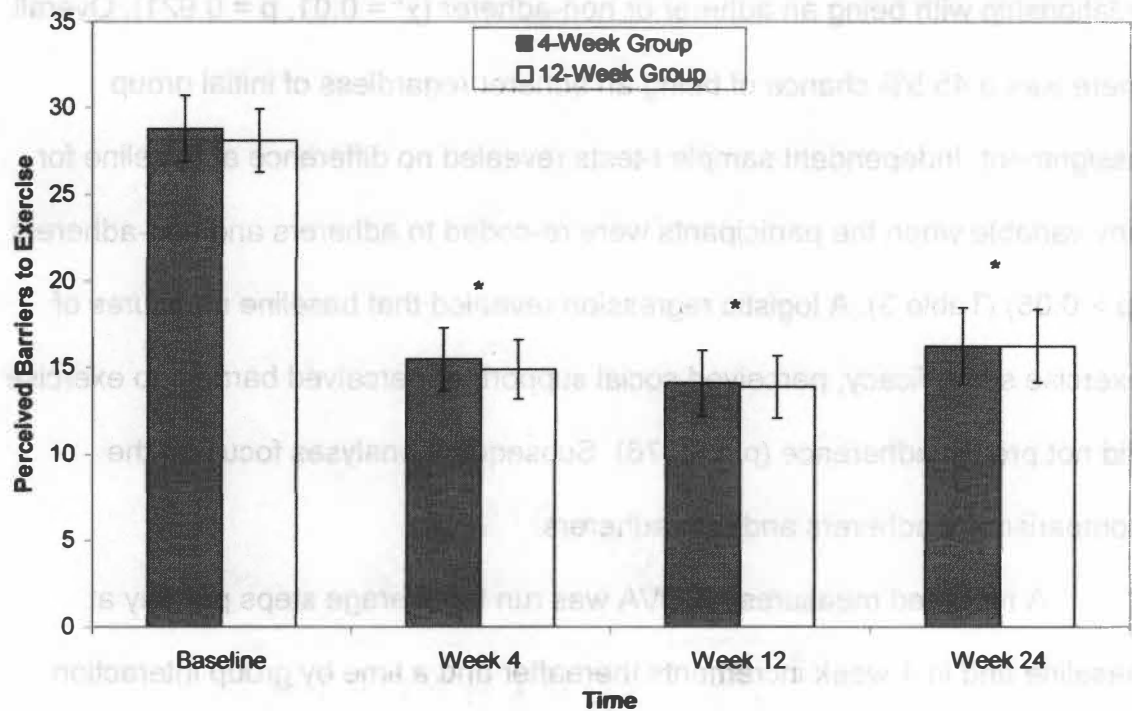


Figure 4. Overall perceived barriers to exercise scores (*Significantly different from baseline)

that initial group assignment (12-week group, 4-week group) did not have a relationship with being an adherer or non-adherer ($\chi^2 = 0.01$, $p = 0.921$). Overall, there was a 45.5% chance of being an adherer regardless of initial group assignment. Independent sample t-tests revealed no difference at baseline for any variable when the participants were re-coded to adherers and non-adherers ($p > 0.05$) (Table 3). A logistic regression revealed that baseline measures of exercise self-efficacy, perceived social support, or perceived barriers to exercise did not predict adherence ($p = 0.876$). Subsequent analyses focus on the comparison of adherers and non-adherers.

A repeated measures ANOVA was run for average steps per day at baseline and in 4-week increments thereafter and a time by group interaction was found ($p = 0.001$) (Figure 5). Independent t-tests were used to compare adherers with non-adherers at each time point with significant differences at weeks 9 to 12, weeks 13 to 16, weeks 17 to 20, and weeks 21 to 24 (Table 4). Paired comparisons were run separately for the adherers and non-adherers to examine differences between baseline and step averages for the 4-week increments and all time points were significantly higher than baseline for both adherers and non-adherers. After 24 weeks, adherers continued to average over 10,000 steps per day. Average daily steps for non-adherers had fallen to less than 7400 (Table 4).

Repeated measures ANOVA was run and a time by group interaction was found for the following variables: body mass ($p < 0.001$), BMI ($p < 0.001$), waist circumference ($p = 0.012$), and hip circumference ($p < 0.001$) (Table 5). There

Table 3. Baseline characteristics of adherers and non-adherers (mean $\pm$ SD).

Measure	Adherers (n = 25)	Non-adherers (n = 30)
Age (y)	49.3 $\pm$ 5.2	46.2 $\pm$ 5.9
Height (cm)	164.7 $\pm$ 6.2	163.2 $\pm$ 6.3
Body mass (kg)	80.8 $\pm$ 14.7	82.3 $\pm$ 16.8
BMI (kg·m ⁻²)	29.7 $\pm$ 5.0	30.9 $\pm$ 6.4
Waist Circumference (cm)	90.3 $\pm$ 13.4	93.1 $\pm$ 14.7
Hip Circumference (cm)	112.3 $\pm$ 10.7	113.5 $\pm$ 13.9
WHR	0.80 $\pm$ 0.09	0.82 $\pm$ 0.07
Body fat (%)	43.2 $\pm$ 6.3	44.2 $\pm$ 8.2
SBP (mmHg)	118 $\pm$ 12	117 $\pm$ 13
DBP (mmHg)	77 $\pm$ 9	75 $\pm$ 8
Baseline step (steps/day)	5327 $\pm$ 948	5435 $\pm$ 1388
Exercise self-efficacy	56.2 $\pm$ 22.6	55.0 $\pm$ 26.4
Perceived social support	44.6 $\pm$ 14.4	42.7 $\pm$ 12.2
Perceived barriers to exercise	29.1 $\pm$ 10.0	27.9 $\pm$ 9.1

BMI = body mass index

WHR = waist to hip ratio

SBP = systolic blood pressure

DBP = diastolic blood pressure

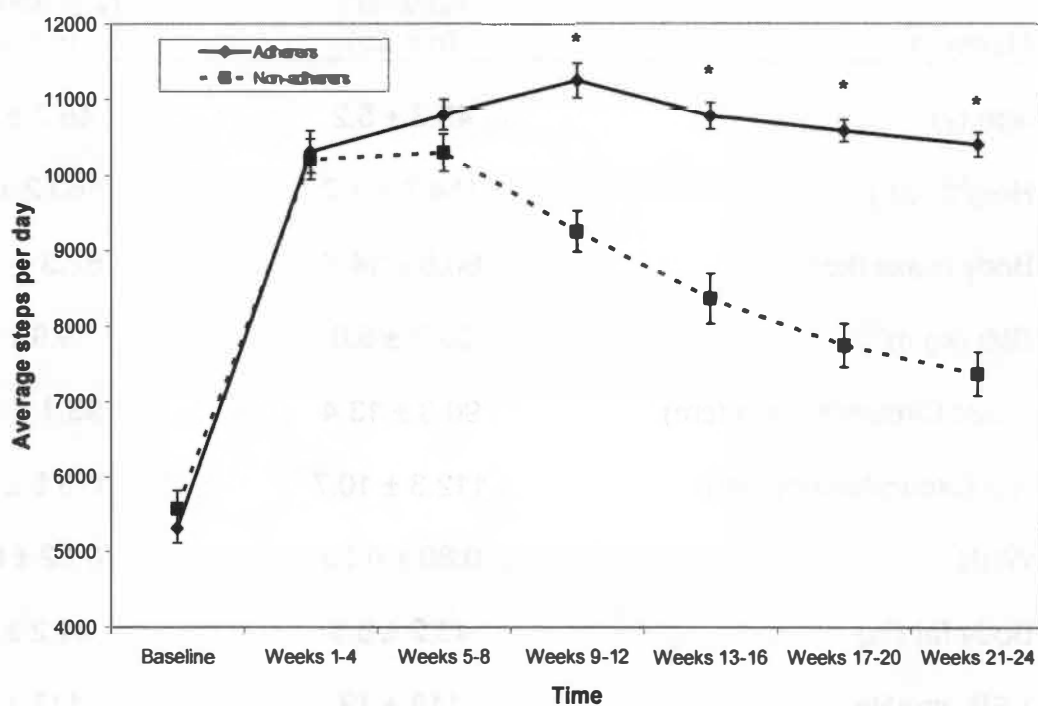


Figure 5. Comparison of adherers and non-adherers for average steps throughout the intervention (*Significant difference between adherers and non-adherers).

Table 4. Comparison of average steps per day between adherers and non-adherers (mean $\pm$ SD)

Time	Adherers (n = 25)	Non-adherers (n = 27)	P-value
Baseline	5327 $\pm$ 948	5584 $\pm$ 1262	0.410
Weeks 1 to 4	10311 $\pm$ 1417	10213 $\pm$ 1401	0.804
Weeks 5 to 8	10801 $\pm$ 978	10300 $\pm$ 1296	0.121
Weeks 9 to 12	11245 $\pm$ 1144	9261 $\pm$ 1413	< 0.001
Weeks 13 to 16	10782 $\pm$ 840	8369 $\pm$ 1733	< 0.001
Weeks 17 to 20	10582 $\pm$ 719	7750 $\pm$ 1506	< 0.001
Weeks 21 to 24	10401 $\pm$ 804	7376 $\pm$ 1513	< 0.001

P-value reflects comparison of adherers and non-adherers

Table 5. Body composition and anthropometric measures for adherers (n = 25) and non-adherers (n = 30) (mean $\pm$ SD).

Measure	Baseline	Week 4	Week 12	Week 24
Body mass (kg)				
Adherers	80.9 $\pm$ 14.7	80.3 $\pm$ 14.5	78.4 $\pm$ 13.7*	76.6 $\pm$ 12.9*
Non-adherers	82.3 $\pm$ 16.8	81.9 $\pm$ 16.8	81.4 $\pm$ 16.3	82.0 $\pm$ 16.8
BMI (kg·m⁻²)				
Adherers	29.7 $\pm$ 5.0	29.5 $\pm$ 5.0	28.9 $\pm$ 4.8*	28.2 $\pm$ 4.5*
Non-adherers	30.9 $\pm$ 6.4	30.8 $\pm$ 6.4	30.6 $\pm$ 6.3	30.8 $\pm$ 6.4
Body fat (%)				
Adherers	43.2 $\pm$ 6.3	42.8 $\pm$ 6.7	41.9 $\pm$ 6.6*	40.1 $\pm$ 6.2*
Non-adherers	44.2 $\pm$ 8.2	43.6 $\pm$ 8.3	43.2 $\pm$ 8.8*	42.6 $\pm$ 9.3*
WC (cm)				
Adherers	90.3 $\pm$ 13.4	89.4 $\pm$ 13.1	87.4 $\pm$ 11.9*	85.3 $\pm$ 10.9*
Non-adherers	93.1 $\pm$ 14.7	91.4 $\pm$ 14.2*	90.2 $\pm$ 13.9*	90.4 $\pm$ 13.7*
HC (cm)				
Adherers	112.3 $\pm$ 10.7	111.5 $\pm$ 10.3*	110.1 $\pm$ 10.3*	108.3 $\pm$ 9.3*
Non-adherers	113.5 $\pm$ 13.9	112.6 $\pm$ 13.7*	112.0 $\pm$ 13.6*	112.2 $\pm$ 9.3*

BMI: body mass index

WC: waist circumference

HC: hip circumference

*Significantly different from baseline (p < 0.05)

was no time by group interaction for body fat percentage ($p = 0.119$) and waist-to-hip ratio ($p = 0.498$), but there was a time effect for both variables ($p < 0.001$ and $p = 0.002$, respectively). Pairwise comparisons were run to determine differences from baseline for adherers and non-adherers (Table 5). In general, the adherers experienced an improvement in body composition profile over the 24-week study, but non-adherers experienced less, if any, change. Figure 6 is used to illustrate this pattern.

Repeated measures ANOVA was run for exercise self-efficacy and a time by group interaction was found ($p = 0.001$) (Figure 7). Independent t-tests were used to compare adherers with non-adherers at each time point with the only difference at week 24. Paired comparisons were run separately for the adherers and non-adherers to examine differences between baseline and week 4, 12, and 24. Non-adherers only differed between baseline and week 12 ($p = 0.043$) with no difference between baseline and week 4 and 24 ($p = .38$ and $p = 1.0$, respectively). For the adherers, week 4, week 12, and week 24 were all significantly higher than baseline ($p = 0.001$, $p = 0.002$, $p < 0.001$, respectively).

Repeated measures ANOVA was run for perceived social support and there was no time by group interaction ($p = 0.808$) or group effect ($p = 0.832$). Due to no interaction, pairwise comparisons for the sample do not differ from those previously reported on this variable. Since perceived social support for exercise consists of the sum of family support and friend support, repeated measures ANOVA was run separately for these subscales. Results revealed no

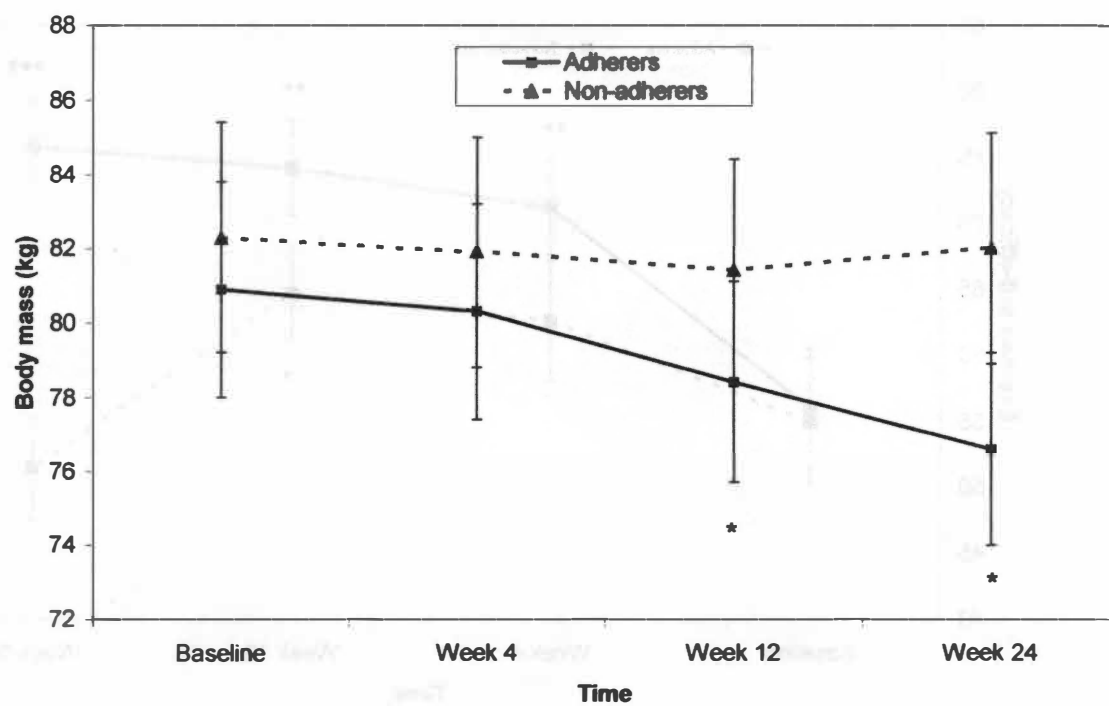


Figure 6. Change in body mass over time for adherers and non-adherers (*Significantly different from baseline)

