Chapter 1: INTRODUCTION

Engagement in physical activity and being physically fit, defined as aerobic capacity (VO_2max), have been inversely associated with morbidity and premature mortality. Diseases that exhibit this relationship include, but are not limited to, coronary heart disease (Blair et al., 1989; Folsom et al., 1997; Haskell et al., 1992; Hunter, 1997; Lee, Blair, & Jackson, 1999; Powell, Thompson, Caspersen, & Kendrick, 1987; Sallis, Haskell, Fortmann, Wood, & Vranizan, 1986; Williams, 2001), some cancers (Kampert, Blair, Barlow, & Kohl, 1996; Paffenbarger et al., 1994; Paffenbarger & Lee, 1996), non-insulin-dependent diabetes (Helmrich, Ragland, Leung, & Paffenbarger, 1991; Kriska, Blair, & Pereira, 1994), obesity (DiPietro, 1995; Stefanick, 1993), osteoporosis and risk of fractures (Snelling, Crespo, Schaeffer, Smith, & Walbourn, 2001), and mental health problems such as depression (Dunn & Dishman, 1991).

In addition to the inverse relationship shown between physical activity and the risk for the diseases listed above, physical activity and exercise have been shown to have protective effects against common risk factors. High blood pressure, high cholesterol, and cigarette smoking are the most commonly known risk factors; however, physical inactivity is now recognized as an equally important modifiable risk factor (Blair et al., 1989; McGinnis & Foege, 1993; Paffenbarger et al., 1994; Paffenbarger & Lee, 1996; Pate et al., 1995; USDHHS, 1990; USDHHS, 1996) and physical fitness is shown to be protective even in the face of common risk factors (Blair et al., 1996).

Prevalence of Physical Activity

Healthy People 2010 (USDHHS; U.S. Department of Health and Human Services, 1990; USDHHS, 1998) outlines our nation's health promotion and disease prevention objectives. According to the progress reports (USDHHS, 1998), in the moderate intensity category, 31% of adults exercised at the goal of three days per week for at least 20 minutes each time (Men = 31%, Women = 30%) and 15% percent of the adult population exercised at the goal of five times per week for at least 30 minutes each time (Men = 16%, Women = 13%). The *Healthy People 2010* goal is to increase from 15 to 30% the number of adults exercising at a moderate intensity five or more times per week for at least 30 minutes each time. In the vigorous category, the progress report (USDHHS, 1998) indicated 23% of the adult population exercised vigorously at the goal of three or more days per week for 20 or more minutes per occasion (Men = 26%, Women = 20%). The *Healthy People 2010* goal is to increase from 23 to 30% the number of adults exercising at a vigorous intensity three or more days per week for 2 minutes or more. Finally, according to the report (USDHHS, 1998), 40% did not engage in *any* leisure time activity (Men = 36%, Women = 43%). The *Healthy People 2010* goal is to decrease from 40 to 20% the number of adults who are sedentary. Note that in all categories men are more active than women (USDHHS, 1998). Thus, the promotion of physical activity is particularly critical for women if they are to realize the many benefits of physical activity and fitness.

Physical Activity and Fitness Defined

Physical activity, exercise, and physical fitness are related but distinct concepts. Physical activity is generally defined as bodily movement produced by skeletal muscles that results in the daily or weekly expenditure of calories in leisure time and other activities, including exercise

(MacAuley et al., 1998; McArdle, Katch, & Katch, 1996). Exercise is considered to be structured and planned physical activity to reach specific goals. Physical activity is typically measured by self-report questionnaires, some of which have been shown to be reliable and valid. The most widely used and accepted self-report measure is the 7-Day Physical Activity Recall (Blair, 1984). However, this measure is administered in an interview format and can, therefore, be time and labor intensive. Physical activity can vary depending on the type, intensity, frequency, and duration of movement (McArdle et al., 1996). This information is typically derived from questionnaires and more recently from pedometers and accelerometers (Bassett et al., 2000; Welk et al., 2000).

Physical activity has also been reported in terms of the amount of calories expended at different levels of intensity and METs. A MET is a multiple of the resting metabolic rate of oxygen consumed per kilogram of body mass per minute (~3.5 $ml \cdot kg^{-1} \cdot min^{-1}$; McArdle et al., 1996). Thus, a MET of six represents an activity that is six times the resting oxygen consumption of someone at rest.

In the exercise literature, physical fitness is a person's aerobic capacity, or maximal oxygen consumption, and represents an individual's capacity for aerobic energy transfer (McArdle et al., 1996). Aerobic capacity is also known as aerobic power, or maximal oxygen uptake (VO_2max). Estimating VO_2max through standard maximal treadmill protocols or submaximal step tests or walking tests is considered to yield objective measures of aerobic power that do not rely on recall or self-report abilities (Blair et al., 1996). A review by Newell and colleagues (Newell, Girgis, Sanson-Fisher, Savolainen, & Hons, 1999) assessed the accuracy of self-reported health behaviors and found that individuals significantly underestimated the prevalence of health risk behaviors when compared to estimates based on gold standard and other objective measures of those same behaviors. Furthermore, of the physical activity studies included, none used gold standard measures adequate enough to be included in further analyses for self-report accuracy (Newell et al., 1999). However, self-report measures of physical activity predominate as they are more convenient to collect, representing a weakness in many physical activity studies.

Physical Activity Recommendations

In their most recent physical activity guidelines, The American College of Sports and Medicine (ACSM, 1998) shifted the emphasis of their recommendations. Although the frequency (3 – 5 days/week for 20 – 60 minutes) and mode of activity (use of large muscle groups) were retained, the intensity level was modified such that a 55/65 – 90% of maximum heart rate was now recommended rather than 60 – 90%, with the lower levels being recommended for the unfit. The way in which duration of training was tabulated was altered so that 3, 10-minute bouts of activity accumulated over the day also meets guideline specifications. Table 1 shows the recommendations issued in 1990 and 1998. These guidelines represent a change in the field, primarily in that the importance of vigorous activity has been de-emphasized in favor of more moderate activity that can be accumulated in shorter bouts of activity (Williams, 1997). However, what may be overlooked in these policy changes is that a number of studies have shown an inverse relationship between intensity of activities engaged in and risk (Paffenbarger et al., 1994; Manson et al., 1999), and a very strong inverse association between fitness and risk (Blair et al., 1989; 1995; 1996; Williams, 2001).

Epidemiological and Experimental Studies on Benefits of Physical Activity

Epidemiological Studies. A recent meta-analysis conducted by Williams (2001) examined the differential and potentially separate benefits of physical activity and fitness on coronary heart disease (CHD) and cardiovascular disease (CVD). Williams (2001) makes the distinction between measuring physical activity (n = 16 studies) and fitness (n = 7 studies), suggesting the two are not synonymous and should be treated independently. Across the studies he examined, Williams found that physical activity had a dose-response relationship with CVD such that as levels of physical activity increased, the relative risk of CHD and CVD decreased. However, this relationship was much stronger between fitness and CVD than physical activity and CVD. This suggests that with increased fitness levels, rather than increased physical activity levels, individuals will see the greatest improvements in their relative risk for CHD and CVD. To date, public health policies have been established recommending physical activity, citing health benefits as a reason for becoming physically active. However, it may be that these health benefits are more closely associated with fitness than physical activity (Williams, 2001).

Experimental Studies. As was mentioned previously, the changes in the ACSM guidelines may give the impression that exercising at a low intensity is as effective as exercising at a more vigorous intensity. Some researchers have claimed that moderate intensity activities have a better adherence rate and recommend the promotion of lifestyle activities such as walking, taking the stairs, parking farther away from your destination, and housework (Blair & Connelly, 1996). A few experimental studies have examined the question of whether less intense activity has the same impact on fitness as more intense forms of activity.

In an attempt to address the issue of whether individuals are more likely to adhere and have better results from a structured exercise program or a lifestyle program, a study was conducted that randomly assigned individuals to one of these two conditions (Dunn et al., 1999). In this study, 117 men and 120 women were randomized to a structured exercise program or a lifestyle program. Participants in both groups received 6 months of intensive treatment and 18 months of follow-up. Those in the structured exercise group received a traditional exercise prescription performed at the center. Those randomized to the lifestyle group were advised to accumulate at least 30 minutes of moderate-intensity physical activity on most, preferably all, days of the week. Dunn and colleagues state that the goal of the program was to increase energy expenditure by 3 kcal/kg and increase VO_2max by 5ml/kg/min by the end of 24 months.

Results indicated that 21% of the lifestyle group and 30% of the structured exercise group increased their cardiorespiratory fitness by 10% or more from their baseline level. Thirty-nine percent of the lifestyle and 35% of the structured exercise participants said they had maintained their activity during 70% or more of the 18-month follow-up period. Significant differences were found on energy expenditure. The structured exercise group had a .69, and the lifestyle group a .84 increase in kcal/kg per day. VO_2max increased 1.34 and .77 ml/kg/min for the structured exercise group and lifestyle group respectively. While these results are statistically significant, they did not reach the researchers' *a priori* goals and arguably they are of marginal clinical significance. Of the CVD risk factors, both groups had significant pre to post changes on blood pressure and body fat. In addition, the structured exercise group had significant

improvement in total cholesterol, low-density lipoprotein cholesterol, and high-density lipoprotein cholesterol.

The authors conclude that the lifestyle group is as effective, if not more effective, than the structured exercise group and should be widely disseminated. This conclusion may be inappropriate given the study design and results. First, the changes were small and not clinically impressive given the length of the study. Second, there was no report of the activities actually done by the lifestyle group. Thus, those in the lifestyle group may have started a structured program on their own. It also was not reported whether they exercised continuously or in accumulated bouts so that this comparison cannot be made. Finally, the advanced cognitive and behavioral skills taught to the lifestyle group could account for the somewhat better adherence rather than the type of activity promoted. In sum, because of these design and interpretation issues, it is difficult to draw conclusive evidence from this study in support of a lifestyle approach.

The Activity Counseling Trail (ACT) examined the effects of three different kinds of physical activity interventions, *advice*, *assistance*, or *counseling*, on fitness and physical activity (The Writing Group for the Activity Counseling Trial Group, 2001). In this study participants were either administered *advice* from their physician, which was to mimic recommended care, *assistance,* which was *advice* plus interactive mail and behavioral counseling at physician visits, or *counseling,* which was *assistance* and *advice* plus telephone counseling and behavioral classes (The Writing Group, 2001). All three groups were given the same physical activity target of 5 or more days, 30 minutes each time of moderate intensity or 3 or more days, 20 minutes each time of vigorous intensity. In this multi-site trial with roughly 290 participants per each arm it was found that after the intervention, women had higher VO_2max levels in the *assistance* and *counseling* groups than in the *advice* group. The VO_2max levels are reported in terms of ml/min and are not corrected for weight, making cross-study comparisons difficult. However, the authors reported that the *assistance* and *counseling* groups improved their VO_2max by 5% at the end of the 24-month follow-up, which can be compared more easily with other studies. There were no fitness differences between the *assistance* and the *counseling* groups and no differences in reported physical activity. For men there were no significant differences among any of the three arms in fitness or physical activity. Thus, this state-of-the-art intervention by the leaders in the field produced seemingly modest results at the individual level suggesting that different treatment approaches are still needed. In particular, as will be discussed, it may be that mastery experiences are needed that can lead to improvements in self-efficacy and subsequent improvements in fitness.

Thus, the types of exercise that will lead to health and public health impacts must translate into activities of sufficient intensity and frequency to have impacts. Furthermore, the movement toward lifestyle activities may only impact health if the activities are of a sufficient intensity.

Walking Studies

A number of studies have examined the relationship between walking and health impacts to determine if walking at a brisk pace, a measure of exercise intensity, is inversely associated with risk or an increase in fitness. One study found that walkers can significantly improve their

walking times on a submaximal walking test after a 12 week program, indicating an increase in fitness (Tucker & Mortell, 1993). Another study compared the fitness benefits of walking 3 miles, 5 days per week at either a stroll (20 minutes/mile), a brisk walk (15 minutes/mile) or an aerobic walk (12 minutes/mile) (Duncan, Gordon, & Scott, 1991). The results indicated that all walkers had significant improvements in their VO_2max as compared to a control group and that the aerobic walkers had a significant improvement over the strollers but not the brisk walkers. Winett (1998) points out that the effect size differences for the three groups were .25 for the strollers, .54 for the brisk walkers, and .91 for the aerobic walkers. In fact, the changes in VO_2max were 1.4, 3.0, and 5.0 ml/kg/min for the strollers, brisk walkers, and aerobic walkers respectively. Thus, the recommended increase of at least one MET (3.5 ml/kg/min) for health benefits was only attained for those between the brisk and aerobic walker categories. The authors report that all three walking groups showed modest improvements in their HDL cholesterol though no other cardiovascular risk factors showed significant improvement. From these findings the authors conclude that vigorous exercise is not necessary to obtain meaningful lipoprotein differences. Winett (1998) suggests that this interpretation of the results is misleading. Instead, there ought to be a focus on the considerable improvement in fitness as measured by VO_2 max for the brisk and aerobic walkers.

