Operationalizing Mastery Experiences in E-mail-Based Fitness Walking Programs

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(ABSTRACT)

The purpose of the present study was to examine the relative effectiveness of two different ways of operationalizing a mastery experience in an e-mail based fitness walking program. Mastery experiences are considered the best way to increase exercise self-efficacy (Bandura, 1997), which is strongly associated with regular physical activity, but little research has systematically explored how effective mastery experiences can be developed. Fifty-nine sedentary adult women were randomly assigned to a mastery experience group (*n*=29) that operationalized mastery experiences in a manner consistent with Bandura's social cognitive theory, or to a standard care group (*n*=30) that operationalized mastery experiences in a manner consistent with standard care. Both intervention conditions received the same physical activity prescription and were designed to promote equivalent levels of contact with the experimenter over the 12-week program. The effects of the program were examined on overall adherence to the program, one-mile walk test times, estimated VO_2max, social cognitive outcomes, and program evaluation ratings. Both the mastery experience group and the standard care group had similar levels of adherence to the program. The mastery experience group demonstrated a significantly greater improvement in one-mile walk test time than the standard care group. Although the mastery experience group also showed a larger increase in estimated VO_2max than the standard care group, this difference did not reach significance. The mastery experience group had significantly greater increases in goal-setting relative to the standard care group, but the intervention did not show any differences between the two groups on three measures of self-efficacy. In program evaluation ratings, the mastery experience group demonstrated greater satisfaction with the program than the standard care group.

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CHAPTER 1: INTRODUCTION

Physical inactivity is linked to approximately 250,000 premature deaths each year in the United States, and is associated with numerous chronic diseases and disabilities including coronary heart disease, type 2 diabetes, some cancers, osteoporosis, hypertension (Booth, Gordon, Carlson, & Hamilton, 2000; USDHHS, 2001), and increased cerebral deterioration in older adults (Colcombe, Erickson, Raz, Webb, Cohen, McAuley, & Cramer, 2003). Furthermore, the growth of sedentary lifestyles is linked to the rising obesity epidemic, both in the United States and around the world. In 2000, 56.4% of U.S. adults were overweight (BMI $\geq$ 25 kg/m^2), compared with 45% of U.S. adults in 1991. Of those who were overweight, 19.8% were obese (BMI $\geq$ 30 kg/m^2) (Mokdad, Bowman, Ford, Vinicor, Marks, & Koplan, 2001). Despite increasing evidence that chronic health conditions and premature mortality are associated with inactive lifestyles, there has been no increase in regular physical activity over the past ten years, and fewer than 25% of U.S. adults currently exercise at the recommended level (USDHHS, 2001).

Because so many people are overweight and inactive, it is imperative to increase our knowledge about how to develop more effective physical activity interventions. Social-cognitive theory (SCT), a multivariate theory that postulates that behavior is influenced by personal, cognitive, and environmental factors (Bandura, 1997), has been one of the most predominant approaches in physical activity interventions. To date, evidence suggests that SCT-based physical activity intervention conditions yield greater short-term improvements in physical fitness and activity levels than (a) no-treatment control groups (Calfas, Sallis, Oldenburg, & Ffrench, 1997; Li et al., 2001; Pinto, Lynn, Marcus, DePue, & Goldstein, 2001; Ready et al., 1996; Woolf-May, Bird, & Owen, 1997), (b) minimal intervention comparison conditions (Bock, Marcus, Pinto, & Forsyth, 2001; Castro, Sallis, Hickmann, Lee, & Chen, 1999; Marcus et al., 1998; Writing Group for the Activity Counseling Trial Research Group, 2001) and (c) attention-control conditions that deliver an equivalent-contact intervention unrelated to physical activity (Avila & Hovell, 1994; Sallis et al., 1999). Thus, it appears that "doing something" to promote physical activity or fitness yields better results than doing little or nothing. The knowledge that targeted physical activity interventions can produce significant changes in activity level, at least in the short term, is an important accomplishment of the last decade of physical activity research.

Global Effectiveness versus Procedure-Specific Effectiveness

To further advance the field of physical activity research, it is imperative to progress from examining the global effectiveness of physical activity interventions, to examining *specific procedures* that may increase the effectiveness of these interventions. Examining how we can increase the effectiveness of interventions that have already demonstrated overall, global effectiveness is critical given that long term effects of physical activity interventions tend to be small (Baranowski, Anderson, & Carmack, 1998), and that not all participants benefit equally from intervention procedures (Bock et al., 2001). Knowledge that better outcomes could result from the presence of an additional behavior change procedure or from operationalizing a SCT variable in one way, as opposed to another way, could improve the potential impact of future interventions. However, few physical activity interventions have assessed the relative effectiveness of theory-based, behavior change procedures for increasing physical activity.

Only a few physical activity studies could be located that compared the relative effectiveness of theory-based process variables. Martin et al. (1984) conducted a series of six studies that systematically manipulated theory-based procedures related to behavior change, while retaining a similar exercise program across the six studies. Their work suggested that more specific, personalized feedback and praise resulted in better exercise adherence than general feedback and praise, and that flexible goals that were individually tailored to an individual's circumstances produced better exercise adherence than fixed goals. However, confidence in their results is limited by their small sample sizes for each study. McAuley, Courneya, Rudolph, & Lox (1994) compared a group that received a 5-month walking program, with a group that received a 5-month walking program *plus* the addition of SCT-based behavior change strategies such as monthly timed walks to observe progress, formation of exercise buddy systems, and self-monitoring of activity and fitness improvements. The intervention group reported greater exercise participation over the course of the program than the comparison group. However, it was unclear whether the results occurred because of the specific SCT procedures used, or because the intervention group received a larger intervention dose. Jakicic, Winters, Lang, & Wing (1999) compared the effectiveness of two groups that were assigned to home-based exercise programs versus a group that received the home-based exercise program *plus* had a motorized treadmill delivered to their homes (a source of environmental support for exercise). Participants who received the home exercise equipment maintained a higher level of exercise over the program than participants who did not receive the equipment. It was unclear whether the more positive results for the group that received the treadmill were related to having the treadmill in the home, or to participants' appreciation of the extra effort to provide them with a treadmill. Overall, these studies provide insight into theoretically-based procedures that influence physical activity behavior change, while raising questions for future studies. Because the number of studies exploring the relative effectiveness of SCT procedures associated with increased fitness and physical activity has been limited, more work is needed to broaden our knowledge base.

Operationalizing Mastery Experiences

The purpose of the present study was to examine the relative effectiveness of two different procedures for operationalizing mastery experiences on the physical fitness and activity outcomes of sedentary adults involved in an e-mail based walking program. Mastery experiences involve developing a sense of accomplishment through success in completing a series of challenging tasks (Bandura, 1997). The present study targeted mastery experiences because they are considered the best way to raise self-efficacy, or confidence in one's ability to produce a given level of performance (Bandura, 1997), which is one of the strongest predictors of engaging in regular physical activity (Hovell, Sallis, Hofstetter, Spry, Faucher, & Casperson, 1989; Rovniak, Anderson, Winett, & Stephens, 2002). Furthermore, the concept of mastery experiences has received little research attention in physical activity interventions (McAuley et al., 1994).

Although Bandura suggests that mastery experiences are important, he does not offer precise guidelines on how best to operationalize mastery experiences. However, his writings suggest that mastery experiences involve four major components: (1) acquiring needed knowledge and subskills to perform the behavior; (2) progressive goal setting; (3) feedback on

performance accomplishments, and (4) practicing skills in diverse settings or situations (Bandura 1983; 1986; 1997, Wood and Bandura, 1989).

Bandura's recommendations for operationalizing these four components is often not followed precisely in standard walking interventions. For the first component of mastery experiences, skill acquisition, Bandura (1997) suggests that an important strategy for acquiring new skills is having someone model the behavior, which not only facilitates skill development, but provides a standard against which to judge one's performance. While many unsupervised fitness walking or physical activity interventions provide orientation sessions with information on walking or exercise-related skills (Calfas et al., 1997; King, Haskell, Taylor, Kraemer, & DeBusk, 1991; Lombard, Lombard, & Winett, 1995; Writing Group for the Activity Counseling Trial Research Group; 2001), most do not mention having a model demonstrate the desired walking or physical activity skills. Therefore, this study aimed to compare skill acquisition operationalized in a manner consistent with descriptions of standard care (provision of information) to skill acquisition operationalized in a manner more consistent with Bandura's SCT (provision of information, plus modeling).

For the second component of mastery experiences, progressive goal-setting, Bandura (1986, 1991, 1997) recommends that goals should be specific, measurable, moderately challenging, and involve subgoals leading to a longer-term goal. Furthermore, one goal should be mastered before moving to the next one. Most walking programs have incorporated the recommendations for goals to be specific, measurable, and moderately challenging, by asking participants to walk a specific number of times per week (e.g. Coleman et al., 1999; Lombard et al., 1995; Perri et al., 2002). However, goals could be made even more specific by targeting specific weekly increases in walking speed, in addition to frequency, which is not done in many standard interventions. Furthermore, many studies do not describe a specific plan for how participants will break longer-term goals into shorter-term goals. Finally, only one physical activity intervention was located in which participants were required to master one goal before moving to the next one (Coleman et al., 1999). Therefore, a key aim of this study was to compare goals operationalized in a manner consistent with descriptions of standard care, to goals operationalized in a manner more consistent with Bandura's SCT.

For the third component of mastery experiences, feedback on performance accomplishments, Bandura (1991) indicates that effective feedback gives participants information about how well they are doing in relation to similar, relevant individuals, in relation to an established norm, or in relation to a clearly defined personal goal. When feedback is described in the physical activity and walking intervention literature, feedback appears to focus more on congratulating people for getting the activity done, rather than on the quality of their performance (e.g. Coleman et al., 1999; Castro et al., 1999; Lombard et al., 1995; Writing Group for the Activity Counseling Research Trial Group, 2001). Therefore, this study aimed to compare feedback operationalized in a manner consistent with descriptions of standard care, to feedback operationalized in a manner more consistent with SCT.

For the fourth component of mastery experiences, practicing skills in diverse settings, many walking programs appear to encourage people to walk in a variety of convenient settings (e.g. Lombard et al., 1995; Perri, Martin, Leermakers, Sears, & Notelovitz, 1997) , but do not

precisely prompt, or give structured feedback for walking in different settings. Therefore, this study aimed to compare general encouragement to walk in different settings with more specific, structured encouragement and feedback.

By manipulating these four components of a mastery experience, while promoting equivalent levels of experimenter contact and physical activity across groups, it was expected that the current study would increase knowledge about whether these theoretically-based procedures enhance intervention effectiveness.

Program Structure

To increase the likelihood that all study participants could obtain mastery experiences, the present study was designed as a fitness walking program. Walking was chosen because it can be done by almost anyone, costs little, requires no special facilities, and is a year-round activity (Morris & Hardman, 1997; Rippe, Ward, Porcari, & Freedson, 1988). Moreover, it is one of the most popular forms of physical activity; in a study of 81,557 adults in 45 states, 36% of the 70% of adults who participated in some form of physical activity in the past month chose to walk for exercise (Siegel et al., 1995).