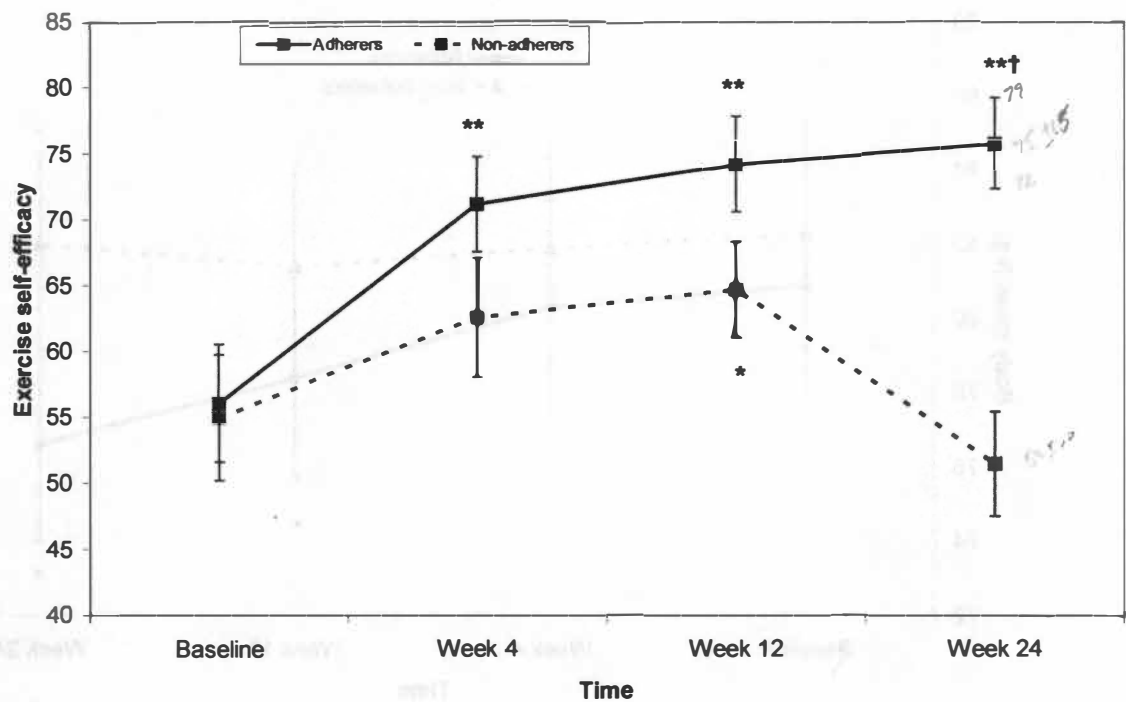


Figure 7. Comparison of exercise self-efficacy scores between adherers and non-adherers over time (*Significantly different from baseline $p \leq 0.05$, **Significantly different from baseline $p \leq 0.01$, †Significant difference between adheres and non-adherers $p \leq 0.01$).

group effect or group by time interaction for perceived family social support ($p = 0.621$ and $p = 0.198$, respectively). There was a difference over time for perceived family support ($p < 0.001$) and paired comparisons were run to determine if baseline differed from week 4, 12, or 24. There was a significant increase in perceived family support between baseline and week 4 and 12 ($p = 0.003$ and $p < 0.001$, respectively) with no difference between baseline and week 24 (Figure 8). There was no time effect ($p = 0.294$), group effect ($p = 0.816$), or group by time interaction ($p = 0.420$) for perceived friend support (Figure 9).

Since the perceived barriers to exercise score consists of a sum of scores that identify seven possible barriers to being physically active, total barriers were assessed along with individual barriers that scored a “5” or higher at baseline which indicated an important barrier according to the instrument (78). Repeated measures ANOVA was run for perceived barriers to exercise and a time by group interaction was found ($p < 0.001$) (Figure 10). Independent t-tests were used to compare adherers with non-adherers at each time point with the only difference at week 24 ($p < 0.001$). At this time point, non-adherers were beginning to report a rise in perceived barriers while adherers were continuing to experience a decline in perceived barriers. Paired comparisons were run separately for the adherers and non-adherers to examine differences between baseline and week 4, 12, and 24 compared to baseline. Non-adherers had significantly lower scores on perceived barriers between baseline and week 4, week 12, and week 24 ($p < 0.001$, $p < 0.001$, $p = 0.002$, respectively). There was also a significant decrease

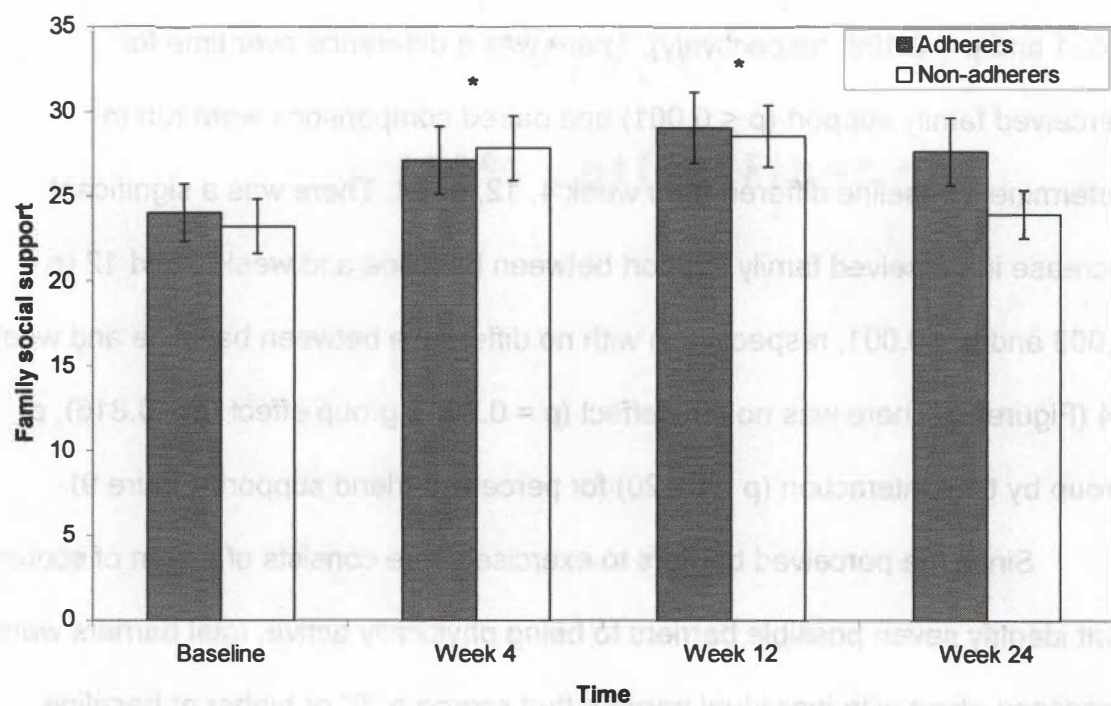


Figure 8. Perceived family social support over time (*Significantly different from baseline).

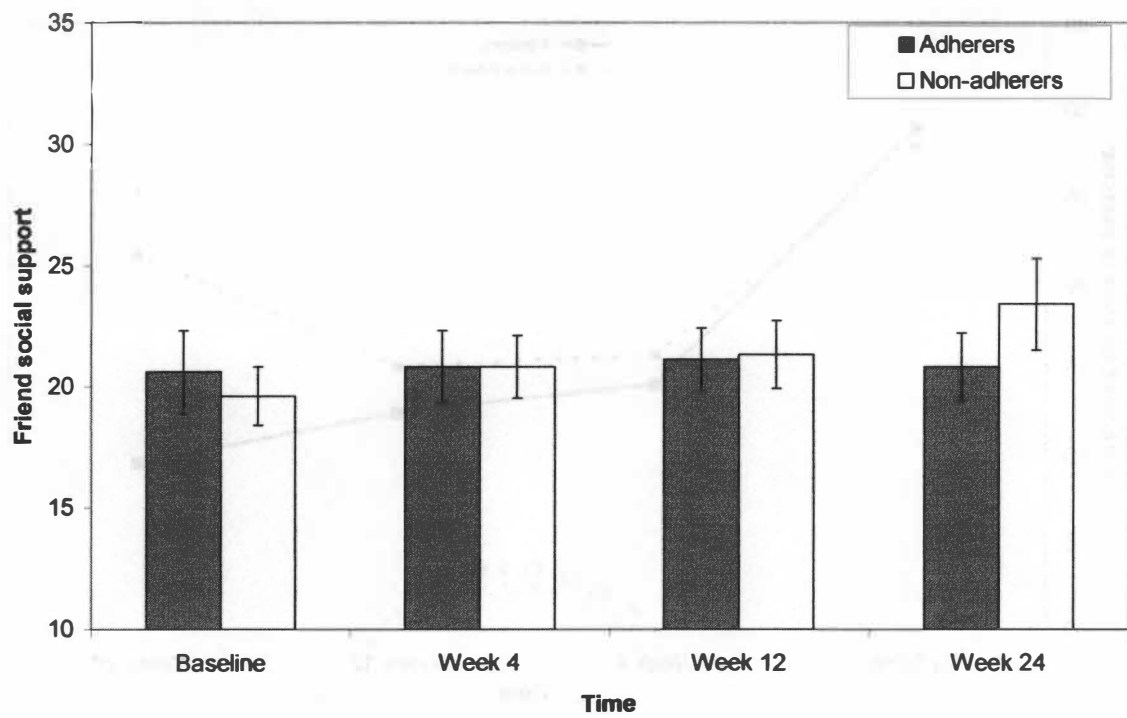


Figure 9. Perceived friend support over time.

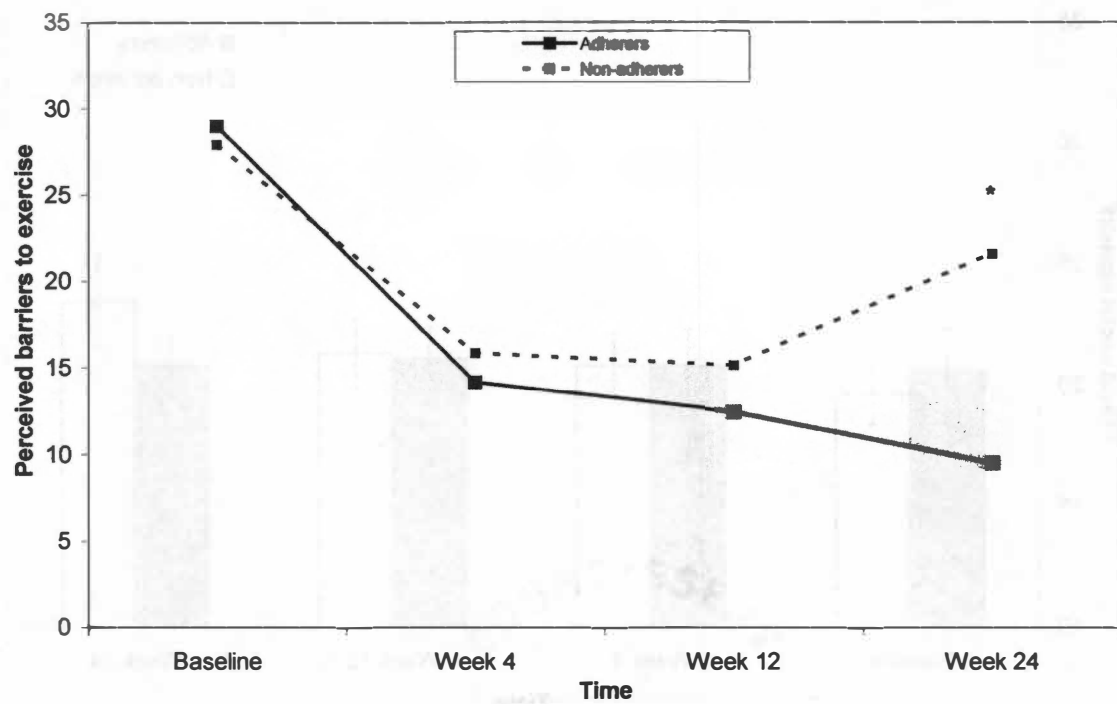


Figure 10. Comparison of perceived barriers to exercise scores between adherers and non-adherers over time (Significant difference between adherers and non-adherers, $p < 0.001$).

in perceived barriers for adherers between baseline and week 4, week 12, and week 24 ($p < 0.001$).

Barriers with a mean score of “5” or higher at baseline were; lack of willpower (7.3 ± 1.8), lack of time (5.2 ± 2.2), and lack of energy (5.1 ± 2.8). Repeated measures ANOVA was run for lack of willpower and there was a significant time by group interaction ($p < 0.001$) (Figure 11). Independent t-tests revealed that adherers and non-adherers differed from each other only at week 24 ($p < 0.001$). Paired comparisons were run separately for the adherers and non-adherers to examine differences between baseline and week 4, 12, and 24. Non-adherers were significantly lower at week 4, 12, and 24 compared to baseline ($p < 0.001$, $p < 0.001$, and $p = 0.001$, respectively). Adherers also experienced a significant decrease between baseline and week 4, 12, and 24 ($p < 0.001$).

Repeated measures ANOVA was run for lack of time and there was a significant time by group interaction ($p < 0.001$). Independent t-tests revealed that adherers and non-adherers differed from each other only at week 24 ($p < 0.001$). Paired comparisons were run separately for the adherers and non-adherers to examine differences between baseline and week 4, 12, and 24. Non-adherers differed from baseline at week 4 and 12 ($p < 0.001$), with no difference between baseline and week 24 ($p = 0.683$). Adherers had a significant decrease between baseline and week 4, 12, and 24 ($p < 0.001$) (Figure 12).