The Nurses' Health Study is a large prospective study of more than 70,000 women that has examined the relationship among physical activity, walking, vigorous exercise and the incidence of multiple diseases. The results have indicated the walking pace was inversely associated with risk for coronary events (Manson et al., 1999). Of the women who walked, those who walked at an average pace (2 – 2.9 mph) had a multivariate relative risk of .75 (CI = .59 to .96) and at a brisk or very brisk pace (≥ 3 mph) had a multivariate relative risk of .64 (CI = .47 to .88) as compared to those in the referent group who walked at an easy or casual pace (< 2 mph). Again the authors place more emphasis on the advantages of brisk rather than very brisk walking. Note also that they "very brisk" pace in this study equates to a pace of a little more than 20 minute/mile pace, a pace that is easily attainable for many individuals. Additionally, from this same cohort of women it has been found that increased level of physical activity was associated with decreased risk of developing Type 2 Diabetes and that a faster usual walking pace was independently associated with decreased risk (Hu et al., 1999). Similarly, an inverse relationship existed for physical activity and risk of ischemic stroke and a brisk or striding walking pace was associated with lower risk of total and ischemic stroke compared with average or casual pace (Hu et al., 2000).

Another recent study found that for those who did not engage in any other vigorous activity there was an inverse relationship for both time spent walking per week and walking pace regarding multivariate risk for CHD (Lee, Rexrode, Cook, Manson, Buring, 2001). However, when both time spent walking and walking pace were used to predict multivariate risk for CHD, only time spent walking, and not walking pace, significantly predicted CHD. Thus, the authors conclude that walking at least one hour per week is associated with lower risk irrespective of walking pace.

Walking also appears to be a popular choice for exercisers. In the study above, 60% of the sample of women walked whereas only 26% participated in vigorous exercise, suggesting walking may be a more acceptable form of exercise in that it is more prevalent (Manson et al.,

1999). Another study found that walking was the most prevalent type of exercise and that most people who chose a moderate activity such as walking were in the moderate to high levels of fitness (Stofan, DiPeitro, Daves, Kohl, & Blair, 1998).

Thus, the goal is to determine if an intervention designed to promote brisk walking can translate into meaningful increases in fitness. Furthermore, if the program is easy and efficient to deliver it might be possible to deliver such a program to enough people to impact public health and work toward reaching the *Healthy People 2010* goals.

Self-help or Minimal Exercise Interventions

Self-help or minimal interventions have examined the efficacy of mailed written materials, tailored written materials, and the addition of prompting by phone or by electronic mail (e-mail) on the Internet to promote physical activity in community samples. A brief review of these studies and mediums follows.

Researchers have investigated the efficacy of mail-delivered, self-instructional exercise packets that were tailored to a woman's particular stage of exercise behavior (Cardinal & Sachs, 1995). These researchers found that the women did progress through the stages of change though no measures of exercise levels or intensity were taken. Similarly, studies examining self-help for exercise have shown an improvement in self-reported readiness to exercise and exercise levels in individuals who received a stage-matched, computer-generated, multiple mailing self-help manual versus those receiving standard self-help materials (Marcus et al., 1998).

To enhance the effectiveness of written materials in promoting exercise, several studies have added prompting by telephone or by e-mail. One study called participants at varying frequencies and either touched base or gave them feedback as to whether or not they had met the goal and set a goal for the following week (Lombard et al, 1995). The researchers found that it was the frequency of contacts, rather than the content of the contact that was important in promoting walking behavior. The researchers report their data in terms of those meeting the ACSM goal of at least 20 minutes per day at least 3 times per week. However, the actual number of minutes and intensity of the exercise is not reported so it is unclear if the intervention had fitness impacts (Lombard et al., 1995).

Another community based study (Chen et al., 1998) compared women who received the materials from the American Heart Association with women who received these materials and six SCT based telephone counseling sessions over 8 weeks. Women in both conditions significantly improved their walking times to 86 and 81 minutes per week. However, these changes do not reflect the recommended duration by the ACSM, the intensity is unknown, and the changes did not maintain at the follow-up.

Finally, as an extension of the Lombard et al. (1995) study, Tate (unpublished manuscript) conducted a walking promotion study in which participants were contacted via electronic mail and given not only feedback on meeting goals but also, personalized goal setting instructions versus more general information. She found that the personalized feedback was more effective in promoting walking and that this was particularly true for those who were not yet fully

prepared to make a change. Therefore, it appears as though providing personalized feedback and goals via e-mail was an effective means of promoting walking behavior. However, despite the promising appearance of these findings the results relied primarily on self-reports of physical activity levels. Thus, it is difficult to determine if the walkers were able to reach ACSM guidelines or if their fitness levels improved.

While these minimal interventions appear promising, the walking programs reviewed did not use objective measures of fitness to determine if the self-reported changes in physical activity translated into fitness changes and in some cases they did not implement strong theoretically based programs.

Behavior Change and the Internet

These minimal interventions demonstrate that self-help, particularly with continued contact, can be an effective means of increasing physical activity levels. A newly emerging means of delivering similar interventions is via the Internet (Marcus, Nigg, Riebe, Forsyth, 2000; Whiteley, 1999b). In the most comprehensive and reliable survey to date, the U.S. Census Bureau (2001) found that in August of 2000, 54 million households (51%) had home computers and that 44 million households (41.5%) had *home* Internet access. The Nielsen Ratings for October, 2001 reported that 169.4 million individuals had access to the Internet (2001). Researchers are stating that in addition to other interactive communication strategies, the Internet should be a prioritized delivery modality for developing physical activity interventions (Marcus et al., 2000). The advantages of the Internet as a medium for intervention delivery include enhanced abilities to tailor, interactivity, ease of access for both parties, and the ability to connect people together (Whiteley, 1999b). The potential for the Internet as a mode of delivery is powerful if the interventions are tested and found to effect behavior change. Currently, many Internet fitness and physical activity sites offer information only or give a one-time-only assessment. Although the feedback from assessments may be individualized, sustained contact and guided mastery experiences in the form of precisely tailored interventions that provide personalized feedback and strategies through self-monitoring, goal setting, and strategy selection in an ongoing manner are likely to be more effective than one-time contact (Bandura, 1997). This is a more structured and interactive process of programming than self-help materials or current Internet programs offer. This process, which is theoretically based, is more likely to promote behavior change, adherence, and maintenance in ways that static self-help materials cannot.

Although not solely for physical activity promotion, a recent project compared Internet Behavior therapy to a Self-Help Internet therapy for weight loss using social cognitive theory principles (Tate, Wing, & Winett, 2001). This study was an extension of the finding that personalized feedback can promote walking in an earlier study by Tate (unpublished manuscript). In the more recent study, 93 participants were randomized to condition. The Self-Help program participants were given web-sites they could use to develop their own weight loss program whereas those in the Behavior Therapy condition participated in self-monitoring, personalized feedback, goal setting, and an on-line "bulletin board" for social support. Results indicated that the Behavior Therapy group had a better participation rate and lost significantly more weight than the Self-Help only group. Thus, merely accessing current on-line sites produced only minimal weight

loss whereas a structured, theoretically-based intervention produced clinically meaningful and significantly greater weight loss. This study is seen as a model for the current walking program intervention in which similar theoretically-driven methods can be used to promote walking with the addition of an enhanced social support component and an objective measure of fitness levels. The critical theoretical components to include in a sound intervention are reviewed below.

Social Cognitive Theory (SCT) as a Theoretical Framework

Social cognitive theory posits that human functioning is explained by a triadic relationship in which behavior, personal factors, and environmental factors are interacting determinants of each other (Bandura, 1986). SCT may be more comprehensive than other theories because it is able to account for situational influences and differences, to explain the effects of beliefs and expectations, to predict behavior, and to provide models and strategies for effective behavior change (Bandura, 1986; Maddux, 1995). It is because SCT assumes people can process and use information symbolically, evaluate their thoughts and behaviors, predict and anticipate events and consequences, set goals and work toward them, and regulate their own behavior that it is able to explain and predict behaviors (Bandura, 1986; Maddux, 1995).

One of the important features of SCT is that it allows for the design of models and strategies for effective behavior change. Bandura, (1986, 1997) states that health behavior is affected by knowledge of the steps necessary to perform the behavior, the perceived ability to perform the behavior, particularly in the face of barriers (self-efficacy), the expected outcomes of the behavior (outcome expectations), the value attached to these outcomes, and the specific goals to perform the behavior and other self-regulatory skills and processes such as planning, problem solving, self-monitoring, and self-incentives. Thus, the key concepts of knowledge, self-efficacy, modeling, outcome expectations and values, goals, and self-regulation should be addressed in a walking promotion program.

Knowledge. Bandura (1997) states that knowledge structures are the rules and strategies of effective behavior. Bandura (1997) claims that an explicit knowledge of the biological and psychological benefits of exercise can provide the incentive to start exercising. Knowledge has been examined in a number of studies seeking to predict physical activity levels but results have been mixed (Sallis et al., 1986, 1989). It does, however, appear that while knowledge is a necessary precondition for change (Bandura, 1997), it is not sufficient to motivate or activate behavior change (Maibach & Cotton, 1995). To perform a behavior, and maintain that behavior, other psychosocial constructs must be targeted.

Self-Efficacy. Self-efficacy is a person's beliefs about his or her capabilities to exercise control over events that affect one's life (Bandura, 1997). Efficacy beliefs influence health behavior choices in that people tend to pursue tasks that they feel competent to perform and avoid those that they feel incompetent (Bandura, 1986; Maibach & Cotton, 1995). Bandura (1986) has listed the influences of self-efficacy as: 1) performance of mastery experiences, 2) vicarious experiences, 3) verbal persuasion regarding one's capabilities, and 4) inferences from physiological and affective responses. Self-efficacy has been shown to be positively related to physical activity in a number of studies (Whiteley, 1999b). An example of which is a study that randomized 125 subjects to an experimental condition or an attentional control group for a five-

month long walking program (McAuley, Courneya, Rudolph, & Lox, 1994). Subjects in the experimental condition received efficacy based information regarding the four primary sources of self-efficacy. There was a significant treatment effect such that the experimental subjects exercised more frequently, for longer periods of time, and walked longer distances. However, this program was fairly labor and time intensive and if these same programmatic elements could be implemented in an Internet-based format, the program might be delivered more efficiently.

Self-Regulation. Self-regulation is the ability to mobilize oneself to perform a behavior regularly in the face of a variety of personal, situational, or social barriers. Bandura (1997) states the major subfunctions of self-regulation include self-monitoring, proximal goal setting, strategy development, and self-motivating incentives. A person's self-regulatory efficacy is crucial for adherence to a behavior such as exercise in that those with low self-regulatory efficacy tend to drop out of programs more quickly and are less able to exercise at the intensity, duration and frequency to accrue health benefits.

According to Bandura, goals do not regulate motivation and action directly. Instead, self-efficacy beliefs influence people's choices of goals and goal-directed behavior, as well as expenditure and persistence of behavior in the face of challenges and obstacles (Bandura, 1986). Through self-monitoring, people can develop efficacy beliefs about their current level of competence and expectation beliefs about the rate of their improvement in competence (Maddux, 1995). Goals provide direction and reference points against which people can monitor their progress (Maibach & Cotton, 1995). It is the structure and properties of goals that determine the level of motivation a person will expend. Bandura (1997) states that goal specificity, challenge, and proximity are the most important qualities of goals to enhance motivation and persistence.

Outcome Expectations. An outcome expectation is the belief that a behavior will produce an outcome or result (Bandura, 1997). People are motivated to perform behaviors for which they have positive outcome expectations or perhaps to avoid negative outcomes. Bandura (1986, 1997) states that outcome expectations take three forms: physical effects such as increasing health and the pleasure of living, social effects such as incurring the approval or disapproval of others, or self-evaluative effects such as self-approval or self-disapproval. Outcome expectations are developed through direct experience, observational learning, and persuasive communication. It is important to reinforce or promote positive expectations and/or minimize negative outcome expectations when promoting behavior change (Maibach & Cotton, 1995). In a study examining physical activity, it was found that when physical activity is being predicted, outcome expectancies added to the accounted-for-variance beyond self-efficacy (Rodgers & Brawley, 1993).

Social Support. Bandura (1997) reports that social support and modeling of active lifestyles by family members and friends can increase perceived self-regulatory efficacy and promote staying physically active. He states that good adherers create environmental supports by enlisting exercise partners, which may serve to promote collective efficacy. Thus, woman can walk with friends or other family members in a buddy system to promote enjoyment, increase self-regulatory efficacy and promote adherence (Bandura, 1997).

Mood. Studies on physical activity have found that exercising is related to improved mood (c.f., Dunn & Dishman, 1991). Symptoms of depression include a lack of pleasure in activities, decreased energy, and difficulty making decisions (APA, 1994), all of which may influence goal setting and

goal attainment abilities. So, while physical activity may improve mood, it may be necessary to first improve mood and motivation before a person will begin exercising. To better understand the relationship between depression and exercise levels, mood and motivation need to be measured.

Summary. The coupling of social cognitive theory and the Internet as a medium for targeting these social cognitive determinants of behavior ought to provide a powerful means of impacting walking behavior. The SCT condition received an intervention where women will be encouraged to promote self-regulatory skills via the mastery of progressively challenging goals. This mastery, in turn, increases self-efficacy and outcome expectations, that lead to more challenging goals and the promotion of walking behaviors.

Summary

This study hopes to explore the ability of a computer-mediated program to promote walking in participants that equates to *fitness* benefits. The program will employ a theoretically based, randomized study where walking is measured with an objective submaximal walk test (Kline et al., 1987).

Chapter 2: METHODS

Pilot Study

All of the measures, the one-mile walk-test, and the SCT condition program were pilot tested from May to August of 1999. Twelve women completed baseline measures and 5 women completed the intervention and the post-test measures. The 5 women who completed the program evidenced significant change in their walk test times, estimated VO_2max, walking frequency, and total time spent walking. The program, including the progressive pace protocol, was well received by the participants. Thus, no changes were implemented to the SCT condition in the full trial reported below.