Furthermore, the present study was conducted through e-mail, since e-mail based interventions have future potential to reach large numbers of people cost-effectively, can be used by participants with older computers, and provide a way to reach people who have difficulty meeting for physical activity programs at structured times. In April, 2002, 166 million people in the U.S. (about 60% of the U.S. population) had home Internet access (Nielsen/Net Ratings, 2003). Although previous Internet-based research in the area of weight loss has reported that Internet/e-mail based interventions produce smaller effects than face-to-face interventions (Tate, Jackvony, & Wing, 2003; Tate, Wing, & Winett, 2001), they provide an important alternative for individuals who prefer to exercise on their own, who require scheduling flexibility, or who live in remote, rural, or medically underserved areas.

In sum, it is imperative to develop more effective physical activity interventions, given that more than half of the U.S. population is overweight, physically inactive, and at high risk for chronic diseases and disabilities attributable to a sedentary lifestyle. An important step in developing more effective interventions is to systematically investigate the influence of theoretically-based behavior change procedures. The present study aimed to expand knowledge in this understudied area, by exploring the relative effectiveness of two different ways of operationalizing mastery experiences for sedentary adults involved in an e-mail based fitness walking program.

CHAPTER 2: METHODS

Participants

Participants were recruited through local listservs, churches, radio, television and print media, and program flyers and announcements. Listserv-based recruitment involved circulating an e-mail describing the walking program to Virginia Tech faculty, staff, and graduate student listservs, the Virginia Tech Corporate Research Center listserv, the Blacksburg-Christiansburg, Virginia Chamber of Commerce listserv, and the faculty and staff listservs at four local elementary and high schools. In addition, the project coordinator (Liza Rovniak) sent an e-mail to every department head at Virginia Tech requesting that they forward the walking program e-mail to members of their department. Church-based recruitment involved having local church pastors/ministers make an announcement about the walking program during Sunday church services and/or place an announcement in their Sunday church bulletin (4 churches), or having the churches post a flyer advertising the program (3 churches). Media-based recruitment, resulting from interviews with Virginia Tech's media department, consisted of two radio broadcasts and a television announcement on local channel two. In addition, an article describing the walking program appeared in the Spectrum, the Virginia Tech faculty and staff newspaper. Other sources of recruitment included program flyers placed in the waiting rooms of six local doctor's offices, a program announcement on the Blacksburg Electronic Village homepage, and an announcement at a local Weight Watchers meeting.

Individuals who contacted the project coordinator for more information were sent an e-mail that provided information about the walking program and a screening form. Eligible participants were required to meet the following criteria: (1) Currently living within 15 miles from Virginia Tech, (2) regular access to e-mail, (3) age between 20 and 54 years, (4) currently sedentary, i.e. no more than one hour of physical activity per week, (5) no more than one of the following five risk factors (family history of heart disease, high cholesterol, high blood pressure, current cigarette smoker, and body mass index (BMI) between 35.5 and 39.9); or, no more than four of these five risk factors *with a physician's medical clearance*, (5) BMI not greater than 39.9, (6) no metabolic related diseases, i.e. diabetes, kidney, liver or thyroid disease; no pulmonary disease, i.e. asthma, emphysema, chronic bronchitis, and cystic fibrosis; and no symptoms of cardiovascular disease, i.e. heart attack, bypass surgery, angioplasty, heart transplant, stroke, dizziness, or chest pain, (7) no bone, joint, or foot problems that could interfere with walking, and (8) not currently pregnant.

Procedure

Two to four weeks before the start of the program, eligible participants attended an assessment session at a local fitness club, during which they completed a one-mile walk test of physical fitness (Kline et al., 1987), and a series of background information questionnaires. Following the baseline assessment session, participants were stratified by age (in ten-year age blocks) and one-mile walk test time, and randomly assigned to either the mastery experience group or the standard care group using a random numbers table. On the baseline background information questionnaire, one-third of the sample indicated knowing one other person at the start of the program. Those couples (e.g. husband/wife couples, good friends) were matched to

another couple similar in age and walk test times, and then each set of matched couples was randomly assigned to one of the two groups using the random numbers table.

Intervention

Table 1 summarizes the key similarities and differences across the standard care group (SC) and the mastery experience group (ME) interventions. Both groups were equated for contact and level of physical activity, while they varied on the operationalization of mastery experience procedures. The SC group was designed to simulate procedures used in many social-cognitive theory-based community walking programs. The ME group incorporated the major features of the SC group, while simultaneously testing the effectiveness of procedures hypothesized to enhance the effectiveness of mastery experiences (Bandura, 1997).

Standard Care Group

Informational Session. At the start of the walking program, participants in the SC group were invited to attend a 30-minute orientation session, during which they met individually with the project coordinator. Participants were told that the purpose of the walking program was to help them to walk three times a week for 30 minutes a session, and to gradually increase their walking speed. They were then given information about the benefits of regular brisk walking, informed of their baseline walk test time, given the walking program manual and a verbal description of its contents, and encouraged to look at a calendar and plan out their walking sessions in advance. In addition, they were given a notebook (walking log) in which to record information about their weekly walks, and they were instructed on the procedure for completing the walking logs each week, and for e-mailing the weekly walking log results to the project coordinator. Participants were encouraged to ask questions and share any concerns they might have. Immediately following the orientation session, participants in the SC group began the 12-week walking program.

Walking Program Design. Participants in the SC group were instructed to walk three times per week for approximately 30 minutes each time, and to gradually increase their walking speed, while keeping their perceived exertion level in the three to four range (moderate exertion level) on Borg's rating of perceived exertion scale (Noble, Borg, & Jacobs, 1983). Participants were informed that they could walk in any location(s) convenient for them. After each walk, SC participants were instructed to write the following details about their walk in their walking log notebook: date, duration, walking pace on a scale that ranged from one (casual or strolling) to 4 (brisk or striding), perceived exertion level based on Borg's rating of perceived exertion , overall well-being while walking on a scale that range from 1 (poor) to 3 (very good), and location of their walk. They were asked to e-mail the project coordinator one note (walking log) for each of the 12 weeks in the program that provided their recorded information on their walking activities for the previous week, using a standardized format. In addition, participants who did not walk were asked to send the project coordinator a brief note (walking log) indicating that no walking took place for the previous week. One to two days before their walking logs were due each week, SC participants received an e-mail note from the project coordinator that reminded them to e-mail the project coordinator the walking logs by the designated time, and that provided a "walking tip of the week".

Feedback. Within seven hours after the walking logs were "due", participants received a feedback note through e-mail that commented on the previous week's walking log, and provided walking guidance for the forthcoming week of walking. Similar to the descriptions of the feedback provided for many SCT-based walking programs, the feedback was designed to provide encouragement, ensure that participants walked at a pace that was comfortable for them, provide weekly social support and answers to ongoing questions/concerns, and provide walking goals for the following week; namely to walk three times a week, and to gradually increase walking speed. The feedback note followed the same general format from week to week, and the weekly content was tailored to the information participants reported each week in their walking logs. The feedback followed a series of algorithms. In addition, participants who reported not completing any walking usually received one of three standardized "encouragement" notes, or a shorter note tailored to their individual circumstances if neither of these notes applied to their situation, or if they had already received all three standardized encouragement notes. Participants who did not return their walking logs for the week also received feedback, consisting of a short note in which the project coordinator acknowledged that a walking log was not received, expressed concern for their well-being, and encouraged them to submit a walking log the following week.

Mastery Experience Group

Informational Session. Similar to the SC group, the Mastery Experience group (ME) also received a 30-minute informational session in which they were oriented to the program, and received all the information covered with the SC group. The key differences were that (a) based on their walk test time, participants were given an individualized long-term walking speed goal and instructed on how to set up short-term walking goals to reach the longer-term goal, (b) they were given a wristwatch stopwatch to help accurately chart their walking speed progress and shown how to use the stopwatch, (c) they were given a list of walking routes in Blacksburg and Christiansburg that had been accurately measured for mileage to enable them to track walking speed relative to a specific distance, and (d) they were given a 3-minute walking demonstration on brisk walking techniques, during which they practiced brisk walking techniques, and received corrective feedback, if necessary.

Walking Program Design. Similar to the SC group, participants in the ME group were instructed to walk three times per week, for approximately 30 minutes each time (or 2 miles per walk), and to gradually increase their walking speed, while keeping their level of perceived exertion between 3 and 4 on the Borg scale. In addition, like the SC group, they were instructed to record specific information in a walking notebook after their walks, and to e-mail the project coordinator weekly walking logs using a standardized format, in which they provided information on walking frequency, duration, miles walked, perceived exertion, and walking locations. Like the SC group, the ME group also received a weekly reminder note/tip of the week.

The key differences in the walking program design between the ME and the SC group were that (a) Participants were informed that their long-term walking speed goal was to be able to walk one mile 80 seconds faster than when they started the program (walk-test baseline score), (b) participants were informed that to reach this long-term goal, they should begin walking each

mile 60 to 90 seconds slower than their one mile walk test time, and then attempt to increase their walking speed by 10 to 20 seconds per mile each week (short-term goals), and (c) participants were not progressed to the next short-term speed goal, until they could achieve the previous speed goal assigned to them without discomfort. In addition, all ME participants were instructed to complete at least two of their three weekly walks on a measured route, either from one of the measured routes provided, or from a route that they had measured with their car odometer, and to attempt to walk in more than one location each week. They were also instructed to use the free wristwatch stopwatch they were given to time each of their weekly measured walks, so that they could track improvement in walking speed relative to a specific distance.

Feedback. Like the SC group, ME group participants received prompt weekly feedback within seven hours after their walking logs were due. In addition, similar to the SC group, the feedback aimed to provide encouragement, social support, and answers to ongoing questions/concerns, ensure that participants walked at a comfortable pace, and provide walking goals for the forthcoming week. As with the SC group, the feedback note followed the same general format from week to week, was tailored to the information participants reported each week in their walking logs, and followed a series algorithms. In addition, ME participants who reported not completing any walking or who did not return a walking log received the same feedback notes as the SC participants.

The key difference between the feedback given to the ME and the SC participants was that ME participants received: (a) an estimate of their average walking speed per mile for the current week, (b) a comparison of the current week's walking speed relative to the previous week, (c) a graph that showed walking speed progress over each week in the 12-week program, (d) normative information on the graph about how each week's walking performance compared to other individuals of similar age, and the same gender, (e) information on expected level of physical fitness that could be achieved by the end of the program if the participant met the walking speed goal, (f) specific encouragement to exercise in a variety of places, while repeating their walking in some of the same places walked in previously, and (g) the specific walking time in minutes/seconds per mile that the participant should aim for the following week.

In sum, participants in the SC and ME groups received a walking program that incorporated key aspects of social cognitive theory; namely, information on the benefits of walking and the importance of planning walking sessions in advance, self-monitoring weekly walking, weekly social support, prompt feedback, encouragement from the project coordinator, and goal-setting for the following week. Although the identical SCT components were included in each group, the operationalization of these components differed. Copies of the feedback protocol and intervention materials are available from the investigator.

Measures

Participants completed the one-mile walk test and all demographic, health, and social-cognitive measures at baseline and post-test. Program evaluation measures were completed at post-test. Walking activity logs were completed from week one through week twelve of the walking program.

Physical Activity Measures

Fitness Outcomes. Improvements in physical fitness were measured with the one-mile walk test (Kline et al., 1987). The walk test is a low-cost field test that requires participants to walk one mile on a level surface at their fastest comfortable pace. The walk test was administered using the standardized procedures outlined in Howley & Franks (1997). Participants walked one mile on a level track at a local indoor fitness facility (the Weight Club), that was precisely measured for mileage with a measuring wheel. They also wore a Polar A1 heart rate monitor during the walk test, which provided an estimate of their heart rate at the end of the walk test.

