PROMOTING EXERCISE ADOPTION THROUGH COMPUTER NETWORKS

by

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ABSTRACT

The purpose of this study was to demonstrate the efficacy of an exercise (walking) adoption intervention delivered through computer networks using electronic mail. The study involved 65 participants (17 males, 48 females), recruited through electronic bulletin board postings and flyers, who were randomly assigned to one of two conditions. The *full* treatment involved information, prompting, self-monitoring, goal setting and specific electronically delivered weekly feedback on walking performance. The *minimal* treatment condition involved all procedures except the specific feedback. During the 10 week program, participants in the full treatment who used the computer based system each week, compared to participants in the minimal treatment, walked more days ($\bar{x}$=2.15 vs $\bar{x}$=3.01), more minutes ($\bar{x}$=76.17 vs $\bar{x}$=107.73), more fitness minutes ($\bar{x}$=57.90 vs $\bar{x}$=88.41), and met ACSM minimum guidelines (frequency and duration) during more weeks ($\bar{x}$=4.14 vs $\bar{x}$=6.30). Analyses also showed setting and attaining goals was related to increased walking frequency. Survival analyses showed the full treatment condition particularly

reduced and delayed dropouts of participants who were designated as contemplators or preparers (stage of change) at the start of the study. In addition, low enjoyment of walking was related to lower walking frequency and drop-out. In this highly computer-literate sample, computer attitudes were not related to infrequent interaction with the computer-based system. The study demonstrated the potential for using computer networks as a health behavior delivery system and showed the importance of goal setting and specific feedback, but also suggested the need for further tailoring of program offerings based on stage of change and other person characteristics.

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The overall health of Americans continues to be adversely affected by preventable illness, injury and disability (United States Department of Health and Human Services [USDHHS], 1991). Preventable risk factors such as tobacco, diet, activity patterns, alcohol, microbial and toxic agents, firearms, sexual behavior, motor vehicles, and illicit drugs have been linked to approximately 50 percent of the deaths occurring in the U.S. (McGinnis & Foege, 1993). Diet and physical activity patterns in particular are associated with 5 of the 10 leading causes of death (McGinnis, Richmond, Brandt, Windom, & Mason, 1992). Physical exercise has proven to be a health protective and disease preventive behavior and is associated with decreased risk for heart disease, hypertension, osteoporosis, non-insulin dependent diabetes, some forms of cancer, obesity and depression. Prospective studies have demonstrated that higher physical fitness is associated with lower relative risk for coronary heart disease mortality and all-cause mortality (Berlin & Colditz, 1990; Blair et al., 1989) and there appears to be a relationship between low activity patterns and increased risk of cancer (Lee, 1994). Furthermore, conditions previously attributed to "normal aging" (e.g. abdominal obesity) have recently been determined to be the result of sedentary lifestyle (Haskell et al., 1992). In addition, studies have shown regular exercise to be positively correlated with mental health and to be a significant factor for increased quality of life and longevity (King et al., 1992).

Well-documented evidence of the advantages of regular exercise has led to widespread belief that physical activity is beneficial for improved quality of life and health. Despite such beliefs, a large percentage of the American population do not engage in regular physical activity. Estimates vary as to the extent of inactivity, largely because the definition of "regular exercise" has many interpretations. However, it has been estimated that fewer than one-half of Americans exercise regularly when regular exercise is defined as exercising three or more days per week for at least 20 minutes, regardless of intensity (USDHHS, 1991). The estimates of exercise in Americans drop considerably when increased frequency or intensity parameters are applied to the definition of regular exercise. It has been estimated that only 22 percent of Americans exercise five or more times per week for at least 30 minutes and less than 10 percent of Americans are active at the level necessary to produce cardiovascular benefit (Dubbert, 1992; USDHHS, 1991).

Physical Activity and Fitness Guidelines

In order to address the public health burden imposed by inactivity, the federal government issued specific physical activity and fitness goals for the nation for the year 2000 (USDHHS, 1991). The two main fitness objectives are to increase moderate daily physical activity to at least 30% of people (a 36% increase) and to reduce sedentary lifestyle to no more than 15% of people (a 38% decrease) by the year 2000. The American College of Sports Medicine (ACSM) has also set forth specific cardiovascular fitness (intensity, duration, frequency), resistance or strength

training, and flexibility recommendations in order to insure health benefits from exercise. In 1990, the ACSM's recommendations included: a) intensity of training between 60-90% maximum heart rate (HR_{max}) or 50-85% of maximum capacity (VO_{2max}); b) duration of training between 20-60 minutes of continuous aerobic activity for each exercise session; and c) frequency of training between three to five days per week. In addition, resistance training of 8 to 12 repetitions for 8 to 10 exercises involving large muscle groups should be performed at least two times per week and each exercise session should have appropriate warm-up and cool-down periods which include flexibility exercises.

The Goals for the Nation and the ACSM guidelines were developed to encourage regular physical activity and to delineate appropriate frequency, duration and intensity parameters necessary for health benefits to accrue. For aerobic activity, the ACSM proposed a minimum standard which would include at least three days of exercise per week for at least 20 minutes at a minimum level of 60% HR_{max}. Despite these minimum standards and recommendations for exercise, few Americans meet these objectives. Thus, exercise promotion has become a major priority for reducing the public health burden imposed by physical inactivity and sedentary lifestyle.

Exercise Promotion Literature Overview

Research on exercise behavior has focused on factors which determine exercise and on developing intervention strategies to enhance exercise adoption and maintenance. A number of malleable (e.g. low self-efficacy) and non-malleable (e.g.

low socio-economic status) person-centered factors are associated with minimal physical activity (King et al., 1992). Overall, reviews of the literature show that initiating and maintaining exercise behaviors to appreciable health beneficial levels has often proven difficult within the context of exercise promotion studies (King et al., 1992).

Cognitive-behavioral approaches have demonstrated efficacy for promoting initiation and maintenance of exercise. Such strategies include: prompting, feedback, goal-setting, self-monitoring, social support, decision making, and relapse-prevention (King et al., 1992). Prior research has shown cognitive-behavioral strategies to be most effective when used in combination. For example, Atkins, Kaplan, Timms, Reinsch & Loftback (1984) found that combining cognitive components (e.g. cognitive restructuring) and behavioral components (e.g. self-control strategies) resulted in significantly more walking when compared with exercise levels of participants receiving either the cognitive or behavioral components alone or attention and no-treatment controls.

Studies on the effectiveness of prompting to enhance exercise adoption and adherence have revealed the efficacy of telephone calls as prompts for activity. Telephone calls have been shown to increase health club attendance (Wankel and Thompson, 1977) and weekly calls have proven successful for ensuring continuation of a moderate-intensity home-based physical activity program (King, Taylor, Haskell & DeBusk, 1988). Similarly, self-monitoring and bi-weekly calls to home-based

exercise participants produced greater adherence as compared with participants assigned to a group exercise condition (King & Garcia, 1991).

Feedback has been used to promote health behaviors, including exercise, but with mixed results (Kazdin, 1994). Results may be inconsistent because specific aspects of the feedback including specificity, frequency, source credibility, valence, value (added) and relationship to goals, determine its success in fostering the desired behavior (Duncan & Bruwelheide, 1986; Ilgen, Fisher & Taylor, 1979). For example, providing specific feedback about a participant's performance on a fitness test has been shown to increase intentions to exercise and self-reported activity (Desharnais, Godin, & Jobin, 1987; Durbeck et al., 1972). Similarly, heart rate monitors which provided contiguous, specific and valuable feedback when exertion surpassed or did not reach prescribed levels were shown to increase fitness levels and resulted in high levels of program adherence (75-90% adherence) (Juneau et al., 1987).