Study Population

Subject Recruitment. Healthy adult women were recruited from the student, staff, and faculty of Medical University of South Carolina (MUSC). After obtaining approval of the Institutional Review Board, a broadcast e-mail was disseminated to all students, faculty, and staff. Additionally, it was listed as a current research project in one issue of the weekly MUSC newspaper.

Inclusion/exclusion criteria. Eligible participants were a) between the ages of 18 and 65 years of age; b) had Internet and e-mail access; c) could attend fitness walk tests initially, at eight weeks, and again at 3 months, d) could obtain physician consent.

Similar to the Dunn et al. study (1999), participants were excluded if they a) had a body mass index was ≥35 (i.e., obese); b) planned to move from the local area during the study period; c) drank 3 or more alcoholic beverages daily; d) exercised at least 3 days a week for 20 minutes or more; or e) were pregnant, planned to become pregnant in the next 12 months, or had been pregnant in the past six months. The Physical Activity Readiness Questionnaire (PAR-Q) was used to screen for potential risk factors but because physician consent was required of each participant, it was only used to identify individuals for whom there was concern regarding participation in the program rather than as a exclusionary criterion.

Procedures

Screening. If participants indicated via a returned e-mail that they were interested, a brief screener was e-mailed to them to determine preliminary eligibility. Initially, 160 women requested screening materials, 97 of whom returned their completed screener. If women appeared to be eligible, and were still interested, they were scheduled for an in-person consent review and signing session. After signing consent forms, participants filled out several questionnaires. If participants were still eligible, they signed up for a walk test time where they completed the walk test and the remaining baseline questionnaires. Of the 97 who returned screeners, 53 completed the walk test. Women dropped out before the walk test due to lack of interest (n = 18), ineligibility (n = 12 ineligible, 7 BMI too high), not attending their consent signing appointment (n = 7), and an inability to obtain physician consent (n = 7). After completing the walk test, participants were randomly assigned to one of two treatment

conditions. The treatment phase of the program was 8 weeks long with an immediate post-test walk and questionnaire session.

Description of Treatment Components: SCT and Education Only. The treatment components and basic methodology of using the Internet for an on-line program with e-mail communications as the mode of delivery represent modifications of an Internet-based weight loss study by Tate, Wing, and Winett (2001). Similar to the Tate et al. (2001) protocol, the current program included the following components:

Condition 1: Educational Only Condition	**Condition 2: SCT Condition**
• Initial walk test	• Initial walk test
• Baseline Fitness Feedback	• Baseline Fitness Feedback
• Access to *Footprints* Web Site	• Access to *Footprints* Web Site
• Weekly e-mail messages of encouragement and general tips and information	• Weekly e-mail messages of encouragement and general tips and information
Intervention Components • Recommended to walk at least 3 times per week, at least 20 minutes each time. • Recommended to self-monitor, general form provided	**SCT Intervention Components** • Exercise Goals based on walk test time. Pace varied, 3x per week, 2 miles each time. • Instructed to Self-Monitor weekly, specific self-monitoring form provided • Individualized Weekly Feedback and coaching • Continued Goal Setting and Problem-solving • Received supplemental materials on self-monitoring, barriers, problem solving, goal setting, and positive thinking

Condition 1: Educational Only Condition	Condition 2: SCT Condition
	Social Support • Structured prompts to provide efficacy building tips, demonstrate coping efficacy, and effective problem solving
• Post-test Walk test	• Post-test Walk test
• Pre to post fitness feedback	• Pre to post fitness feedback

Walk Test. The walk-test instructions and techniques were formalized and standardized subsequent to the pilot study and found to be functional during the implementation of the pilot study. In the current study, all participants attended a one-mile walk test in groups of 1 - 5 women at pre and post-test. If more 3 or more participants were signed up for a walk test, 2 researchers performed the test. The walk test was conducted at an indoor state-of-the-art track on the MUSC campus. Use of the indoor track allowed for standardized climate and testing conditions. Each participant wore a Polar Heart Rate monitor, which monitored her heart rate while walking. The instructions for the pre-test were derived from the *ACSM Guidelines for Exercise Testing and Prescription* (ACSM, 2000) and the walk test instructional set was derived from the *Health Fitness Instructor's Handbook* (Howley & Franks, 1997). One day before the test, participants were e-mailed an informational instruction set. This advised participants to get a good night's rest, not to drink caffeine or smoke 3 hours before the test, and to only participate if they were feeling well.

On the day of the test, participants were greeted and escorted into the facilities that housed the indoor track. Participants were instructed as follows "You will walk one mile, or 6 laps, as quickly as you can. Walk as close to the white line down the middle of the track as you can. If you experience pain or discomfort slow down or, if necessary, stop. Please walk, don't jog, for the entire test." Participants were instructed to stretch out before and after the test. If multiple participants were walking at the same time, they were staggered at random intervals. After each lap, the tester repeated the standardized phrases to let participants know how many laps they had completed or had yet to complete. For example, after the second lap each participant was told "two laps down, 1/3 of the way there!" These statements, consistent across participants, were intended to help the participant keep track of her progress and to sustain motivation and attendance to her walking throughout the entire test. The time on the walk test and finishing heart rate were used to estimate fitness as described later. All participants received normative feedback about their level of fitness at both pre and post test.

Weekly e-mails. Participants in both groups received a weekly e-mail message containing general encouragement and tips and recommendations that included links to visit related web sites. Examples of these topics included where to find walking audio walking tapes, how to choose the right shoes, how to beat the heat, and adding variety to one's routine. In addition to these general topics, at 5 points throughout the 8 weeks, participants in the SCT condition

received five SCT supplements and worksheets regarding self-monitoring, barriers, problem solving, goal setting, positive thinking.

Directory of Web-sites for Health and Exercise. All participants were given a password and the address to access the Footprints web-site. The web-site provided links to nine different pages that were developed by the author. The resources used to develop these pages included the author's previous work (Whiteley and Winett, 2000; Whiteley, unpublished manuscript) and the *Jump Start* manuals developed by Marcus and colleagues (1998). The topics of these pages were 1) a description of the health benefits of exercise, 2) dispelling the myths of exercise, 3) information on how to take a heart rate, 4) determining if barriers were excuses, 5) a general walking program, 6) general forms to track progress, 7) a list of local resources, 8) links to related sites, and 9) information about the creators of the site. The Education Only condition was instructed to walk at least 3 days per week for at least 20 minutes each time. The SCT condition had a specific self-monitoring form and a detailed walking program adapted from the Cooper Walking Program (Cooper, 1994) to be described in more detail in the following section.

Additional Procedures for SCT Condition Only. In addition to all of the above treatment components, the SCT condition also contained the following elements.

Self-Monitoring. The self-monitoring forms for the SCT condition asked the participants to record their weekly walking frequency, duration, and distance. They also were given a place to make any comments they wished about their individual walks. Participants were asked to indicate what their difficulties were, if any, in reaching their weekly goals and rate their enjoyment of their walking. Participants were given the opportunity to list what strategies were helpful, what they might do differently, leave messages to be passed on to the group, and give the director a message. Participants were prompted by e-mail to return self-monitoring forms if they were not received within a day of when they were due to arrive and again 1-3 days later. Participants who did not return self-monitoring forms after two prompts were not prompted again until the following week's e-mail was overdue.

Exercise Goals based on Walking Time. Participants in the SCT condition were instructed to follow a standard exercise prescription. The progressive walking program was adapted from the Cooper progressive walking program (Cooper, 1994) and with the collaboration of the dissertation committee members (Anderson, Clum, Finney, Stephens and Winett, personal communication, October 18, 1999). A participant's walk test time was used to determine the starting point, which was an average of 2 minutes slower per mile than the walk test time. For example, if a woman completed the walk test in 17 minutes she would start the program walking at a 19 minutes/mile pace. The frequency, 3 times/week, and the distance, 2 miles per session, were held constant for all 8 weeks. The pace, however, progressively quickened such that the participants tried to improve their speed by 30 seconds/mile every week. Thus, a woman starting at a pace of 19 minutes/mile would finish the program at a pace of 15 minutes and 30 seconds/mile. This pace would represent a 3.5 minute improvement from the beginning pace in the program and a 1.5 minute (90 seconds) improvement from the baseline walk test time. Although the program was prescribed, it was made clear to participants that it was meant to be flexible and could be amended at any point with the assistance of the director if there were difficulties.

Weekly E-Mails. In addition to the information that was provided to the participants in the Educational Only group, a second weekly e-mail went to the SCT condition for those women who returned their self-monitoring forms. This e-mail contained feedback based on the SCT principles for mastering experiences including feedback on goal achievement progress, problem solving, goal setting for the next week based on their progress and difficulties to date, and positive reinforcement. Feedback was based on the information from the self-monitoring forms that was collected and stored in a database. As mentioned previously, this feedback was sent as a Weekly E-mail. Feedback included the following topic areas.

Exercise. Participants received feedback to let them know if they were walking at the stated goals of the program in terms of frequency, distance, and pace. Recommendations and strategies were offered and encouragement provided contingent upon the individual's standing relative to her goals. These strategies were specifically tailored to the individual's stated barriers from the self-monitoring forms. In general, if a woman had not been able to achieve the progression in the pace or had only walked at the new pace 1 or 2 times during the week, the pace was maintained for another week or until she had been able to achieve the pace 3 times for 2 miles each time. Thus, in many instances the pace progression was slower than prescribed at baseline. An example of a participant's walking feedback is as follows. One woman had the goal to walk at a pace of 18 minutes/mile, 3x for 2 miles and she indicated she walked 1.5 – 2.4 miles, 3 times, at paces of 13.3, 17.6, and 18.7 minutes/mile. She was given the following feedback:

Great job. You met the frequency goal again this week and if you average out the distance you met the distance goal as well. Your pace seems to really vary however. The slower pace was on the longest walk so as far as I am concerned you are doing fine and meeting the program goals. These goals do not have to be etched in stone. In general, the paces on either end of your range are quickening so I see big improvements!

This week you will be down to a 17:30 minute/mile pace so do your best to average around this pace. I don't want you to worry about the pace too much though. You are walking in vastly different places with different people, which can help to make the walking more interesting so I would rather see you do that and get 3 walks than to worry about the pace.

Difficulties. Feedback was provided about what the individual indicated were her difficulties she had experienced over the week. The same participant above was given the following feedback:

You reported it was difficult to do the duration and pace. However, given your other time commitments I think you did quite well. Plus, as I mentioned above, on average you are meeting all of the program goals!

Helpful Strategies. Feedback was provided about what the individual indicated was helpful. If this information was not provided by the individual, she was encouraged to think about this and provide information the following week. The same participant as above was given the following feedback:

You did not list anything here this week. Have you figured out anything here? Are you using the pedometer you mentioned last week with all of the fancy options?

Enjoyment Level. The participants received feedback on their stated enjoyment of the program. Efforts were made to problem solve with the individual to increase enjoyment and this was stressed throughout the program as a critical component to maintaining a walking program. The following is an example of the feedback for the same participant as above.

You rated your walking as a 4 out of 5. This is good. Continue to think if there are any ideas as to what you might be able to do differently to increase your enjoyment.

Miscellaneous Areas. In this section participants were given feedback regarding the number of times they accessed the site, whether or not they had monitored their heart rate, and whether or not they were walking with a partner. The above participant was given the following feedback:

You accessed the web site 1 time. You may want to visit the page with the links to other sites. In particular, the http:www.thriveonline.com site has many interesting tips and information.

You did not monitor your heart rate. This may be helpful for you to do so that we can determine if the program pace is too easy or too difficult.

You did walk with a partner. Good. It really seems like the time you spend walking is also a good time to socialize with family or friends. Having a support system in place like this can really help you to maintain your interest and motivation.

Overall Feedback. General statements were made to encourage the participants and to compare their progress to previous weeks. For example, the following was the "wrap-up" for the woman above:

Good job again!! Thanks for submitting the tracking form and all of the feedback you are providing in the form. Again, try for the 17:30 minute/mile pace and let me know if any problems arise. Keep up the good work.

Participants in the SCT condition were encouraged to provide comments in the self-monitoring form that could be shared with the group. Examples of comments that women indicated they would like to share included tips on where to walk, where to buy pedometers on sale, recommendations to listen to books on tape, where to buy walking audiotapes to listen to, and words of encouragement. These comments were passed on to the group by the program director as part of the weekly e-mail with general tips.

Measures

Participants completed the demographic information, psychosocial measures, The Aerobics Center Physical Activity Questionnaire, and the One Mile Walk Test Walk test at baseline and 8 weeks for the purpose of the dissertation. The self-efficacy, social support, outcome expectations, and stage of change questionnaires were administered at 3 weeks as well to

determine if changes in these measures were made with the initiation of the behavior change in the program. The schedule for the administration of these measures is shown in Table 2.

Demographics. A demographics questionnaire was administered to each subject to assess such variables as current age, race/ethnicity, marital status, years of education, and household/family income. This questionnaire also included self-reports of alcohol consumption (i.e., number of drinks per week), smoking status (cigarettes smoked per week), personal history of disease (have they had a history of coronary heart disease, cancer, alcoholism, diabetes, high blood pressure, high cholesterol, overweight, and depression or mental health problems), and pregnancy status.

Physical Activity Readiness Questionnaire (PAR-Q; Thomas, Reading, & Shephard, 1992). This seven item, self-administered questionnaire, has been shown to detect those who might have coronary heart disease. Scores represent the total number of positively endorsed items of the seven items. This measure was not used as a screening device as is more commonly the case in community interventions given that physician consent was required of all participants.