Two measures of physical fitness were obtained from the walk test. The first, walk test time, was *directly* measured using a stopwatch. Timing started when the investigator said "go", and stopped when participants' feet crossed the finish line. The second measure of physical fitness, *estimated* VO_2max, was computed using the equation provided in Howley & Franks (1997, p. 207). The walk test has been shown to yield estimates of VO_2max similar to those obtained from gold-standard treadmill tests across different age and gender groups (Freedson, Ward, Wilke, Rippe, 1991; Kline et al., 1987). Kline et al. (1987) reported that comparing observed and estimated VO_2max values for the one-mile walk test in a cross-validation group (N=169) resulted in r = .92.

Walking Program Adherence and Participation. Adherence to the 12-week walking program was obtained from walking logs that participants returned on a weekly basis through e-mail. Three measures of adherence to the program were obtained. First, the total number of walking logs returned was computed. Second, adherence to the walking prescription was calculated by dividing the number of walking sessions completed over the 12-week program by the number of session prescribed (36 sessions total). Third, the average number of times walked per week in each group was computed for (a) the entire 12-week program period, and (b) the final six weeks in the program.

Furthermore, the number of questions/comments participants submitted to the investigator from weeks one through 12 were summed to obtain a measure of "extra contact", in addition to the ongoing walking log submissions and feedback. A question/comment was counted as an extra-contact question if it focused specifically on some aspect of fitness walking or health-related outcomes of fitness walking, and if it required a response from the investigator. Questions about administrative aspects of the program (e.g. scheduling of walk-test assessments) were not counted.

In addition, the frequency participants reported walking in 21 different locations was summed, to obtain an estimate of frequently used walking locations. The 21 different walking locations were: unmeasured vs. measured route in own neighborhood, unmeasured vs. measured route in relative/friend's neighborhood, unmeasured vs. measured walking trail, measured school track, measured indoor walking track at community center, measured indoor walking track at gym, treadmill at gym, treadmill at home, unmeasured vs. measured route in a mall, unmeasured vs. measured route to/from an errand, unmeasured vs. measured campus route, beach, hiking location, other, and unknown.

Other Physical Activity. To determine the extent to which participants were engaging in physical activity *other* than walking, participants completed the Aerobics Center Longitudinal Study Physical Activity Questionnaire (ACLS, Kohl, Blair, Paffenbarger, Macera, & Kronenfeld, 1988), which measures the typical amount of weekly activity completed over the past three months. The total number of minutes participants reported for nine categories of physical activity (jogging, biking, swimming, aerobics, moderate sports, vigorous racquet sports, other vigorous sports, other activities, and weight training) in a typical week was summed.

Participants also completed the Stages of Change for Exercise Behavior Scale (Marcus, Selby, et al., 1992), which asks participants to select one of five statements that best describes their current level of exercise. Cardinal (1997) reported large differences between the exercise stages for VO_2max.

Demographic, Health, and Social Cognitive Measures

Demographic Variables. Self-reported information on sex, age, race, and educational level were obtained from the questionnaires to characterize the sample.

Body Mass Index. Participants' height and weight were assessed with a balance beam scale. Participants wore street clothing, without shoes and were instructed to remove heavy items from their pockets. Body mass index (BMI) was computed by dividing weight in kilograms by height in meters, squared.

Sleep Quality. Participants' sleep quality was assessed with the Pittsburgh Sleep Quality Index (PSQI, Buysse, Reynolds, Monk, Berman, & Kupfer, 1989), which assesses sleep quality and disturbances over a one-month time interval. Participants completed 18 questions that assessed seven dimensions of sleep quality: subjective sleep quality, sleep latency (time to fall asleep), sleep duration, habitual sleep efficiency (time spent sleeping divided by time in bed), sleep disturbances, use of sleeping medication, and daytime dysfunction. Following the procedure outlined by Buysse et al. (1989), these seven components were summed to obtain a global sleep quality score. The global PSQI score significantly differentiates normal sleepers from those with sleep disturbances on polysomnograms (sleep tests) (Buysse et al., 1989).

Social Support. Social support was measured with the 13-item Social Support for Exercise Scale (Sallis, Grossman, Pinski, Patterson, & Nader, 1987), which assesses how often family and friends provide support for exercise activities. This questionnaire was slightly modified by replacing the word "exercise" with the word "walk". Participants rated items on a 5-point Likert-type scale ranging from 1 (*None*) to 5 (*Very Often*). The modified family support and friend support subscales exhibited good internal consistency (alpha = .87 and .89, respectively).

Self-Efficacy. Self-efficacy was measured with two versions of the 12-item Self-Efficacy for Exercise Behavior Scale (Sallis, Pinski, Grossman, Patterson, & Nader, 1988), which assesses self-efficacy for making time for exercise, and for continuing a regular exercise program in the face of competing demands. The first version of this scale was the original version. In the second version of this scale, the word "exercise" in each sentence was substituted with the word

"walk". Two versions of this scale were administered to determine if a more specific version of this scale would yield similar results to the original version. Participants rated items on both scales on a 5-point Likert-type scale ranging from 1 (*I know I cannot*) to 5 (*I know I can*). The original and the modified versions of the self-efficacy scale exhibited good internal consistency (alpha = .82 and .81, respectively).

In addition, participants completed a 12-item self-efficacy questionnaire designed by the investigator, which assessed self-efficacy for using different walking skills. Participants rated items on a 5-point Likert-type scale ranging from 1 (*I know I cannot*) to 5 (*I know I can*). The self-efficacy for walking skills questionnaire exhibited good internal consistency (alpha = .82).

Outcome Expectations. Outcome expectations was measured with an expanded version of the Benefits of Physical Activity (BPA) Scale (Sallis, Hovell, Hofstetter et al., 1989). The 12-item BPA scale, used to assess positive outcome expectations, was supplemented with 12 items that assessed negative outcome expectations (Rovniak, Anderson, Winett, & Stephens, 2002). The scale was slightly modified by replacing the word "exercise" with the word "walk". Participants rated each of the positive and the negative outcome expectations on a scale ranging from 1 (*Not at all likely*) to 5 (*Extremely likely*). Furthermore, participants indicated the value placed on each outcome, by rating the personal importance of each of the positive and negative outcome expectations on a 5-point scale ranging from 1 (*Not at all important*) to 5 (*Extremely important*). As recommended by Rodgers and Brawley (1996), participants' ratings of the positive and the negative outcome expectation items were multiplied by their corresponding ratings of the outcome's value to obtain a score of valued outcome expectations for each item. The modified positive outcome expectations scale and the modified negative outcome expectations scales exhibited good internal consistency (alpha = .89 and .76 respectively).

Enjoyment. The 18-item Physical Activity Enjoyment Scale (Kendzierski &DeCarlo, 1991) assessed attitudes related to the enjoyment of physical activity. This scale was slightly modified by replacing the word "exercise" with the word "walk". Participants rated items on a 7-point Likert-type scale ranging from 1 (*I hate it*) to 7 *(I enjoy it*). The modified enjoyment scale exhibited excellent internal consistency (alpha = .94).

Self-Regulation. The 10-item Exercise Goal-Setting Scale (EGS) and the 10-item Exercise Planning and Scheduling Scale (EPS, Rovniak et al., 2002) were used to assess goal-setting, self-monitoring, problem solving, and scheduling and planning regular exercise. The two scales were slightly modified by replacing the word "exercise" with the word "walk". In addition, one item in the EPS scale, "Everything is scheduled around my exercise routine—both classes and work", was changed to "Everything is scheduled around my walking routine—both work and social relationships". Participants rated items on a 5-point scale ranging from 1 (*does not describe*) to 5 (*describes completely*). The modified EGS scale and the modified EPS scale exhibited good internal consistency (alpha = .83 and .80, respectively).

Program Evaluation. Both the SC and the ME participants completed a 32-item program evaluation questionnaire at post-test to assess satisfaction with various aspects of the walking program. There was also a section for open-ended comments about the positive and negative aspects of the walking program. In addition, the ME group completed 13 additional program

evaluation questions to assess satisfaction with aspects of the walking program specific to the ME group (e.g. using a stopwatch, feedback graphs).

Hypotheses

1. Participants in the ME group will exhibit greater change in physical fitness (measured by walk test time and estimated VO_2max) from baseline to posttest than participants in the SC group.
2. Participants in the ME group will demonstrate better self-reported walking adherence (measured by walking log return rate, adherence rate, and mean number of times walked per week), than participants in the SC group.
3. Participants in the ME group will exhibit greater change in walking self-efficacy, walking skills self-efficacy, goal setting, and planning from baseline to posttest compared to participants in the SC group.
4. Both the ME and the SC group will exhibit similar change in social support from family and friends, positive and negative outcome expectations, and enjoyment.

Statistical Analyses

All measured variables were examined for their normality. Following the procedures described in Tabachnick and Fidell (2001), attempts were made to transform all variables with significant skewness. If a transformed variable still exhibited significant departure from normality, as suggested by Tabachnick and Fidell (2001), the variable was dichotomized. Next, a series of one-way analyses of variance (ANOVA) were conducted to evaluate the baseline equivalence of the SC and ME groups. Changes from baseline to post-test in walk test time, estimated VO_2max, BMI, minutes engaged in activity other than walking, sleep quality, social support, self-efficacy, outcome expectations, and self-regulation were examined separately using a 2 × 2 repeated measures analysis of covariance. The between-participants factor was treatment group (SC, ME) and the within-participants factor was time (baseline, posttest). Between-group differences in walking adherence and program evaluation ratings were examined using one-way analysis of covariance (ANCOVA) for normally distributed, continuous variables, and logistic regression for dichotomized variables. In the analyses of walking adherence, it was conservatively assumed that participants who did not return a walking log for a week did not complete any walking for that week. In all analyses, age was included as a covariate.

In addition, effect sizes (Cohen's *d*) were computed for all key outcome measures (see Tables 4 to 7) following the procedures described in Lipsey (1990, p. 77-78), and Lemura, Duvillard, and Mookerjee (2000). Two types of effect sizes were calculated. First, as recommended by Lipsey (1990) between-group effect sizes were calculated as the posttest ME group mean minus the posttest SC group mean divided by the pooled standard deviation. Second, as described by Lemura et al. (2000) within-group effect sizes were calculated for both the SC and the ME group to determine the extent to which each group improved from their baseline scores. This was done by taking the mean of posttest scores minus the mean of pretest scores for each group and dividing by the pooled standard deviation.

CHAPTER 3: RESULTS

Participants

Participant recruitment and attrition at each stage of the walking program is shown in Figure 1. Of the 235 individuals who responded to program advertisements, 68 (29%) met study inclusion criteria. Of these 68 individuals, 65 completed the baseline walk test assessment and questionnaires. Of the 65 individuals who completed the baseline assessment session, 62 (59 women, 3 men) attended the baseline orientation session and started the program. Of the 62 participants who started the program, 9 participants dropped out (5 in SC group, 4 in ME group). A dropout was defined as a person who formally dropped out (n=7), or who could not be contacted, or refused to complete the follow-up assessment (n=2). Reasons reported for dropping out included illness (1 person), being too busy (5 people), and dissatisfaction with program format (1 person); the remaining two people dropped out without reporting a reason. Additionally, because only three men entered the program, the investigator decided the results would be more interpretable if analyses were based on women; thus, the three men were dropped from analyses, resulting in a final sample of 50 women. Of these 50 women, all completed the baseline and posttest questionnaires, and the walking log measures. As a result of personal injuries sustained in the final three weeks of the program, 5 of the women were unable to provide data for the one-mile walk test (SC=2, ME=3). These injuries are detailed in Table 2.