Weber and Wertheim (1989) examined the additive value of positive feedback given to subjects who were self-monitoring and setting goals for activity. They found that the addition of feedback to self-monitoring and goal setting did not significantly increase exercise class attendance. Similarly, Lombard, Lombard and Winett (in press) found that the addition of feedback to a weekly telephone prompt did not significantly increase adherence to exercise in subjects who were already self-monitoring and setting exercise goals. In both cases, evaluator's feedback may not

have added any value about performance because study participants were already aware of their performance through self-monitoring.

Feedback and goal setting are often combined in cognitive-behavioral interventions. Although Locke's goal setting principles receive consistent empirical support from research in industrial and organizational settings, the data from sport and exercise studies have been equivocal (Poag & McAuley, 1992; Weinberg, 1994). Methodological variations between studies and difficulty in manipulating the feedback given to individuals about their sport performance (performance can be more ambiguous in organizational settings) has led to discrepant findings between the two bodies of literature. For example, Weinberg and his colleagues conducted a series of studies investigating goal difficulty and its effect upon performance in sports and exercise settings (Weinberg, Bruya, Garland & Jackson, 1990; Weinberg, Bruya, Jackson & Garland, 1987; Weinberg, Burton, Yukelson, & Weigand; 1993). In these studies the experimenter assigned participants to easy, moderately difficult, very difficult and virtually impossible goal conditions. No significant differences in performance were found between groups in any of the studies. One proposed hypothesis for the lack of differential performance between groups was that participants often set their own exercise goals and did not rely exclusively on experimenter goals to drive performance (Weinberg, 1994). Other studies examining differences in goal specificity in sport and exercise settings have found support for Locke's theory that specific, challenging goals lead to greater performance than do-

your-best goals or no goals (Hall, Weinberg, & Jackson, 1987; Weinberg, Bruya & Jackson, 1985). Despite inconsistent findings in the sport and exercise literature, Weinberg (1994) still endorsed the importance of goal setting as a potential source of self-motivation for individuals involved in exercise programs.

In considering what motivates people to exercise researchers have investigated the role of enjoyment in adherence to exercise regimens. Much of the research in exercise promotion has focused on "what" people perceive they are doing during exercise (i.e. exertion levels). In order to assess "how" people feel during exercise, Rejeski, Best, Griffith and Kenney (1987) developed the Feeling Scale (FS), an 11-point Likert scale of pleasure/displeasure for rating affective response to exercise. Investigations of ratings of perceived exertion (RPE; Borg, 1962) and feelings or affective responses to exercise have shown them to be related, especially as the demand of exercise increases; however the RPE and FS have proven to be conceptually distinct measures (Hardy & Rejeski, 1989). King and Garcia (1991) examined perceived exertion, enjoyment, and convenience (PEEC) as predictors of long term (e.g., 12 month) adherence to exercise and found that these variables did not account for a significant portion of the variance over and above self-efficacy and group assignment; however, they recommended further examination of these variables in future research. Wankel (1993) proposed enjoyment to be critical for increasing adherence, stating that enjoyment of the activity leads to psychological benefits derived from exercise.

Problems in Assessing Outcomes of Exercise Research

It has been difficult to evaluate the efficacy of exercise promotion interventions because comparisons between programs has been complicated by the use of different outcome measures. Given the disparity among outcome measures, direct comparisons between and across programs are not always possible. Comparisons of compliance or adherence rates between studies are dependent upon comparable operational definitions of the terms. Typical measures of exercise adherence have included various behavioral, physiological, and psychological indices. Within any given category, definitions of program success and adherence can vary. For example, the behavioral outcome of a walking program could be frequency of walking, frequency of sustained walking (e.g. for 20 minutes or more), or frequency of sustained walking at desired intensity (e.g. target heart rate). In addition, adherence may be operationalized as meeting a minimum frequency goal of three sessions of exercise per week or merely attending any exercise session in a given week. Thus, reported results of any given study may convey differing levels of fitness benefit and treatment effectiveness depending upon the outcome measure used.

Despite difficulties involved in comparing exercise promotion interventions, it has been concluded that treatments using cognitive-behavioral and behavior modification techniques have shown 10 to 75% increases in the frequency of exercise as compared with no-treatment controls (King et al., 1992). Belisle, Roskies, and Levesques (1987) used a cognitive-behavioral intervention, including relapse-

prevention, and reported adherence (e.g., attendance of group exercise sessions) rates of 42.6%. Similarly, King and Garcia (1991) reported long term (12 month) adherence rates (e.g., exercise reported/exercise prescribed) of over 60% across all groups and 70% in participants assigned to a home-based exercise condition. Lombard et al. (in press) also combined cognitive behavioral strategies (prompting, feedback, goal-setting, self-monitoring, and social support) in an intervention designed to promote exercise adoption. They found weekly contact to program participants to "touch base" increased both the number of days of exercise per week ($\bar{x}$=2.25 days per week) and exercise duration ($\bar{x}$=98 minutes) when compared to participants contacted once per three weeks ($\bar{x}$=1.9 days, $\bar{x}$=52 minutes) and control subjects ($\bar{x}$=1.1 days, $\bar{x}$=40 minutes) who received no project-initiated contact. Thus, more frequent phone prompts enhanced the outcomes of a program using self-monitoring, goal-setting and social support.

In Lombard et al. (in press) participants were contacted via telephone, however, the person who delivered the telephone prompt was randomized each week. Therefore, no attachment to the contactor, or confounding based on characteristics of the contactor, influenced the results of the study. Because such interpersonal processes seemingly did not contribute to the efficacy of procedures, the researchers recommended extending this intervention research to examine the effects of telephone voice mail or electronic mail to prompt participants to exercise. This recommendation served as one basis for the current project.

Stages of Change

The transtheoretical model (stages of change) has provided a useful framework for matching various health-behavior change interventions to the participant's level of readiness for change (Prochaska, DiClemente, & Norcross, 1992; Prochaska, DiClemente, Velicer, & Rossi, 1993). The initial stage, *Precontemplation*, occurs when a person is not considering making a change in his/her behavior. Precontemplation is followed by *Contemplation* in which a person is considering making a change in their behavior and focus is placed on positive outcomes which can be expected from the behavior change. The *Preparation* stage represents a critical point in the behavior change process because it involves making steps toward the target behavior. For most health behaviors, a person in the preparation stage has experienced a cross-over in a "decisional balance," such that the pros of change now outweigh the cons (Prochaska. et al., 1993). For preparers, identification of individual barriers to change, plans for overcoming barriers, a commitment and a plan for action should facilitate movement into the Action stage. *Action* involves performance of the target behavior and is the stage for which most behavior change programs are designed. Techniques useful for action include reinforcement management, social support, shaping, and practice. Many of the cognitive-behavioral strategies used in exercise promotion interventions are appropriate for the person in the Action stage. Finally, *Maintenance* represents a phase in which the behavior developed in the action stage is sustained. Initial performance of the target behavior

is important but maintenance of the change is the ultimate goal of health promotion programs. Successful performance of the target behavior, meeting goals, and dealing with lapses should increase efficacy and help to maintain the behavior change.

The transtheoretical model suggests that the intervention components or interventions which are most appropriate at each step of the change process may differ and that change may be facilitated by tailoring a behavior change program to account for the process of change (Prochaska, et al., 1992). The current study focused on an intervention most appropriate for those in *preparation* and early stages of *action*.

Computer Technology

The limited resources allocated for health promotion mandate the development of innovative and cost-effective interventions. The utility of designing "expert systems" for computer mediated interventions has been demonstrated in a number of studies (for review see Bloom, 1992). Interactive computer treatments have been designed for use in cases of mild depression (Selmi, Klein, Griesk, Sorrell & Erdman, 1990), agoraphobia (Ghosh, Marks, & Carr, 1984) , obesity (Burnett, Taylor, & Agras, 1985), dietary change (Winett et al., 1991), smoking cessation (Burling et al., 1989; Prochaska et al., 1993; Velicer et al., 1993) and for general health counseling including changes in diet, weight, exercise and smoking (Burnett, Magel, Harrington, & Taylor, 1989).