Beck Depression Inventory (BDI, Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961). This 21-item inventory included four statements ranked in order of severity of experience of a depressive symptom. The subject chose the statement that most closely reflects how she felt during the past 2 weeks. The original reliability studies showed that internal consistency was indicated by odd-even item correlation of $r = .86$ (Beck, Ward, Mendelsohn, Mock, & Erbaugh, 1961). The depression variable was a total of the 21 items.

Exercise knowledge. This 14-item measure asked participants to respond true or false to a series of items that reflect the content of the program. The score on this scale was a total of the correct responses. Internal consistency estimates for this scale yielded a coefficient alpha of .67 and .68 for this sample indicating the scale was only moderately reliable.

Exercise Self-efficacy. An 18-item measure developed by Bandura (Bandura, 1995) instructed participants to indicate how confident they were they could exercise under a number of different conditions on a scale from 0 (Not at all confident) to 100 (totally confident). The directions were modified to define fitness in a way that is commensurate with the goals of the program. This measure has shown high reliability with a similar sample (Cronbach $\alpha = .96$). The internal consistency estimates for the current sample yielded coefficient alphas of .94 and .96 indicating good reliability.

Social Support (Sallis, Grossman, Pinski, Patterson, & Nader, 1987). Social support for exercise was assessed using the exercise portions of the Sallis Social Support for Exercise Scale. This 13-item scale instructs participants to rate how often (1 = none to 5 = very often) their family and friends supported various exercise related behaviors. The social support from family subscale yielded coefficient alphas of .88 and .92 indicating satisfactory reliability in the current sample. The social support from friends subscale yielded coefficient alphas of .86 and .87 indicating satisfactory reliability in the current sample.

Exercise Outcome Expectations. (Neff & King, 1995). The outcome expectations measure was a 17-item measure that has participants rate what factors they expect to change (e.g., energy, sleep,

physical fitness) due to regular exercise on a scale from 0 (to get worse) to 10 (extreme improvement). Scores on this scale were the average of the responses answered by the participant. The internal consistency estimates for the current sample yielded coefficient alphas of .90 and .83 indicating satisfactory reliability in the current sample.

Stage of Change (Marcus, Rakowski, & Rossi, 1992). The stages of change was assessed by asking participants to indicate which of the following best applies to themselves: I currently do not exercise and I do not intend to start exercising in the next 6 months (precontemplation), I currently do not exercise, but I am thinking about starting to exercise in the next 6 months (contemplation), I currently exercise some, but not regularly (preparation), I currently exercise regularly but I have begun doing so within the last 6 months (action), and I currently exercise regularly and have done so for longer than 6 months (maintenance). Regular exercise was defined as exercising three or more times per week for at least 20 minutes or more each time.

The Decisional Balance for Physical Activity Scale (DBPA; Marcus, Rossi, Selby, Niaura, & Abrams, 1992) measures 16 positive and negative features of engaging in physical activity on a 5-point Likert scale with endpoints of 1 (not at all important) and 5 (extremely important). The pros subscale had coefficient alphas of .86 and .93 indicating satisfactory reliability in the current sample. The cons subscale had coefficient alphas of .69 and .80 indicating only moderate reliability in the current sample.

The Aerobics Center Physical Activity Questionnaire (Kohl, Blair, Paffenbarger, Macera, & Kronenfeld, 1988). This self-report questionnaire assessed the average leisure and household activities over the past 7 days. Participants were prompted to indicate the number of sessions, duration, and where applicable, distance covered, of physical activities in the following categories: walking, stair climbing, jogging, biking, swimming, moderate sports, vigorous racquet sports, and other vigorous sports. For the purposes of the current study, the number of times walked per week, total number of minutes walked per week, the number of times exercised per week (walking + jogging + biking + swimming + moderate sports + vigorous racquet sports + other vigorous sports) and the total time spent exercising per week were calculated for each participant and used as the self-reported outcome variables in the analyses.

One-Mile Walk Test (Kline et al., 1987). The one-mile Walk test is a submaximal exercise test that can provide estimates of a person's VO_2max. It has been shown to be sensitive to change, is specific to the training goals in the program, and is cost effective for community interventions (Kline et al., 1987). Participants walked one mile as quickly as they could. Their heart rates at the finish (but before stopping their walking), walk test time, age, weight, and gender are used to estimate VO_2max using the following regressing equation.

VO_2max = 116.579 - (0.0585*WT) – (0.3885*AGE) + (.5955*SEX) – (2.7961*T) – (0.1109*HR) where, WT = Weight (pounds), AGE = Age (years), SEX = 0 for females, T = Time (minutes), and HR = Heart Rate (beats per minute). The progressive walking program should allow for a one minute, 30 second improvement on walk test times. This, in turn, should translate into the clinically meaningful improvement of 3.5 ml/kg/min or more increase in estimated VO_2max if participants adhere to the program.

Weekly self-monitoring forms. Participants accessed the web-site on a weekly basis and provided information that was used to derive the following outcomes.

Adherence. As a measure of adherence the number of self-monitoring forms submitted was calculated. The average frequency, distance, and pace walked were calculated and compared to the goals of the program.

Enjoyment. Participants rated their enjoyment on a five-point scale each week with 1 representing not at all enjoyable and 5 representing extremely enjoyable.

Barriers. Participants were able to select from a list of 16 typically encountered barriers which of the difficulties they had experienced in the past week.

Program Evaluations. Participants in the Education Only condition responded anonymously to 14-items on a five-point likert scale regarding different aspects of the program. They also responded in an open-ended format to what they liked best and what they would most like to see changed in the program. In addition to these 14 items and two open-ended questions, the SCT condition responded to 19 items, some of which were on the same likert scales, some were on a check-off format, and others were open-ended questions to primarily assess the specifics of the progressive walking program.

Sample Size Calculations

Sample size calculations were based on the ability to detect average differences of 1 MET, or 3.5 ml/kg/min, that represents a gain in fitness (Winett & Carpinelli, 2000). If individuals can reach a level of 7 METs or 24.5 ml/kg/min they can achieve a level of fitness to appreciably reduce their level of risk (Winett, personal communication). This goal can be reached by walking at the 3.5 - 4 MET range. In an article by Tucker and Mortell (1993) the walkers improved their time by 103 seconds, improving roughly from a 16-minute mile to a 14.5-minute mile on the One Mile Walk Test (Kline et al., 1987). This equates to an increase of 5ml/kg/min in estimated VO_2max and represents more than the 3.5 ml/kg/min improvement needed for a clinically meaningful difference. The pilot study indicated that the 5 participants who participated in the SCT condition were able to make a 4.4 ml/kg/min improvement in their estimated VO_2max suggesting that a statistically and clinically significant result was possible with only five participants. An effect size estimate using the pre and post walking times and standard deviations yielded an effect size of 1.2 from the Kline et al. (1987) study. However, this intervention did not employ a control group nor did the pilot study reported herein. Thus, the effect size was calculated for Tate's weight loss Internet and e-mail intervention and yielded an effect size of 1.03. Therefore, to be conservative an effect size of 1.0 was used, with a power of .90 and an alpha level of .05, indicating 20 subjects were needed per condition. Assuming a 15% rate of attrition (Dunn et al., 1999), roughly 25 subjects per condition would be the suggested recruitment goal. However, to better power the psychosocial outcome analyses, minimal detectable difference calculations were conducted that suggested 25 - 30 people per condition would be required to detect differences in these variables.

Hypotheses

The primary outcomes for this project revolved around the fitness and exercise gains made by participants as measured by estimated VO_2max, time on one-mile walk test, stage of change, and self-reported frequency, duration, and intensity of walking and exercise sessions per week. Secondary outcomes were the psychosocial measures, which include knowledge, depression, self-efficacy, outcome expectations, social support, and decisional balance pros and cons. The hypotheses for these outcome measures are listed below:

$Education_{post} < SCT_{post}$
$SCT_{pre} < SCT_{post}$
$Education_{pre} < Education_{post}$

For the three measures that were taken at the 3-week time point, self-efficacy, outcome expectations and social support, it was expected there would be a linear relationship, with increases in these measures over time. It was also expected that knowledge, self-efficacy, outcome expectations, social support, decisional pros, and the number of self-monitoring forms returned (SCT condition only) would be positively correlated with fitness levels and walking behavior. It was expected that depression and decisional balance cons would be negatively correlated with fitness levels and walking behavior.

Chapter 3: RESULTS

Demographics

Those who completed the walk-test at post-test were considered to be program completers (PC, N = 42). Participants dropped out at two time points; some dropped out after completing the walk-test and entering treatment, treatment dropouts (TD, n = 11), and some dropped out after completing the screening only (SO, n = 15). Table 3 shows the demographic characteristics for all three of these subsets. A one-way ANOVA revealed that participants who dropped out were before the walk-test were significantly younger (M = 34.87 years) than those who dropped out in treatment (M = 50.9 years) or those who completed the program (M = 46.5 years), F (2,65) = 15.57, p = <.01; Tukey's HSD SO < PC & TD, p < .01. Although trends appeared in the difference among the three groups on the categorical variables of marital status, ethnicity, education, and income level, Pearson's Chi Square tabulations revealed no statistical differences among the three groups on any of these demographic variables. The three groups were not statistically different in their stage of change, depression levels, or body mass indices either.

Of those who completed the baseline walk test, it was found that those who dropped out during treatment, TD, did not differ significantly from those who completed treatment, PC, in their walk test times, estimated VO_2max, or exercise self-efficacy level. The TD did, however, walk fewer times per week than the PC, .64 times/wk versus 2.46 times/wk respectively, F(1,51) = 3.99, p = .051, and there was a trend for walking less total minutes per week between the TD (M = 17.05 min/wk) and the PC (M = 47.4 min/wk) respectively, F(1,51) =3.50, p = .067.

The final sample of participants, N = 42, were used in all following analyses. The average age was 46.4 (SD = 8.12). This sample was 85.7% Caucasian, 11.9% African American, and 2.4% of mixed ethnicities. In this sample, 11.9% were single, 59.5% married, 23.8% divorced, 2.4% living together, and 2.4% re-married. Additionally, 11.9% received their GED or were high school educated, 16.7% had a certificate or 2-year college degree, 38.1% had a 4-year college degree, and 33.4% had a graduate degree. In terms of household income levels, 11.9% made less than $29,999 per year, 42.8% made $30,000 – $69,000 per year and 42.8% made more than $70,000 per year. Most participants were either in the contemplation or preparation stage of change (SD = .64), had an average body mass index of 27.29 (SD = 4.27) and were not depressed (M = 4.5, SD = 6.4).

Randomization

A series of one-way analyses of variance were conducted to evaluate the relationship between those who were randomized to the SCT condition and those randomized to the Education only condition on walk test time, estimated VO_2max, self-reported walking frequency, depression levels, or self-efficacy. The independent variable had two levels: SCT condition or Educational Only condition. The dependent variables were time on the walk test, estimated VO_2max, self-reported walking frequency, depression levels, and self-efficacy. None of the ANOVAs were significant, suggesting that the two groups did not differ significantly on any of these dependent variables.

Outcome Results

The means for the outcome variables are presented in Table 4. A series of analyses were conducted to assess the effects of treatment. To determine if there were differences at post-test between the conditions, one-way analysis of covariance (ANCOVA) tests were preformed. Paired sample t-tests were conducted to determine if there were within-group treatment effects. Finally, for the few measures that were administered at week 3, repeated measures analysis of variance were conducted.

Post-test Between Group Differences

To determine if there was a difference at post-test between the SCT condition and the Education Only condition (regardless of within group change), one-way analysis of covariance (ANCOVA) tests were preformed. The independent variable, condition, contained the two levels of SCT condition and Education Only condition. The dependent variables were the post-test scores for fitness, physical activity, and the psychosocial outcome measures. For each analysis, the pre-test score for the given variable served as the covariate for the analysis. In each case, preliminary analyses evaluating the homogeneity-of-slopes assumption were conducted before proceeding with the ANCOVA to determine if the relationship between the covariate and the dependent variable differed significantly as a function of the independent variables (Green, Salkind, & Akey, 2000). The tests of the homogeneity-of-slopes assumption were largely nonsignificant. Only when the violations of this assumption were significant will these results be reported.

Fitness and Physical Activity Outcomes. Results indicated that the estimated VO_2max post-test difference between the SCT condition and the Education Only condition was significant $F(1, 39) = 6.60$, $p < .05$. The difference in the walk test times at post-test between the SCT condition and the Education Only condition was significant $F(1, 39) = 13.05$, $p < .01$, with the SCT condition having better walk test times. In terms of the self-report measures of physical activity, the two conditions did not differ significantly at post-test in the number of times walked per week $F(1, 38) = .629$, $p = .43$, total minutes walked per week $F(1, 37) = .059$, $p = .81$, nor their walking pace $F(1, 38) = .469$, $p = .50$. The assumption of homogeneity-of-slopes was violated for number of exercise sessions per week, $F(1, 37) = 6.15$, MSE = 6.38, $p < .05$, and for total minutes spent exercising per week $F(1, 36) = 4.26$, MSE = 3448.45, $p < .05$ so that ANCOVAs could not be performed on these variables.