Repeated measures ANOVA was run for lack of energy and there was a significant time by group interaction ($p < 0.001$). Independent t-tests revealed that

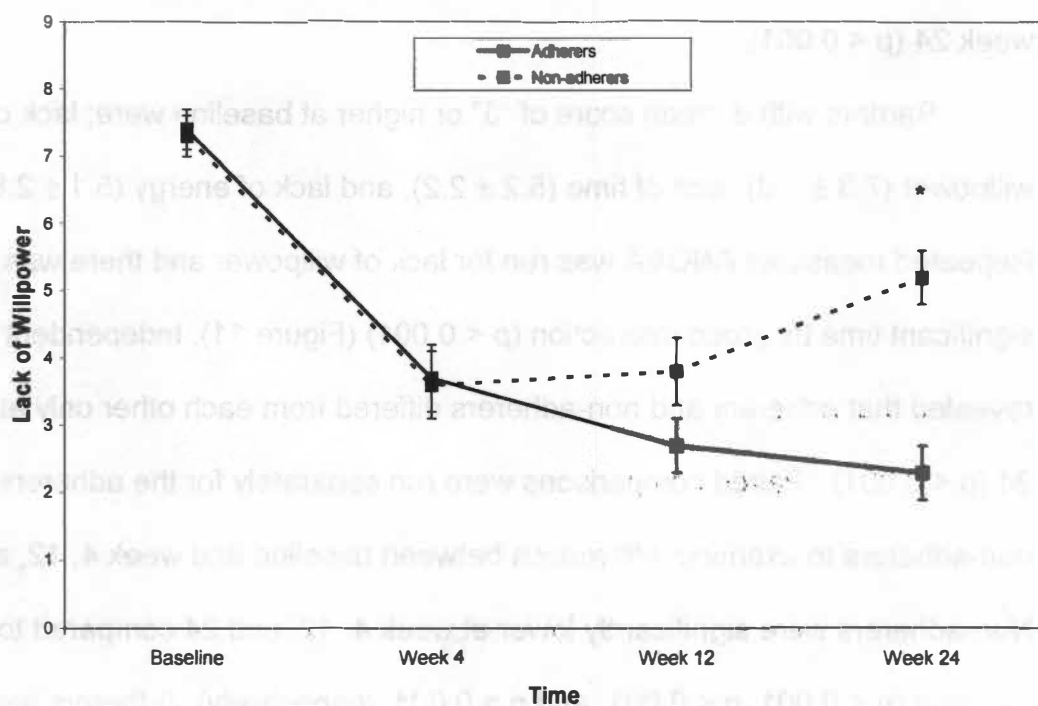


Figure 11. Comparison of adherers vs. non-adherers for the lack of willpower barrier (*Significant difference between groups)

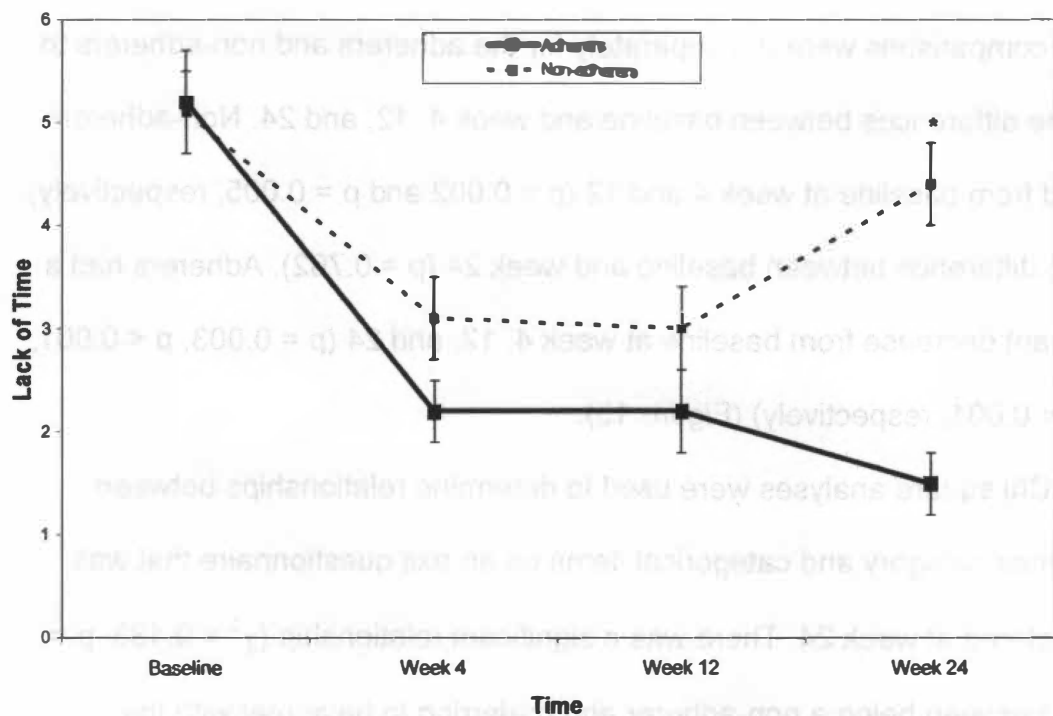


Figure 12. Comparison of adherers vs. non-adherers for the lack of time barrier (*Significant difference between groups)

adherers and non-adherers differed from each other only at week 24 ($p < 0.001$). Paired comparisons were run separately for the adherers and non-adherers to examine differences between baseline and week 4, 12, and 24. Non-adherers differed from baseline at week 4 and 12 ($p = 0.002$ and $p = 0.005$, respectively), with no difference between baseline and week 24 ($p = 0.762$). Adherers had a significant decrease from baseline at week 4, 12, and 24 ($p = 0.003$, $p < 0.001$, and $p < 0.001$, respectively) (Figure 13).

Chi square analyses were used to determine relationships between adherence category and categorical items on an exit questionnaire that was administered at week 24. There was a significant relationship ($\chi^2 = 9.183$, $p = 0.002$) between being a non-adherer and preferring to have met with the researcher weekly during the entire intervention. Results indicate that 74.2% of non-adherers would have preferred to keep weekly meetings with the researcher compared with only 33.3% of the adherers. There was no relationship with being an adherer or non-adherer and feeling that the initial weekly check-ins with the researcher were useful, with 90.9% of participants feeling it was useful ($\chi^2 = 2.957$, $p = 0.086$). Regardless of group, 81.8% of participants felt they were more active at week 24 compared to when they began the intervention ($\chi^2 = 2.776$, $p = 0.096$). Independent t-tests revealed that adherers and non-adherers differed from each other when asked how many days per week that the pedometer was worn after the weekly meetings ceased, adherers reported wearing it 7 days per week and non-adherers reported wearing it 5.8 days per week ($p = 0.014$). There was also a difference between groups when asked how many days per week

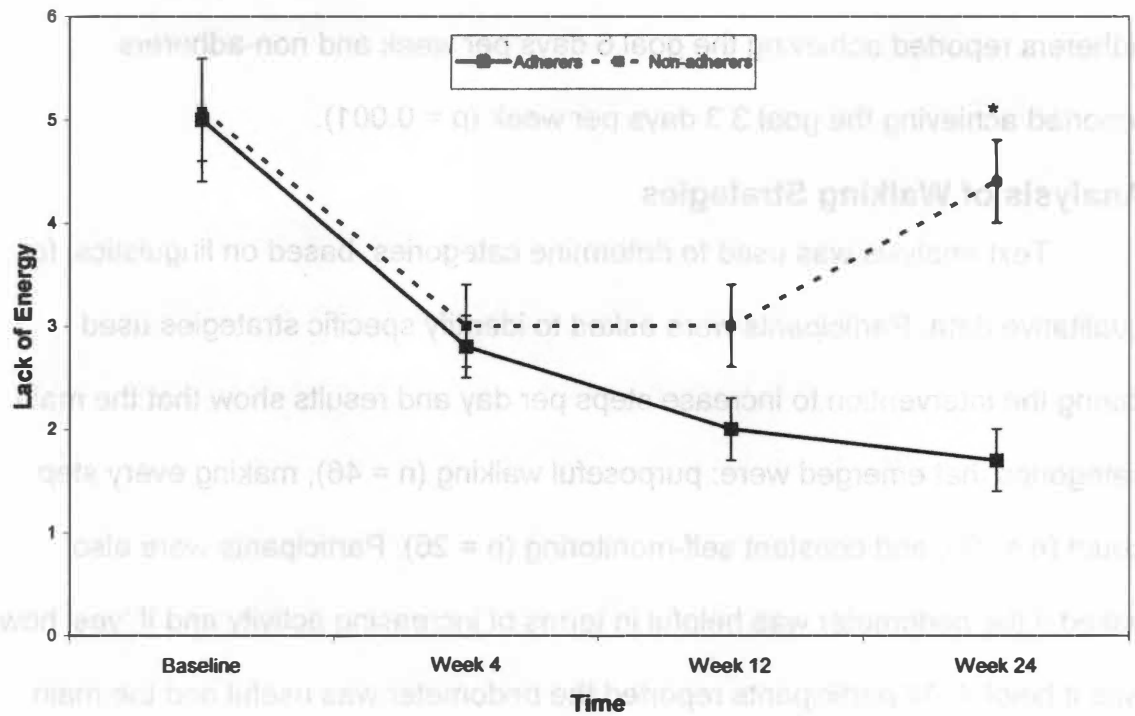


Figure 13. Comparison of adherers vs. non-adherers for the lack of energy barrier (*Significant difference between groups)

they felt they achieved 10,000 steps per day after the weekly meetings ceased, adherers reported achieving the goal 6 days per week and non-adherers reported achieving the goal 3.3 days per week ($p = 0.001$).

Analysis of Walking Strategies

Text analysis was used to determine categories, based on linguistics, for qualitative data. Participants were asked to identify specific strategies used during the intervention to increase steps per day and results show that the main categories that emerged were: purposeful walking ($n = 46$), making every step count ($n = 37$), and constant self-monitoring ($n = 26$). Participants were also asked if the pedometer was helpful in terms of increasing activity and if 'yes' how was it helpful. All participants reported the pedometer was useful and the main categories that emerged for why were: constant and immediate feedback ($n = 35$), increased motivation to achieve daily step goal ($n = 15$), and objective measure of activity ($n = 14$). Fifty participants felt the weekly meetings made it easier to meet the recommendation in the first part of the intervention and the main reasons why were: accountability ($n = 24$), positive interaction with the researcher ($n = 21$), and encouragement ($n = 15$). Thirty-one participants indicated they would have preferred meeting with the researcher throughout the intervention, and the main categories for why were: accountability ($n = 22$), support provided by the researcher ($n = 17$), and encouragement/motivation ($n = 10$).

Chapter 5

Discussion

The primary purpose of this study was to examine the effects of 4 weeks of contact versus 12 weeks of contact with a fitness professional when women are beginning a home-based 10,000 steps per day walking program. The dependent variables of interest were daily step accumulation, physical characteristics, exercise self-efficacy, perceived social support, and perceived barriers to exercise over a 24-week period. This study did not find an interaction or a group effect for any variable of interest. Overall, there was a significant increase in step volume, and average steps per day were higher than baseline at all time points (Figure 1). For this sample of women, there was also a decrease in total perceived barriers to exercise between baseline and weeks 4, 12, and 24 (Figure 4). There was a significant increase above baseline in exercise self-efficacy and perceived social support observed at weeks 4 and 12, but these variables had decreased again by week 24 (Figures 2 & 3).

There is currently no consensus on the ideal amount of time that a physical activity intervention should last and what should occur at the points of contact. It has been suggested that a theory-based physical activity intervention may prove most useful in eliciting behavior change (17). The current intervention was based on social cognitive theory where, according to Bandura (3), self-efficacy is an important determinant of behavior. Social cognitive theory is dynamic in nature and does not focus on progressing a person through stages of change, but rather focuses on increasing self-efficacy cognitions to change

beliefs, in an effort to improve long-term behavior (3). This study proposes a more mutually influential relationship between psychosocial variables and behavior change. For example, perceived barriers to exercise and social support were presented as variables that could directly influence exercise behavior or influence behavior by affecting other variables such as exercise self-efficacy.

There are several components to exercise self-efficacy, including mastery experiences and verbal persuasion. Since this was a pedometer-based walking intervention, a measure of mastery experience was the assessment of average steps per day throughout the intervention, which indicated a change in exercise behavior. Verbal persuasion came from weekly individual meetings where the researcher provided positive feedback such as encouragement and strategies for increasing activity. Regardless of group assignment, all participants received the same physical activity recommendation, informational handouts in the same order, and met with the same researcher, making the individual weekly meetings consistent between participants. The handouts were designed to be informative and support the participants in their efforts to increase activity. Another purpose of the handouts was to reinforce outcome expectations of living an active life including improved psychological and physical health. Topics addressed in the handouts were: benefits of the 10,000 steps per day recommendation, how to build steps into the day, physical activity and women's health, psychological benefits of exercise, overcoming barriers to exercise, self-monitoring/tracking progress, creating a social support network, tips for an active lifestyle/time management, exercising in the elements, and goal setting (Appendix H). Many

participants commented that these handouts were informative and useful.

Overall, participants were more active throughout the 24-week study, and there were no differences in adherence, exercise self-efficacy, perceived social support, or perceived barriers based on receiving 4 weeks or 12 weeks of weekly contact. This leads to the conclusion that the additional 8 weeks of contact did not change behavior or psychological variables.

To further examine the characteristics of those who were successful throughout the intervention, participants were classified as adherers and non-adherers based on a cut point of averaging 9500 steps per day throughout the intervention. This cut point is consistent with Anshel's (1) definition of adherence which is the tendency of an individual to continue with a behavior once he or she has agreed to undertake that behavior and with Schneider and colleagues (64) who also examined adherence to the 10,000 steps per day recommendation. The first significant difference in average steps per day between adherers and non-adherers was seen for the average of weeks 9 to 12, suggesting that adherence during the first 6 months of exercise may be determined in as few as 9 weeks.

Assessment of adherence for this study may have been affected by the strict cut point of ≥ 9500 steps per day. Also, the daily requirements of the recommendation may make it harder for some people to achieve; yet, the rate of adherence over a 6-month period was similar to other studies (16, 17, 64).

Accurately comparing adherence patterns between this and other studies that examined a home-based walking protocol is challenging, since different criteria for adherence were used in these investigations. Wilbur et al. (82) had an

adherence rate of 64.8% with an adherence cut point of completing 77 out of 96 prescribed walks over a 24-week period, as long as there was not a lapse of longer than one week. This translates to completing 80% of prescribed walks. In a more direct comparison, this study modeled its cut point for adherence after Schneider et al. (64) who observed an adherence rate of 50% of those who completed a 36-week intervention. Only 34% of Schneider et al.'s participants who initiated the exercise intervention adhered to the entire program. The current investigation had an adherence rate of 45.5% for those who completed the intervention and 40% for those who initiated exercise. It is important to note that a direct comparison to Schneider et al. (64) cannot be made due to different intervention lengths. Adherence is the ultimate goal with any exercise behavior change and the longer that one adheres, the more likely behavior change will be sustained.