The baseline characteristics of the female participants who provided data for the baseline and post-test measures are reported in Table 3. No differences between conditions were found on any of the demographic, physical fitness, health, and social cognitive variables, with the exception of age. Overall, the sample was middle-aged, overweight, 82% White, and 70% college-educated. Participants' sleep quality was slightly worse than in non-clinical samples (Buysse et al., 1989). Participants in both groups exhibited low levels of social support for walking, moderate to high levels of self-efficacy, high positive outcome expectations, low negative outcome expectations, moderately high enjoyment from walking, and low use of self-regulatory strategies. Participants were also physically inactive, with 92% of the sample indicating that they were "thinking of starting to exercise" or that they "exercised some, but not regularly". Participants completed the walk test in an average of 15.41 minutes, and their estimated VO_2max levels were in the "fair" to "good" range relative to other adults of similar age (ACSM, 2000).

A one-way ANOVA was conducted to determine if the women who dropped out of the program (n=9) differed significantly from those participants who remained in the program (n=50). There were no significant differences between the two groups on any of the demographic, health, social-cognitive, physical fitness, or physical activity measures. Furthermore, a one-way ANOVA was conducted to determine if the women who did not complete the walk test as a result of injuries (n=5) differed significantly from the remainder of the baseline sample (n=54). Compared to the other participants at baseline, women who did not complete the walk test as a result of injuries had a significantly slower walk-test time (17.52 vs. 15.56 minutes, F (1, 57) = 7.360; p = .009), a significantly lower estimated VO_2max (23.61 ml/kg/min vs. 32.48 ml/kg/min, F (1, 57)= 6.599, p = .01), and a significantly higher BMI (32.97 vs. 27.03, F (1, 57) = 7.037, p = .01).

Program Adherence and Participation

Walking Log Return Rate. Out of a possible 12 weekly walking logs that could be returned for each group, participants in the ME group returned a mean of 11.5 walking logs (SD =1.8) while the SC group returned a mean 10.72 walking logs (SD=2.34). Because the distribution of this variable still exhibited significant skewness after a Log-10 transformation (skewness greater than two), the variable was dichotomized into those who returned all 12 walking logs versus those who returned fewer than 12 walking logs. Logistic regression analysis indicated that the ME group was 2.95 times more likely to return all 12 walking logs than the SC group, but this difference did not reach significance (95% confidence interval for difference (CI), .78 to 11.19; p = .11).

Walking Adherence Measures. ANCOVA indicated no between-group differences in adherence to the 36 walking sessions prescribed over the 12-week program (Table 4). The ME group completed 74% of the prescribed sessions, while the SC group completed 68% of the prescribed sessions (p = .90). Furthermore, ANCOVA indicated no between-group differences in the mean number of walking sessions completed per week from weeks 1 through 12 of the walking program (p = .90), and from weeks 7 through 12 (p = .73).

Extra Contact. ANCOVA indicated significant between-group differences in the number of fitness walking-related questions/comments from participants that required a response from the investigator. Over the 12-week program, the ME group submitted a mean of 2.46 questions per participant, while the SC group submitted a mean of 1.08 questions per participant (F (1, 47) = 4.281, p = .04). Questions/comments spanned a variety of topics.

Walking Locations. Frequency distributions were examined to determine the number of people in each group who completed at least one walk in each of the 21 different walking locations. These frequency distributions indicated that the top three most frequently chosen walking locations for the ME group were measured walking trails (n=18), measured routes in their own neighborhoods (n=15), and measured school tracks (n=9). The top three most frequently chosen walking locations for the SC group were unmeasured routes in their own neighborhood (n=20), unmeasured routes on a university/college campus (n=15), and unmeasured routes in relatives'/friends' neighborhoods (n=10). There were no significant between-group differences in the average number of different locations walked in over the 12 week program (p = .81) (Table 4).

Physical Fitness and Body Mass Index

Walk Test Time. Repeated measures ANCOVA indicated a significant interaction between group and time for one-mile walk test time (Table 5). The ME group improved their walk test time by a mean of 86 seconds (equivalent to 1.43 minutes), while the SC group improved their walk test time by a mean of 32 seconds (equivalent to .54 minutes) from baseline to posttest (F (1,42) = 7.271, p = .01). The main effect for group showed a trend toward significance (F (1,42) = 3.730, p = .06); the main effect for time was nonsignificant. Furthermore, an intent-to-treat analysis was conducted in which baseline walk test times were substituted for post-test walk times for the fourteen women who did not complete the walk test as

a result of attrition or injury (seven scores each were substituted for the SC and the ME group). The intent-to-treat analysis indicated a significant interaction between group and time for walk test time. The ME group improved their walk test time by a mean of 65 seconds (equivalent to 1.09 minutes), while the SC group improved their walk test time by a mean of 25 seconds (equivalent to .41 minutes) from baseline to posttest (F (1, 56) = 5.855, p = .02). The main effect for group showed a trend toward significance (F (1,56) = 3.774, p = .06); the main effect for time was nonsignificant.

Estimated VO_2max. The ME group showed a larger mean increase in estimated VO_2max than the SC group from baseline to post-test, but the interaction between group and time did not reach significance (p=.22). The ME group improved their estimated VO_2max by 2.11 ml/kg/min, while the SC group improved their estimated VO_2max by .78 ml/kg/min (Table 5). The main effect for group and the main effect for time were both nonsignificant. An intent-to-treat analysis was conducted in which baseline VO_2max scores were substituted for posttest VO_2max scores for the 14 women who did not complete the walk test. Although the ME group still showed a larger mean increase in estimated VO_2max than the SC group from baseline to posttest (1.60 ml/kg/min vs. .61 ml/kg/min), once again, the interaction between treatment and time did not reach significance (p = .22). Results of the intent-to-treat analysis for estimated VO_2max also indicated that the main effect for group and the main effect for time were nonsignificant.

Body Mass Index. Results of repeated measures ANCOVA for body mass index indicated that the main effect for group, the main effect for time, and the interaction between group and time were nonsignificant. The walking program did not decrease body mass index for participants in either the SC or the ME group.

Physical Activity and Sleep

Physical Activity. Because the distribution for the physical activity variable measuring non-walking related physical activity exhibited significant skewness, a Log-10 transformation was performed on baseline and post-test scores across both groups. Repeated measures ANCOVA with the log-transformed physical activity variable indicated that the main effect for group, the main effect for time, and the interaction between group and time were nonsignificant. The walking program did not result in an increase in non-walking related physical activity for participants in either the SC or the ME groups. In repeated measures ANCOVA with the exercise stage-of-change measure, the main effect for time exhibited a trend toward significance (F (1,47) = 2.776, p = .10); the main effect for group and the interaction between group and time were nonsignificant (Table 6).

Sleep Quality. Results of repeated measures ANCOVA for sleep quality indicated a trend toward significance for the main effect of group (F(1,47) = 2.892, p = .10); the main effect for time, and the interaction between group and time were nonsignificant. The walking program did not improve sleep quality for participants in either the SC or the ME group (Table 6).

Social Cognitive Outcomes

Self Efficacy. Repeated measures ANCOVA for *exercise* self-efficacy indicated that the main effect for group, the main effect for time, and the interaction between group and time were

nonsignificant. The walking program did not result in an increase in self-efficacy for making time for exercise and for dealing with competing demands for both the SC and the ME groups. Repeated measures ANCOVA for *walking* self-efficacy indicated a trend toward significance for the main effect of time (F (1,47) = 3.665, p=.06); the main effect for group and the interaction of group and time were nonsignificant. Participants in both the SC and the ME may have increased their self-efficacy for making time for walking and for dealing with competing demands. Repeated measures ANCOVA for walking skills self-efficacy indicated that the main effect for group, the main effect for time, and the interaction between group and time were nonsignificant. Overall, the walking program did not result in an increase in confidence for walking skills such as walking briskly and swinging one's arms at 90 degree angle for both the SC and the ME groups (Table 6).

Self-Regulation. Repeated measures ANCOVA indicated a significant interaction between group and time for goal-setting (F (1, 47) = 4.600, p = .04). Participants in the ME group increased their level of goal-setting to a greater extent than participants in the SC group from baseline to posttest. The main effect of group and the main effect of time were nonsignificant. Furthermore, results of repeated measures ANCOVA for planning and scheduling walking indicated that the main effect for group, the main effect for time, and the interaction between group and time were nonsignificant. The walking program did not result in an increase in scheduling and planning walking activities for participants in either the SC or the ME group (Table 6).

Enjoyment. Results of repeated measures ANCOVA for enjoyment indicated that the main effect for group, the main effect for time, and the interaction between group and time were nonsignificant. The walking program did not result in an increase in walking enjoyment for participants in either the SC or the ME group (Table 6).

Outcome Expectations. Results of repeated measures ANCOVA for positive outcome expectations indicated a trend toward significance for the interaction between group and time (F (1,47) = 3.233, p=.08), and a trend toward significance for the main effect of group (F (1,47) = 2.869, p =.10). The main effect for time was nonsignificant. The ME group may have increased their positive expectations about the outcomes of walking more than the SC group. Results of repeated measures ANCOVA for negative outcome expectations indicated that the main effect for group, the main effect for time, and the interaction between group and time were nonsignificant. The walking program did not result in a decrease in negative expectations about the outcomes of walking for participants in either the SC or the ME group (Table 6).

Social Support. Results of repeated measures ANCOVA for family and friend social support indicated that the main effect for group, the main effect for time, and the interaction between group and time were nonsignificant. The walking program did not result in an increase in social support for participants in either the SC or the ME group (Table 6).

Program Evaluation Outcomes

ANCOVA indicated significant between-group differences in overall satisfaction with the program (Table 7). In response to 27 questions assessing program satisfaction on a 1 to 5 point

Likert-type scale, participants in the ME group had a mean satisfaction score of 4.59 compared to a mean score of 4.01 for the SC group (F (1,47) = 2.991, p = .001). Furthermore, participants were compared on their responses to the question: "If another 12 weeks of the program were offered, I would sign up again". Because the distribution of this variable was still skewed after a Log-10 transformation, participants were dichotomized into those who selected a response of 5, indicating "total agreement" that they would sign up for another 12 weeks of the program versus those who selected a response less than 5 (indicating less than total agreement that they would sign up for another 12 weeks of the program). Participants in the ME group were 3.8 times more likely to indicate "total agreement" that they would sign up for another 12 weeks of the program, compared to participants in the SC group (95% CI for difference, 1.12 to 13.10; p = .03). Overall, 64% of participants in the ME group indicated total agreement that they would sign up for 12 additional weeks of the program, compared to 32% of participants in the SC group. In addition, participants were compared on their responses to the question, "I felt a sense of mastery and accomplishment in this program". There was no significant between-group difference for scores on this variable (p=.20).