There is accumulating evidence to suggest that computer-based interventions, combining information with tailored programs and individual feedback, can effectively change health behaviors. Although results from their study must be tempered by the difficulties associated with small sample sizes and self-report measures, Burnett et al. (1989) found students' health behavior was more positively influenced by a computer-assisted program when compared to a standard health education program. Similarly, Prochaska et. al. (1993) compared four self-help smoking cessation programs and found no significant increases in effectiveness with the addition of counselor initiated phone calls ("personalized treatment") to a treatment already including stage-appropriate smoking cessation manuals and computer-generated individualized feedback reports. In fact, the interactive computer treatment equalled and eventually surpassed (at 18 month follow-up) the personalized treatment group and more than doubled the long-term outcomes achieved with a standard treatment (American Lung Association Manual), providing more evidence for computerized systems as economical and effective intervention agents. These results speak to the potential efficacy of designing other expert systems for health behavior change which can be delivered through computer-based technology.

Goals of the Present Research

In the present study, an intervention which combined information, prompting, feedback, goal-setting and self-monitoring was delivered through computer electronic mail (e-mail). E-mail was chosen based on the effectiveness of prior exercise

promotion research using telephone prompts and feedback. One of the great advantages to e-mail was that it provided greater efficiency for contacting program participants when compared with telephone contact because the program operator could deliver feedback to a large number of people without a set appointment. In addition, the automated procedures used in this intervention allowed for more efficient and standard delivery of feedback to participants, thus yielding a shorter time interval between the target behavior and receipt of a potential reinforcer. Further, e-mail has great appeal for use in future interventions as it alleviates the limitations geographic proximity imposes on participants access to programs, in a sense expanding the definition of "community" in community health promotion.

The primary objective of this research was assessment of the efficacy of computer e-mail for promoting the initiation of walking for exercise. Although computer applications have been developed for a variety of health behaviors and phone calls have been shown to promote exercise, the success of computer contact and computer-generated feedback messages has not been demonstrated for promotion of exercise. Thus, a demonstration study and efficacy trial was desirable in order to justify further refinements of computer intervention techniques for exercise promotion. Furthermore, this study provided a scientific investigation of the potential for adapting or translating an intervention strategy which was successful in one communication mode (e.g. print plus phone contact, Lombard et al., in press) into electronic medium. Another goal of this research was to assess the additive value of

specific feedback in response to a participant's self-reported performance and goals - over and above information, self-monitoring, goal setting, and general exhortation. It was hypothesized that e-mail contact would be as effective as phone contact (i.e., Lombard et al., in press) for promoting the initiation of exercise and that specific feedback would enhance exercise adoption.

A secondary objective of this research was the investigation of weekly computer prompts and computer transmission of logs for return of data to improve the reporting compliance of participants. Finally, process goals of this research involved an examination of (a) the association between interacting with the computer-based system and participants' attitudes, anxiety and self-efficacy towards computers, (b) the relationship between walking during the weeks of the program and stage of change, (c) the relationship between walking and participants' perceived exertion and enjoyment ratings, and (d) critical points of exercise drop-out in the program (detected by the hazard function in survival analysis).

Methods

Participants

Seventy-two participants volunteered for the "Healthy Habits Walking for Fitness Program". The program was advertised using flyers, newspaper articles, and postings on electronic bulletin boards (see Appendix A). Participants were faculty and staff from Virginia Polytechnic Institute and State University, although participation was open to any community resident with computer access to the

Blacksburg Electronic Village (a network linking Blacksburg residents and the University to the Internet).

Participants were randomly assigned to either a *full* treatment condition (information, prompts, self-monitoring, goal setting, and specific feedback) or a *minimal* treatment condition (information, prompts, self-monitoring, goal setting, and general exhortation). *Thus the only difference between conditions was the specific feedback given in the full treatment on performance and goal attainment.*

Some participants enrolled in the program with a partner(s). In order to avoid treatment contamination from partners discussing the nature of the feedback they received during the program, partners were randomly assigned to treatment groups as pairs or groups after all individuals were assigned.

Three participants assigned to the minimal treatment condition telephoned to drop-out prior to the first week of the study (one due to illness and two with difficulty connecting by modem to the BEV network). In addition, two participants in each condition never responded or provided any data to the project. Thus, the total sample of participants in the walking program was 65 (full treatment, n=35; minimal treatment, n=30). See Table 1 for participant characteristics of the total sample.

Procedure

Individual or small group face-to-face training sessions were conducted one-week prior to the start of the program. Participants were given a handbook of

walking information, target heart rate training, and received instructions about how to transmit walking logs via computer (see Appendix B). Target heart rate training involved completing a worksheet to find each participant's 10 second heart rate, instructions about appropriate methods for taking their heart rate, and a practice trial.

All participants were randomly assigned to transmit their walking log on a scheduled day each week. If a participant did not walk during any week, they were instructed to send an e-mail message stating "I did not walk this week". Walking logs contained the following information about each walking session - day of the week; length of walk; distance of walk (miles); 10 second heart rate; rating of perceived-exertion (RPE, Borg, 1962); feeling scale rating of exercise enjoyment (Hardy & Rejeski, 1989), names of walking partners, and a walking goal for the following week (time goal and if desired distance goal). Borg's rating of perceived exertion scale (RPE) was used as it has been shown to be a reliable and valid evaluation of the perception of exercise intensity and has been shown to reliably estimate physiological heart rate measures (Dunbar et al., 1992, Hardy & Rejeski, 1989). Similarly, the FS has been shown to have face and content validity as a measure of "in-task" exercise related affect (Hardy & Rejeski, 1989).

The Computer-based System (Walkbot)

A UNIX mainframe computer was programmed to receive and process all data. The computer system was designed to parse out the relevant walking log

information from the e-mail message, to save the data to a file, and to send any questions from participants to the program administrator (via e-mail).

Each week, during the 10 weeks of the program (February 28, 1994 to May 8, 1994), participants in both conditions were automatically sent a computer-generated reminder prompt (through e-mail) to return walking logs. The following prompt was delivered in the morning on participant's assigned reporting days: "Remember to send in your walking log today!" The log information was entered in a specific format to enable the logs to be read and processed by the computer. When the program computer received a participant's log and it was error free, a receipt/confirmation note was sent to the participant via e-mail. If a participant's log contained errors (e.g. if information was missing, in an improper order, or exceeded range of values set for a variable) it was returned to the participant automatically by the computer-based system for corrections and re-submittal. All participants in each condition were involved in these procedures.

Computer-Generated Feedback: Difference between conditions

As noted, walking logs were automatically stored for processing by a mainframe computer the evening they were received. Feedback was generated by the computer and automatically sent to participants during off-peak network hours (e.g. 1-3 am). Thus, each week all participants received a computer generated feedback e-mail message the morning after they submitted their log. If no log was received on the specified reporting day, a message was sent stating that the log was not received

and requesting that it be sent as soon as possible. No follow-up phone calls or experimenter e-mail contacts were made so as not to confound the treatments with personalized contact or feedback. In the case that a log was sent in late, the computer generated and sent feedback when the log was received.

Different specific feedback messages were uploaded to the computer by the experimenter each week of the study. A series of algorithms were programmed into the computer-based system to determine appropriate feedback for participants. The algorithms were based on the treatment condition (full or minimal treatment) and the content of the participant's walking log. If a weekly log was received, all participants were sent the same "basic" message of encouragement. Participants in the full treatment received an expanded message which included feedback specific to performance (see example of weekly feedback for all algorithms in Appendix C). Feedback was provided which commented on progress in all of the specified reporting areas (e.g. number of days, duration, distance, heart rate, perceived exertion, enjoyment, goals). If a participant reported exceeding 75% of his/her specified heart rate during any session, instructions were given to reduce speed or otherwise moderate intensity. This message was provided for safety because this was an unsupervised program.