Despite the fact that adherers had significantly higher step counts than non-adherers after week 8, there was no difference for any psychological variable until week 24. Participants had higher scores on exercise self-efficacy at weeks 4 and 12. At week 24 the adherers still had significantly elevated scores compared to baseline, while the non-adherers had a decrease in scores which were similar to baseline measures. Unlike Oman and King (52), who found that baseline self-efficacy significantly predicted early exercise adherence for months 1 to 6, baseline exercise self-efficacy did not predict early adherence in this sample. However, adherers having higher scores over time for exercise self-efficacy was consistent with the findings of Sherwood et al. (68), McAuley et al.

(43), D'Alonzo et al. (15), White et al. (80), and Sharma et al. (67) who all found that individuals who adhered to an exercise program had high exercise self-efficacy scores. These results add to exercise self-efficacy literature by confirming that higher exercise self-efficacy scores are related to adherence. These results also demonstrate that different amounts of contact with a fitness professional did not have a relationship with the increase in exercise self-efficacy; therefore, the actual impact of contact with a fitness professional remains unknown.

The intervention was also successful in decreasing the amount of total perceived barriers to exercise for both adherers and non-adherers, with both groups scoring significantly lower for total barriers at week 24 compared to baseline. The main difference between adherers and non-adherers was that at week 24, the adherers had continued to decrease the amount of barriers they perceived while the non-adherers experienced a rise in total perceived barriers. Therefore, even with the overall decrease, the adherers scored significantly lower for total barriers than non-adherers at week 24. The identification of lack of time and lack of energy at baseline are consistent with the typical barriers to exercise associated with women in general (21, 53, 83). Lack of willpower was another important barrier that emerged for this sample. Individuals who identified this as a significant barrier scored high on the following items: had a difficult time starting an exercise program, were likely to find an excuse not to exercise, and cannot stay committed to an exercise program (78). At the conclusion of the intervention, non-adherers identified lack of willpower, lack of time, and lack of energy as their

top three barriers to exercise and their scores for these barriers were significantly higher than adherers. These barriers may represent specific challenges that women face such as balancing family and career, further supporting a lifestyle approach to physical activity and the use of pedometers as a method of constant self-monitoring. Overall, these findings indicate that overcoming barriers may be important for sedentary women to adhere to exercise.

The exact role that social support plays in exercise adherence is not fully understood. In this sample, both adherers and non-adherers had an increase in perceived social support scores at weeks 4 and 12, but these scores decreased by week 24. These results are not consistent with research that suggests that social support for exercise is related to exercise participation in women (20, 49, 71). Interestingly, the increase in perceived social support coincided with the portion of the intervention when participants experienced the majority of contact with the researcher and this pattern did not differ between adherers and non-adherers or between the 4-week group and the 12-week group.

One limitation of the Social Support and Exercise Survey is that it only measures support from family and friends and does not consider other people that may provide support such as a fitness professional or an organized support group. Also, this was a home-based walking program where participants could individualize their activity; therefore, the role of the fitness professional could be different with other types of exercise in a more structured setting. The development of a survey that measures social support from a fitness professional would be beneficial as the effects of this type of support on exercise behavior

have not been firmly established. Due to the various needs of the individual, and the countless ways that social support can be delivered (20), it may be advantageous to address social support on an individual basis. This was evident as the majority of adherers in this sample did not prefer to meet with the researcher throughout the intervention, they did have a decrease in the amount of perceived social support at week 24, yet they continued to adhere to the recommendation. These findings suggest that the amount of social support and the type of social support needed may differ greatly among individuals when it comes to enhancing exercise behavior.

Another important aspect of this investigation was the identification of specific strategies that these women used to achieve the 10,000 steps per day goal. One of the unique aspects of the 10,000 steps per day recommendation is the lifestyle approach where steps can be built into one's day. To support the lifestyle approach, the women in this study were not required to accumulate steps in a certain way; in fact they were encouraged to find strategies that fit within their lifestyle. Only one other known study examined how people build steps into their day (12), but in that study individuals decided on certain strategies ahead of time and then focused on implementing those specific strategies over the next week. In the current study, women were asked at the end of the 24-week period to identify up to three strategies that they used consistently to reach 10,000 steps per day. These open-ended answers were thematized by the researcher and confirmed with computer-assessed text analysis. With a variety of responses, the four main strategies that emerged were

purposeful walking, constant self-monitoring, time-management, and making every step count. Purposeful walking was the most frequently cited strategy. Some examples of purposeful walking were taking a walk for a specific amount of time (outdoor or treadmill), walking until a certain number of steps were achieved, walking early in the day, walking after work, walking on a lunch break, and walking while watching television. These strategies are not surprising as several studies have shown that a purposeful walk is necessary for sedentary people to achieve 10,000 steps per day (31, 36, 69, 84). Checking the pedometer frequently was another strategy. Women reported checking it often so that they knew how far they were from the goal throughout the day. The pedometer served as a constant reminder that there was a daily step goal to achieve. These findings are consistent with another study that found that women who reported wearing their pedometer more often also reported more daily activity compared to those who reported not wearing their pedometer as often (30). Many participants (n = 40) reported that time had to be set aside each day to achieve the 10,000 steps per day. Referring back to the purposeful walk that many women needed in order to achieve the goal, they needed to identify and reserve time that would be available for walking. Although purposeful walks were critical to achieving the 10,000 steps per day goal, women also tended to look for ways to build in steps to their daily routine. The strategy of making every step count included parking farther away, taking stairs whenever possible, and doing more household chores.

These findings lend additional support for the 10,000 steps per day recommendation as a viable option for increasing daily activity in sedentary individuals. Participants had to consciously alter daily routines to take more steps in a day and this often resulted in purposeful walking. Although over half the sample did not regularly adhere to the program, they did significantly increase daily activity over baseline and this difference was still significant despite a gradual drop off in average steps per day. Overall, this sample was significantly more active throughout the intervention than they were when they volunteered for the study suggesting some level of behavior change did occur. There was also an overall improvement for all participants in body fat percentage and waist and hip circumference. A significant loss of body mass and reduction in BMI was only observed in the adherers.

The use of an exit questionnaire gave the participants a chance to provide feedback regarding their experience with this pedometer-based recommendation. Several questions allowed the women to provide answers in their own words. Some of these questions were about whether the weekly meetings were useful and why, and if they would have preferred to continue the meetings and why. The majority of the participants felt that the weekly meetings were useful and the main reason given was because they felt accountable to someone. Participants also reported positive interaction with the researcher made the meeting useful; this included strategizing, coaching, and encouragement. Of the women who would have preferred continuing the meetings, accountability was cited as the main reason. It is important to note that the non-adherers were more likely to

have wanted to continue with the meetings suggesting that those who are not adhering to an exercise program may do better if accountability to someone continues over time. Although the non-adherers from the 12-week group indicated that they would have preferred to keep the weekly meetings throughout the study, they had already started to significantly differ from the adherers by week 9 when they were still meeting weekly. While these participants believed that continued contact would have made a difference in adherence, it was not a factor for weeks 9 to 12.

There were several strengths to this study including that participants in both randomly assigned groups had contact with the same researcher throughout the intervention, which eliminated any bias that could have emerged due to multiple researchers providing different information. Additionally, adherence was objectively measured with a pedometer thus not relying on subjective evaluation of daily walking. A limitation of this study is that a rather homogenous group of middle-aged, overweight, and previously sedentary women served as participants thus results may not apply to all groups. Another limitation of this study is that walking was the only activity examined. Because pedometers were the tools used to quantify physical activity, subjects were not given the option to use cycling, swimming, or other non-ambulatory activity for exercise. Additionally, other factors that may influence exercise behavior such as marital status, number and age of kids, and socioeconomic status were not examined. The possible effect of seasonality was not controlled for as all participants were enrolled in July and August and all post-testing occurred in January and February. It is also

important to note that this was only a 24-week study and long-term adherence was not addressed.

Since most new exercisers drop out within the first 3 to 6 months (16), this time frame is rather crucial for health and fitness professionals to make an impact. With limited resources and funds available for public health initiatives, health and fitness professionals must be efficient and effective when delivering information. Without a gold standard for the design of physical activity interventions, an ideal amount of time for an intervention needs to be established, as well as guidelines of what should occur during that time. For this sample, all the participants who dropped out did so by week 12, which is also when adherence had been set, making it an important time to establish physical activity patterns.

With the high prevalence of U.S. adults failing to reach minimum recommended levels of physical activity, it is important to identify ways to help these individuals become more active. The use of a theory-based intervention may serve as a guide to fitness professionals who are interested in a systematic approach towards changing exercise behavior. For example, social cognitive theory encourages a fitness professional to use a variety of tools, including verbal persuasion and mastery of the exercise behavior, to enhance exercise self-efficacy leading to improved exercise behavior. This study demonstrates the importance of increasing levels of exercise self-efficacy and decreasing perceived barriers, as these were variables that differed significantly between adherers and non-adherers after 24 weeks. As fitness professionals seek

methods for increasing daily physical activity, pedometer-monitored goals should be considered as they are capable of increasing daily activity in sedentary individuals (31, 36, 64, 84), along with improving health outcomes (48, 72). They also provide a concrete measure of daily activity that allows people to self-monitor their daily progress towards a step goal, and there is no limit to how one decides to build steps into the day. However, based on the present study and that of Schneider et al. (64) sedentary adults may have difficulty adhering to this recommendation or may discontinue participation altogether for a variety of reasons. With a variety of alarming statistics regarding physical inactivity and the increased risk for disease that inactivity brings, behavior change regarding exercise is essential. It is the responsibility of fitness professionals to provide as many strategies and tools as possible to help sedentary individuals engage in regular physical activity.

1. Anshel, M. H. *Applied exercise psychology: a practitioner's guide to improving client health and fitness*. 1st ed. New York, NY: Springer Publishing Company, 2006.
2. Bandura, A. *Self-efficacy: the exercise of control*. New York: W.H. Freeman, 1997.
3. Bandura, A. *Social foundations of thought and action: a social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall, 1986.
4. Bassett, D. R., B. E. Ainsworth, S. R. Leggett, C. A. Mathien, and J. A. Main. Accuracy of five electronic pedometers for measuring distance walked. *Med Sci Sports Exerc.* 8:1071-1077, 1996.
5. Bassett Jr., D. R., A. L. Cureton, and B. E. Ainsworth. Measurement of daily walking distance-questionnaire versus pedometer. *Med Sci Sports Exerc.* 32:1018-1023, 2000.
6. Bauman, A. E. Updating the evidence that physical activity is good for health: an epidemiological review 2000-2003. *J Sci Med Sport.* 7:6-19, 2004.
7. Brownson, R. C., E. A. Baker, R. A. Housemann, L. K. Brennan, and S. J. Bacak. Environmental and policy determinants of physical activity in the United States. *Am J Public Health.* 91:1995-2003, 2001.
8. Calfas, K. J., J. F. Sallis, B. Oldenburg, and M. French. Mediators of change in physical activity following an intervention in primary care. *Prev Med.* 26:297-304, 1997.
9. Chan, C. B., E. Spangler, J. Valcour, and C. Tudor-Locke. Cross-sectional relationship of pedometer determined ambulatory activity to indicators of health. *Obes Res.* 11:1563-1570, 2003.
10. Chobian, A. V., G. L. Bakris, H. R. Black, W. C. Cushman, L. A. Green, and J. L. Izzo. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood pressure. *JAMA.* 289:2560-2572, 2003.
11. Cox, K. L., V. Burke, T. J. Gorely, L. J. Beilin, and I. B. Puddey. Controlled comparison of retention and adherence in home- vs center-initiated exercise interventions in women ages 40-65 years: the S.W.E.A.T. study. *Prev Med.* 36:17-29, 2003.
12. Croteau, K. A. Strategies used to increase lifestyle physical activity in a pedometer-based intervention. *J Allied Health.* 33:278-281, 2004.
13. Crouter, S. E., P. L. Schneider, and D. R. Bassett Jr. Spring-levered versus piezo-electric pedometer accuracy in overweight and obese adults. *Med Sci Sports Exerc.* 37:1673-1679, 2005.
14. Crouter, S. E., P. L. Schneider, M. Karabulut, and D. R. Bassett Jr. Validity of 10 electronic pedometers for measuring steps, distance, and energy cost. *Med Sci Sports Exerc.* 35:1455-1460, 2003.
15. D'Alonzo, K. T., J. S. Stevenson, and S. E. Davis. Outcomes of a program to enhance exercise self-efficacy and improve fitness in Black and Hispanic college-age women. *Res Nurs Health.* 27:357-369, 2004.

16. Dishman, R. K. *Exercise adherence: Its impact on public health*. Champaign, IL: Human Kinetics, 1988.
17. Dishman, R. K. The problem of exercise adherence: fighting sloth in nations with market economies. *Quest*. 53:279-294, 2001.
18. DuCharme, K. A. and L. R. Brawley. Predicting the intentions and behavior of exercise initiates using two forms of self-efficacy. *J Behav Med*. 18:479-497, 1995.
19. Eastep, E., S. Beveridge, P. Eisenman, L. Ransdell, and B. Shultz. Does augmented feedback from pedometers increase adults' walking behavior? *Percept Mot Skills*. 99:392-402, 2004.
20. Eyler, A. A., R. C. Brownson, R. J. Donatelle, A. C. King, D. Brown, and J. F. Sallis. Physical activity social support and middle- and older-aged minority women: results from a US survey. *Soc Sci Med*. 49:781-789, 1999.
21. Eyler, A. A., D. Matson-Koffman, J. R. Vest, K. R. Evenson, B. Sanderson, J. L. Thompson, J. Wilbur, S. Wilcox, and D. R. Young. Environmental, policy, and cultural factors related to physical activity in a diverse sample of women: The Women's Cardiovascular Health Network Project--summary and discussion. *Women Health*. 36:123-134, 2002.
22. Fallon, E. A., S. Wilcox, and B. E. Ainsworth. Correlates of self-efficacy for physical activity in African American women. *Women Health*. 41:47-62, 2005.
23. Fletcher, J. S. and J. L. Banasik. Exercise self-efficacy. *Clin Excell Nurse Pract*. 5:134-143, 2001.
24. Gabriele, J. M., M. S. Walker, D. L. Gill, K. D. Harber, and E. B. Fisher. Differentiated roles of social encouragement and social constraint on physical activity behavior. *Ann Behav Med*. 29:210-215, 2005.
25. Gonzales, V., K. Lorig, and A. Stewart. *Outcome measures for health education and other health care interventions*. Thousand Oaks, CA: Sage Publications, 1996, 106.
26. Heesch, K. C., M. K. Dinger, K. R. McClary, and K. R. Rice. Experiences of women in a minimal contact pedometer-based intervention: a qualitative study. *Women Health*. 41:97-116, 2005.
27. Helgeson, V. S. Social support and quality of life. *Qual Life Res*. 12:25-31, 2003.
28. Heyward, V. H. and L. M. Stolarczyk. *Applied body composition assesement*. Champaign, IL: Human Kinetics, 1996, 12.
29. Hornbuckle, L. M., D. R. Bassett Jr., and D. L. Thompson. Pedometer-determined walking and body composition variables in African-American women. *Med Sci Sports Exerc*. 37:1069-1074, 2005.
30. Hultquist, C. N., C. Albright, and D. L. Thompson. Changes in walking volume during a one-year follow-up study. *JEPonline*, in press.
31. Hultquist, C. N., C. Albright, and D. L. Thompson. Comparison of walking recommendations in previously inactive women. *Med Sci Sports Exerc*. 37:676-683, 2005.