Psychosocial Outcomes. There were significant difference between the two conditions at post test for self-efficacy $F(1, 38) = 6.17$, $p < .05$, with the SCT condition having higher self-efficacy, decisional balance pros, $F(1, 37) = 4.57$, $p < .05$, with the Educational Only condition listing more pros for exercise. Results indicated that the differences between the SCT and Education Only condition approached significance on post-test knowledge $F(1, 39) = 3.71$, $p < .10$, with the SCT condition having higher knowledge scores and there was a trend for significance on the cons of exercising $F(1, 39) = 3.18$, $p < .10$, with the Education Only condition listing more cons for exercising. There were no significant post-test differences between the two conditions for depression, $F(1, 38) = 1.60$, $p = .21$, outcome expectations $F(1, 38) = .034$, $p = .85$, family social

support, F(1, 37) = .045, p = .83, friends' social support, F(1, 37) = .836, p = .37, nor total social support, F(1, 37) = .333, p = .57.

Within-group treatment effects

SCT Condition.

Fitness and Physical Activity Outcomes. Paired-samples t-tests were conducted to evaluate whether the SCT treatment evidenced significantly improvements on the fitness and physical activity outcomes. It was hypothesized that there would be an increase in estimated VO_2max, decreased walk test time, increased stage of change, increased walking pace, frequency, and duration, and increased overall exercise frequency and duration at post treatment.

For the SCT treatment, results indicated that estimated VO_2max post (M = 30.00, SD = 3.45) was significantly greater than the estimated VO_2max pre (M = 27.35, SD = 3.67), t(19) = 7.54, p < .001. The mean difference was 2.65 ml/kg/min. Results indicated that there was a significant improvement in walk test time pre (M = 16.38, SD = 1.00) to post, (M = 15.12, SD = 1.16), t(19) = 9.57, p < .001, with a mean difference of 1.26 minutes.

The following results were found for the self-reported measures of physical activity. There was significant movement in the stages of change from pre (M = 2.75, SD = .72) to post, (M = 4.00, SD = .46), t(19) = 6.57, p < .001. In terms of self-reported walking behaviors, there was no significant change in frequency of walking sessions from pre (M = 3.35, SD = 3.44) to post, (M = 2.95, SD = .93), t(19) = .472, p = .68, but there was a significant improvement in overall minutes spent walking per week from pre (M = 63.18, SD = 61.51) to post, (M = 93.91, SD = 36.08), t(19) = 2.13, p < .05. However, there was no significant change in the frequency of exercise sessions per week from pre (M = 3.98, SD = 3.72) to post, (M = 3.56, SD = 1.9), t(19) = .436, p = .67 nor in the total duration of exercise from pre (M = 77.49, SD = 76.73) to post, (M = 108.41, SD = 51.60), t(19) = 2.01, p < .10.

Psychosocial Outcomes. Paired sample t-tests were conducted to determine whether the SCT treatment significantly improved their knowledge, depression, self-efficacy, outcome expectations, social support, and decisional balance pros and cons. Results indicated that the only psychosocial measure that evidenced change was the decisional pros and in the opposite direction than was hypothesized. There was a significant *decrease* in decisional pros listed from pre (M = 4.02, SD = .61) to post, (M = 3.57, SD = .92), t(19) = 2.56, p < .05. Results indicated that there was no change in knowledge pre (M = 10.35, SD = 10.18) to post, (M = 11.3, SD = 1.38), t(19) = 1.71, p = .10, depression pre (M = 4.05, SD = 6.14) to post, (M = 2.9, SD = 3.13), t(19) = 1.09, p = .29, self-efficacy pre (M = 62.94, SD = 18.65) to post, (M = 66.08, SD = 19.88), t(19) = 1.14, p = .27, outcome expectations pre (M = 7.50, SD = 1.32) to post, (M = 7.25, SD = 1.25), t(19) = .83, p = .42, family social support pre (M = 10.11, SD = 10.63) to post, (M = 11.0, SD = 9.94), t(19) = .701, p = .49, friends social support pre (M = 8.74, SD = 8.59) to post, (M = 7.42, SD = 7.64), t(19) = .663, p = .52, total social support pre (M = 18.84, SD = 16.07) to post, (M = 17.63, SD = 13.22), t(18) = .589, p = .56, nor decisional balances cons pre (M = 1.87, SD = .65) to post, (M = 1.64, SD = .68), t(19) = 1.70, p = .11.

Education Only Condition.

Fitness and Physical Activity Outcomes. Paired samples t-tests were conducted to determine if the Education Only condition impacted the same fitness and physical activity measures. For the Education Only treatment, results indicated that estimated VO_2max significantly improved from pre (M = 29.02, SD = 4.66) to post (M = 30.14, SD = 4.58), t(21) = 2.87, p < .01. The mean difference was 1.11 ml/kg/min. Results indicated that there was a significant improvement in walk test time pre (M = 16.46, SD = 1.31) to post, (M = 15.89, SD = 1.15), t(21) = 3.82, p < .001, with a mean difference of .57 minutes.

In terms of the self-report measures of physical activity, there was significant movement in the stages of change from pre (M = 2.67, SD = .48) to post, (M = 3.43, SD = .60), t(20) = 5.59, p < .001. For the self-reported walking behaviors, there was no significant change in frequency of walking sessions from pre (M = 1.74, SD = 2.33) to post, (M = 2.57, SD = 1.91), t(20) = 1.37, p = .19, but there was a significant improvement in overall minutes spent walking per week from pre (M = 35.13, SD = 37.71) to post, (M = 81.69, SD = 69.04), t(19) = 3.22, p < .01. There were significant changes in the frequency of exercise sessions per week from pre (M = 2.87, SD = 2.78) to post, (M = 4.56, SD = 3.43), t(20) = 2.59, p < .05 and in the total number of minutes spent exercising per week from pre (M = 70.64, SD = 65.66) to post, (M = 120.13, SD = 88.59), t(19) = 3.28, p < .05.

Psychosocial Outcomes. Paired sample t-tests were conducted to determine whether the Education Only treatment significantly improved on the psychosocial measures of knowledge, depression, self-efficacy, outcome expectations, social support, and decisional balance pros and cons. The only psychosocial measure to evidence change was self-efficacy, where a significant *decrease* in self-efficacy was found from pre (M = 64.88, SD = 13.45) to post, (M = 55.07, SD = 18.32), t(19) = 2.29, p < .05. Results indicated that there was no change in knowledge pre (M = 10.61, SD = 1.63) to post, (M = 10.10, SD = 2.59), t(20) = .903, p = .38, depression pre (M = 4.86, SD = 6.97) to post, (M = 4.24, SD = 3.62), t(20) = .489, p = .63, outcome expectations pre (M = 7.43, SD = 1.14) to post, (M = 7.18, SD = 1.19), t(20) = .98, p = .34, family social support pre (M = 10.33, SD = 10.21) to post, (M = 10.67, SD = 13.83), t(20) = .158, p = .88, friends social support pre (M = 9.14, SD = 6.89) to post, (M = 10.00, SD = 9.81), t(20) = .40, p = .69, total social support pre (M = 19.48, SD = 9.72) to post, (M = 20.67, SD = 20.08), t(18) = .316, p = .76, decisional balances pros pre (M = 3.87, SD = .60) to post, (M = 3.95, SD = .74), t(19) = .55, p = .59, nor decisional balances cons pre (M = 1.85, SD = .54) to post, (M = 1.98, SD = .62), t(19) = .736, p = .47.

Intent to Treat Analyses

An intent to treat approach was taken for the two major fitness outcome variables of time on the walk test and estimated VO_2max in order to determine if the relationships would hold with a more conservative set of data analyses. In these analyses for the n = 8 SCT condition members and the n = 4 Education Only condition members who did not attend the post-test walk test it was assumed that they would not have evidenced change at post test. Thus, their baseline walk test times and baseline estimated VO_2max scores were held constant at post test so that all N =

53 members could be included in the analyses. All of the relationships remained significant as reported below.

Between-group post-test differences. One-Way ANCOVAs indicated that when all 53 participants are included, the estimated VO_2max post-test difference between the SCT condition and the Education Only condition was significant $F(1, 50) = 5.10$, $p < .05$. The difference in the walk test times at post-test between the SCT condition and the Education Only condition was significant $F(1, 50) = 3.95$, $p = .05$, with the SCT condition having better walk test times.

Within-group treatment effects. For the SCT condition, there was a significant difference in walk test time pre ($M = 16.54$, $SD = 1.50$) to post ($M = 15.62$, $SD = 1.80$), $t(26) = 6.42$, $p < .001$ and a significant difference for estimated VO_2max pre ($M = 26.82$, $SD = 6.33$) to post ($M = 28.79$, $SD = 6.51$), $t(26) = 5.7$, $p < .001$. For the Education Only condition there were also significant differences in walk test time pre ($M = 16.55$, $SD = 1.54$) to post ($M = 16.06$, $SD = 1.42$), $t(25) = 3.64$, $p < .01$ and for estimated VO_2max pre ($M = 28.58$, $SD = 5.22$) to post ($M = 29.52$, $SD = 5.26$), $t(25) = 2.87$, $p < .01$.

Repeated Measures

The means for the self-efficacy, outcome expectations, and social support measures are shown in Table 5 for pre-treatment, week 3, and post-treatment by condition. Due to the poor response rate these tests were most likely underpowered. However, a one-way within subjects ANOVA was conducted for each of the measures with the factor being the time point in the study and the dependent measures being self-efficacy, outcome expectations, family social support, friends' social support, or total social support. The only significant result was the ANOVA for friends' social support for the Education Only condition, Wilks' Lambda = .58, $F(2,11) = 3.97$, $p = .05$. Follow-up polynomial contrasts indicated a significant linear effect with means decreasing over time, $F(1,12) = 5.39$, $p < .05$. Higher-order polynomial contrasts were nonsignificant. It should be noted that there was little change in friends' social support from pre-treatment to week 3 and that most of the change occurred between week 3 and post-treatment, suggesting that less support from friends occurred over time and particularly in the latter part of the program.

Correlations

Correlation coefficients were computed among age, the psychosocial measures, and for the SCT condition only, number of self-monitoring forms submitted, to determine how they associated with estimated VO_2max and minutes walked per week. In an attempt to help control for Type I error, a p-value of .01 was required for significance. The results of the correlation analyses presented in Table 6 show that seven of the 66 correlations were statistically significant and were greater than or equal to .41. Not surprisingly, the correlations between age and estimated VO_2max was significant, $r(40) = -.46$, $p < .01$, suggesting that as age increases, fitness levels decrease. This would be expected given that age is one of the variables in the regression equation used to estimate VO_2max. There were positive correlations between self-efficacy and minutes walked per week, $r(38) = .46$, $p < .01$and outcome expectations and minutes walked per week, $r(38) = .47$, $p < .01$, suggesting that as both self-efficacy and outcome expectations increase, the number of minutes walked per week increases. For the SCT condition, there was a

trend for a significant positive correlation between the number of weekly self-monitoring forms returned and the number of minutes walked per week $r(18) = .47$, $p < .05$.

Correlations among the psychosocial variables indicated that depression was negatively correlated with self-efficacy $r(39) = -.41$, $p < .01$, suggesting that as depression increases, self-efficacy decreases. For the SCT condition only, exercise knowledge, $r(18) = .59$, $p < .01$ was positively correlated with the number of self-monitoring forms returned. There was a trend for a significant positive correlation for self-efficacy, $r(18) = .53$, $p < .05$ and a negative correlation for depression $r(18) = .-.53$, $p < .05$, with the number of weekly self-monitoring forms returned.

Participation and Adherence

As an indication of the amount of participation in the program the number of times that a participant accessed the web site was automatically recorded in a database each time she logged in. All 53 of the initial participants logged in to the web site at least one time. When all 53 participants are analyzed, the SCT condition averaged 7.4 web site accesses ($SD = 3.76$) and the Education Only condition averaged 2.0 web site accesses ($SD = 1.32$), $F(1,51) = 53.7$, $p < .001$. Of those 42 participants who completed the program, those in the SCT condition averaged significantly more visits to the site, accessing it 8.4 times ($SD = 3.27$) whereas the Education Only condition accessed the site 1.9 times ($SD = 1.11$), $F(1,40) = 76.12$, $p < .001$. In the SCT condition, on average the women accessed the web site 2.2 more times ($SD = 2.6$) than the number of times they had to access the site to submit their weekly monitoring form. Ten women accessed the web site only when submitting their monitoring forms whereas the other women in the SCT condition accessed it anywhere from 1 to 10 additional times other than the times they submitted their monitoring forms.

As an indication of adherence to the program, the self-monitoring forms were examined for frequency of submission as well as content of the submissions. During the course of the 8-week program, participants submitted an average of 5.4 monitoring forms. The rate of submission of forms by week was as follows: Week 1 = 18 forms, Week 2 = 20 forms, Week 3 = 25 forms (100%), Week 4 = 21 forms, Week 5 = 18 forms, Week 6 = 16 forms, Week 7 = 13 forms, and Week 8 = 12 forms. One woman submitted zero forms, one woman submitted one form, one woman submitted 2 forms, zero women submitted three forms, seven women submitted four forms, three women submitted five forms, four women submitted six forms, one woman submitted seven forms, and eight women submitted all eight forms.

Participants reported their frequency, distance, and pace of their walks taken each week. The elements of the walking program that were consistently prescribed across most participants were the frequency of 3 times/week and the distance of 2 miles/time. According to the data submitted, the average number of walking sessions per week was 2.7 times/week and the average distance was 1.9 miles/time. The goals for two women were to walk one mile per session due to discomfort from walking two miles. They were included, however, in the average of the miles per session for the participants.