Participants were also asked about their satisfaction with structural aspects of the program. When asked if they would prefer to send in their walking logs through e-mail or through a webpage in a future walking program, 88% of the ME group indicated that they would prefer to send in their walking information through e-mail, compared to 60% of participants in the SC group (p = .05). Participants' feedback was also collected for walking pace-related aspects of the program. Eighty-eight percent of ME group participants indicated that increasing walking speed by 10 to 20 seconds each week felt "about right", while 8% said it was "too challenging". Participants in the SC group also exhibited high levels of satisfaction with the program's walking pace: 100% indicated that the walking pace was "about right". Satisfaction with the prescribed walking frequency of three times a week was also high; 88% of the ME group participants and 76% of the SC group participants indicated that the walking frequency felt "about right". Satisfaction with the prescription to walk 2 miles (or approximately 30 minutes) per walk was more mixed; 84% of ME group participants and 56% of SC group participants were satisfied with this walking duration/distance. Eight percent of the ME participants would have preferred to walk more than the prescribed two miles, and 8 percent would have preferred to walk less. Thirty-two percent of the SC group participants would have preferred to walk more than 30 minutes, and 8 percent would have preferred to walk less. Overall, most participants felt that the level of contact with the investigator (one weekly reminder note/tip of the week and one weekly feedback e-mail) was "about right"; 100% of ME participants and 92% of SC participants were satisfied with this level of contact.

Additional Analyses

Additional analyses were conducted to determine the correlation between specific mastery-based procedures; namely goal-setting, feedback, modeling, and walking in different locations, and three walking outcomes: improvement in walk test time, improvement in estimated VO_2max, and program adherence. To obtain improvement in walk test time and improvement in estimated VO_2max, difference scores were calculated by subtracting baseline scores from posstest scores. Subsequently, the three walking outcomes were correlated with each item on the goal-setting scale administered at posttest, with all items on the program evaluation

questionnaire, and with the total number of different locations walked in from weeks one through 12 of the walking program. None of the individual goal-setting items correlated significantly with improvements in estimated VO_2max or walk test time. However, one item, "I tend to break more difficult goals down into a series of smaller goals" exhibited a trend toward a significant association with improvement in walk test time (r = - .29, p = .05). Almost all of the goal-setting items exhibited significant correlations with walking adherence, with correlations typically ranging between r = .31 and r = .34. The two goal-setting items most strongly associated with adherence were: "I usually have more than one major walking goal" (r = .42, p = .003), and "I usually achieve the walking goals I set for myself" (r = .38, p = .007).

Among the program evaluation outcomes, only four items emerged as significant correlates of walking outcomes. The item, "I found it motivating to measure my walking speed relative to a specific distance" (administered only to ME participants) demonstrated a significant correlation with improvement in estimated VO_2max (r = .43, p < .05) and with improvement in walk test time (r = - .52, p = .01). The item, "I changed my walking style as a result of the walking demonstration" (administered only to ME participants) emerged as a significant correlate of improvement in walk test time (r = - .44, p = .04). The items, "I plan to continue walking after the program ends", and "I felt a sense of mastery and accomplishment in the program" were significant correlates of walking adherence (r = .34, p = .02; and r = .30, p = .04, respectively).

The total number of different locations walked in from weeks 1 through 12 of the walking program was significantly correlated with walking adherence (r = .31, p = .03), but not with improvements in walk test time or estimated VO_2max.

CHAPTER 4: DISCUSSION

SCT variables appear to be important determinants of physical activity (Bandura, 1997; Rovniak et al, 2002), but little is known about how to operationalize these variables to maximize increases in physical activity and physical fitness. The current study emphasized two different ways of operationalizing the SCT variables of goal-setting and feedback to produce mastery experiences. Although the identical SCT variables were targeted in both the SC and the ME conditions, these variables were operationalized in distinctly different ways. The SC group received general walking goals and general feedback that while encouraging, did not provide precise information on how well they were doing. The ME group received more specific walking goals, and precise feedback that informed them precisely how good (or how badly) they were doing, and what specific steps needed to be taken the following week to increase walking speed. Although the three-minute walking/modeling demonstration was not designed to be an intensive training session, its purpose was to set a "standard" for what brisk walking should resemble.

Physical Fitness Outcomes and Program Participation

Overall, on the fitness outcome of one-mile walk test time, the ME group performed better than the SC group. The ME group exhibited a decrease in walk test time of 86 seconds, almost three times as much as the 32 second decrease evidenced by the SC group. The 86 second improvement was similar to the 84 second improvement observed in a 12-week, walking program with weekly face-to-face meetings (Tucker & Mortell, 1993), and was also similar to the 69 second improvement observed in another recent, Internet-based walking program (Whiteley, 2002). Although this improvement in walk test time did not translate to a significant difference between groups in estimated VO_2max, the ME group's VO_2max increase of 2.11 ml/kg/min was double that of the SC group's increase of .78 ml/kg/min. The lack of correspondence between the ME group's walk test time improvement and estimated VO_2max suggests that while ME participants had learned to walk faster, their cardiovascular systems had not yet adapted physiologically to the increased pace. This ME group's increase in heart rate at the end of the walk test from 136 beats per minute at baseline to 152 beats per minute at posttest, is consistent with this notion. It may be that a longer program or a longer follow-up period is needed to produce larger increases in estimated VO_2max. In a SCT-based fitness walking study by Coleman et al. (1999) which involved once-weekly meetings with an exercise counselor for 16 weeks, participants who were instructed to walk three to five times a week for 30 minutes a session evidenced a 2.1 ml/kg/min improvement in estimated VO_2max at the end of 16-weeks—identical to the outcome for the ME group. However, by 32-week follow-up, the same participants in the Coleman et al. (1999) intervention had increased their estimated VO_2max by 4.9 ml/kg/min from baseline.

An alternative explanation for the lack of correspondence between the one-mile walk test time and estimated VO_2max is that walk test time is a *direct* measure of physical fitness, while estimated VO_2max is based on a combination of variables that may be subject to a greater amount of error. For example, heart rate for estimated VO_2max is taken when the participant stops the walk test; however, it is unknown if this heart rate is representative of participants' average heart rate while walking. Similarly, while body weight for the estimated VO_2max equation was objectively measured in this study, participants were wearing a variety of street

clothes. Still, the estimated VO_2max score from the one-mile walk test shows a high correspondence with gold standard measures of VO_2max (Kline et al., 1987), which supports the validity of the current estimated VO_2max measure.

Finally, it may be that both groups did not significantly improve their estimated VO_2max scores, as both groups were relatively fit at the beginning of the study, with fitness levels in the fair to good range. Although participants' baseline fitness levels were similar to those reported in the Coleman et al. (1999) study, they had higher baseline fitness levels than those reported in many other walking programs with sedentary adults (e.g. Avila & Hovell, 1994; Jakicic et al., 1999 (personal communication for specific data); Perri et al., 2002; Whiteley, 2002). It may be that a moderate intensity, unsupervised walking program did not provide a sufficient training stimulus to raise participants' fitness levels. Although fitness walking can be aerobically challenging (Rippe et al., 1988), participants may have needed more intensive training in racewalking skills, or direct walking supervision to continuously walk at an intensity sufficient to produce fitness benefits. Providing heart rate monitors to participants might also have helped them to maintain an aerobically challenging walking pace. However, even the small, nonsignificant fitness changes observed in the ME group may have public health significance, as evidence suggests that small fitness improvements can substantially reduce risk of heart disease and stroke (Lee & Blair, 2002; Williams, 2001). Furthermore, the ME group's ability to walk at a faster pace at the end of the walking program is important, as the ability to walk quickly could facilitate greater fitness improvements in the long-term. Current research also suggests that regular brisk walking, and exercise at higher perceived intensity levels independently reduces risk for cardiovascular disease (Manson et al., 1999; Lee, Sesso, Oguma, & Paffenbarger, 2003).

In addition to improved one-mile walk test times, the ME group gave the program a significantly higher overall evaluation than the SC group on 27 questions that assessed program satisfaction. The magnitude of this difference was equivalent to an effect size of 1.17. Furthermore, twice the number of ME participants as SC participants (64 vs 32%) indicated that they would definitely sign up for another 12-weeks of the program. These findings are relevant, as an important goal of physical activity research is to promote long-term maintenance of physical activity (Marcus et al., 2000). Furthermore, because e-mail/Internet based interventions may one day be fully automated and require minimal human input, they have the potential to become lifelong interventions if they can sustain participants' interest over time.

Given that participants were sufficiently motivated to sign up for a walking program, and received reminders to turn in their walking logs each week, it is not surprising that both groups exhibited similar levels of adherence to the program, and walked an average of approximately two times per week. The approximately 70% adherence rate across both groups is similar to the 71% adherence level observed in a recent review of 29 fitness walking interventions (Rovniak, 2001). However, there was a slight trend for ME participants to return more walking logs than SC participants, suggesting that they may have been more motivated to receive the weekly feedback. Unexpectedly, ME participants had a higher level of contact with the investigator and e-mailed a substantially greater number of questions/comments over the program that required a personal response. The reasons for this greater number of questions are unclear. The additional questions spanned a variety of topics from the reasons for feeling a sense of happiness/elation at the end of a walk, to dealing with shin splints, to questions about the feedback graph, amongst

other topics. Overall it appeared that the ME group that was more involved and more actively thinking about their training than was the SC group. This extra contact partially compromises interpretation of the results of this study, as the intervention effects may have been influenced by the additional e-mail exchanges, independent of the specific manipulation of feedback and goal-setting.

Self-Efficacy and Mastery Experiences

Unexpectedly, ME participants did not show greater improvements than SC participants did on any of the three measures of self-efficacy. This may suggest that the theoretically based procedures used in the ME group did not significantly enhance mastery beyond those used in the SC group. On a program evaluation question that assessed whether participants experienced a sense of mastery and accomplishment in the program, the ME group's slightly higher mean scores than the SC group were equivalent to a medium effect size (Rosenthal, Rosnow, & Rubin, 2000) but this difference did not reach significance. It is possible that having succeeded in taking approximately two walks per week, both groups felt similar levels of mastery. Alternatively, it is likely that the operationalization of mastery experiences in the ME group could be improved in future interventions. By the second week of the program, the investigator observed a flaw in the design of the ME program. The instructions to walk in a variety of different locations to build generalized self-efficacy across different walking situations were not compatible with the goal of showing walking speed improvement on a graph. If participants walked in a hilly location one week and on flat terrain the following week, walking times could differ substantially. The ideal solution might have been to have multiple graphs for different types of walking routes, but given that graphs were individually produced in Microsoft Excel, the investigator's schedule and resources did not permit the production of multiple graphs for each person. Another solution to this issue could be to conduct a study to determine the effect of different inclines/terrain types on participants' average walking speeds. Then, in future studies, it might be possible to impute a "correction factor" for the type of terrain walked on, when considering walking time. In the present study, the investigator dealt with this issue by adding a short note to the participants' feedback e-mails, reminding them that walking speeds reflect the types of terrain walked on. In addition, attempts were made to compare participants' walk times for the current week with walks completed earlier in the program on similar surfaces.

Another factor that may have compromised the development of effective mastery experiences for participants in the ME group was that the walking demonstration was brief, and did not coherently cover advanced race-walking skills. Although it appeared sufficient for most participants, there were a few participants whose baseline walk test time was in the 12 to 13 minute/mile range. Such participants might need a more intensive training workshop to develop skills to permit them to walk faster. Furthermore, all ME participants, regardless of baseline walk test time might have realized a greater sense of increased mastery if they had been exposed to the instruction of an expert race-walker in a longer training session. Again, this was not possible given the resources of the current study.

It is also notable that participants' baseline levels of self-efficacy were already relatively high, with mean scores averaging over three on all of the self-efficacy measures. Given that our current environments typically present more opportunities and prompts for sedentary, than for

active behaviors (Sallis, Bauman, & Pratt, 1998), it may not be realistic to expect participants to exhibit substantially higher scores on items that assess confidence for "making time" for exercise and for dealing with competing demands.