32. Iwane, M., M. Arita, S. Tomimoto, O. Satani, M. Matsumoto, K. Miyashita, and I. Nishio. Walking 10,000 steps/day or more reduces blood pressure and sympathetic nerve activity in mild essential hypertension. *Hypertens Res.* 6:573-580, 2000.
33. Jerome, G. J., D. X. Marquez, E. McAuley, S. Canaklisova, E. Snook, and M. Vickers. Self-efficacy effects on feeling states in women. *Int J Behav Med.* 9:139-154, 2002.
34. Kruger, J., S. A. Ham, and H. W. Kohl. Trends in leisure-time physical inactivity by age, sex, and race/ethnicity-United States, 1994-2004. *Morb Mortal Wkly Rep.* 54:991-994, 2005.
35. Krumm, E. M., O. L. Dessieux, P. Andrews, and D. L. Thompson. The relationship between daily steps and body composition in postmenopausal women. *J Womens Health.* 15:202-209, 2006.
36. Le Masurier, G. C., C. L. Sidman, and C. B. Corbin. Accumulating 10,000 steps: does this meet current physical activity guidelines? *Res Q Exerc Sport.* 74:389-394, 2003.
37. Lee, I. M., K. M. Rexrode, N. R. Cook, J. E. Manson, and J. E. Buring. Physical activity and coronary heart disease in women: is "no pain, no gain" passe? *JAMA.* 285:1447-1454, 2001.
38. Manson, J. E., P. Greenland, A. Z. LaCroix, M. L. Stefanick, C. P. Mouton, A. Oberman, M. G. Perri, D. S. Sheps, M. B. Pettinger, and D. S. Siscovick. Walking compared with vigorous exercise for the prevention of cardiovascular events in women. *N Engl J Med.* 347:716-725, 2002.
39. McAuley, E. The role of efficacy cognitions in the prediction of exercise behavior in middle-aged adults. *J Behav Med.* 15:65-88, 1992.
40. McAuley, E. Self-efficacy and the maintenance of exercise participation in older adults. *J Behav Med.* 16:103-113, 1993.
41. McAuley, E., K. S. Courneya, D. L. Rudolf, and et al. Enhancing exercise adherence in middle-aged males and females. *Prev Med.* 23:498-506, 1994.
42. McAuley, E., S. Elavsky, G. J. Jerome, J. F. Konopack, and D. X. Marquez. Physical activity-related well-being in older adults: social cognitive influences. *Psychol Aging.* 20:295-302, 2005.
43. McAuley, E. and L. Jacobson. Self-efficacy and exercise participation in sedentary adult females. *Am J Health Promot.* 5:185-191, 1991.
44. McAuley, E., C. Lox, and T. E. Duncan. Long-term maintenance of exercise, self-efficacy, physiological change in older adults. *J Gerontol.* 48:218-224, 1993.
45. McAuley, E., H. Talbot, and S. Martinez. Manipulating self-efficacy in the exercise environment in women: influences on affective responses. *Health Psychol.* 18:288-294, 1999.
46. Mokdad, A. H., J. S. Marks, D. F. Stroup, and J. L. Gerberding. Actual causes of death in the United States, 2000. *JAMA.* 291:1238-1245, 2004.

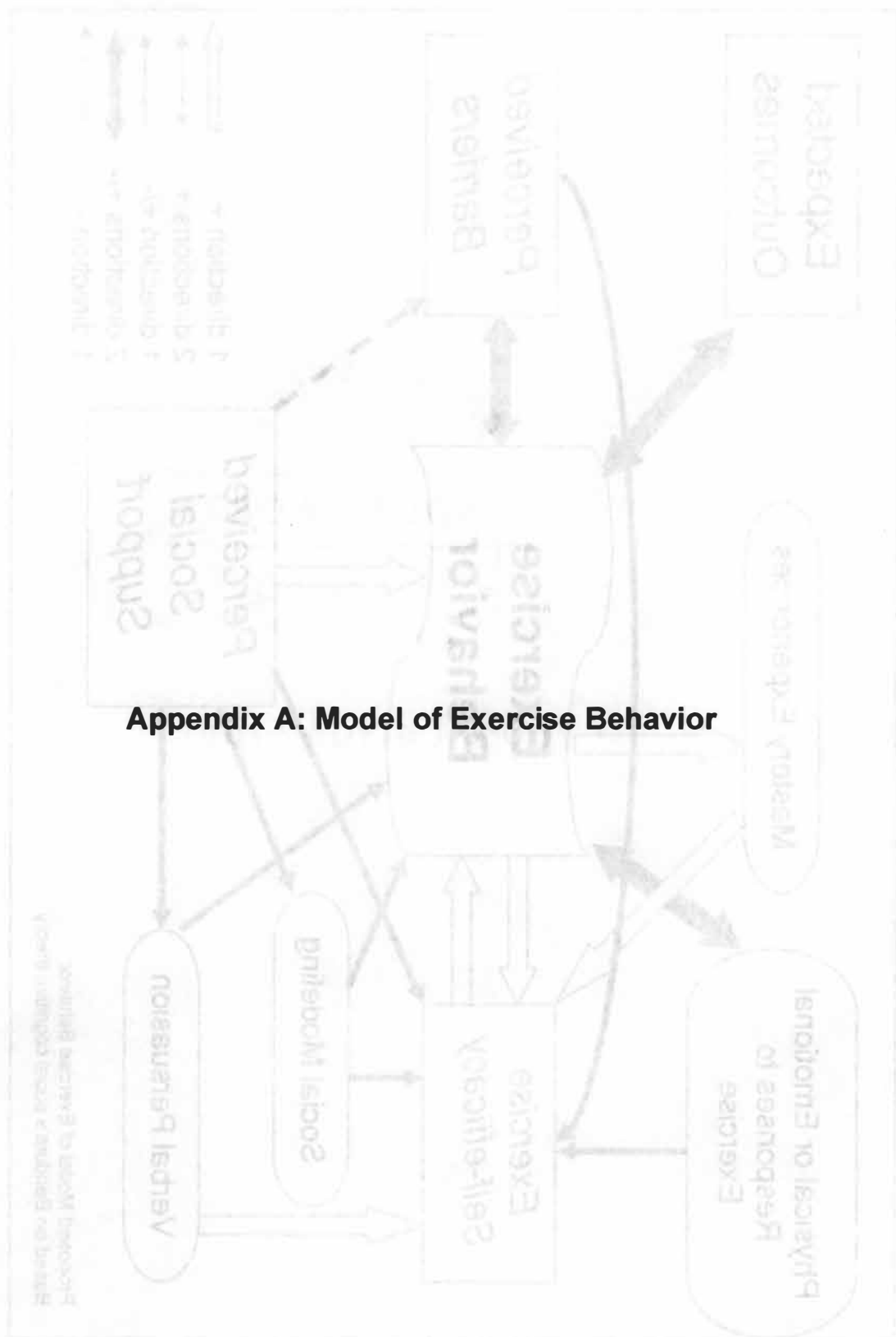
47. Mokdad, A. H., J. S. Marks, D. F. Stroup, and J. L. Gerberding. Correction: actual causes of death in the United States, 2000. *JAMA*. 293:293-294, 2005.
48. Moreau, K. L., R. Degarmo, J. Langley, C. McMahon, E. T. Howley, D. R. Bassett Jr., and D. L. Thompson. Increasing daily walking lowers blood pressure in postmenopausal women. *Med Sci Sports Exerc*. 33:1825-1831, 2001.
49. Nies, M., M. Vollman, and T. Cook. Facilitators, barriers and strategies for exercise in European American women in the community. *Public Health Nurs*. 15:263-272, 1998.
50. Nies, M. A., H. L. Chruscial, and J. T. Hepworth. An intervention to promote walking in sedentary women in the community. *Am J Health Behav*. 27:524-535, 2003.
51. Oman, R. F. and T. E. Duncan. Women and exercise: an investigation of the roles of social support, self-efficacy, and hardiness. *Med Exerc Nutr Health*. 5:306-315, 1995.
52. Oman, R. F. and A. C. King. Predicting the adoption and maintenance of exercise participation using self-efficacy and previous exercise participation rates *Am J Health Promot*. 12:154-161, 1998.
53. Osuji, T., S. Lovegreen, M. Elliot, and R. C. Brownson. Barriers to physical activity among women in the rural midwest. *Women Health*. 44:41-55, 2006.
54. Paffenbarger, R. S., R. T. Hyde, A. L. Wing, and C.-C. Hsieh. Physical activity, all-cause mortality, and longevity of college alumni. *N Engl J Med*. 314:605-613, 1986.
55. Parks, S. E., R. A. Housemann, and R. C. Brownson. Differential correlates of physical activity in urban and rural adults of various socioeconomic backgrounds in the United States. *J Epidemiol Community Health*. 57:29-35, 2003.
56. Pate, R. R., M. Pratt, S. N. Blair, W. L. Haskell, C. A. Macera, C. Bouchard, D. Buchner, W. Ettinger, G. W. Heath, and A. C. King. Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *JAMA*. 273:402-407, 1995.
57. Resnick, B. and L. S. Jenkins. Testing the reliability and validity of the self-efficacy for exercise scale. *Nurs Res*. 49:154-159, 2000.
58. Resnick, B., M. H. Palmer, L. S. Jenkins, and A. M. Spellbring. Path analysis of efficacy expectations and exercise behavior in older adults. *J Adv Nurs*. 31:1309-1315, 2000.
59. Resnick, B. and A. M. Spellbring. Understanding what motivates older adults to exercise. *J Gerontol Nurs*. 26:17-21, 2000.
60. Rooney, B. L., K. Smalley, J. Larson, and S. Havens. Is knowing enough? Increasing physical activity by wearing a pedometer. *Wis Med J*. 102:31-36, 2003.

61. Ryckman, R. M., M. A. Robbins, B. Thornton, and P. Cantrell. Development and validation of a physical self-efficacy scale. *J Pers Soc Psychol.* 42:891-900, 1982.
62. Sallis, J. F., R. M. Grossman, R. B. Pinski, T. L. Patterson, and P. R. Nader. The development of scales to measure social support for diet and exercise. *Prev Med.* 16:825-836, 1987.
63. Sapkota, S., H. R. Bowles, S. A. Ham, and H. W. Kohl. Adult participation in recommended levels of physical activity --- United States, 2001 and 2003. *Morb Mortal Wkly Rep.* 54:1208-1212, 2005.
64. Schneider, P. L., D. R. Bassett Jr., D. L. Thompson, N. P. Pronk, and K. M. Bielak. Effects of a 10,000 steps per day goal in overweight adults. *Am J Health Promot.* 21:85-89, 2006.
65. Schneider, P. L., S. E. Crouter, and D. R. Bassett Jr. Pedometer measures of free-living physical activity: comparison of 13 models. *Med Sci Sports Exerc.* 36:331-335, 2004.
66. Schneider, P. L., S. E. Crouter, O. Lukajic, and D. R. Bassett Jr. Accuracy and reliability of 10 pedometers for measuring steps over a 400-m walk. *Med Sci Sports Exerc.* 35:1779-1784, 2003.
67. Sharma, M., L. Sargent, and R. Stacy. Predictors of leisure-time physical activity among African American women. *Am J Health Behav.* 29:352-359, 2005.
68. Sherwood, N. E. and R. W. Jeffery. The behavioral determinants of exercise: implications for physical activity interventions. *Annual Reviews.* 20:21-44, 2000.
69. Sidman, C. L., C. B. Corbin, and G. C. Le Masurier. Promoting physical activity among sedentary women using pedometers. *Res Q Exerc Sport.* 75:122-129, 2004.
70. Steinhardt, M. and R. K. Dishman. Reliability and validity of expected outcomes and barriers for habitual physical activity. *J Occup Med.* 31:536-546, 1989.
71. Sternfeld, B., B. Ainsworth, and C. Quesenberry. Physical activity patterns in a diverse population of women. *Prev Med.* 28:313-323, 1999.
72. Swartz, A. M., S. J. Strath, D. R. Bassett, B. J. Moore, B. A. Redwine, M. Groer, and D. L. Thompson. Increasing daily walking improves glucose tolerance in overweight women. *Prev Med.* 37:356-362, 2003.
73. Thompson, D. L., J. Rakow, and S. M. Perdue. Relationship between accumulated walking and body composition in middle-aged women. *Med Sci Sports Exerc.* 36:911-914, 2004.
74. Toobert, D., R. Glasgow, J. Nettekoven, and J. Brown. Behavioral and psychosocial effects on intensive lifestyle management for women with coronary heart disease. *Patient Educ Couns.* 35:177-188, 1998.
75. Tudor-Locke, C. A preliminary study to determine instrument responsiveness to change with a walking program: Physical activity logs versus pedometers. *Res Q Exerc Sport.* 72:288, 2001.