Unlike the frequency and distance, the pace was individualized for each woman based on her walk test time. The first week of the program participants were prescribed a walking pace that

was on average two minutes slower than their walk test time. Only six women (23%) walked their prescribed pace in the first week that they submitted a monitoring form. Seven women (27%) walked anywhere from 10 seconds to 3 minutes slower than the prescribed pace and 13 women (50%) walked anywhere from 10 seconds to 3 minutes faster than the prescribed pace. If women had been able to follow the program without difficulties, they would have increased their pace by 3.5 minutes from their starting pace, or 1.5 minutes from their baseline walk test time. The average increase in pace did not meet this level, however. Instead, the average increase in pace was 1.1 minutes faster from the initially prescribed pace to the recorded final pace submitted. Only six women (23%) achieved a 1.5-minute or higher improvement in pace with one woman improving her pace by 3.75 minutes. Three women (12%) had a decrease in their pace from the prescribed pace to the last recorded pace, one woman's pace remained constant, and 16 women (62%) improved their pace anywhere from 10 seconds to a little over 1 minute from their walk test time pace to the final pace recorded on the self-monitoring forms.

Given that many women started the program at a different pace than was prescribed, the data was examined in terms of the difference in the first and final pace recorded on the self-monitoring forms. On average, this difference in pace was 1.6 minutes faster from the first to the final pace. Of the 20 women who completed the walk test, 16 (70%) walked anywhere from 20 seconds to 3.5 minutes faster on their walk test than their last recorded pace on the self-monitoring sheets. Four women (30%) walked anywhere from 25 to 50 seconds slower on their walk test than their last recorded walk test time on the self-monitoring forms. Table 7 contains the average pace reported by each participant on the self-monitoring forms that were submitted.

Evaluations

SCT vs. Education Only. The anonymous evaluations were used to identify overall satisfaction with the program as well as specific areas that may or may not be in need of improvement. Examining the items common to both condition, the SCT condition had a significantly higher overall rating of satisfaction with the program ($M = 62.78$, $SD = 5.15$) than the Education Only condition ($M = 52.44$, $SD = 5.65$), $F(1,34) = 32.89$, $p < .001$. The SCT condition was significantly more satisfied with the amount of contact from the program director ($M = 4.53$, $SD = .51$) than the Education Only condition ($M = 3.75$, $SD = .87$), $F(1,37) = 11.44$, $p < .01$ and the amount of guidance provided (SCT: $M = 4.53$, $SD = .51$; Education: $M = 4.53$, $SD = .51$), $F(1,36) = 39.57$, $p < .001$. The SCT condition also rated themselves as more active ($M = 4.63$, $SD = .68$) than the Education Only condition ($M = 3.15$, $SD = 1.39$), $F(1,37) = 17.60$, $p < .001$ and the SCT condition thought the program was significantly more helpful to them in becoming active ($M = 4.68$, $SD = .58$) than the Education Only condition ($M = 3.32$, $SD = 1.46$), $F(1,36) = 14.49$, $p < .001$. There were no significant differences between the SCT condition and the Education Only condition on ease of accessing the Internet (SCT: $M = 4.89$, $SD = .21$; Education: $M = 4.78$, $SD = .41$), $F(1,37) = 1.28$, $p = .27$, the amount and usefulness of the information provided on the website (SCT: $M = 4.51$, $SD = .54$; Education: $M = 4.54$, $SD = .46$), $F(1,37) = .023$, $p = .88$, nor on the amount of interactivity provided (SCT: $M = 3.66$, $SD = .77$; Education: $M = 3.34$, $SD = 1.07$), $F(1,36) = 1.10$, $p = .30$.

SCT Only. In terms of the components of the SCT program that the women rated, the mean for the overall weekly feedback was 4.22 (SD = .79) and for the degree of personalization it was also

a 4.22 (SD = .92). A qualitative look at the elements of the program showed that the women liked the frequency of the program (M = 4.58, SD = .62) best, followed by the distance of the program (M = 4.47, SD = .77), and then the pace of the program (M = 4.21, SD = .79). When asked at what point the pace in the program was best, participants responded that they preferred the pace in the middle of the program the best (M = 4.47, SD = .77), followed by the beginning of the program (M = 4.37, SD = .83), and then the end of the program (M = 4.16, SD = 1.12).

In an open-ended format response, 82.4% chose the pace as the least liked portion of the walking program, 11.8% chose the distance, and only 5.8% chose the frequency as their least liked part of the walking program. Regarding the weekly feedback, the section on helpful strategies was most useful, followed by feedback on pace, duration, frequency, difficulties and then enjoyment level. Pertaining to the SCT supplementary materials, participants found the materials on goal-setting to be most helpful followed by positive thinking, self-monitoring, problem-solving, and finally determining barriers.

Self-Monitoring Forms

For the SCT condition participants submitted monitoring forms on a weekly basis. Interestingly, when asked week-to-week where their difficulties were occurring with the walking program itself, *frequency* was the most commonly noted difficulty followed by the pace and then the distance. Aside from the fundamental components of the walking program, the most commonly reported difficulties were the following: too many other time commitments (25 times), too much to do at home (19 times), on vacation (11 times), had visitors (9 times), too tired (9 times), bad weather (7 times), illness (7 times), too much pressure from work (6 times), in pain or injured (4 times), could not walk with a partner (4 times), having personal and/or family problems (4 times), too stressed, depressed, or anxious (3 times). Too boring, unclear goals, and not supported by my friends and family were noted one time each. On seventeen occasions participants cited "other" as the reason for their difficulties. Additionally, according to the self-monitoring forms, the average reported enjoyment level was a 3.99 out of 5.0 over the course of the program.

Time Requirements

The greatest amount of time that was involved in the administration of the program to the SCT condition was in writing the weekly feedback e-mails. On average, 15 minutes per person per week were devoted to writing the weekly feedback. A total of 143 self-monitoring forms were submitted over the course of the program so that approximately 40 hours was dedicated to writing feedback e-mails over the 8 weeks of the program. Tracking participants in order to accurately write the personalized feedback and to send reminder e-mails when participants did not submit feedback took an additional 4 hours per week for the 8 weeks of the program. Sending the tips sheets and SCT supplements were separate, but comparably minimal time requirements, taking an estimated hour per week. In total, approximately 10 hours per week was dedicated to running the two conditions of the program. This does not include time spent scheduling the consent signing session or the pre and post walk tests.

Chapter 4: DISCUSSION

The present study investigated the differential effects of two Internet-based walking programs, one that was based on Social Cognitive Theory with a progressive walking program, the other an Education Only program with generic walking instructions. The one-mile walk test provided the walk test times and estimated VO_2max that served as objective measures of fitness and the primary outcomes in this investigation. Women were recruited through a worksite in a Southeastern city and represented a physically inactive group.

Fitness and Activity

Before and after the 8-week, home-based walking programs individuals were tested on the one-mile walk test. *Results indicated that at post-test, the SCT condition participants were more fit than the Education Only participants as evidenced by their significantly better walk test times and estimated VO_2max.* The SCT condition showed an average decrease of 69 seconds in their walk test times while the Education Only group showed an average decrease of 37 seconds. In parallel, the SCT condition showed an improvement in their estimated VO_2max level of 2.65 ml/kg/min while the Education Only condition improved by 1.11 ml/kg/min. *Thus, while both conditions did evidence significant gains in their fitness levels improvement was significantly greater for the SCT condition*. Given that both of the conditions did not differ significantly in their self-reported walking and exercise parameters, it appears as though the pace achieved by those in the SCT condition might be responsible for the improvements in fitness evidenced by this group. Furthermore, though less dramatic, these relationships held up even under the more stringent intent-to-treat analyses.

Additionally, the average percent increase in estimated VO_2max was over 10% for the SCT condition and only 4% for the Education only condition. If the percent of women who reached the 10% or greater improvement in estimated VO_2max is examined, 45% of the women in the SCT condition versus 18% of the women in the Education Only condition reached this 10% or greater marker.

Given that both conditions evidenced statistically significant fitness gains, it could be argued that the Education Only condition would be an extremely cost effective approach to disseminate on a large scale in that with minimal efforts by personnel it demonstrated significant improvements in fitness and activity level. The level of improvement by the Education Only participants would be acceptable to those who advocate for a lifestyle change approach where significant change in activity level is considered to be adequate to impact public health. However, it is posited that only the women in the SCT condition made the most *meaningful fitness improvements* and did so without having to greatly improve their pace. Thus, while both groups made significant, objective, gains in their fitness levels, it was *only the SCT condition, with a focus on fitness gains, that evidenced improvements that are likely to better influence risk factors and diseases, such as cardiovascular disease, that are more closely associated with fitness* (Williams, 2001).

These results compare favorably to those from the Dunn et al. study (1999) where in a 6-month treatment program those in the lifestyle group and those in the structured exercise group increased VO_2max by 1.34 ml/kg/min and .77 ml/kg/min respectively. In this same study, 21%

of the lifestyle group and 30% of the structured exercise group increased VO_2max by 10% or more from their baseline levels, compared to the 45% of the SCT and 18% of the Education Only condition achieved this 10% or greater improvement. The improvements in estimated VO_2max in the current study were also greater than those in the Activity Counseling Trial (The Writing Group, 2001) where participants in the two experimental conditions, *assistance* and *counseling*, improved their VO_2max by 5% after 24 months of intensive intervention. While the SCT condition in the present study did not reach the desired goal of an average improvement of 3.5 ml/kg/min, this is a goal that has not been achieved in other, longer studies. It may be that if the current program were longer, greater fitness gains could have been achieved. In the current 8-week program, only six women achieved the 90-second improvement in pace that the program was designed to accomplish. Thus, it may be that if the program were lengthened and the pace quickened more gradually, participants would have continued to see improvements in their fitness levels beyond what they were able to achieve within the confines of an 8-week period.

In addition to the fitness improvements that were evidenced, there were also improvements in self-reported walking and exercise frequencies though these results were more mixed. Both conditions started out to average between contemplation and preparation, but closer to preparation than not. By the end of the program, although both conditions had significant improvements in their stage of change, the SCT's improvement in the stages was significantly greater. For example, 90% of the women in the SCT condition reported being in at least the action stage whereas 50% of the women in the Education only condition reported being in at least the action stage.

For the walking frequency and duration, those in the SCT condition evidenced no change in the frequency but did improve the total number of minutes walked per week from 63 minutes at baseline to 94 minutes at post-test. Similarly, the women in the Education Only condition evidenced no significant improvement in their walking frequency but did improve the total minutes walked per week from 35 minutes at baseline to 82 minutes at post-test. When all of the physical activity categories are combined to create a measure of total exercise frequency and total minutes spent exercising per week, the SCT condition's improvement from 78 minutes to 108 minutes was not significant whereas the Education only group improved in frequency and increased significantly increased from 71 minutes to 120 minutes. Compared side-by-side it appears as if the increases in time spent exercising were 99% accounted for by the increase in walking time for the SCT condition and 94% for the Education Only group. Seemingly, women did not start alternative exercise activities so that the fitness gains witnessed after the program can be largely attributed to the increases in walking behaviors.

It appears, however, that there was a trend for the SCT group to walk and exercise less at post test than baseline whereas the Education Only had a trend toward increasing their walking frequency and significantly increased their exercising at post-test. One possible explanation is that the women in the SCT condition concentrated solely on the program goals and may have decreased other physical activities that they engaged in before the prescribed program, almost as if they were "in training." Women in the Education Only condition had more room for improvement from their baseline levels but nonetheless did make greater gains in their walking and exercising frequency and duration than the SCT condition. Similar to the fitness results, the improvements in walking duration in the Education Only condition are notable given the self-

help nature of this program and lack of guided mastery experiences. Moreover, according to the Lee et al. (2001) findings, walking 60 – 90 minutes per week, regardless of pace, such as occurred in the current study, can lead to a 50% reduction in multivariate risk. Such improvements in physical activity in the Education Only group, if sustained, are likely to have improved the participants' health and were achieved through a minimal program. Thus, from a cost effectiveness perspective, the Education Only condition may be the better intervention for wide spread distribution despite the larger gains in health benefits likely in the SCT condition.

Psychosocial Measures

While the fitness and physical activity outcomes for this trial were robust, the psychosocial variables, that theoretically mediate the changes evidenced in these outcome variables, saw little to no change. Of note was the significant decrease in exercise self-efficacy by the Education Only condition so that the SCT condition had significantly higher levels of self-efficacy at post-test. The SCT condition had a small, but nonsignificant increase in self-efficacy. This increase in self-efficacy may have been statistically significant if the sample size were larger.

According to Bandura (1997) self-efficacy is the largest contributor to prediction of behavior. In the present study, the self-efficacy scale measured a participant's confidence in her ability to "walk 3 or more times per week at a gradual, but progressively faster pace each week" in light of barriers. Because the pace was not the target in the Education Only group, it appears to make sense that these women would feel less confident to do this at post-test than baseline because they had increased their total walking time but had not been given guidance and feedback regarding increasing their pace. Without these mastery experiences one would predict that self-efficacy would not increase, and possibly decrease, as was the case here. Perhaps if a measure of self-efficacy had been included with the instruction set of rating "ability to exercise 3 times per week at least 20 minutes each time" might have yielded a more accurate estimate of self-efficacy for the Education Only condition in that they might have been better able to judge this based on their experiences with the intervention. A decrease in self-efficacy as it was defined for the current study could account for some of the differences found in fitness levels between the two conditions.

Unfortunately, the repeated measures analyses were underpowered and so the following are only observations. There is an interesting pattern wherein the SCT condition evidenced a 5% increase in their self-efficacy from baseline to week 3 and the Education only condition evidenced a 10% decrease in their self-efficacy from baseline to week 3. It may be that the SCT program was having successful mastery experiences through the submission of their self-monitoring forms, goal-setting, feedback, problem-solving, and social support promotion that served to increase their efficacy and in the absence of these experiences, the Education Only condition was losing their confidence in their abilities to walk.