Finally, it is possible that the current method of assessing self-efficacy was not sensitive enough to detect change. Items measuring self-efficacy to "walk at a brisk pace for 30 minutes" or to "walk briskly in different settings", might have had stronger effects had they been phrased with more precise terminology. For example, participants could have been asked about their self-efficacy to walk at a specific pace (in minutes: seconds) for 30 minutes, or to walk at a specific pace (in minutes: seconds) in a frequently used walking location. This idea is consistent with Bandura's (1997) recommendation that self-efficacy should be assessed relative to a specific context, and relative to the specific level of challenge in a situation.

Mastery-Based Processes

Although the mastery-based procedures did not increase self-efficacy in the present study, correlational analyses suggested that these procedures may have been important determinants of program adherence and fitness outcomes. Specific goal-setting and feedback were the mastery-based variables most strongly targeted in the ME group, and, as hypothesized, participants in the ME group increased their level of goal-setting more than participants in the SC group. As with previous research, (Martin et al., 1984), the current study suggests that these specific goal-setting and feedback procedures may have been critical for achieving good program outcomes. Participants in the ME group who reported finding it motivating to measure walking speed relative to a specific distance, an activity that inherently provides specific goals and feedback, were more likely to demonstrate improvements in estimated VO_2max and walk test times. In turn, those who experienced mastery in meeting their goals tended to have better program adherence. In addition to the important contribution of specific goal setting and feedback, the walking modeling demonstration appeared to have important effects for some participants. Those who changed their walking style as a result of the walking demonstration tended to have better walk test times at posttest. These results suggest that specific goal-setting and feedback, in conjunction with modeling are critical variables to target in future interventions with sedentary adults.

The findings extend previous research by suggesting that operationalizing goals and feedback in more specific ways than has traditionally been done may lead to better program outcomes. Most previous walking interventions with sedentary adults have emphasized goal-setting and feedback related to walking frequency, rather than focusing on gradual improvements in walking time (e.g Avila & Hovell, 1994; Coleman et al., 1999; Chen et al., 1998). In addition, the use of feedback graphs in walking studies with sedentary adults has been rare. Only one walking study (Martin et al., 1984) could be located in which participants received individualized feedback through graphs, and no walking study was located in which the experimenter delivered graphs that showed both self-improvement and improvement relative to similar others. The use of these procedures in the present study led to better walk test times, more frequent goal-setting, and greater program satisfaction in the ME group. Further refinements to these mastery-based procedures such as using more sophisticated feedback graphs, having a more intensive racewalking training session, incorporating heart rate monitors

into some training sessions, and incorporating greater environmental supports might lead to even better program outcomes.

Strengths and Limitations

Strengths of the present study include its use of the one-mile walk test, an objective measure of physical activity. In addition, it is one of the few studies that has attempted to maintain equivalent contact and physical activity levels across groups, while operationalizing SCT variables in different in different ways.

Weaknesses of the current study include its use of a one-mile walk test assessor who was not blind to treatment condition, and having the same person conduct both the assessments and the intervention. Some participants may have tried "harder" because they had developed a relationship with the assessor over 12 weeks of e-mail contact. Although standardized directions were followed in the walk-test administration, it would have been desirable to have an assessor without background knowledge of the program. The participants were also highly educated, and predominantly White. It is possible that the results might not generalize to more diverse groups with lower education. In addition, the lack of long-term follow-up limits our knowledge of the longer-term effectiveness of this program. Moreover this study assessed the relative effectiveness of four combined procedures involved in mastery experiences: goal setting, feedback, modeling, and mastery in different settings. The individual contributions of each of these variables to treatment outcome are unknown. Finally, this study revealed the inherent challenge of trying to manipulate one variable without having unintended effects on another variable. In addition to the unexpected level of extra-contact in the ME group as a result of extra questions, one participant commented that getting a free stopwatch was a nice "gift" that impressed her with the "professionalism" of the investigators, and increased her level of commitment to the program. Thus, while the stopwatch was intended to promote accurate self-monitoring of walking speed, it may have had additional effects that were likely not experienced by the SC group. Future studies might control for the perception of receiving a "gift" by giving the SC group a gift unrelated to physical fitness such as a sunhat or t-shirt.

Overall, among a sample of highly educated, self-selected women motivated to walk, an intervention that operationalized mastery experiences in a manner consistent with SCT resulted in better one-mile walk test times, increased goal setting, and higher program satisfaction than an intervention that operationalized mastery experiences in a manner consistent with standard care. These results suggest that the effectiveness of an intervention is more than "the sum of its parts". Implementing an SCT-based intervention that targets the key variables of social support, self-efficacy, outcome expectations, and self-regulation provides no guarantee of treatment effectiveness. What may matter more than the total sum of SCT components targeted is the "features" of these parts or components. Operationalizing variables in a manner consistent with theory, and incorporating knowledge gained from pilot studies is likely to lead to interventions that yield better physical activity and fitness outcomes, and reduced risk of chronic diseases in sedentary adults.

FIGURE 1.

Participant Flow Diagram

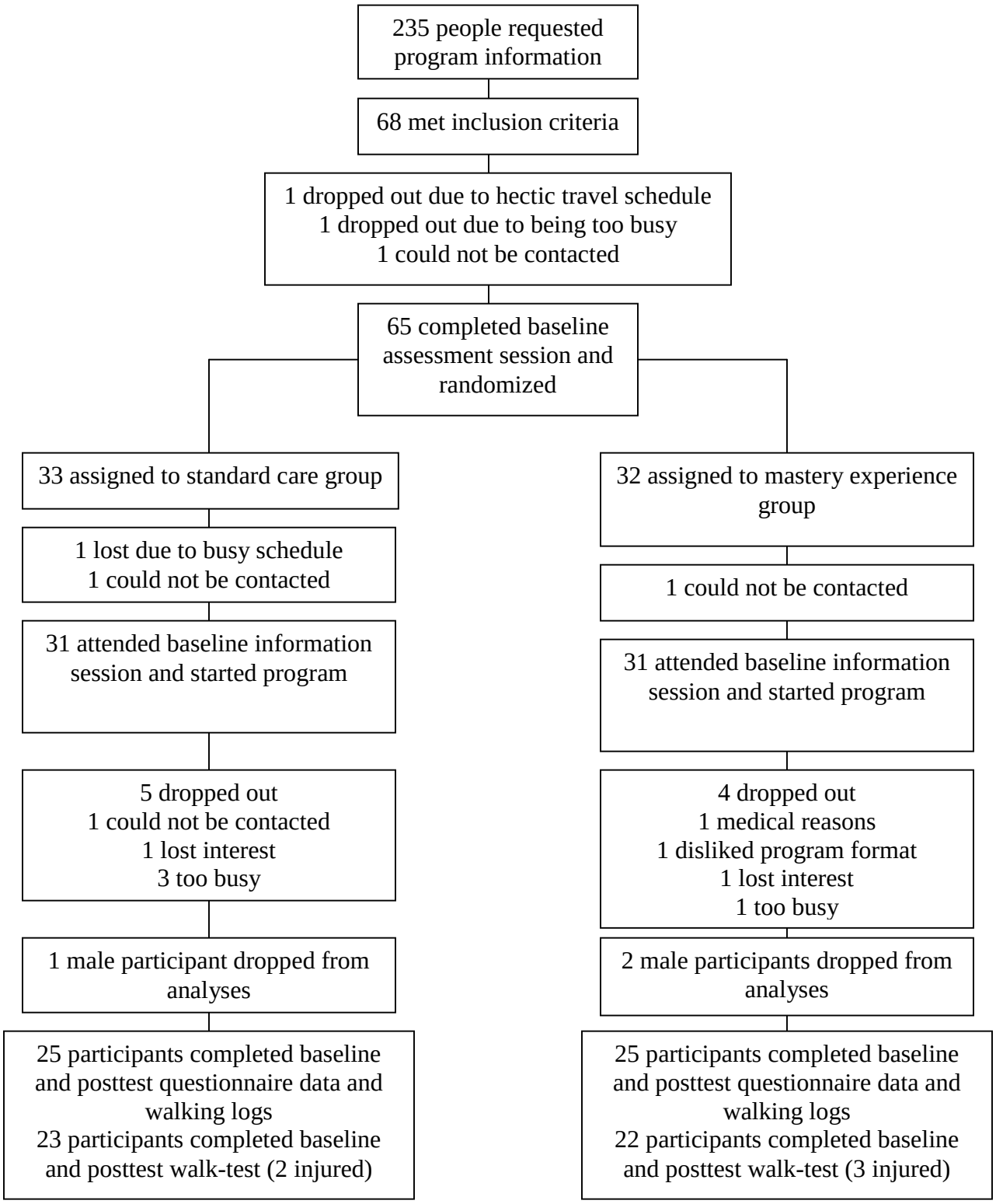

TABLE 1.

Intervention Procedures

Common Intervention Procedures Across the SC and ME Groups		
Assessments: Both the SC and ME groups were required to complete the one-mile walk test and the same set of questionnaires before and after the walking program.		
Informational Session: Both groups attended an approximately 30-minute orientation session, during which both groups received a walking program manual and a walking log notebook.		
Equivalent Contact: Both groups completed a 12-week walking program, received a once weekly tip of the week/reminder note, e-mailed their walking logs once weekly to the project coordinator, and received a once weekly feedback note.		
Equivalent amount of information self-monitored: Both groups were instructed to write down six pieces of information about their walks: date, duration, pace (SC group) or mileage (ME group), rating of perceived exertion, overall well-being, and walking location.		
Walking Prescription: Both groups were instructed to walk three times per week for approximately 30 minutes, and to attempt to gradually increase their speed.		
Walking Safety: Because the walking program was unsupervised, both groups were instructed to keep their level of exertion between 3 and 4 on the Borg rating of perceived exertion scale.		
Differences in the Operationalization of Mastery Experiences Across the SC and ME Groups		
	Standard Care Group	*Mastery Experience Group*
Modeling	• Received information on brisk walking techniques in walking program manual, but did not receive a 3-minute walking demonstration, or corrective feedback on their walking form.	• Received information on brisk walking techniques in walking program manual, AND received a 3-minute walking demonstration, and corrective feedback on their walking form, as needed.
Self-monitoring	• Self-monitoring of walking speed is imprecise. Participants rank walking speed on a 1 to 4 point descriptive scale.	• Self-monitoring of walking speed is precise. Participants walk on measured walking routes, and time their walks with a stopwatch.
Goal setting and progression	• Participants are told to "gradually increase their walking speed", but no long-term walking speed goal is given, nor are participants instructed on how much to increase their walking speed each week. There is no hierarchical organization of goals.	• Participants are told to "gradually increase their speed". They are given a long-term speed goal, and specific instructions about how much to increase their walking speed each week (short-term goals). Goals are organized hierarchically. Participants must achieve their current speed goal before attempting a more difficult speed goal.
Feedback	• Participants are given general feedback about their walking speed. The feedback does not include normative information about how their walking speed	• Participants are given specific feedback about their walking speed. Average walking speeds are computed weekly and compared to the previous week's performance,

	compares to other individuals of similar age and the same gender.	self-improvement can be observed on the feedback graph, and normative information is provided about how the participant's walking speed compares to other individuals of similar age and the same gender.
Practice in Diverse Settings	• Participants are advised in the walking program manual that it is a good idea to walk in a variety of settings, and the weekly feedback note indicates that walking in a variety of settings adds interest to walking.	• Participants are advised in the walking program manual that it is a good idea to walk in a variety of settings. In addition, in the weekly feedback note, they receive specific instructions to walk in several different places each week, while repeating their walks in some of the places they walked previously. They also receive a specific prompt in week two of the program to try a new walking location.