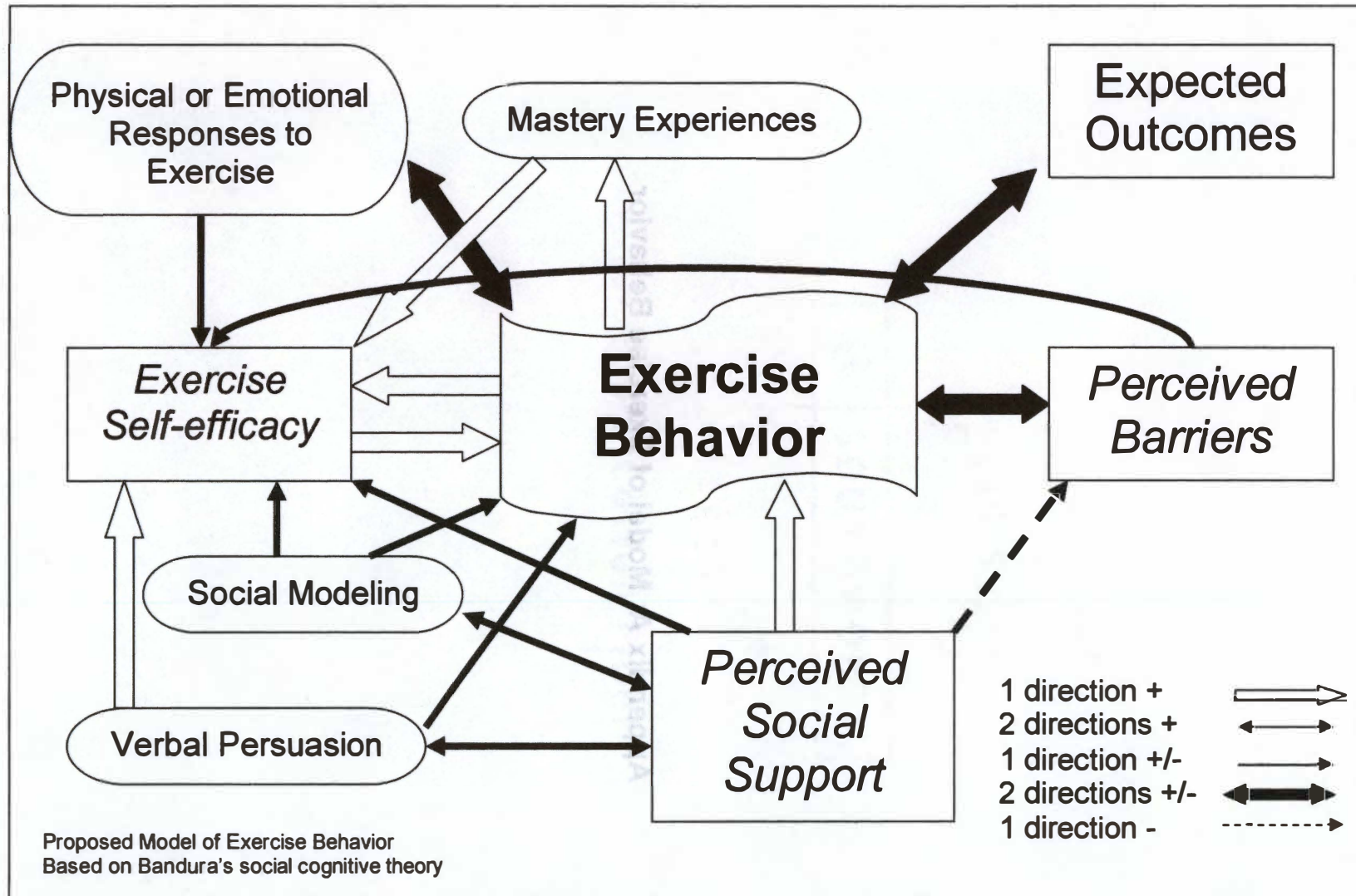
76. Tudor-Locke, C. and D. R. Bassett Jr. How many steps/day are enough? Preliminary pedometer indices for public health. *Sports Med.* 34:1-8, 2004.
77. Tudor-Locke, C. and A. M. Myers. Challenges and opportunities for measuring physical activity in sedentary adults. *Sports Med.* 31:91-100, 2001.
78. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, and Division of Nutrition and Physical Activity. Barriers to being active quiz. In: *Promoting physical activity: a guide for community action* Champaign, Ill: Human Kinetics, 1999, pp. 100-101.
79. US Department of Health and Human Services. *Physical activity and health: a report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.
80. White, J. L., L. B. Ransdell, J. Vener, and J. A. Flohr. Factors related to physical activity adherence in women: review and suggestions for future research. *Women Health.* 41:123-148, 2005.
81. Whitt, M., S. Kumanyika, and S. Bellamy. Amount and bouts of physical activity in a sample of African-American women. *Med Sci Sports Exerc.* 35:1887-1893, 2003.
82. Wilbur, J., A. Vassalo, P. Chandler, J. McDevitt, and A. M. Miller. Midlife women's adherence to home-based walking during maintenance. *Nurs Res.* 54:33-40, 2005.
83. Wilcox, S., C. Castro, A. C. King, R. Housemann, and R. C. Brownson. Determinants of leisure-time physical activity in rural compared with urban older and ethnically diverse women in the United States. *J Epidemiol Community Health.* 54:667-672, 2000.
84. Wilde, B. E., C. L. Sidman, and C. B. Corbin. A 10,000 step count as a physical activity target for sedentary women. *Res Q Exerc Sport.* 72:411-414, 2001.
85. Williams, D. M., E. S. Anderson, and R. A. Winett. A review of the outcome expectancy construct in physical activity research. *Ann Behav Med.* 29:70-79, 2005.

76	Tudor-Locke, C. and D. R. Bassett, Jr. How many steps/day are enough? Preliminary pooled cohort indices for public health. <i>Sports Med</i> 34:1-9, 2004
77	Tudor-Locke, C. and A. M. Myers. Guidelines and opportunities for measuring physical activity in sedentary adults. <i>Sports Med</i> 33:91-100, 2001
78	U.S. Department of Health and Human Services. Public Health Service. Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion. and Division of Nutrition and Physical Activity. Guidelines to bring active goals. In: <i>Physical activity: a guide for community action</i> . Champaign, IL: Human Kinetics, 1998, pp. 105-111
79	U.S. Department of Health and Human Services. Physical activity and health: a report of the Surgeon General. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, 1996
80	Wilder, J. L., J. B. Fawcett, J. Veier, and J. A. Fisher. Factors related to physical activity adherence in women: review and suggestions for future research. <i>Women Health</i> 41:133-144, 2000
81	Wink, M., S. Kananvika, and S. Barany. Amount and bouts of physical activity in a sample of African-American women. <i>Men Sex Sports Exerc</i> 35:1887-1892, 2003
82	Wolcott, J., A. Vassallo, P. Chandler, J. McDowell, and A. M. Miller. Men's activity: reference to health and body mass index. <i>Women Health</i> 34:33-40, 2000
83	Wolcott, J., C. G. Datto, A. C. King, R. Hovverson, and R. C. Brownson. Determinants of leisure-time physical activity in rural communities with urban and ethnically diverse women in the United States. <i>J. Ethnopharmacol</i> 64:607-612, 2002
84	Wong, S. F., C. L. Baker, and C. B. Cohen. A 10,000 step count as a physical activity target for sedentary women. <i>Med Sci Sports Exerc</i> 35:1747-1751, 2003
85	Wong, S. F., M. E. S. Anderson, and R. A. Wadell. A review of the outcome expectancy construct in physical activity research. <i>Ann Behav Med</i> 29:17-19, 2005

Appendices



Appendix A: Model of Exercise Behavior



INFORMED CONSENT FORM

Investigator: Cherilyn Hultquist, M.S.

Address:

The University of Tennessee
Department of Exercise, Sport, and Leisure Studies
1914 Andy Holt Ave.
Knoxville, TN 37966

Telephone: (865) 974-6040

Purpose

You are invited to participate in a research study. The purpose of this study is to determine the effectiveness of the exercise prescription, "Walk 10,000 steps per day." If you give your consent, you will be asked to perform the testing below. This testing will take approximately one hour. You will first complete a health history questionnaire to determine your health status. Body composition, circumference measurements, and blood pressure will be determined in the Applied Physiology Laboratory in the HPER building on the UT campus. You will report to the lab following an overnight fast having abstained from both food and exercise the morning of the test.

Testing

1. Resting blood pressure will be measured using a stethoscope and a mercury sphygmomanometer, much like the blood pressure procedures in a doctor's office. You will be seated for 5-10 minutes in a comfortable position prior to the measurement. This procedure will be repeated 3 times after short rest periods to ensure accuracy.
2. We will measure your height, weight, and the distance around your hips and waist.
3. Your body fat will be determined using the Bod Pod and Bioelectrical Impedance Analysis (BIA). During these tests you will wear either a swimsuit or your undergarments. The Bod Pod is a machine that is able to measure your body size as you sit inside it. You will sit in the Bod Pod chamber for 2-3 one-minute trials. While in the chamber you will be able to breathe normally and see your surroundings. After the Bod Pod test, you will have your body fat measured with the BIA. This technique measures electrical currents in your body. This instrument is a scale as well as a BIA and you will stand on the scale while holding two hand grips for a few seconds while your body fat percentage is being determined.
4. You will fill out 3 separate questionnaires about barriers to exercise that you experience, how confident you are in your ability to exercise, and how much support you have from your family and friends regarding exercise.
5. A baseline walking assessment will take place for 1 week following the lab tests. You will wear a pedometer (step counter) on your belt or waistband in order to count your steps each day. You will return to the lab 7 days after the lab tests in order for us to

gather information from your pedometer. We do not want you to change your activity levels during this time. At the end of this 1 week period, we will determine whether you fit the activity profile to be included in this study. If you do not, you will still be given all of the health information we have collected and we will help design an individual exercise program for you.

Exercise Training

The exercise training will begin after the 1 week baseline assessment. You will wear a digital pedometer on your belt or waistband everyday. This pedometer can be opened to check your step count throughout the day. For 24 weeks you will “Walk 10,000 steps per day.” You will keep a daily activity log in which you will record your steps per day and other physical activities at the end of each day. During the first 12 weeks you will report to the Applied Physiology Lab to return your activity log and receive feedback. Each visit will last about 10 minutes. At 4 weeks all testing will be repeated in addition to your normal visit. At the end of the 12 weeks weekly visits will cease and all testing will be repeated. After the initial 12 weeks of the study, you will continue with the exercise recommendation of “Walk 10,000 steps per day” but you will no longer report to the lab each week. You will however, continue to record your steps per day and physical activity each day and you will send your daily log sheets to the lab each week. You will then return to the lab after 24 weeks for further testing. At 24 weeks an exit questionnaire will also be filled out.

Potential Risks

The risks associated with exercising are very slight in a healthy population during submaximal exercise. These risks include abnormal blood pressure responses, musculoskeletal injuries, dizziness, difficulty in breathing, and in rare cases heart attack or death. If you experience any abnormal feelings while walking such as chest pain or severe breathlessness, you should contact your physician immediately. There are no known risks to the laboratory tests you will complete.

Benefits of Participation

From the results of your tests, you will be told your body fat percentage, blood pressure and circumference measurements. Additionally you will receive valuable information regarding exercise prescription and your average steps per day. Previous studies have shown walking to be important in controlling weight and blood pressure, so you may experience these benefits. After the intervention is over, you will have an opportunity to make an appointment with Cherilyn to discuss further exercise goals.

Confidentiality

The information obtained from these tests will be treated as privileged and confidential and will consequently not be released to any person without your consent. However, the information will be used in research reports and presentations; however your name and other identity will not be disclosed.

Contact Information

If you have questions at any time concerning the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact Cherilyn Hultquist at any time (865) 974-6040 or Dr. Dixie Thompson at (865) 974-8883. If you have questions about your rights as a participant, contact Research Compliance Services of the Office of Research at (865) 974-3466.

Right to Ask Questions and to Withdraw

You are free to decide whether or not to participate in this study and are free to withdraw from the study at any time.

Before you sign this form, please ask questions about any aspects of the study, which are unclear to you.

Consent

By signing, I am indicating that I understand and agree to take part in this research study.

Your signature

Date

Researcher's signature

Date

INFORMED CONSENT FORM

Investigator: Cherilyn Hultquist, M.S.

Address:

The University of Tennessee
Department of Exercise, Sport, and Leisure Studies
1914 Andy Holt Ave.
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Potential Risks

The risks associated with exercising are very slight in a healthy population during submaximal exercise. These risks include abnormal blood pressure responses, musculo-skeletal injuries, dizziness, difficulty in breathing, and in rare cases heart attack or death. If you experience any abnormal feelings while walking such as chest pain or severe breathlessness, you should contact your physician immediately. There are no known risks to the laboratory tests you will complete.

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The information obtained from these tests will be treated as privileged and confidential and will consequently not be released to any person without your consent. However, the information will be used in research reports and presentations; however your name and other identity will not be disclosed.

Contact Information

If you have questions at any time concerning the study or the procedures, (or you experience adverse effects as a result of participating in this study,) you may contact Cheryl Hultquist at any time (865) 974-6040 or Dr. Dixie Thompson at (865) 974-8883. If you have questions about your rights as a participant, contact Research Compliance Services of the Office of Research at (865) 974-3466.

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You are free to decide whether or not to participate in this study and are free to withdraw from the study at any time.

Before you sign this form, please ask questions about any aspects of the study, which are unclear to you.

Consent

By signing, I am indicating that I understand and agree to take part in this research study.

Your signature

Date

Researcher's signature

Date

Appendix C: Health History Questionnaire

HEALTH HISTORY QUESTIONNAIRE

NAME _____ DATE _____

DATE OF BIRTH _____ AGE _____

ADDRESS _____

PHONE NUMBERS (HOME) _____ (WORK) _____

e-mail address: _____

When is the best time to contact you? _____

Please answer the following questions. This information will only be used for research purposes and will not be made public. Please answer the following questions based on physical exercise in which you regularly engage. **This should not include daily work activities such as walking from one office to another.**

1. Do you regularly engage in exercise? Yes/No If yes, please describe.

2. On average, how many times per week do you engage in exercise training?

0 _____ 1 _____ 2 _____ 3 _____ 4 _____ 5 _____ 6 _____ 7 _____

3. On average, how long do you exercise each time?

0-19 minutes _____ 20-40 minutes _____ more than 40 minutes _____

4. How long have you been exercising at this level?

Less than 6 months _____

6 – 12 months _____

1 – 2 years _____

3 or more years _____

MEDICAL HISTORY

Past History:

Have you ever been diagnosed with the following conditions? Please check the appropriate column.

	Yes	No	Don't Know
Rheumatic Fever	()	()	()
Heart Murmur	()	()	()
High Blood Pressure	()	()	()
Any heart problem	()	()	()
Lung Disease	()	()	()
Seizures	()	()	()
Irregular heart beat	()	()	()
Bronchitis	()	()	()
Emphysema	()	()	()
Diabetes	()	()	()
Asthma	()	()	()
Kidney Disease	()	()	()
Liver Disease	()	()	()
Severe Allergies	()	()	()
Orthopedic problems	()	()	()
Hyper- or Hypothyroidism	()	()	()
AIDS	()	()	()

Present Symptom Review:

Have you recently had any of the following symptoms? Please check if so.

Chest Pain	()	Frequent Urination	()
Shortness of Breath	()	Blood in Urine	()
Heart palpitations	()	Leg or ankle swelling	()
Severe headache	()	Significant emotional problem	()
Coughing up blood	()	Blurred vision	()
Low blood sugar	()	Difficulty walking	()
Feeling faint or dizzy	()	Weakness in arm	()
Leg numbness	()		

Do you smoke? Yes/No

If yes, how many per day? _____

Are you currently trying to lose weight (through diet, exercise, and/or medication)?