Participants in the minimal treatment received feedback added to their "basic" message only if their report of target heart rate for any days walked during a given week exceeded 75% of their specified target heart rate. They did not receive

feedback about any other reported parameters and thus, the only difference between the full and minimal treatment was the specific individualized feedback received by the full treatment participants each week.

Measures

Pre-program/Baseline Assessment

Participants completed the following assessment instruments (see Appendix D) at the initial training session: consent form, demographic questionnaire, physical activity readiness questionnaire (PAR-Q) (Chisholm, Collis, Kulak, Davenport, & Gruber, 1975); stages of exercise behavior change questionnaire; computer attitude scale (Nickell & Pinto, 1987); computer anxiety rating scale (Heinssen, Glass, & Knight, 1987); and computer self-efficacy scale (Murphy, Coover & Owen, 1989). Participants answering "yes" to any question on the PAR-Q were required to consult with their physician before beginning in the program. Thirteen participants were identified by the PAR-Q as in need of consultation with a physician before beginning an exercise program. These participants were asked to contact their physician and to send an e-mail message stating their physicians recommendations. In all cases, the physician gave clearance for (and often recommended) walking for exercise and approved of the intensity level prescribed by the program.

Exercise Outcome Measures

There were five outcome measures for exercise adoption and adherence. The measures were defined as follows:

(a) Walking frequency - the number of exercise sessions per week (range 0-7);

(b) Walking duration - the number of minutes of walking per week;

(c) Fitness minutes - the number of minutes walked at or above a participant's reported specified target heart rate (i.e., 60% HR_{max});

(d) Minimum ACSM -.the number of weeks each participant exercised three times for 20 minutes or more per session (i.e. meeting minimum ACSM minimum guidelines) (range 0 - 10 weeks); and

(e) Fitness ACSM - the number of weeks each participant exercised at least three times for at least 20 fitness minutes (i.e., 20 minutes at or above 60% HR_{max}) (range 0 - 10 weeks).

Goal Setting and Attainment

Goal setting was measured by recording the number of weeks a participant submitted a weekly exercise goal (e.g., goal of days and/or minutes, although both were encouraged). Goal attainment was measured through a comparison of the goal set for a given week with the actual number of exercise sessions and minutes recorded. The number of weeks participants met their goals for the number of exercise sessions and the number of weeks participants met their goals for number of minutes of exercise were the most liberal measures of goal attainment. The most stringent measure required that participants met their goal for number of days and minutes of exercise. None of the measures of goal attainment required that a participants' goal be at any set level of frequency, duration or intensity, rather, goals

were considered met if the participants' activity matched or exceeded their personal goal.

Survival Measures

In order to assess the process of participant drop-out during the exercise program, several definitions of drop-out were developed (see Table 3). The first and most stringent definition of drop-out corresponds to the first lapse in exercise or the first week a participant did not walk (D1W). The week after a participant had not exercised for three consecutive weeks was considered the next definition of drop-out (DW3). For example, a participant who did not exercise during weeks four, five and six would be considered to have dropped out during week seven of the study. The point at which a participant no longer met minimum ACSM guidelines of at least three sessions per week for at least 20 minutes during any subsequent weeks was the third definition of participant drop-out. For example, if a participant met ACSM guidelines during the first three weeks, did not meet them in weeks four and five, and met them again in week six (but not in any subsequent week), they would be considered to have dropped out in week seven. In order to facilitate comparisons to other literature, the preceding drop-out criteria are consistent with definitions of drop-out used by Lombard et al. (in press).

A final drop-out criterion was developed to incorporate the intensity measure used in this study. Using this definition, drop-out occurred at the point at which a participant had not accrued any fitness minutes for three (consecutive or non-

consecutive) weeks (Fit3W). For example, not obtaining any fitness minutes in weeks two, four and six would be indicative of drop-out in week six regardless of whether fitness minutes were accrued during any remaining weeks.

Reliability

The accuracy of the data contained in the self-report logs was verified using the following procedure, modified from Lombard et al. (in press). Each week the researcher randomly selected (using a computer program to randomly select from the group of subject numbers) 15% of participants with a walking partner for verification. Reliability was assessed through comparison of logs within walking groups or partners. The date (exact day of the week) and duration (plus or minus 15 minutes) of walking were cross-checked for accuracy. On each comparison, a participant would be given a point if, and only if, their log matched the exact day of the week reported by their partner. Similarly, one point was given if the duration of the specified walking episode matched their partners reported duration within 15 minutes. In order to determine percent agreement for each comparison, the points were totalled and divided by two. Throughout the study, 40 of these comparisons were made. The reliability of this method was 91% agreement.

Many participants, however, chose to walk alone or with their dog, thus partners were not available for verification. The researcher randomly checked walking paths in the community throughout the study in order to make behavioral observations. Nine behavioral observations were made. On each observation, the

researcher recorded participant(s) names and cross-checked the observed date with the self-report log. Reliability of this method was 100% agreement.

Missing Data

One advantage to computer contact was to eliminate any demand characteristic introduced by personal contact and to provide an efficient transmittal system. It was believed that these factors would contribute to greater reporting compliance. Despite these attempts a portion of the initial sample did not submit complete walking logs for the entire 10 weeks. At the end of the study, all of the initial 65 participants with one or two weeks of missing data were contacted and the data was obtained through recall. There were, however, 18 participants (9 participants in each condition) with three or more weeks of missing data (16 of 18 with 4 or more weeks missing).

Given these reporting omissions, the data were analyzed in two ways. Data from the total initial sample were analyzed. In these analyses, participants with missing data (non-reporters) were assumed not to have been exercising, and zeros were entered for missing values. Such analyses follow the "intent to treat model" more appropriate for a fully developed intervention tested in a randomized clinical trial. In order to test the effects of the intervention with participants who consistently accessed the computer-based program, the data from the subsample without missing data (reporters) were analyzed (minimal treatment n=21, full treatment n=26). Such

analyses have been noted as suitable for evaluating interventions in an early development stage, such as the one tested in this project (Lipsey, 1990).

Statistical Analysis

Baseline characteristics (i.e., age, weight and stage of change) and goal data were analyzed using the Student's t-test if the normality assumption was not violated. When the normality assumption was violated, the Mann-Whitney U test was used. F-tests of the equal variance assumption were conducted. In the case that variances were found to be unequal, a two sample t-test assuming unequal variances was used (Satterthwaite method for adjusting degrees of freedom).

Dependent exercise variables were analyzed by means of repeated measures analysis of variance (ANOVA) with treatment groups as the between subjects variable and time as the repeated factor. Pearson coefficients of correlation were computed to test the association between various exercise and computer-related variables. Survival analysis (Life tables, SPSS Statistical Software) was performed to determine the effects of treatment and stage of change on participant dropout patterns. The non-parametric Life tables procedure calculates test statistics based on a chi-square distribution. An alpha level of .05 was used for all statistical tests.

Results

Participant Characteristics

Total Sample

The total sample consisted of 30 (23 females, 7 males) and 35 participants (25 females, 10 males) in the minimal and full treatments respectively. Participants in the two treatments differed on age ($t=-1.68$, $df=63$, $p<.05$ full treatment older), and bodymass ($t=-2.43$, $df=58.88$, $p<.01$ full treatment heavier), but not for exercise stage of change ($t=0.82$, $df=63$) (see Table 1).

Reporters Subsample

The reporters subsample consisted of 21 (17 females, 4 males) and 26 participants (18 females, 8 males) in the minimal and full treatments respectively. In the reporters subsample, participants in the two treatments differed on age ($t=2.01$, $df=45$, $p<.05$ full treatment older) but not on bodymass ($t=-1.21$, $df=45$) or exercise stage of change ($t=2.01$, $df=45$) (see Table 2).

Means Table

A full listing of means and standard deviations for exercise, goal setting and computer-related variables calculated for treatments in both the total and reporters sample can be found in Table 4.