TABLE 2.

Description of Injuries in Both Groups

Participant	Description of Injury
Standard Care	
Participant A	Went on vacation in final week of program, and severely sprained ankle while windsurfing. The investigator observed that the women's ankle was in a brace when post-test questionnaires were completed.
Participant B	Injured foot while moving heavy items around at work. A heavy item reportedly fell on her foot.
Mastery Experience	
Participant A	Suffered from plantar fascitis in the last few weeks of the walking program. Participant reported that she did not have time to seek medical treatment for her condition, and reported feeling some pain while walking.
Participant B	Reported cramps in her ankles in the last few weeks of the program. She was unable to walk without limping (as observed by the investigator). She reported that she did not have time to seek medical treatment for her condition during the post-test assessment period.
Participant C	She reportedly injured her back and neck while landscaping her yard at home. During the post-test assessment period, she indicated that she was still receiving physical therapy and was not feeling "100%".

TABLE 3.

Baseline Characteristics of Participants in Both Groups

Self-reported variables	Standard Care Group (*n* =25) Mean (SD) or n	Mastery Experience Group (*n*=25) Mean (SD) or n	Significance (*p*-value)
Age	37.36 (9.35)	42.64 (8.01)	.04
Ethnicity			
White	20	21	.38
Education			
High School	2	6	
Some College	5	1	
Bachelor's degree	9	9	
Masters/Ph.D.	8	9	.93
Overall sleep quality	6.08 (3.37)	4.80 (2.14)	.12
Social support from family	1.82 (.60)	2.06 (.85)	.26
Social support from friends	1.95 (.85)	1.81 (.74)	.53
Exercise self-efficacy	3.36 (.57)	3.42 (.61)	.73
Walking self-efficacy	3.62 (.48)	3.62 (.62)	.99
Walking skills self-efficacy	4.42 (.45)	4.39 (.44)	.80
Positive outcome expectations	16.52 (4.90)	17.27 (4.35)	.57
Negative outcome expectations	4.40 (1.65)	4.03 (1.97)	.48
Enjoyment	5.37 (1.20)	5.53 (.83)	.60
Goal Setting	1.88 (.75)	1.80 (.62)	.71
Planning	1.93 (.57)	1.95 (.78)	.90
Weekly minutes of physical Activity (Log-10)	.67 (.93)	.36 (.75)	.19
Exercise stage of change	2.64 (.64)	2.72 (.61)	.65

Measured Variables	Standard Care Group (*n* =23) Mean (SD) or n	Mastery Experience Group (*n*=22) Mean (SD) or n	Significance (*p*-value)
Body mass index (kg/m^2)	26.85 (4.45)	27.09 (4.74)	.86
Walk test time (minutes)	15.49 (1.29)	15.34 (1.36)	.71
Estimated VO_2max (ml/kg/min)	34.99 (6.73)	32.15 (5.29)	.29

TABLE 4.

Data from Walking Logs on Walking Adherence and Participation

	Standard Care Group (n = 25) Mean (SD)	Mastery Experience Group (n = 25) Mean (SD)	F (p-value)	Effect Size (Cohen's d)
Adherence (%)	.68 (.28)	.74 (.31)	F (1, 47) = .02, p = .90	.20
Mean number of walking sessions completed (weeks 1 to 12)	2.04 (.85)	2.20 (.93)	F (1, 47) = .02, p = .90	.18
Mean number of walking sessions completed (weeks 6 to 12)	1.89 (.99)	2.17 (1.17)	F (1, 47) = .12, p = .73	.26
Mean number of walking questions/comments (weeks 1 to 12)	1.08 (1.29)	2.46 (1.98)	F (1, 47) = 4.281, p = .04	.83
Total number of different places walked in (weeks 1 to 12)	5.72 (2.69)	5.92 (3.06)	F (1, 47) = .06, p = .81	.07

TABLE 5.

Changes from Baseline to Posttest for Physical Fitness and Body Mass Index

	Standard Care		**Mastery Experience**		***F (df)* (*p*-value)**			**Effect Size (Cohen's *d*)**		
Measure	Baseline Mean (SD)	Posttest Mean (SD)	Baseline Mean (SD)	Posttest Mean (SD)	Group	Time	Group × Time	Between -groups	Within-group, SC	Within-group, ME
TREATMENT COMPLETERS (SC, *n* = 23; ME, *n* = 22)										
1-mile walk test time (minutes)	15.49 (1.29)	14.95 (1.51)	15.34 (1.36)	13.91 (1.34)	3.730 (1,42) (.06)	.725 (1, 42) (.40)	7.271 (1,42) (.01)	- .73	- .38	- 1.06
Estimated VO_2max (ml/kg/min)	34.21 (7.35)	34.99 (6.73)	32.15 (5.29)	34.26 (5.62)	.468 (1,42) (.50)	.016 (1,42) (.90)	1.559 (1,42) (.22)	- .12	.11	.39
Body mass index (kg/m^2)	26.85 (4.45)	26.69 (4.30)	27.09 (4.74)	26.84 (4.65)	.010 (1,42) (.92)	.044 (1,42) (.84)	.151 (1,42) (.70)	.03	- .04	- .05
INTENT-TO-TREAT (SC, *n* = 23; ME, *n* = 22)										
1-mile walk test time (minutes)	15.91 (1.60)	15.50 (1.85)	15.56 (1.66)	14.47 (1.90)	3.774 (1,56) (.06)	.589 (1,56) (.45)	5.855 (1,56) (.02)	- .55	- .24	- .61
Estimated VO_2max (ml/kg/min)	32.37 (8.68)	32.98 (8.43)	31.07 (6.71)	32.67 (7.22)	.740 (1,56) (.39)	.014 (1,56) (.91)	1.572 (1,56) (.22)	- .04	.07	.23

TABLE 6.

Changes from Baseline to Posttest for Social Cognitive and Health Variables

	Standard Care (*n*=25)		**Mastery Experience (*n*=25)**		***F* (*df*) (*p*-value)**			**Effect Size (Cohen's *d*)**		
Measure	Baseline Mean (SD)	Posttest Mean (SD)	Baseline Mean (SD)	Posttest Mean (SD)	Group	Time	Group × Time	Between -groups	Within-group, SC	Within-group, ME
Exercise self-efficacy	3.36 (.57)	3.31 (.59)	3.42 (.61)	3.59 (.78)	.551(1,47) (.46)	1.242 (1,47) (.27)	.570 (1,47) (.45)	.40	-.09	.24
Walking self-efficacy	3.62 (.48)	3.42 (.63)	3.62 (.62)	3.67 (.84)	.263 (1,47) (.61)	3.665 (1,47) (.06)	.307 (1,47) (.58)	.34	-.36	.07
Walking skills self-efficacy	4.42 (.45)	4.30 (.51)	4.39 (.44)	4.48 (.60)	.101 (1,47) (.75)	.166 (1,47) (.69)	1.123 (1,47) (.30)	.32	- .25	.17
Positive outcomes	16.52 (4.89)	16.51 (4.40)	17.27 (4.35)	19.03 (3.91)	2.869 (1,47) (.10)	.644 (1,47) (.42)	3.233 (1,47) (.08)	.61	.00	.43
Negative outcomes	4.40 (1.65)	4.92 (2.30)	4.03 (1.97)	4.40 (1.86)	.408 (1,47) (.53)	.668 (1,47) (.42)	.045 (1,47) (.83)	- .25	.26	.19
Enjoyment	5.37 (1.20)	5.67 (.78)	5.53 (.83)	5.96 (.88)	.509 (1,47) (.48)	.936 (1,47) (.34)	.313 (1,47) (.58)	.35	.30	.50
Goal-setting	1.88 (.75)	2.43 (1.10)	1.80 (.62)	3.02 (.87)	.963 (1,47) (.33)	.922 (1,47) (.34)	4.600 (1,47) (.04)	.59	.58	1.62
Planning and scheduling	1.93 (.57)	2.56 (.74)	1.95 (.78)	2.76 (.89)	.694 (1,47) (.41)	1.109 (1,47) (.30)	.337 (1,47) (.56)	.24	.95	.97

	Standard Care (*n*=25)		**Mastery Experience (*n*=25)**		***F* (*df*) (*p*-value)**			**Effect Size (Cohen's *d*)**		
Measure	Baseline Mean (SD)	Posttest Mean (SD)	Baseline Mean (SD)	Posttest Mean (SD)	Group	Time	Group × Time	Between -groups	Within-group, SC	Within-group, ME
Family social support	1.82 (.60)	2.34 (.67)	2.06 (.85)	2.64 (.65)	1.178 (1,47) (.28)	.291 (1,47) (.59)	.013 (1,47) (.91)	.45	.82	.77
Friend social support	1.95 (.85)	2.18 (.65)	1.81 (.74)	2.19 (.64)	.078 (1,47) (.78)	.018 (1,47) (.89)	.197 (1,47) (.66)	.02	.30	.55
Overall sleep quality (lower scores better)	6.08 (3.37)	5.76 (3.43)	4.80 (2.14)	4.36 (2.58)	2.892 (1,47) (.10)	1.055 (1,47) (.31)	.171 (1,47) (.68)	-.46	-.09	-.19
Physical activity (Log-10)	.67 (.93)	1.27 (1.05)	.36 (.75)	.61 (.94)	2.170 (1,47) (.15)	1.927 (1,47) (.17)	1.298 (1,47) (.26)	-.66	.60	.29
Stage of change	2.64 (.64)	3.84 (.55)	2.72 (.61)	3.72 (.74)	.037 (1,47) (.85)	2.776 (1,47) (.10)	.688 (1,47) (.41)	-.18	2.01	1.47

TABLE 7.

Summary of Data from Program Evaluation Questionnaires

	Standard Care Group (n = 25) Mean (SD)	Mastery Experience Group (n = 25) Mean (SD)	F (p-value)	Effect Size (Cohen's d)
Overall program satisfaction	4.01 (.61)	4.59 (.35)	F (1, 47) =2.991, p = .001	1.17
Felt a sense of mastery and accomplishment in the program	3.96 (1.06)	4.48 (.82)	F (1, 47) =1.661, p = .20	.55

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Writing Group for the Activity Counseling Trial Research Group (2001). Effects of physical activity counseling in primary care. JAMA, 286(6), 677-687.

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CURRICULUM VITAE

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EDUCATION

Doctoral Student, August 1997 – present
Clinical Health Psychology
Virginia Polytechnic Institute and State University

Dissertation: Operationalizing Mastery Experiences in E-mail-Based Fitness Walking Programs
Chair: Richard A. Winett, Ph.D.

Preliminary Examination: How Well are We Operationalizing Social-Cognitive Theory in Walking Programs?: A Critical Review and Research Agenda
Chair: Richard A. Winett, Ph.D.

Master of Science, December 1999
Clinical Health Psychology
Virginia Polytechnic Institute and State University

Thesis: Social-Cognitive Determinants of Physical Activity in Young Adults:
A Prospective Structural Equation Analysis
Chair: Richard A. Winett, Ph.D.

Bachelor ofArts, October 1996
Psychology, with Distinction
McGill University, Montreal, Quebec

Diploma of College Studies, June 1993
Liberal Arts, with Honors
Dawson College, Montreal, Quebec

PROFESSIONAL AFFILIATIONS

American Psychological Association (student affiliate).
Association for the Advancement of Behavior Therapy (student affiliate).