Yes/No

Are you taking any medications? Yes/No

If yes, please
describe: _____

Can you walk 1 continuous mile without pain or discomfort? _____

OTHER INFORMATION

Whom should we notify in case of emergency?

Name _____

Address _____

Phone # _____

I have been given the opportunity to ask questions about any of the above items that were unclear, and I have answered all questions completely and truthfully to the best of my knowledge.

SIGNATURE _____ DATE _____

Appendix D: Barriers Specific Self-Efficacy Scale

Barriers Specific Exercise Self-Efficacy Scale

The following items reflect situations that are listed as common reasons for preventing individuals from participating in exercise sessions or, in some cases, dropping out. Using the scales below please indicate how confident you are that you could exercise in the event that any of the following circumstances were to occur.

Please indicate the degree to which you are confident that you could exercise in the event that any of the following circumstances were to occur by circling the appropriate %. Select the response that most closely matches your own, remembering that there are no right or wrong answers.

For example, in question #1 if you have complete confidence that you could exercise even if "the weather was very bad," you would circle 100%. If, however, you had no confidence at all that you could exercise, if you failed to make or continue making progress (that is, confidence you would not exercise), you would circle 0%.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

NOT AT ALL
CONFIDENT

MODERATELY
CONFIDENT

HIGHLY
CONFIDENT

I BELIEVE THAT I COULD EXERCISE REGULARLY FOR THE NEXT 3 MONTHS IF:

1. The weather was very bad (hot, humid, rainy, cold).

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

2. I was bored by the program or activity.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

3. I was on vacation.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Mark your answer by circling a %.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

**NOT AT ALL
CONFIDENT**

**MODERATELY
CONFIDENT**

**HIGHLY
CONFIDENT**

I BELIEVE THAT I COULD EXERCISE REGULARLY FOR THE NEXT 3 MONTHS IF:

4. I was not interested in the activity.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

5. I felt pain or discomfort when exercising.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

6. I had to exercise alone.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

7. It was not fun or enjoyable.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

8. It became difficult to get to the exercise location.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

9. I didn't like the particular activity program that I was involved in.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Mark your answer by circling a %.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

NOT AT ALL
CONFIDENT

MODERATELY
CONFIDENT

HIGHLY
CONFIDENT

I BELIEVE THAT I COULD EXERCISE REGULARLY FOR THE NEXT 3 MONTHS IF:

10. My schedule conflicted with my exercise session.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

11. I felt self-conscious about my appearance when I exercised.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

12. An instructor does not offer me any encouragement.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

13. I was under personal stress of some kind.

0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

Mark your answer by circling a %.

NOT AT ALL CONFIDENT	MODERATELY CONFIDENT	HIGHLY CONFIDENT
0%	20%	40%
60%	80%	100%

1. I BELIEVE THAT I COULD EXERCISE REGULARLY FOR THE NEXT 3 MONTHS IF:

10. My schedule conflicted with my exercise session.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

11. I felt self-conscious about my appearance when I exercised.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Appendix E: Social Support for Exercise Scale

12. An instructor does not offer me any encouragement.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

13. I was under personal stress of some kind.

0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
----	-----	-----	-----	-----	-----	-----	-----	-----	-----	------

Social Support and Exercise Survey

Below is a list of things people might do or say to someone who is trying to exercise regularly. If you are not trying to exercise, then some of the questions may not apply to you, but please read and give an answer to every question.

Please rate each question *twice*. Under *family*, rate how often anyone living in your household has said or done what is described during the last three months. Under *friends*, rate how often your friends, acquaintances, or coworkers have said or done what is described during the last three months.

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

None	Rarely	A few times	Often	Very often	Does not apply
1	2	3	4	5	8

During the past three months, my family (or members of my household) or friends:

	Family	Friends
1. Exercised with me.	1. _____	1. _____
2. Offered to exercise with me	2. _____	2. _____
3. Gave me helpful reminders to exercise ("Are you going to exercise tonight?")	3. _____	3. _____
4. Gave me encouragement to stick with my exercise program.	4. _____	4. _____
5. Changed their schedule so that we could exercise together.	5. _____	5. _____
6. Discussed exercise with me.	6. _____	6. _____
7. Complained about the time I spend exercising	7. _____	7. _____
8. Criticized me or made fun of me for exercising.	8. _____	8. _____
9. Gave me rewards for exercise (bought me something or gave me something I like).	9. _____	9. _____
10. Planned for exercise on recreational outings	10. _____	10. _____
11. Helped plan activities around my exercise.	11. _____	11. _____
12. Asked me for ideas on how <i>they</i> can get more exercise.	12. _____	12. _____
13. Talked about how much they like to exercise.	13. _____	13. _____

Social Support and Exercise Survey

This survey is designed to assess your level of social support for exercise. It is a self-report survey and your responses will be confidential. The survey is designed to be completed in about 10 minutes. Please answer the following questions as honestly as you can.

Please rate each statement on the following scale: 1 = Never, 2 = A few times, 3 = Often, 4 = Very often, 5 = Always.

1	2	3	4	5
Never	A few times	Often	Very often	Always

During the past 12 months, how often have you experienced the following barriers to being active?

1	2	3	4	5
1. Lack of time	2. Lack of motivation	3. Lack of knowledge	4. Lack of social support	5. Lack of resources
6. Lack of information	7. Lack of confidence	8. Lack of energy	9. Lack of interest	10. Lack of ability
11. Lack of opportunity	12. Lack of encouragement	13. Lack of role models	14. Lack of incentives	15. Lack of feedback
16. Lack of variety	17. Lack of challenge	18. Lack of fun	19. Lack of convenience	20. Lack of safety
21. Lack of weather	22. Lack of facilities	23. Lack of equipment	24. Lack of transportation	25. Lack of cost
26. Lack of community support	27. Lack of government support	28. Lack of employer support	29. Lack of family support	30. Lack of friend support
31. Lack of neighborhood support	32. Lack of school support	33. Lack of religious support	34. Lack of cultural support	35. Lack of ethnic support
36. Lack of age support	37. Lack of gender support	38. Lack of disability support	39. Lack of sexual orientation support	40. Lack of race support
41. Lack of language support	42. Lack of literacy support	43. Lack of numeracy support	44. Lack of computer support	45. Lack of internet support
46. Lack of mobile phone support	47. Lack of email support	48. Lack of social media support	49. Lack of video support	50. Lack of audio support
51. Lack of print support	52. Lack of digital support	53. Lack of physical support	54. Lack of emotional support	55. Lack of financial support
56. Lack of spiritual support	57. Lack of intellectual support	58. Lack of creative support	59. Lack of artistic support	60. Lack of scientific support
61. Lack of historical support	62. Lack of cultural support	63. Lack of religious support	64. Lack of ethnic support	65. Lack of racial support
66. Lack of gender support	67. Lack of sexual orientation support	68. Lack of disability support	69. Lack of age support	70. Lack of language support
71. Lack of literacy support	72. Lack of numeracy support	73. Lack of computer support	74. Lack of internet support	75. Lack of mobile phone support
76. Lack of email support	77. Lack of social media support	78. Lack of video support	79. Lack of audio support	80. Lack of print support
81. Lack of digital support	82. Lack of physical support	83. Lack of emotional support	84. Lack of financial support	85. Lack of spiritual support
86. Lack of intellectual support	87. Lack of creative support	88. Lack of artistic support	89. Lack of scientific support	90. Lack of historical support
91. Lack of cultural support	92. Lack of religious support	93. Lack of ethnic support	94. Lack of racial support	95. Lack of gender support
96. Lack of sexual orientation support	97. Lack of disability support	98. Lack of age support	99. Lack of language support	100. Lack of literacy support
101. Lack of numeracy support	102. Lack of computer support	103. Lack of internet support	104. Lack of mobile phone support	105. Lack of email support
106. Lack of social media support	107. Lack of video support	108. Lack of audio support	109. Lack of print support	110. Lack of digital support
111. Lack of physical support	112. Lack of emotional support	113. Lack of financial support	114. Lack of spiritual support	115. Lack of intellectual support
116. Lack of creative support	117. Lack of artistic support	118. Lack of scientific support	119. Lack of historical support	120. Lack of cultural support
121. Lack of religious support	122. Lack of ethnic support	123. Lack of racial support	124. Lack of gender support	125. Lack of sexual orientation support
126. Lack of disability support	127. Lack of age support	128. Lack of language support	129. Lack of literacy support	130. Lack of numeracy support
131. Lack of computer support	132. Lack of internet support	133. Lack of mobile phone support	134. Lack of email support	135. Lack of social media support
136. Lack of video support	137. Lack of audio support	138. Lack of print support	139. Lack of digital support	140. Lack of physical support
141. Lack of emotional support	142. Lack of financial support	143. Lack of spiritual support	144. Lack of intellectual support	145. Lack of creative support
146. Lack of artistic support	147. Lack of scientific support	148. Lack of historical support	149. Lack of cultural support	150. Lack of religious support
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166. Lack of audio support	167. Lack of print support	168. Lack of digital support	169. Lack of physical support	170. Lack of emotional support
171. Lack of financial support	172. Lack of spiritual support	173. Lack of intellectual support	174. Lack of creative support	175. Lack of artistic support
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196. Lack of print support	197. Lack of digital support	198. Lack of physical support	199. Lack of emotional support	200. Lack of financial support
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206. Lack of historical support	207. Lack of cultural support	208. Lack of religious support	209. Lack of ethnic support	210. Lack of racial support
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231. Lack of intellectual support	232. Lack of creative support	233. Lack of artistic support	234. Lack of scientific support	235. Lack of historical support
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266. Lack of religious support	267. Lack of ethnic support	268. Lack of racial support	269. Lack of gender support	270. Lack of sexual orientation support
271. Lack of disability support	272. Lack of age support	273. Lack of language support	274. Lack of literacy support	275. Lack of numeracy support
276. Lack of computer support	277. Lack of internet support	278. Lack of mobile phone support	279. Lack of email support	280. Lack of social media support
281. Lack of video support	282. Lack of audio support	283. Lack of print support	284. Lack of digital support	285. Lack of physical support
286. Lack of emotional support	287. Lack of financial support	288. Lack of spiritual support	289. Lack of intellectual support	290. Lack of creative support
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311. Lack of audio support	312. Lack of print support	313. Lack of digital support	314. Lack of physical support	315. Lack of emotional support
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326. Lack of racial support	327. Lack of gender support	328. Lack of sexual orientation support	329. Lack of disability support	330. Lack of age support
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406. Lack of creative support	407. Lack of artistic support	408. Lack of scientific support	409. Lack of historical support	410. Lack of cultural support
411. Lack of religious support	412. Lack of ethnic support	413. Lack of racial support	414. Lack of gender support	415. Lack of sexual orientation support
416. Lack of disability support	417. Lack of age support	418. Lack of language support	419. Lack of literacy support	420. Lack of numeracy support
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461. Lack of financial support	462. Lack of spiritual support	463. Lack of intellectual support	464. Lack of creative support	465. Lack of artistic support
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486. Lack of print support	487. Lack of digital support	488. Lack of physical support	489. Lack of emotional support	490. Lack of financial support
491. Lack of spiritual support	492. Lack of intellectual support	493. Lack of creative support	494. Lack of artistic support	495. Lack of scientific support
496. Lack of historical support	497. Lack of cultural support	498. Lack of religious support	499. Lack of ethnic support	500. Lack of racial support

Barriers to Being Active Quiz

Directions: Listed below are reasons that people give to describe why they do not get as much physical activity as they think they should. Please read each statement and indicate how likely you are to say each of the following statements:

<u>How likely are you to say?</u>	Very Likely	Somewhat Likely	Somewhat Unlikely	Very Unlikely
1. My day is so busy now, I just don't think I can make the time to include physical activity in my regular schedule.				
2. None of my family members or friends like to do anything active, so I don't have a chance to exercise.				
3. I'm just too tired after work to get any exercise.				
4. I've been thinking about getting more exercise, but I just can't seem to get started.				
5. I'm getting older, so exercise can be risky.				
6. I don't get enough exercise because I have never learned the skills from any sport.				
7. I don't have access to jogging trails, swimming pools, bike paths, etc.				
8. Physical activity takes too much time away from other commitments-time, work, family, etc.				
9. I'm embarrassed about how I will look when I exercise with others.				
10. I don't get enough sleep as it is. I just couldn't get up early or stay up late to get some exercise.				
11. It's easier for me to find excuses not to exercise than to go out and do something.				
12. I know of too many people who have hurt themselves by overdoing it with exercise.				
13. I really can't see learning a new sport at my age.				
14. It's just too expensive. You have to take a class or join a club or buy the right equipment.				
15. My free times during the day are too short to include exercise.				
16. My usual social activities with family and friends do not include physical activity.				
17. I'm too tired during the week and I need the weekend to catch up on my rest.				
18. I want to get more exercise, but I just can't seem to make myself stick to anything.				
19. I'm afraid I might injure myself or have a heart attack.				
20. I'm not good enough at any physical activity to make it fun.				
21. If we had exercise facilities and showers at work, then I would be more likely to exercise.				

Barriers to Being Active Quiz

Directions: I need to know the reasons that people give to describe why they do not get as much physical activity as they think they should. Please mark each statement and indicate how likely you are to say each of the following statements.

How likely are you to say	Very likely	Somewhat likely	Somewhat unlikely	Very unlikely
1. My day is so busy that I just don't think I can make the time to find additional activity to fit in.				
2. It is not my kind of thing to be active, so I just don't do it.				
3. I don't have the energy to be active.				
4. I don't have the time to be active.				
5. I don't have the money to be active.				
6. I don't have the knowledge to be active.				
7. I don't have the motivation to be active.				
8. I don't have the equipment to be active.				
9. I don't have the weather to be active.				
10. I don't have the place to be active.				
11. I don't have the friends to be active.				
12. I don't have the family to be active.				
13. I don't have the health to be active.				
14. I don't have the clothes to be active.				
15. I don't have the shoes to be active.				
16. I don't have the hair to be active.				
17. I don't have the makeup to be active.				
18. I don't have the jewelry to be active.				
19. I don't have the perfume to be active.				
20. I don't have the cologne to be active.				
21. I don't have the soap to be active.				
22. I don't have the shampoo to be active.				
23. I don't have the conditioner to be active.				
24. I don't have the lotion to be active.				
25. I don't have the cream to be active.				
26. I don't have the oil to be active.				
27. I don't have the powder to be active.				
28. I don't have the blush to be active.				
29. I don't have the lipstick to be active.				
30. I don't have the nail polish to be active.				
31. I don't have the hairbrush to be active.				
32. I don't have the hair dryer to be active.				
33. I don't have the hair curler to be active.				
34. I don't have the hair straightener to be active.				
35. I don't have the hair iron to be active.				
36. I don't have the hair clipper to be active.				
37. I don't have the hair trimmer to be active.				
38. I don't have the hair shaver to be active.				
39. I don't have the hair wax to be active.				
40. I don't have the hair gel to be active.				
41. I don't have the hair spray to be active.				
42. I don't have the hair cream to be active.				
43. I don't have the hair oil to be active.				
44. I don't have the hair conditioner to be active.				
45. I don't have the hair mask to be active.				
46. I don't have the hair treatment to be active.				
47. I don't have the hair care to be active.				
48. I don't have the hair styling to be active.				
49. I don't have the hair design to be active.				
50. I don't have the hair color to be active.				