Exercise Outcome Variables

Total Sample

Trends supporting the full treatment condition occurred across all exercise outcome measures. Repeated measures analysis of variance was conducted for number of exercise sessions per week, minutes walked per week, number of minutes walking at or above 60% HR_{max} (fitness minutes) and number of weeks meeting ACSM minimum frequency and duration standards. Although results of these analyses were not statistically significant (see Tables 5-8), means for all measures were greater in the full treatment.

Reporters Subsample

Repeated measures analysis of variance on the mean number of exercise sessions per week (minimal treatment $\bar{x}=2.15$, full treatment $\bar{x}=3.01$) showed a significant main effect for treatment $F(1, 45)=7.74$, $p<.01$ and a non-significant effect for time and the treatment by time interaction (see Table 9). Similarly, analysis of the mean number of minutes (minimal treatment $\bar{x}=76.17$, full treatment $\bar{x}=107.73$) walked per week revealed a significant main effect for treatment $F(1, 45)=5.17$, $p<.05$ and a significant treatment by time interaction $F(9, 405)=2.18$, $p<.05$, but no significant effect for time (see Table 10).

Subsequent analyses of the combined outcome measures produced similar findings. Analysis of the number of minutes walked per week at or above a participant's 60% HR_{max} (minimal treatment $\bar{x}=57.9$, full treatment $\bar{x}=88.4$) revealed

significant main effects for treatment $F(1, 45)=4.32$, $p<.05$ and for time $F(9, 405)=2.26$, $p<.05$, but not the treatment by time interaction (see Table 11). An analysis of the number of weeks participants met minimum ACSM frequency and duration requirements (e.g., exercised at least three times for 20 minutes or more; ACSM)(minimal treatment $\bar{x}=4.1$, full treatment $\bar{x}=6.3$) produced a significant main effect for treatment $F(1, 45)=6.03$, $p<.05$, but no significant effect for time or treatment by time interaction (see Table 12).

The most stringent outcome measure involved the number of weeks a participant met ACSM minimum frequency, duration and intensity requirements (i.e. exercised at a level of three times per week for 20 minutes at or above 60% HR max; Fitness ACSM). Analysis of this measure (minimal treatment $\bar{x}=3.3$, full treatment $\bar{x}=5.3$) showed a significant main effect for treatment $F(1, 45)=4.35$, $p<.05$ and for time $F(9, 405)=2.66$, $p<.01$ but not for the treatment by time interaction (see Table 13).

Subject Selected Goals

Goal setting was evaluated in terms of the number of weeks during the program that subjects set a weekly goal. Goal attainment was evaluated in three ways and was based on the following criteria: (a) meeting weekly goal for number of days of walking, (b) meeting weekly goal for the number of minutes of walking, and (c) meeting the combined goal for days and minutes of walking.

Total Sample

On all of the goal measures the full treatment outperformed the minimal treatment condition. There was a significant difference between the number of weeks participants met their goals for walking frequency (minimal treatment $\bar{x}=1.6$, full treatment $\bar{x}=3.6$; $t=-3.15$, $df=60.67$, $p<.01$) and the number of weeks participants met their goals for walking duration (minimal treatment $\bar{x}=1.3$, full treatment $\bar{x}=2.3$;$t=-2.16$, $df=59.84$, $p<.05$) (see Table 14). The Mann Whitney U (used for non-normal data) test revealed a significant difference between treatments on the number of weeks subjects met goals for both walking frequency and duration ($z=-2.11$, $p<.05$) and the number of weeks subjects set goals during the study ($z=-1.83$, $p<.05$) (see Table 15).

Reporters Subsample

Again, the full treatment outperformed the minimal treatment on measures of goal attainment and goal setting. There was a significant difference between the number of weeks participants met their goals for walking frequency (minimal treatment $\bar{x}=2.0$, full treatment $\bar{x}=4.7$; $t=-4.03$, $df=45$, $p<.001$) and the number of weeks participants met their goals for walking duration (minimal treatment $\bar{x}=1.6$, full treatment $\bar{x}=3.1$;$t=-2.71$, $df=45$, $p<.01$)(see Table 16). The Mann Whitney U (used for non-normal data) test revealed a significant difference between treatments on the number of weeks subjects met goals for walking frequency and duration ($z=-2.87$,

$p < .01$) and the number of weeks subjects set goals during the study ($z = -2.31$, $p < .05$) (see Table 17).

Relationship of Goal Setting to Exercise Frequency

The extent to which goal setting was related to exercise frequency was assessed by dividing the sample into groups of "high goal setters" and "low goal setters". The groups were divided at the mean and t-tests were conducted on the average number of days walked per week.

Total Sample

The mean number of weeks participants set goals was five weeks for the total sample; therefore, high goal setters were defined as those participants setting goals for five or more weeks during the study. In contrast, low goal setters were defined as those participants setting goals during less than five weeks. Across the total sample, high goal setters ($\bar{x} = 2.71$) walked significantly more days per week than low goal setters ($\bar{x} = 1.36$) ($t = -4.79$, $df = 62$, $p < .001$). Within the minimal treatment, there were no significant differences between the walking frequency of high goal setters and low goal setters. Within the full treatment, high goal setters ($\bar{x} = 3.10$) walked more frequently than low goal setters ($\bar{x} = .97$) ($t = -6.42$, $df = 33$, $p < .001$) (see Table 18).

Reporters Subsample

The mean number of weeks participant set goals was seven weeks for the reporters subsample; therefore, high goal setters were defined as those participants setting goals for seven or more weeks during the study. In contrast, low goal setters

were defined as those participants setting goals during less than seven weeks. Across the reporters subsample, high goal setters ($\bar{x}$=2.78) walked significantly more days per week than low goal setters ($\bar{x}$=2.04) (t=-1.97, df=44, p<.05). Within the minimal treatment, there were no significant differences between the walking frequency of high goal setters and low goal setters. Within the full treatment, high goal setters ($\bar{x}$=3.15) walked more frequently than low goal setters ($\bar{x}$=2.20) (t=-1.95, df=24, p<.05) (see Table 18).

Relationship of Goal Attainment to Exercise Frequency

In order to assess the extent to which goal attainment was related to exercise frequency the sample was divided into "high goal attainers" and "low goal attainers". The groups were divided by a split on the mean. The mean number of weeks goals for exercise frequency were met was three for both the total sample and the reporters subsample; therefore high goal attainers were defined as those participants meeting their goals for exercise frequency during three or more weeks. Low goal attainers were defined as those participants attaining goals during less than 3 weeks during the study.

Total Sample

Across the total sample, high goal attainers ($\bar{x}$=3.24) walked significantly more days per week than low goal attainers ($\bar{x}$=1.60) (t=-7.00, df=55, p<.001). Within the minimal treatment, high goal attainers ($\bar{x}$=3.00) walked more frequently that low goal attainers ($\bar{x}$=1.62) (t=-3.33, df=24, p<.01). Similarly, within the full

treatment, high goal attainers ($\bar{x}$=3.31) walked more frequently than low goal attainers ($\bar{x}$=1.56) (t=-5.35, df=29, p<.001) (see Table 19).

Reporters Subsample

Across the reporters subsample, high goal attainers ($\bar{x}$=3.24) walked significantly more days per week than low goal attainers ($\bar{x}$=1.76) (t=-5.82, df=43, p<.001). Within the minimal treatment, high goal attainers ($\bar{x}$=3.00) walked more frequently that low goal attainers ($\bar{x}$=1.53) (t=-3.50, df=17, p<.01). Similarly, within the full treatment, high goal attainers ($\bar{x}$=3.31) walked more frequently than low goal attainers ($\bar{x}$=2.18) (t=-3.11, df=24, p<.01) (see Table 19).

Survival Analysis: Four Definitions of Drop-out

Survival analysis was conducted using the nonparametric analysis Life Tables (SPSS statistical software) on each of the four definitions of drop-out in the study (see Table 3 for dropout criteria).