The only other psychosocial measure to evidence significant change was a decrease in pros for exercising listed by the SCT condition. Although it was not significant, there was also a tendency for a decrease in the outcome expectations by both groups. It may be that when women tackle the difficult process of exercise adoption they are better able to make realistic appraisals of what can be expected from exercise. In the case of the SCT condition, it may be that these

new, more realistic pros for exercising attenuated the increases one would expect in self-efficacy given the tremendous gains in fitness levels and walking behavior.

Of the repeated measures analyses, the only significant change was a decrease in Social Support from friends in the Education Only condition. Because the number of participants in these analyses is small, this finding must be interpreted with caution. However, although nonsignificant, the numbers followed a similar downward trend for Social Support from family whereas the numbers increased for the SCT condition for both friends and family. Social support was targeted on a weekly basis with the SCT condition and it may be that with more power this trend for increasing support scores might have been detected as significant. Social support was not targeted in the Education Only condition and may account for the decrease in perceived social support from friends.

Ultimately, the study may have been underpowered to detect change in the psychosocial measures. In addition to the trends for greater improvements in knowledge and decisional cons for the SCT condition, the post-test means between the conditions seem to indicate greater improvements in depression and social support from friends in the SCT condition than the Education Only condition. Knowledge, decisional cons, depression, and social support were all constructs that were targeted in the SCT intervention so that the differences between the groups suggest that the intervention may have been effective. The differences between the groups in outcome expectations and social support from family; however, are unlikely to be significant even with a larger sample size. It may be that these constructs were not adequately targeted in the intervention and in the case of social support it may be that women do not turn to their friends as readily as their family unless specifically prompted to do so as they were in the SCT condition.

Additionally, some of the measures, such as knowledge and decisional cons showed only modest estimated of internal consistency. Bandura (1997) has also suggested that at baseline it may be difficult for some participants to accurately estimate their perceptions about a behavior in which they are not currently engaging. Thus, it is possible that a participant might under or overestimate her abilities or expectations from exercise. If this were to occur the pre to post comparisons become difficult to interpret.

Alternatively or perhaps in addition to, the measures may not have adequately measured the theoretical constructs they were intended to measure. Some evidence was provided that the relationships were in the expected directions. Self-efficacy and outcome expectations were positively correlated with time spent walking per week such that those who had higher self-efficacy and expected more benefits from exercise spent more time walking. There was a trend for social support from friends to be positively correlated with time spent walking per week at post-test. Additionally, there was a trend for those who reported more cons for exercising to have lower estimated VO_2max.

The psychosocial measures also tended to correlate with each other in the expected directions. Self-efficacy was negatively correlated with depression, suggesting that those with higher levels of confidence in their exercise abilities are less depressed. There was a trend for a positive correlation between self-efficacy and outcome expectations suggesting that as confidence

increases the expected benefits of exercise also increased. There were trends between outcome expectations being positively related to listing more pros of exercise and negatively related to listing more cons for exercise which also follows predicted relationships between the variables. Unexpectedly, there was a trend for a positive correlation between pros and cons of exercise, which would suggest that those who list more pros for exercise also list more cons.

Thus, in most cases the psychosocial measures seem to be relating to each other and the measure of walking behavior and number of self-monitoring forms submitted in the expected directions. This suggests the study was underpowered due to the sample size recruited to detect changes in these measures post-test rather than the measures not evidencing construct validity because it was only with fairly robust correlations of .4 or greater that significant findings could be attained. It may be too that an 8-week intervention is too short a period for these largely cognitive constructs to change. It may be that with continued mastery experiences for behavior change that these constructs would show change in the predicted direction.

Participation and Adherence

On the whole, adherence to the program appeared to be fairly good. As was reported previously, an average of 5.4 monitoring forms were returned by participants with 8 women returning forms all 8 weeks. As might be expected, the trend was for less forms to be returned over time in the program. The program frequency of 3 times per week and distance of 2 miles per walking session had excellent adherence rates over the course of the program whereas the adherence to the pace protocol was less successful. Only six women achieved the intended progression of a 90 second improvement in pace from their walk test to their final self-reported walking pace. However, 73% of the women did improve their self-reported pace while in the program. This, coupled with the low ratings of the pace portion of the program in the participant evaluations, suggests that the pace progressions were too ambitious. Based on some of the women's feedback it seemed as though some participants felt the need to stick to the prescribed pace even if it felt too fast or too slow despite the investigator's attempts to state that the program was meant to be flexible. In the cases where this was true, typically after two weeks of self-monitoring form submissions and feedback, the participant altered her pace as suggested and was subsequently more pleased with the walking experience as evidenced by her enjoyment ratings. However, on the whole, women did improve their pace and the improvement seen in the self-monitoring forms of 66 seconds matches well with the changes in estimated VO_2max that were evidenced at post-test.

Program Evaluation

The evaluations of the program appeared to be higher for the SCT condition than the Education Only condition. Possibly accounting for these higher ratings were the SCT condition's higher ratings of the amount of contact with the program director, the amount of guidance provided and that they thought the program contributed to their increases in activity levels. In the open-ended responses, many of the SCT condition participants stated that they liked the "accountability" provided by the program best and the Education Only participants cited the "lack of accountability" as what they would most like to see changed.

For the SCT condition, the feedback and degree of personalization were highly rated. As was mentioned previously, the pace received the lowest ratings when compared to the frequency and distance goals of the program. Again it appears that the pace was too ambitious. In future research endeavors the investigator plans to test several variations of the pace protocol for increased satisfaction and adherence.

Limitations

Several limitations of this study warrant discussion. The walk test administrator was not blind to condition introducing the possibility for differential bias. However, attempts were made to avoid this bias by standardizing the instruction set and the motivational statements that were given to all participants after each lap was completed. Nonetheless, despite these precautions a blind assessor would be the obvious preferred choice. Additionally, there was no true control group so that it is not possible to state with absolute certainty that either treatment would be better than a no-treatment condition. Contact time was not equated for in the two groups such that the women in the SCT condition received two e-mails per week if the participant submitted her weekly monitoring form whereas the Education Only participants received one e-mail per week. Ideally, the contact time would be equated to hold this variable constant between the two conditions.

Although the walk test was an addition to the integrity of the study, it is difficult to measure what impact it might have had on the participants while in the program in that the walk test itself may have provided a sense of accountability to both conditions that would not be present in an on-line only program. It may be that women, knowing they had to complete a walk-test at the end of the program, found this motivating and stimulated their walking behaviors beyond what might have occurred in the absence of this objective test. It may be that the Education Only condition with a pre an post walking test may be the more cost effective program to promote.

Another limitation to the study is the lack of follow-up. It may be that the significant differences found immediately following the 8-week program would not have been maintained at a long-term follow up date. Additionally, the sample size was also too small to conduct mediator and moderator analyses on the psychosocial measures to better explain the direct and indirect effects of the treatment and psychosocial variables on the fitness and physical activity outcomes. Due to the time constraints of the project, a second recruitment wave was not possible to achieve the initial recruitment goal of 60 participants. A larger sample size and multiple indicators for each construct would have allowed for a structural equation model to test the theoretical relationships hypothesized for these variables. Such analyses are critical for explaining why the treatment was effective and are becoming increasingly expected of treatment outcome studies (Baranowski, 1998). Furthermore, the use of more reliable measures may have enhanced the psychosocial outcomes.

Future Directions

It appears this study will provide excellent pilot data for a larger scale study. Before such a larger-scale study can be conducted, a number of other aspects of the program would need to be pilot tested. For example, a longer program of 12 weeks with varying pace protocols should be tested for acceptability, adherence, and behavior change. One possibility might be to spread the

program out to twelve weeks and have the pace decrease by one minute every third week. Some participants found working with paces that were not round numbers such as 16 minutes and 30 seconds per mile to be confusing to calculate and preferred working with round numbers such as a 17 minute/mile pace or 16 minute/mile pace. Thus, in future programs the pace protocol should be further tested and the flexibility of the program needs to be more strongly emphasized. The more gradual approach could allow for a greater sense of mastery, might be easier to judge and measure, and might be less stressful to participants. Another variation that might help participants to better track their pace would be the provision of a pedometer. Pedometers such as the Digiwalker (Yamax, Toykyo, Japan) provide steps walked per day and are available for $10-15 per instrument. The more sophisticated versions of the Digi-walker can provide distance in miles and timing devices. Polar Heart Rate monitors could also provide means of monitoring target heart rates to determine if the pace is too easy or too difficult. Ultimately, the easiest and cheapest means must be developed for a progressive pace protocol to be effective. In the current study, participants were able to improve their pace and this translated to fitness benefits. However, pace was also cited as the least liked aspect of the program and variations on the protocol should therefore be developed and tested to enhance acceptability, which might then increase adherence and outcomes.

Alternatively, it may be the Education Only condition that needs to be examined more closely. This condition required very little time and effort on the part of the researcher and yet yielded surprisingly good results in terms of increases in walking time. Again, it is not possible to know if the post walk-test was in part responsible for these outcomes in that it added a greater sense of accountability to what would have otherwise been a self-help program. This finding should be replicated in other studies with a possible outcome of delivery this program to women who are interested in health benefits but who are less interested in achieving fitness benefits.

It may also be possible to alter the walking instructions for the Education Only condition such that they are directed to improve their pace, as was the case for the SCT condition in the current study. If this were compared to an SCT condition with the same walking instructions for pace improvements it would be a cleaner test of the SCT elements of the program. It may be that guided mastery experiences are necessary for the pace improvements. If, however, the mastery experiences with feedback and goal setting are not needed and women are able to improve their pace on their own, than such a program may provide the improved fitness and health gains while maintaining cost effectiveness.

Another area that warrants future testing is changes to the web site itself. The web site would need to have additional programmed features to enhance its appeal such as greater interactivity with the addition of quizzes and games, more change in the weekly presentation with the addition of the weekly tips on the web site itself, and greater automation. The last point, automation, is one that could and should be tested in several ways. The personal coaching approach taken in the present study appeared to be well received but was clearly time consuming and would not be efficient were this program to be made available to larger numbers of women. It must, therefore, be determined at what point automation, with its increased efficiency, has diminishing returns for behavior change due to the necessary loss of personalization that occurs. For example, there was one woman in this study who on two occasions encountered an alligator sunbathing across her driveway while walking. She turned around and did not complete the full

2 miles on those days. This encountered difficulty came up under the "other" category and in her comments section on the submitted self-monitoring form. Were the program fully automated, it is difficult to imagine that this particular barrier could have been properly identified and addressed as it was by the program director. Thus, as future iterations are developed it will be interesting to determine where the line between automation and personalization should be drawn. It may be that during a 12-week program the feedback process could be fully automated but that once per month thereafter a person can check-in and problem solve with personalized, non-automated feedback from a personal coach (Marcus, personal communication, October, 2001). Or, perhaps, the feedback sheets can be generated automatically in the program, but once every three weeks the personal coach can check in with the individual to problem solve and provide support and reinforcement. These variations can be tested in future iterations.

In summary, the current study demonstrated that an on-line program can lead to improvements in fitness and time spent walking per week. It appears that it was only with a more theoretically based approach wherein participants progressively increased their pace via mastery experiences (i.e., self-monitoring, goal-setting, feedback, problem-solving for identified barriers) that this improvement in fitness level became not only statistically significant but clinically significant as well. In the future, variations of both programs can be developed in order to optimize cost and time effectiveness while at the same time providing a strong, theoretically-based, individualized program for maximum impact on fitness and health outcomes.

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Table 1

Comparison of the 1990 and 1998 ACSM Position Stands for Physical Activity (ACSM, 1998).

1990 Position Stand	1998 Position Stand
Frequency of training: 3-5 days/week.	Frequency of training: 3-5 days/week.
Intensity of training: 60 - 90% of maximum heart rate (HR_{max}), or 50%-85% of maximum oxygen uptake reserve (VO_2R) or HR_{max} reserve.	Intensity of training: 55/65%-90% of maximum heart rate (HR_{max}), or 40/50%-85% of maximum oxygen uptake reserve (VO_2R) or HR_{max} reserve (HRR). The lower intensity values, i.e., 40-49% of VO_2R or HRR and 55-64% of HR_{max} are most applicable to individuals who are quite unfit.
Duration of training: 20-60 min of continuous aerobic activity. Duration is dependent on the intensity of the activity; thus, lower-intensity activity should be conducted over a longer period of time. Because of the importance of "total fitness" and the fact that it is more readily attained in longer duration programs, and because of the potential hazards and compliance problems associated with high-intensity activity, lower to moderate intensity activity of longer duration is recommended for the nonathletic adult.	Duration of training: 20-60 min of continuous or intermittent (minimum of 10-min bouts accumulated throughout the day) aerobic activity. Duration is dependent on the intensity of the activity; thus, lower-intensity activity should be conducted over a longer period of time (30 min or more), and, conversely, individuals training at higher levels of intensity should train at least 20 min or longer. Because of the importance of "total fitness" and that it is more readily attained with exercise sessions of longer duration and because of the potential hazards and adherence problems associated with high-intensity activity, moderate-intensity activity of longer duration is recommended for adults not training for athletic competition.
Mode of activity: any activity that uses large muscle groups, can be maintained continuously, and is rhythmical and aerobic in nature, e.g., walking-hiking, running-jogging, cycling-bicycling, cross-country skiing, dancing, rope skipping, rowing, stair climbing, swimming, skating, and various endurance game activities.	Mode of activity: any activity that uses large muscle groups, which can be maintained continuously, and is rhythmical and aerobic in nature, e.g., walking-hiking, running-jogging, cycling-bicycling, cross-country skiing, aerobic dance/group exercise, rope skipping, rowing, stair climbing, swimming, skating, and various endurance game activities or some combination thereof.