Physical Activity Log

Your next appointment is: _____ Week# _____ Subject ID _____

Please fill out this log every day. Be sure to wear your pedometer at all times except when sleeping or swimming. Be sure to remove your pedometer from your clothing before you wash them. Remember to put your pedometer on as soon as you wake up and as you remove it at night, record your steps for the day. Write down specific ways you achieved your step count each day.

Date: _____ Day: _____	
Time on: _____	Time off: _____ Total steps: _____
Write down specifically how you built steps into your day. Include types of activities, time spent walking, and other strategies .	

If you exercised today, did someone exercise with you? Yes No	

Date: _____ Day: _____	
Time on: _____	Time off: _____ Total steps: _____
Write down specifically how you built steps into your day. Include types of activities, time spent walking, and other strategies .	

If you exercised today, did someone exercise with you? Yes No	

Date: _____ Day: _____	
Time on: _____	Time off: _____ Total steps: _____
Write down specifically how you built steps into your day. Include types of activities, time spent walking, and other strategies .	

If you exercised today, did someone exercise with you? Yes No	

Appendix H: Informational Handouts

What is the 10,000 Steps per Day Recommendation All About Anyway?

The 10,000 steps per day goal is a popular physical activity recommendation that has received recent attention. This recommendation can actually be traced back to Japan in the 1960's as part of a campaign to encourage people to be more active throughout the day. It was not until recent years that this recommendation gained popularity in the U.S.

One unique feature of the 10,000 steps per day goal is the use of a pedometer to measure daily step accumulation. Pedometers are “step counters” that are worn at the waistline and they digitally record the steps you take. They tally accumulated steps throughout the day, which can be viewed, and this helps people track their daily physical activity.

Accumulating 10,000 steps per day is roughly equivalent to walking 5 miles per day. People with active jobs probably achieve this with work, but for the majority of the population deliberate walking is required in order to reach this daily step goal.

Another unique feature is the “lifestyle” approach to exercise that this recommendation allows. People can accumulate steps throughout the day by making conscious decisions like parking farther away, taking stairs instead of elevators, or just taking a walk. There is no limit to how steps can be accumulated, every step you take counts. Just be careful to remove your pedometer if you are going to hit the pool, they don't hold up well in water.



How to Build Steps into Your Day

People use several strategies to build steps into their day, here are just a few:

- ✓ Take a brisk 30-minute walk each day (outdoor or treadmill)
- ✓ Walk the dog
- ✓ Walk with friends, significant others or children
- ✓ Take a 10-minute walk during your lunch hour
- ✓ Deliver messages to co-workers instead of using email or phoning
- ✓ Take the stairs instead of the elevator
- ✓ Don't look for the closest spot, park farther away
- ✓ Walk to a neighbor's house instead of phoning or driving
- ✓ When watching TV, get up and walk around during commercials
- ✓ Get up to change the channel
- ✓ Window shop
- ✓ Organize a "walking meeting"

Creating a Social Support Network

Social support for physical activity refers to the ways others are helpful when it comes to reaching your health and fitness goals. There are several types of social support and it can come from a variety of sources.

Social support is:

- A network of relatives and friends who provide positive feedback.
- The people in your life giving you emotional support.
- It consists of compliments on your success, reminders when you deviate, and understanding when you are discouraged.
- The people in your life accepting no excuses from you, but helping you to maintain your motivation and commitment to exercise.
- The people in your life (your network) pulling for you to be a successful exerciser.
- Emotional support and understanding from others as you struggle with a new lifestyle.

Social Support can come from:

- Your spouse
- Family members
- Neighbors
- Close friends
- Fitness professionals
- Co-workers
- Social contacts
- Members at church

Give those in your social support system permission to:

- Give open and honest feedback concerning your progress and efforts to exercise.
- Help keep you on track with your exercise.
- Compliment your efforts to exercise.

By establishing a social support network you will:

- Feel motivated to continue exercising.
- Feel supported and cared for when you are experiencing a plateau.
- Feel good about yourself and the efforts you are making.
- Work harder and longer on your efforts to recover.
- Become more conscientious in your efforts to exercise.

Overcoming Barriers to Exercise

One key to long-term exercise adherence is the ability to identify and overcome barriers to exercise. Here are some tips to overcoming common barriers.

1. Not enough time to exercise: This is one of the most common barriers to exercise, but the bottom line is that we all have the same 24 hours in each day and regular exercisers consistently make time to be active. If you cannot find an extra 30 minutes in a day then try to walk for 5-10 minutes several times a day. Schedule exercise into your day and keep it as you would an important meeting, making exercise a daily priority will help you find the time. Also, choose activities that you enjoy and that are convenient to you.
2. Lack of Energy: Keep in mind that fatigue is often self-induced through busy work schedules and daily stresses. Exercise can actually decrease stress and make you feel more energized. If you are feeling sluggish then take a brisk walk, this might be the jump-start that you need. Also, if you are too tired after work, try to exercise in the morning before your day gets too hectic.
3. My family and friends don't exercise: Remind your family and friends about the benefits of physical activity, that this is important to you, and invite them to exercise with you. Find activities that you can do with other people, such as walking at lunch with co-workers or with neighbors after work. Remember that this is for you and having someone to exercise with is not essential.
4. Boredom or Lack of Enjoyment: It is important to keep physical activity fun and enjoyable. Be sure to identify a variety of activities that you enjoy so that you have options. Vary your routine by exercising at different times of day, or by walking in different locations such as a park or a shopping mall.

Physical Activity and Women's Health

The health benefits for physically active women are endless. Women who choose to exercise are often times extending their life and staving off disease. It is important for women to take control of their health and fitness and experience all the benefits of a healthy and active lifestyle.

For women, exercise can:

- Reduce the risk of dying early**
- Reduce the risk of dying from heart disease**
- Reduce the risk of developing diabetes**
- Reduce the risk of developing certain cancers**
- Reduce feelings of depression and anxiety**
- Reduce the risk of osteoporosis**
- Reduce the risk of arthritis, or alleviate symptoms**
- Prevent or reduce blood pressure**
- Help to control weight**
- Help to build lean muscle and reduce fat**
- Help relieve daily stress**
- Increase energy**
- Promote overall psychological well-being**

Research has also shown that women who lead regularly active lives consistently benefit from this activity. Women who take more steps per day tend to have lower body fat percentages, lower waist and hip circumferences, and fall into a healthful body mass index (BMI) category. Therefore, women should engage in daily physical activity for a more favorable health profile.

Psychological Benefits of Exercise

There are many psychological benefits of physical activity. Some common benefits are listed below:

Decreased Daily and Chronic Stress: Exercise is one of the best ways to help you deal with stress. It can help relieve stress by creating an outlet from daily tension and anxiety. An exercise session can be a great time to socialize with others or take some time for yourself.

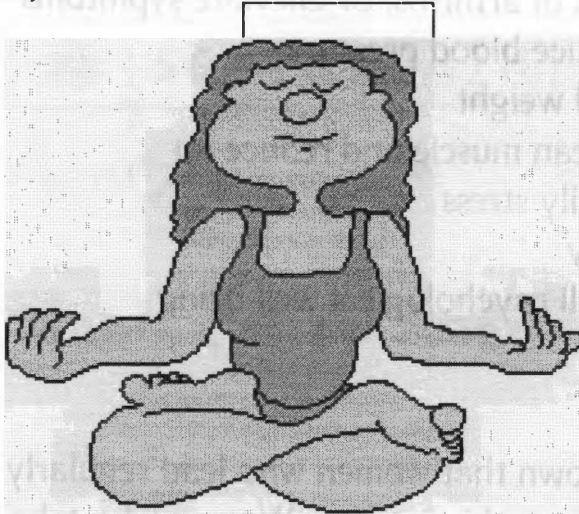
Improved Self-Confidence and Body Image: Many women are unhappy with their physical appearance. With regular exercise, most people see positive physical changes. These results often enhance perception of body image and self-confidence.

Enhanced Moods: When done appropriately, exercise makes most people feel good. This often leads to elevation in mood. This may be due to the release of endorphins or simply the distraction from daily stress. Several studies have shown that regular exercisers have a better quality of life and are happier overall in comparison to sedentary people.

Alleviate Depression: Studies show that regular exercise is associated with a reduction in the symptoms of depression.

The exact cause of these benefits is unknown, but some possible reasons are:

- Enhanced feeling of control
- Feeling competent
- Positive social interactions
- Opportunity to have fun



Self-monitoring/Tracking Progress

What is self-monitoring?

Self-monitoring refers to holding *yourself* accountable to your physical activity goals. For example, with the 10,000 steps/day recommendation you can use the pedometer to monitor your daily activity and your activity log will help you identify how often you are reaching your activity goal. By monitoring yourself on several levels you will be more likely to correct poor habits and meet your goals

What types of things should I be tracking?

- Daily step accumulation
- Changes in body composition
- All types of physical activity including time spent in those activities
- How you successfully built activity into your day
- Note any positive or negative mood changes due to exercise
- Personal goals

How often should I assess my progress?

In order to determine if you are on the right track you should frequently assess your progress. Step accumulation can be assessed throughout each day. On a weekly basis, you should determine how many days you met your activity goal. If you were successful, take note of how it happened and plan to repeat those habits the next week. If you fell short, assess which barriers stopped you and map out a plan to overcome those barriers the next time they present themselves.

You should also assess progress with your body composition goals. If you are seeing physical results it will motivate you to continue, if you are not seeing results you should increase frequency and/or intensity of physical activity. You may also wish to consult with a fitness professional on how to adjust your exercise routine in order to see results.

Tips:

- Write down physical activity immediately after it occurs, while it's fresh in your mind.
- Record your step count at the end of each day.
- Take note of specific ways you achieved your steps.
- Keep your log with you at all times.

Tips for Active Lifestyles

- ✓ Make time management a daily habit.
- ✓ Set your priorities so that daily activity is scheduled into your daily routine.
- ✓ Do not allow the excuse that “there isn't enough time to exercise.”
- ✓ Set goals on a daily, weekly, monthly, and yearly basis.
- ✓ Create a daily schedule or routine that can be followed as near as possible on vacations, business trips, weekends, or in times of crisis.
- ✓ Manage all of the little things that take up precious time, i.e., reading newspapers and magazines to excess, watching TV, gossip or small talk.
- ✓ Create an atmosphere in which there is a sense of order, routine, and purpose yet remaining flexible enough to allow for life's changing pattern.
- ✓ Analyzing the expenditure of time in your life. Minimize or eliminate unproductive time; maximize or add productive, balanced activities.
- ✓ Rewarding of self for sticking to a physically active, balanced schedule.
- ✓ The inclusion of time in a weekly schedule for social support, exercise, stress-control activities, adequate sleep, constructive labor, recreation, leisure, and relaxation.
- ✓ Organizing your life to ensure all human needs for a balanced life are met, leaving nothing to chance.
- ✓ Recognizing the need for being single-minded, determined, and committed to personal growth, health, and high self-esteem.

Exercising in the Elements

Exercising in the heat

As the temperature increases, special precautions should be taken when exercising outdoors. There can be serious adverse effects to exercising in the heat if certain risks are not taken into consideration. These risks include but are not limited to:

- Dehydration
- Sunburn
- Heat cramps, heat exhaustion, and heat stroke

By being sensible, you can avoid heat related injuries and have an enjoyable outdoor exercise bout.

When preparing to exercise outdoors on a hot, sunny day:

- Wear light-weight, light-colored clothing
- Wear plenty of sunscreen on both exposed and unexposed skin
- Wear sunglasses that block 90 to 100 percent of the sun's UV rays
- Wear a hat to protect the top of your head from sun damage
- Drink plenty of water (approximately 96 ounces of water per day and add 24 to 48 ounces for every hour of exercise).
- Walk with a buddy in case you experience any heat illness
- Avoid the hottest part of the day
- Carry a cell phone if possible

Exercising in the cold

Exercising in the cold presents its own concerns. To avoid cold weather related injuries:

- Exercise indoors
- Dress in layers, don't forget the hat and gloves
- Start slow with an extended warm-up
- Be aware of slippery surfaces
- Be aware of wind chill
- Drink plenty of fluids, cold air has a drying effect which can increase dehydration
- Exercise with a buddy for safety
- Carry a cell phone if possible

Goal Setting

When setting your personal fitness goals, make sure they are
S.M.A.R.T.

Specific: A specific goal has a much greater chance of being accomplished than a general goal. Identify exactly what you want to accomplish. For example, "I want to walk 10,000 steps/day for the next 4 weeks" or "I want to lose 5 pounds in the next 4 weeks."

Measurable: Establish criteria for measuring progress toward each goal you set. When you measure your progress, you stay on track! To determine if your goal is measurable, ask questions such as.....How much? How many? How will I know when it is accomplished? If you can't measure it, you can't manage it.

Attainable: When you identify goals that are most important to you, you begin to figure out ways you can make them come true. A goal needs to challenge you slightly so you feel you can do it and it will need a real commitment from you. For example, if you aim to run a marathon next month, this is not attainable, but walking 2 miles per day probably is.

Realistic: Do not confuse realistic with easy! Realistic simply means that the goal is within the availability of resources, knowledge and time.

Time-oriented: Set a timeframe for the goal: for next week, in three months, by fifth grade. Putting an end point on your goal gives you a clear target to work towards. If you don't set a time, the commitment is too vague. It tends not to happen because you feel you can start at any time. Without a time limit, there's no urgency to start taking action now.

What is your specific goal? _____

How will you measure your progress? _____

What is your timeline for reaching your goal? _____

Is this an attainable and realistic goal for you? _____

Vita

Cherilyn Nicole Hultquist was born in California on January 10, 1974 to Steve and Diane Hultquist. She earned her Bachelor of Science degree in Kinesiology/Athletic Training from San Diego State University. She earned her Master of Science degree in Exercise Physiology at the University of Tennessee, Knoxville. While pursuing her Ph.D. in Exercise Science at The University of Tennessee, Knoxville, she has worked as a graduate teaching assistant, graduate assistant for the Center for Physical Activity and Health, and a research assistant. She has recently received the University of Tennessee Chancellor's Honors Award for Professional Promise for her achievements at the University of Tennessee.

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