Total Sample

Analyses revealed a significant difference between survival curves for the two treatment conditions for the first week a participant did not walk (D1W) ($\chi^2_{(1)}$=10.2, p<.01) and the point at which a participant had not accrued any fitness minutes for three (consecutive or non-consecutive) weeks (Fit3W) ($\chi^2_{(1)}$=3.951, p<.05). No significant differences were found between the survival curves for participant drop-out, defined as the point at which a participant had not walked for three consecutive weeks (D3W), or for point at which a participant no longer met ACSM minimum

standards for frequency and duration (ACSM) during any subsequent week (see Table 20). Figures 1-4 show survival curves and hazard functions for the total sample on these measures. Generally (across both conditions), these curves indicate the full treatment compared to the minimal treatment reduced and delayed drop-out rate. Hazard functions for these curves indicate weeks one, six and nine as critical points for participant lapses in exercise (e.g., first week of no exercise).

Reporters Subsample

Analyses of the reporters subsample revealed significant differences between the survival curves of the two treatments across all definitions of survival, including the first week a participant did not walk (D1W) ($\chi^2_{(1)}=10.6$, $p<.01$), the point at which a participant had not walked for three consecutive weeks (D3W) ($\chi^2_{(1)}=3.8$, $p<.05$), the point at which a participant had not accrued any fitness minutes for three (consecutive or non-consecutive) weeks (Fit3W) ($\chi^2_{(1)}=6.07$, $p<.05$) and the point at which a participant no longer met ACSM minimum standards for frequency and duration (ACSM) during any subsequent week ($\chi^2_{(1)}=5.13$, $p<.05$) (see Table 21). Figures 5-8 show the survival curves and hazard functions for the reporters subsample on these measures. These curves indicate the full treatment compared to the minimal treatment reduced and delayed dropouts. Hazard functions for these survival curves indicate increased potential for lapses in exercise (ie., first week of no exercise) at weeks one, six and nine, and low risk for participants to experience prolonged absences from exercise (ie., three weeks). Different hazard functions emerge for the

two treatments in terms of fitness criteria. There is increased risk for "fitness drop-out" (i.e., drop out in terms of not walking at or above 60%HRmax) in the minimal treatment as compared with the full treatment.

Survival Analysis with Stage of Change as Stratification Variable

An analysis of the survival curves across both conditions was performed using stage of change as the stratification variable and the point at which a participant no longer met ACSM minimum standards for frequency and duration during any subsequent week as the criterion for drop-out.

Total Sample

These analyses revealed a significant overall difference in the survival curves by stage of change ($\chi^2_{(3)}=10.10$, $p<.05$). Multiple pairwise comparisons revealed significant differences between the survival curves for Contemplation (stage 2) and Action (stage 4) ($\chi^2_{(1)}=5.75$, $p<.05$), Preparation (stage 3) and Action (stage 4) ($\chi^2_{(1)}=4.03$, $p<.05$), Contemplation (stage 2) and Maintenance (stage 5) ($\chi^2_{(1)}=5.09$, $p<.05$) and between Preparation (stage 3) and Maintenance (stage 5) ($\chi^2_{(1)}=7.41$, $p<.01$) (see Table 22 and Figure 9). Examination of these curves shows the most striking differences between stages was the relatively large and persistent drop-out rates of contemplators and preparers compared to few dropouts for the action and maintenance stages.

Reporters Subsample

These analyses also revealed an overall difference in the survival curves by stage of change ($\chi^2_{(3)}=10.05$, $p<.05$). Multiple pairwise comparisons revealed significant differences between the survival curves for Preparation (stage 3) and Action (stage 4) ($\chi^2_{(1)}=6.48$, $p<.05$) and between Preparation (stage 3) and Maintenance (stage 5) ($\chi^2_{(1)}=7.41$, $p<.01$) (see Table 23 and Figure 10). Examination of these curves also shows the most striking differences between stages was the relatively large and persistent drop-out rates of contemplators and preparers compared to few dropouts for the action and maintenance stages.

Survival Analysis with Stage of Change and Treatment as Stratification Variables

A similar analysis was performed to determine if survival curves for participants in different stages of change differed between the two treatments. In the reporters subsample, the survival curves were significantly different for participants in stage three (Preparation) between the two treatments ($\chi^2_{(1)}=7.56$, $p<.01$) and approached significance in the analysis of the total sample ($\chi^2_{(1)}=3.22$, $p=.07$) (see Tables 24 and 25). Survival curves and hazard functions are presented in Figures 11-18. An examination of these curves indicates that the full treatment, compared with the minimal treatment, reduced and delayed the drop-out rate of preparers and that reporting (interacting with the system and thus, self-monitoring) improved the survival rates of contemplators across both treatments.

Correlational Analyses

Exercise Measures

A multiple correlation analysis was performed on seven variables related to exercise initiation (see Table 26). Stage of change was correlated with the average number of exercise sessions ($r=.30$, $p<.05$) and minutes of exercise ($r=.35$, $p<.01$) but was not correlated with fitness minutes ($r=.02$). Average number of exercise sessions per week (e.g., exercise frequency) was positively correlated with mean feeling rating of exercise enjoyment ($r=.45$, $p<.001$) and showed a significant negative correlation with bodymass index ($r=-.30$, $p<.05$). Similarly, mean number of minutes of exercise per week (e.g., exercise duration) was positively associated with exercise enjoyment and negatively associated with bodymass index.

Computer Comfort Measures

A correlation analysis was performed to assess the extent to which computer attitudes, computer anxiety, and computer self-efficacy were associated with reporting and interacting with the computer. No significant correlations were found between number of weeks participants interacted with the computer-based system (weeks reporting) and computer attitudes ($r=.04$), computer anxiety ($r=-.04$) or computer self-efficacy ($r=-.10$) (see Table 27).

A t-test was performed to assess whether there were differences between reporters (reporting data 10 weeks) and non-reporters (reporting data <10 weeks) on the measures of computer attitudes, anxiety and self-efficacy. No statistically

significant differences were found between reporters and non-reporters groups on these variables (See Table 28).

Effect Size Determination: Reporters Subsample

In order to estimate treatment effectiveness, effect sizes were calculated on each of the major exercise outcome variables for the reporters subsample. Effect sizes ranged from .61 (Fitness Minutes, FitACSM) to .82 (Exercise sessions per week), which are considered medium to large effect sizes (Lipsey, 1990) (see Table 29).

Discussion

The results of the present study suggest that fully automated computer-based systems are a feasible alternative to personalized telephone contact (e.g. Lombard et al., in press) for exercise promotion when combined with information, self-monitoring, and goal-setting. The addition of specific, personalized feedback, based on individual performance, delivered by the computer-based system was found to increase the frequency, duration, and intensity of walking for exercise as well as setting and meeting goals for exercise. Moreover, these outcomes equal or surpass results reported for initiating walking and other exercise using face-to-face individual or small group interventions (King et al., 1992).

In order to consider the effect of the experimental manipulation in this intervention, it is necessary to discuss outcomes of the reporting subsample as they interacted with the computer based system, thus, receiving the intervention. The

results from this sample suggest that both treatment groups achieved a level of early exercise initiation commensurate with the results of other studies of exercise adoption (e.g., King & Frederiksen, 1984). Furthermore, the additive value of specific personalized feedback appeared to enhance exercise initiation across all exercise outcome measures. Perhaps the most meaningful outcome of this study, in terms of health benefit, was the difference between the two treatments on the "fitness" variables. The average number of fitness minutes (minutes accrued at or above 60% HR_{max}) (57.9 vs 88.4) and the number of weeks participants achieved ACSM minimum goals for frequency, duration and intensity (3.3 vs 5.3) favored the full treatment.