Table 2

Measurement Schedule

MEASURE	**Screening**	**Pre Week 0**	**Week 1**	**Week 2**	**Week 3**	**Week 4**	**Week 5**	**Week 6**	**Week 7**	**Post Week 8**
PAR-Q	X									
Consent	X									
One Mile Walk Test		X								X
Demographics	X									Weight only
The Aerobics Center Physical Activity Questionnaire		X								X
Exercise Knowledge		X								X
Exercise Self-efficacy		X			X					X
Social Support for Exercise Survey		X			X					X
Exercise Outcome Expectations		X			X					X
Stages of Change	X									X
BDI	X									X
Decisional Balance		X								X
Self-Monitoring Form (SCT Condition only)			X	X	X	X	X	X	X	X

Table 3

Demographic Characteristics of Participants

	Program Completers		**Dropouts**
Demographic Characteristic	*n* = 42 Walk Test Post (PC)	*n* = 11 Walk Test Pre, Tx Dropout (TD)	*n* = 15 Screening Measures Only (SO)
Age	46.5_a	50.9_b	34.87
Marital Status			
Single	11.9	9.1	33.3
Married	59.5	63.6	53.3
Divorced	23.8	27.3	0
Other	4.8	0	13.3
Ethnicity			
Caucasian	85.7	90.9	60
African American	11.9	9.1	26.7
Hispanic	0	0	6.7
Asian	0	0	6.7
Other	2.4	0	0
Education			
High School or GED	11.9	27.3	0
Certificate/2yr. college	16.7	18.2	26.7
4 yr. College	38.1	18.2	60
Graduate degree	33.4	36.4	13.3
Income			
< 30,000	11.9	18.2	13.3
30 – 69,999	42.8	36.4	46.6
> 70,000	42.8	45.5	40
Stage of Change	2.69	2.73	2.40
Depression (BDI)	4.5	7.2	5.8
Body Mass Index	27.29	27.93	26.56
Walk Test Time	16.42	17.03	--
Estimated VO_2max	28.23	25.62	--
Walking Frequency	2.46_c	$.64_c$	--
Walking Duration (total min./wk)	47.4_d	17.05_d	--
Self-efficacy	64.29	57.55	--

a F (2,65) = 15.57, p = <.01, Tukey's HSD SO < PC & TD, p < .01
b F (2,65) = 15.57, p = <.01, Tukey's HSD SO < PC & TD, p < .01
c F(1,51) = 3.99, p = .051
d F(1,51) =3.50, p = .067

Table 4

Means of Outcome Variables by Condition

Variable		Pre		Post		
		Mean	SD	Mean		SD
Walk Test Time	Education Only	16.46	1.31	15.87	*	1.15
	SCT	16.38	1.00	15.12	*	1.16
Estimated VO_2max	Education Only	29.02	4.66	30.14	*	4.58
	SCT	27.35	3.67	30.00	*	3.45
Stage of Change	Education Only	2.67	.48	3.43	*	.60
	SCT	2.75	.72	4.00	*	.46
Walk Frequency	Education Only	1.74	2.33	2.57		1.91
	SCT	3.35	3.44	2.95		.93
Walk Minutes	Education Only	35.13	37.71	81.69	*	69.04
	SCT	63.18	61.51	93.91	*	36.08
Exercise Frequency	Education Only	2.87	2.78	4.60	*	3.43
	SCT	3.98	3.72	3.58		1.90
Exercise Minutes	Education Only	70.68	65.66	120.13	*	88.59
	SCT	77.49	76.72	108.41		51.60
Knowledge	Education Only	10.62	1.63	10.10		2.59
	SCT	10.35	2.18	11.30		1.38
BDI	Education Only	4.86	6.97	4.24		3.62
	SCT	4.05	6.14	2.90		3.13
Self-efficacy	Education Only	64.88	13.45	55.07	*	18.32
	SCT	62.94	18.64	66.08		19.88
Outcome Expectations	Education Only	7.43	1.14	7.18		1.19
	SCT	7.50	1.32	7.28		1.25
Social Support: Family	Education Only	10.33	10.21	10.67		13.83
	SCT	10.11	10.63	11.00		9.94
Social Support: Friends	Education Only	9.14	6.89	10.00		9.81
	SCT	8.74	8.59	7.42		7.64
Pros	Education Only	3.87	.60	3.99		.74
	SCT	4.02	.61	3.57	*	.92
Cons	Education Only	1.85	.54	1.98		.62
	SCT	1.87	.65	1.64		.68

* $p < .05$ within group pre to post

Table 5

Means of Repeated Measures

	Mean Scores		
	Pre-treatment	Week 3	Post-treatment
Self-Efficacy			
SCT (n = 15)	61.7	66.7	66.3
Education Only (n = 15)	64.8	54.9	58.6
Outcome Expectations			
SCT (n = 13)	9.0	7.5	7.5
Education Only (n = 11)	7.0	7.0	7.2
Family Social Support			
SCT (n = 13)	7.7	9.4	10.3
Education Only (n = 13)	6.9	6.3	5.2
Friends Social Support			
SCT (n = 13)	8.0	9.5	9.1
Education Only (n = 13) *	10.8	10.5	7.6
Total Social Support			
SCT (n = 13)	15.7	18.9	18.2
Education Only (n = 13)	17.8	16.8	12.8

*p = .05

Table 6

Correlation Matrix

	Age	Know	BDI	SE	OE	SSfm	SSfr	Pros	Cons	VO2	Wk dur	# sm forms
Age	1.00											
Know	-.22	1.00										
BDI	-.03	-.19	1.00									
SE	-.03	.31	-.41**	1.00								
OE	-.13	-.17	-.20	.33*	1.00							
SSfm	.03	-.08	-.18	.22	.37*	1.00						
SSfr	-.36*	-.15	-.14	.13	.23	.27	1.00					
Pros	.01	-.21	.08	-.13	.34*	.21	.27	1.00				
Cons	.14	.04	.26	-.23	-.34*	.25	.15	.33*	1.00			
VO2	-.46**	.13	-09	-.05	.14	-.14	.05	-.11	-.34*	1.00		
Wk dur	-.12	.17	-.14	.46**	.47**	.28	.37*	.15	-.09	.02	1.00	
# sm forms	-.12	.59**	-.53*	.53*	.20	.38	.32	-.22	-.19	-.01	.47*	1.00

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 7

Average paces per week reported on the self-monitoring forms for each participant in the SCT condition

Participant	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
A			16.5	14.5		15.7		15.4
B	18.5	18.17	22.8	18.33	18.33	18.75	20	15.33
C		17.33	16	16		16		
D			20					
E			23					
F	16	15.5	15.25	14.75				
G	18		17.5	17	16.5			
H	18	16.5	16.5	16.5	16	15.5	15.33	15
I	18.5	18.66	18	17	16.5	16.21	15.5	15.5
J	15.5		12.25					
K	15.5	15	14.66		14.58	15		13.38
L	17.16	17	17.67	17.5	17.5	16.5	17.9	18.25
M		22.1	20	20			21.35	
N	17.17	17.23	16.57	18	16.84	17.1		
O	20	16.83	17.17	17	16.83			
P	18.17		18		18	17.5	17	
Q	19.33	17.33	17	18.25	17.75	17.7	17.33	17.5
R	18	17.33	17	16.5	16		15.83	
S		17	16.85	14.25	14.50	13.97	13.51	13.12
T		20	19.5	19		19		
U	19.17	17.03	16.57	17.5	16.55	17	18.5	18.4
V		19	17.5	18	18			
W	20	19.33	19	19	18.66			
X	17.83	17.5	17.48	18.3	16.43	15.5	16.33	15.33
Y	16.85	16.5	16.5	16	15.3	15	14.75	14.75
Z	18	17.5	16.75	16.25	16	15.4	15.25	15

CURRICULUM VITAE

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EDUCATION

Doctor of Philosophy, December, 2001
Clinical Psychology
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HONORS AND AWARDS

Honor Societies:
Phi Kappa Phi, 1998
Phi Beta Kappa, 1993
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PROFESSIONAL ORGANIZATIONS AND ACTIVITIES

Service Activities	Graduate Honor Board, Virginia Tech, 1997 – present Clinical Student Representative, Virginia Tech, 1997-1998
Journal Reviews	Guest reviewer, Journal of Clinical Child Psychology Guest reviewer, Journal of Gender, Culture, and Health
Professional Organizations	American Psychological Association, Student Member Association for the Advancement of Behavior Therapy, Student Member Society of Behavioral Medicine, Student Member

PUBLICATIONS

Whiteley, J. A. & Winett, R. A. (2000). Enhancing Women's Health through Principled Exercise Training. *Handbook of Gender, Culture and Health*, In Richard M. Eisler and Mischel Hersen (Eds.).

Winett, R. A., Whiteley, J. A., Rovniak, L., Galper, D. I., & Graves, K. D. (1999). Blueprint for Motivation: Theory and Applications for Exercise Training. *Blueprint for Strength and Fitness*, In Matt Brzycki (Ed.), Indianapolis: Masters Press.

Winett, R.A, Roodman, A. A., Winett, S. G., Bajzek, W., Rovniak, L. S., & Whiteley, J. A. (1999). The Effects of the **Eat4Life** Internet-based Health Behavior Program on the Nutrition and Activity Practices of High School Girls. *Journal of Gender, Culture, and Health, 4*(3), 239-254.

Winett, R. A., Anderson, E. S., Whiteley, J. A., Wojcik, J., Winett, S., Rovniak, L., Graves, R., Galper, D. (1999). Church-based health behavior programs: Using social cognitive theory to formulate interventions for at-risk populations. *Applied and Preventive Psychology*, **8**, 129-142.

Brown, R. A., Burgess, E. S., Sales, S. D., Whiteley, J. A., Evans, D. M., & Miller, I. (1998). Reliability and validity of a smoking time-line follow-back interview. *Psychology of Addicted Behaviors, 12*(2), 101-112.

Russ, C. R., Tate, D. F., Whiteley, J. A., Winett, R. A., Winett, S. & Pfleger, J. (1998). The Effects of a WWW-based Health Behavior Programs on the Nutritional Practices of Tenth Grade Girls: Report on the **Eat4Life** Prototype. *Journal of Gender, Culture, and Health*.

POSTER PRESENTATIONS

Whiteley, J. A., Diehl, N.S., Eagan, B. (2001, November). Physical activity correlates among African American women. Poster presented at the annual meeting of the association of the Advancement of Behavior Therapy, Philadelphia, PA.

Whiteley, J. A., Winett, R. A., Anderson, E.S., Wojcik, J. (2000, November). *Internet-based cognitive behavioral walking program for women.* Poster presented at the annual meeting of the association of the Advancement of Behavior Therapy, New Orleans, LS.

Whiteley, J.A., Andersen, E. S. & Winett, R.A. (2000, March). *Measuring women's exercise outcome expectations and values.* Poster presented at the annual meeting of the Society of Behavioral Medicine, Nashville, TN.

Rovniak, L.S., Anderson, E.S., Winett, R.A., & Whiteley, J.A. (2000, March). *The Development of Measures to Assess Self-Regulation for Exercise: The Exercise Goal-Setting and Planning Scales.* Poster presented at the annual meeting of the Society of Behavioral Medicine, Nashville, TN.

Whiteley, J.A., Richard A. Winett, Sheila G. Winett, William Bajzek, Liza Rovniak & Dave Williams (1999, November). *The application of social cognitive theory to the dissemination of Eat 4 Life: An Internet-based health behavior program for rural adolescents.* Poster presented at the annual meeting of the Association of the Advancement of Behavior Therapy, Toronto, Canada.

Whiteley, J. A., Anderson, E.S., & Winett, R. A. (1999, March). *Stages of change versus self-efficacy as predictors of level of physical activity for women*. Poster presented at the Society of Behavioral Medicine, San Diego, CA.

Winett, R.A., Roodman, A., Rovniak, L., Whiteley, J. A., Winett, S. G., & Bajzek, W. (1999, March). *Internet-based health behavior program for high school girls: Results of a year long trial.* Poster presented at the Society of Behavioral Medicine, San Diego, CA.

Whiteley, J. A., Psujek, J., McClinch, C., & Winett, R. A. (1998, November). *Physical activity and women: A social cognitive perspective*. Poster presented at the annual meeting of the Association for the Advancement of Behavior Therapy, Washington D.C.

Russ, C. R., Tate, D. F., Whiteley, J. A., & Winett, R. A. (1997, November). *Dietary, exercise, and smoking habits among rural adolescents: Implications for intervention.* Poster presented at the annual meeting of the Association for the Advancement of Behavior Therapy, Miami, FL.

Tate, D. F., Russ, C. R., Whiteley, J. A., & Winett, R. A. (1997, November). *Development of self-efficacy and outcome expectancy measures for dietary change among rural adolescent females.* Poster presented at the annual meeting of the Association for the Advancement of Behavior Therapy, Miami, FL.

Whiteley, J. A. & Bradley, D. (1996, November). *Personality and situational factors that differentiate regular and occasional smokers.* Poster presented at the annual meeting of the Association for the Advancement of Behavior Therapy, New York, New York.

EXPERIENCE

Research

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Title: *An Internet-based walking program for women*
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