Society of Behavioral Medicine (student affiliate).

RESEARCH EXPERIENCE

Psychology Intern
Center for Behavioral Epidemiology & Community Health, San Diego State University, August 2002 to present.
Supervisors: Melbourne F. Hovell, Ph.D., MPH, Mary Mulvihill, Ph.D., Kristen Keating, Ph.D.

Assisting with the write-up of several manuscripts for HIV-prevention interventions targeting individuals with high risk sexual practices, helped to refine physical activity assessment procedures for a physical activity and diabetes prevention program with Latino women, wrote assessment section for physical activity promotion grant for low-income Latino women that was recently funded, helping to deliver injury prevention classes to children as part of a family-based osteoporosis prevention project, wrote two grant proposals to examine how stressful life events compromise tobacco-control efforts in low income women, critically evaluating ongoing center projects and providing feedback to improve program effectiveness.

Project Coordinator—E-Mail Based Fitness Walking Program
Center for Research in Health Behavior, Virginia Tech, October 2001 to May 7, 2003.
Supervisors: Richard A. Winett, Ph.D., Janet Wojcik, Ph.D.

Coordinated a 12-week e-mail based fitness walking program for 62 sedentary adults based on social cognitive theory, as part of doctoral dissertation. Tested the effectiveness of two different ways of operationalizing mastery experiences through an experimental intervention group and a standard care comparison group. Designed intervention protocol, coordinated and supervised fitness assessments, met individually with each participant to explain walking program and answer questions, and delivered weekly walking feedback and walking tips to all participants.

Program Developer—Nutrition Intervention
Virginia Tech ASPIRES grant
Center for Research in Health Behavior, Virginia Tech, March 2001 to August 2001
Supervisors: Janet Wojcik, Ph.D., Richard Winett, Ph.D.

Designed a nutrition intervention based on motivational principles of behavior change in collaboration with a nutritionist.

Health Interviewer and Assessment Clinic Assistant
National Cancer Institute Cancer Prevention in Rural Churches Grant
Center for Research in Health Behavior, Virginia Tech, May 2001 to August 2001
Supervisors: Eileen Anderson, Ed.D., Janet Wojcik, Ph.D., Richard Winett, Ph.D.

Conducted interviews with church members to assess cardiovascular risk factors, nutrition, and exercise habits. Assessed church members' blood pressure, heart rate, body

fat, height and weight, and assisted with administration of 1-mile walk test for physical fitness. Prepared tailored health feedback letters for 65 church members.

Research Assistant—Web-based Program for Adolescents in Underserved Rural Areas
Virginia Health Care Foundation Grant
Center for Research in Health Behavior, Virginia Tech, May 1998 to January 1999.
Supervisors: Richard A. Winett, Ph.D., Jessica A.Whiteley, M.S.

Administered web-based nutrition education modules to female high school students; analyzed and coded outcome data, designed physical activity part of web-based intervention; researched physical activity outcome measures.

Research Assistant—Meta-Analysis on Motivational Effects of Rewards
McGill University, Department of Psychology, September 1996 to July 1997
Supervisor: Richard Koestner, Ph.D.

Assisted in developing a meta-analysis on the effects of rewards and verbal feedback on people's intrinsic motivation for diverse activities, conducted literature searches, coded experimental data.

Independent Undergraduate Research Project
McGill University, Department of Psychology, September 1996 to July 1997
Supervisor: Richard Koestner, Ph.D.

Proposed an original project on exercise motivation, conducted study at fitness club, analyzed data using SPSS for Windows, prepared manuscript.

Research Assistant—Health and Mental Health Services for Deaf People
McGill University, Department of Psychology, May 1995 to July 1996
Supervisor: James MacDougall, Ph.D.

Organized and produced an annotated bibliography covering approximately 150 articles on deafness, health, and mental health issues; prepared a written report.

CLINICAL EXPERIENCE

Project Coordinator—Internet-Based Treatment Program for Insomnia
Virginia Tech Psychological Services Center, January 2001 to Janaury 2002.
Supervisor: Lee D. Cooper, Ph.D.

Developed an Internet-based treatment program for insomnia using an empirically validated treatment protocol, created a 36-page treatment manual, organized and wrote material for an affiliated website (http://www.iprimus.ca/~sheilah/webone/index.htm), and successfully pilot-tested program with adults with insomnia.

Graduate Clinician—Clinical Practicum
Virginia Tech Psychological Services Center

August 1997-May 1998; August 1998-May 1999; August 2000 to January 2002.
Supervisors: George A. Clum, Ph.D., Lee D. Cooper, Ph.D., Angela Scarpa, Ph.D., Robert S. Stephens, Ph.D.

Conduct individual psychotherapy and assessments with adult and child clients using a cognitive-behavioral approach. Issues dealt with in therapy and assessment cases have included: relationship difficulties, depression, anxiety, stress management, substance abuse, anger management, adjustment disorders, problem-solving, assertiveness training, weight loss and exercise, lesbian/gay adjustment issues, coping with visual impairment, bullying, social skills training, school phobia, ADHD, and school-related attention and motivational difficulties.

Psychology Intern—Pain Management Clinic
Center for Rehabilitative Medicine, Carilion New River Valley Hospital, Radford, VA
August 1999 to August 2000 (355 hour internship)
Supervisor: Roy H. Crouse, Ph.D.

Co-led psycho-educational group therapy for adults with chronic pain. Topics covered included pain education, relaxation training, stress management, cognitive therapy, sleep education, assertiveness training, problem solving, and goal-setting. Assessed and treated 21 adults with chronic pain, most with low socio-economic status, and many with a history of physical or sexual abuse. Wrote intake reports for 40 patients. Researched assessment instruments to improve intake procedures.

Psychology Intern—Sleep Disorders Clinic
Sleep Disorders Center of Southwest Virginia, Christiansburg, VA
June 1999 to July 1999 (100 hour internship)
Supervisor: Donald Zedalis, M.D.

Completed sleep medicine training program. Received training in scoring sleep studies, observed sleep consultations, attended surgical meetings, administered sleep questionnaire to clients.

TEACHING/EDUCATIONAL EXPERIENCE

Graduate Instructor—Personality Psychology
Department of Psychology, Virginia Tech, August 2000 to May 2001.
Supervisor: Richard A. Winett, Ph.D.

Taught undergraduate course in Personality Psychology for two semesters. Prepared and delivered course lectures for approximately 70 students each semester, held office hours, mentored four students, administered exams, graded essays, maintained course website and listserv.

Data Management Coordinator—Site-visit for reaccreditation
Department of Psychology, Virginia Tech, January 1999 to August 2000

Supervisor: Richard A. Winett, Ph.D.

Coordinated data collection to prepare for the clinical psychology program's site visit for reaccreditation. Designed a survey to track student outcomes, collected and analyzed outcome data, wrote sections of accreditation report, developed material to update clinical psychology program's web site.

Introductory Psychology Office Assistant
Virginia Tech, Department of Psychology, August 1997 to May 1998
Supervisor: Daniel LeBreton, M.S.

Answered students' questions, photocopied course material, assisted in creation of web-based psychology tutorials, word-processed documents, administered make-up exams.

Peer Health Educator
McGill University, Student Health Services, September 1996 to April 1997

Developed an e-mail hotline system to answer students' health questions, conducted health education seminars, assisted with health newsletter, 3 hours weekly.

Literacy Teacher
Reading Council for Literacy Advance in Montreal, September 1992 to June 1994.

Instructed illiterate English-speaking adults in basic reading and writing skills.

EXTERNAL FUNDING AND AWARDS

Fonds Pour La Formation de Chercheurs et L'aide à La Recherche (FCAR)
Dissertation Research Scholarship
Award from the Quebec government, given to top 20% of Ph.D. applicants.
Value = $33,000 Canadian, May 2001 to December 2002.

Graduate Research Development Project Grant
Award from Virginia Tech Graduate Student Association to conduct dissertation.
Value = $500, March 2002 to July 2002.

Citation Award from Society of Behavioral Medicine (April, 2002) for poster presentation entitled "Operationalizing social cognitive theory in walking programs: A critical review."

PUBLICATIONS

Rovniak, L.S., Anderson, E.S., Winett, R.A., & Stephens, R.S. (2002). Social-cognitive determinants of physical activity in young adults: A prospective structural equation analysis. *Annals of Behavioral Medicine, 24*(2), 149-156.

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

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 patterns of high school girls. *Journal of Gender, Culture, and Health*, *4*(3), 239-254.

Winett, R.A., Whiteley, J.A., Rovniak, L, Galper, D. I., & Graves, K.D. (1999). Blueprint for motivation: Theory and applications for exercise training. In M. Brzycki. (Ed.), *Maximize Your Training: Insights from Leading Strength and Fitness Professionals* (pp. 161-180). Indianapolis: Masters Press.

CONFERENCE PRESENTATIONS

Rovniak, L.S. (2002, April). *Operationalizing Social-Cognitive Theory in Walking Programs: A Critical Review.* Poster session presented at the 23rd annual convention of the Society of Behavioral Medicine, Washington, DC.

Rovniak, L.S. (2001, March). *Increasing Participation in Fitness Walking Programs: A Review of Recruitment Strategies, Participant Attrition, and Fitness Outcomes.* Poster session presented at the 22nd annual convention of the Society of Behavioral Medicine, Seattle, WA.

Rovniak, L.S., Anderson, E.S., & Winett, R.A. (2000, November). *The Development of Measures to Assess Valued Positive and Negative Outcome Expectations for Exercise: Results of a Prospective Study.* Poster session presented at the 34th annual convention of the Association for the Advancement of Behavior Therapy, New Orleans, LA.

Rovniak, L.S., Anderson, E.S., Winett, R.A., & Whiteley, J.A. (2000, April). *The Development of Measures to Assess Self-Regulation for Exercise: The Exercise Goal-Setting and Planning Scales*. Poster session presented at the 21st annual convention of the Society of Behavioral Medicine, Nashville, TN.

Rovniak, L.S., & Winett, R.A. (1999, November). *Social-Cognitive Determinants of Exercise Participation: A Prospective Investigation.* Poster session presented at the 33rd annual convention of the Association for the Advancement of Behavior Therapy, Toronto, Canada.

Rovniak, L., Finkelberg, D., & Koestner, R. (1998, August). *Rewards and Intrinsic Motivation: The Importance of Considering the Interest Level of the Activity*. Paper presented at the 106th annual convention of the American Psychological Association, San Francisco, CA.

Rovniak, L. (1998, April). *Strategies for Overcoming Exercise Barriers*. Poster session presented at the 2nd annual Virginia Collegiate Psychology Conference, Blacksburg, VA.

Whiteley, J., Psujek, J., Rovniak, L. (1998, April). *A New Measure to Assess Women's Physical Activity Outcome Expectations*. Poster session presented at the 2nd annual Virginia Collegiate Psychology Conference, Blacksburg, VA.

Whiteley, J.A., Winett, R.A., Winett, S.G., Bajzek, W., Rovniak, L., & Williams, D. (1999, November). *The Application of Social Cognitive Theory to the Dissemination of Eat4Life: An Internet-Based Health Behavior Program for Rural Adolescents.* Poster session presented at the 33rd annual convention of the Association for the Advancement of Behavior Therapy, Toronto, Canada.

Winett, R.A., Roodman, A.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 session presented at the 20th annual convention of the Society of Behavioral Medicine, San Diego, CA.

REFERENCES

References available upon request.