Feedback Effectiveness

The positive effects shown by the addition of feedback in this study differ from results obtained by Lombard et al. (in press) and Weber and Wertheim (1989). Interestingly, these researchers found no significant positive outcomes with the addition of experimenter feedback when participants were self-monitoring. Specific aspects of the feedback used in these interventions may have resulted in differential outcomes. The current study used individual based feedback on all self-monitored parameters as well as occasional comparative group based feedback. In Lombard et al. (in press), participants received verbal feedback, whereas participants in this study received a written message which could be read and re-read as desired. The form of written feedback used in this intervention is similar to the computer-generated reports

which were successful in other studies (Prochaska et al. 1993; Burnett et al., 1989). The use of the computer to process, generate and deliver information enabled efficient delivery of feedback. For example, feedback messages were waiting for participants when they arrived at their offices the morning following submittal of their weekly log, which may have resulted in a closer temporal relationship of the feedback to participants weekly self-assessment of their progress. Similarly, participants received their feedback on the first day of the new "walking week," therefore feedback had the potential to influence participants' planned exercise schedules for the entire week.

In addition, information provided to participants about performance has been shown to increase perceived competence (i.e. self-efficacy). For example, males with low sport experience (e.g. less than one year of participation in sports in high school or college and no awards for competence) have been shown to increase perceived competence when information about their performance was provided by the experimenter (Rutheford, Corbin, & Chase, 1992). In fact, perceived competence was associated with feelings that exercise was enjoyable, interesting and important in these subjects.

Prompting Frequency

Initial examination of the nature of contact used in Lombard et al. (in press) and that of the current study reveal several differences other than personal contact vs. contact by an "expert" system. In the Lombard et al. (in press) study, participants in the frequent contact condition received a weekly phone call. Although these calls

were primarily designed for delivery of feedback, the calls also served as a prompt for exercise. The intervention tested in this study allowed the opportunity for several indirect prompts, as well as the prompt provided by the feedback. The initial prompt for return of walking logs was sent to participants on their reporting day. A second prompt was sent in the form of a confirmation note when the participant's walking log was received by the project computer system. Finally, specific feedback or general encouragement was received by participants the morning after logs were submitted. Thus, participants in both treatments in this study had the potential for three prompts for exercise from the computer-based system as compared with one personal contact as prompt for exercise in Lombard et al. (in press). In cases where a weekly log was not submitted, the participant received two messages from the computer each week (reminder prompt and feedback message regarding no receipt of weekly log). In cases where participants sent logs in later than their specified reporting day, four messages would have been sent including a reminder prompt, a feedback message regarding no receipt of log, a confirmation note upon receipt of log, and regular feedback related to performance or general encouragement depending upon condition.

Comparison of the Intervention with Lombard et al. (in press)

In also considering the results of this intervention, it should be recalled that both the full and minimal treatments received an exercise promotion intervention founded on cognitive-behavioral principles. A comparison of the rates of walking in the present study with a group receiving cognitive-behavioral components, but no

project-initiated contact (i.e., no contact control group) can be obtained by examining the means of exercise outcome measures with those of the no-contact control group from Lombard et al. (in press). This descriptive comparison provides a meaningful anchor point for interpretation of these results. In Lombard et al. (in press), the no-contact control group which received information, social support, self-monitoring and individual goal-setting but no contact, achieved a mean (for the first ten weeks of the study) of 1.1 (SD=.42) exercise sessions per week compared with 2.2 (SD=.30) and 3.0 (SD=.34) exercise sessions for the minimal and full treatment, respectively (reporters subsample, see Table 30 for full comparison of all groups). Although statistical comparisons between the two studies are tenuous, both samples were taken from the same population (faculty and staff at Virginia Polytechnic Institute and Stage University) and were similar on relevant variables (e.g. age, sex, stage of change, smoking history) thus enabling a potentially interesting descriptive comparison. The estimated effects size for the full treatment condition (reporters subsample) of this study compared with the Lombard et al. (in press) study's no-contact condition for number of exercise sessions per week was 3.03, further pointing toward the efficacy of the present study's intervention.

Goal Setting and Goal Attainment

Analysis of the goals set by participants in the two treatment conditions revealed that participants were setting goals more consistently throughout the program in the full treatment. Also, despite similar levels of goal difficulty in the two

treatments, participants in the full treatment met their goals more often. Feedback given to participants in the full treatment encouraged participants to set achievable goals and to change their goals as necessary (e.g., if they met or exceeded their goal or if they were unable to achieve their goal). This process may have resulted in more effective self-regulatory strategies (e.g. goal setting, self-monitoring) and increased exercise self-efficacy through goal attainment. Bandura (1994) has endorsed the idea of building self-efficacy through demonstration trials and cited this component as critical for generalized adoption of healthful habits.

The analyses of walking frequency in high goal setters and/or attainers vs. low goal setters and/or attainers suggest that setting and attaining goals are indeed related to increased walking frequency. Moreover, a comparison of high goal setters in the full treatment compared to the minimal treatment showed that feedback about goal setting led to increased frequency (e.g., 2.16 vs. 3.15 days per week, respectively). Thus, feedback about appropriate use of self-regulatory strategies (e.g., goal setting) may have enabled participants to use these strategies more effectively in their exercise program, which in turn, led to increased walking.

Exercise Enjoyment

The significant correlations (.45 and .46) of mean exercise enjoyment rating (FS) with measures of activity (number of exercise sessions and minutes), respectively, indicate the positive relationship between greater enjoyment and increased exercise frequency. Thus, enjoyment of exercise accounted for 20% of the

variance in walking frequency and duration in this sample. The mean rating of exercise enjoyment (2.36) found in this study is also consistent with levels of enjoyment found by other researchers (Hardy & Rejeski, 1989; King & Garcia, 1991).

Past research of what constitutes an appropriate exercise prescription has focused predominantly on physiological indices and the intensity levels necessary for health benefit and relatively little attention has been given to enjoyment. Enjoyment appears to be related to self-efficacy and outcome expectations, processes which mediate adherence and maintenance of behaviors (Bandura, 1994). Thus, programs which focus exclusively on the physiology (e.g. exertion levels) of exercise, without adequate emphasis on affective components of the behavior, may not be designed effectively to promote maintenance or generalization of the behavior. Studies demonstrating the relationship of exercise enjoyment to exercise frequency illustrate the need to consider this overlooked dimension in design of future interventions.

Program Drop-Out (Non-Reporters)

The term "program drop-out" can be used to describe persons who discontinued interacting with the computer based program. However, it is not clear if these participants discontinued exercise, per se. Analyses of the two groups (e.g. reporters and non-reporters) on the computer-comfort variables did not show statistically significant differences between the two conditions related to attitudes, anxiety or self-efficacy, and computers which suggests that the decision to discontinue

interacting with the computer-based system was not related to a difference in computer efficacy. In this study, the number of program drop-outs was equal across conditions and consistent with program dropout rates of other studies (e.g., 25%) (Robison et al., 1992).

Process Measures

Process results of the current study have significant implications for design of future exercise promotion interventions. Survival analysis showed hazard points for participant drop-out at approximately week one and week three of the program. These results combined with similar hazard points found by Lombard et al. (in press), suggest the need for supplemental intervention components to prevent lapses and relapses implemented at these specific points in an exercise initiation program. Overall, these analyses suggest that the probability of continuation of exercise increases significantly if the participant is still involved past week three of the program.

Further analysis of participant drop-out with stage of change as a stratification variable provided an important distinction between the success of participants across different stages of change. Although this study was not designed as a direct test of the trans-theoretical model, the empirical findings provide strong support for the notion of targeting interventions to stage of change. Analysis of drop-out points (for both samples) revealed the effect of the intervention on the drop-out points of participants in the Preparation stage. Preparers in the full treatment had a

significantly different pattern of survival (survived longer) than preparers in the minimal treatment which suggests that the feedback may have been more influential for this group of participants. It appears, for participants in the action and maintenance stages, that the minimal treatment (self-monitoring, goal setting, prompting and general encouragement) was sufficient to sustain their exercise patterns and the addition of feedback was not critical for continuation of exercise participation.

Limitations of the Study

From a health perspective, the results indicating fitness benefit are encouraging and support the effectiveness of the feedback surrounding exercise intensity parameters; however, these results must be tempered by the fact that participants in the full treatment were prompted to exercise within their target heart rate range. Therefore, differences on fitness parameters may represent a reporting bias on the part of subjects in the full treatment. However, it should be noted that the mean RPE rating for participants in this study was 12.3 which was consistent with RPE's (12.4) obtained during a controlled trial in which participants cycled at 60%HR_{max} (Hardy & Rejeski, 1989). Similarly, the researchers found mean FS rating of participants with RPE of 11 was 2.56 which corresponds to the mean FS of 2.36 at RPE of 12 found in the present study.

In addition, it was not possible to assess the degree to which participants in either condition read and understood the feedback messages each week. Thus inferences about the effect of the manipulation must also be made with caution.

Despite this shortcoming it should be recalled that participants were randomly assigned to treatment groups and did not differ on baseline variables which are related to engagement in exercise. Thus, it seems reasonable to examine group differences in terms of the manipulation (computer generated feedback) to investigate its utility for future exercise interventions.

Furthermore, this intervention was successful for a population characterized by a low computer anxiety, positive attitudes about computers and a high level of computer self-efficacy. It should be noted that this type of computer-based intervention might be less effective with a population that was not familiar with e-mail and/or had low computer self-efficacy

Future Directions

The present investigation illustrates the efficacy of computer-based interventions for promoting exercise adoption; however, modifications and enhancements of the present system may increase exercise behaviors to even greater levels.

The computer-human interface used in this project was fairly "crude" in that the system was text-based and not enhanced by color or graphic images. Thus, modifications which would simplify the requirements of the participant (e.g., specific data entry format), add visual images or graphs of exercise progress, and vary the feedback and message formats may increase participant interest in the program and desire to continue interacting with the system.

Several other aspects of the current program could be modified to tailor each exercise prescription to better meet an individual's needs. In this program, feedback was based on the previous week's performance, but the pattern of performance across the weeks was not incorporated into the feedback algorithms. For example, the same message was sent to a participant for missing a week of exercise regardless of whether it was the first week a participant skipped or the third week of exercise skipped.

Perhaps one of the most significant modifications to the current program would be customizing program offerings to fit a participants' stage of change. For example, contemplators and preparers should receive program material which emphasizes the benefits of exercise and provides a plan for gradual shaping of the participants behavior toward a minimal exercise goal (Prochaska et al., 1992). Thus, providing different feedback for persons in different stages of change may be an even more successful feedback strategy. These types of interventions have proven successful for a variety of behavioral changes in the area of smoking cessation and exercise (Prochaska et al., 1993, Marcus et al., 1992).

It may also be useful to fine-tune and adjust a person's program and recommendations for exercise based on their overall goals (e.g., overall health benefits vs. weight loss) and to change the program prescription as performance levels change. Such tailoring of an exercise program to fit each individual participant could be achieved by designing a more "expert" system to provide sophisticated

recommendations and feedback, based on performance and periodic assessment, throughout the entire process of change. Similarly, a tailoring approach based upon hazard functions for participants in various stages of exercise behavior change may reduce exercise drop-out by providing the necessary program contact and direction at "critical" points during the program.

Furthermore, social support might be enhanced in future interventions by organizing on-line walking groups or posting announcements on electronic "walking bulletin boards" about meeting for exercise sessions or fun walks throughout the community. Also, contact could be encouraged among participants signing up for such a program. For example, participants could chat with each other through e-mail, thus increasing social support and promoting maintenance of exercise (Bandura, 1994). Finally, improvements should be made in electronically delivered programs to allow researchers to better assess the use of the intervention system. For example, future studies could test the feedback manipulation by incorporating a "return receipt request" into the e-mail feedback message. This receipt would be automatically returned to the program computer when the message was accessed by the participant. Although this mechanism would not provide a measure of feedback retainment (i.e., actual reading of the message), it would reliably estimate the number of messages that were opened and accessed across the conditions, and might provide data as to which messages were most related to actual performance.

Although electronically delivered interventions will not appeal to or be effective with everyone, it is clear that the use of computer-based systems is proliferating in everyday life. The present study shows that when computer-based systems follow sound psychological concepts and strategies, they have potential as tools for promoting health behaviors.

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Table 1
Summary of initial participant characteristics

Demographic Variable	Treatment Condition	
	Minimal	Full
N	30	35
Gender		
Females (N)	23	25
Males (N)	7	10
Age (years)	37.4 (9.2)*	41.1 (8.7)*
Bodymass	25.42 (4.3)*	28.74 (6.6)*
Stage of Change	3.8 (0.99)	3.6 (0.95)
Smokers (N)	2	3

Note: Standard deviations shown in parentheses; values are means unless otherwise indicated
*$p < .05$

Table 2
Summary of reporters subsample participant characteristics

Demographic Variable	Treatment Condition	
	Minimal	Full
N	21	26
Gender		
Females (N)	17	18
Males (N)	4	8
Age (years)	36.9 (8.5)*	42.2 (8.7)*
Bodymass	25.42 (4.5)	27.46 (6.5)
Stage of Change	3.76 (0.94)	3.65 (0.94)
Smokers (N)	2	2

Note: Standard deviations shown in parentheses; values are means unless otherwise indicated
* $p < .05$

Table 3
Drop-out Criteria For Survival Analyses

Variable	Definition
Dead 1Week (D1W)	The first lapse in exercise or the first week a participant did not walk during the 10 week period.
Dead 3 Weeks (D3W)	The week after a participant had not exercised for three consecutive weeks.
Dead ACSM (ACSM)	The point at which a participant no longer met minimum ACSM frequency and duration (e.g. three times per week for 20 minutes) during any subsequent weeks of the study.
Dead Fitness (Fit3W)	The point at which a participant had not accrued any fitness minutes (e.g. minutes of exercise at or above 60% HRmax) for three consecutive or non-consecutive weeks.

Table 4
Means Table: Exercise, Goal Setting and Computer-Comfort Level Measures

	Total Sample				Reporters Sample			
	Minimal		Full		Minimal		Full	
Variable Name	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Days	1.77	1.18	2.31	1.44	2.15	1.15	3.01	0.95
Minutes	65.95	49.17	83.36	55.46	76.17	53.27	107.73	41.96
Fitness Minutes	51.09	43.89	67.73	59.44	57.90	42.65	88.41	55.22
ACSM - Frequency/Duration (weeks meeting these criteria)	3.23	2.89	4.51	3.72	4.14	2.90	6.30	3.08
Weeks Frequency Goal Met	1.66	2.00	3.57	2.87	2.09	2.18	4.76	2.32
Weeks Duration Goal Met	1.30	1.51	2.31	2.24	1.61	1.62	3.11	2.06
Weeks Freq. & Dur. Goal Met	1.10	1.37	2.25	2.18	1.38	1.49	3.03	2.00
Weeks Goals Set	4.70	3.49	6.08	3.47	5.95	3.36	7.73	2.18
Computer Anxiety Score	54.72	6.88	56.11	5.19	55.04	7.32	55.96	5.70
Computer Attitude Score	81.65	6.58	80.58	8.26	81.80	7.37	80.64	8.14
Computer Self-Efficacy Score	133.20	16.49	119.67	18.25	133.61	17.53	116.80	19.35

Table 5
Analysis of Variance for Total Sample: Number of Exercise Sessions per Week

Source	df	MS	F
Between Subjects			
Condition (C)	1	45.21	2.56
Error	63	17.66	
Within Subjects			
Time (T)	9	2.25	1.29
C x T	9	0.39	0.22
Error	567	1.75	

$p > .05$

Table 6
Analysis of Variance for Total Sample: Number of Minutes of Exercise per Week

Source	df	MS	F
Between Subjects			
Condition (C)	1	48960.93	1.77
Error	63	27727.52	
Within Subjects			
Time (T)	9	4155.83	1.30
C x T	9	2878.45	0.90
Error	567	31951.89	

$p > .05$

Table 7
Analysis of Variance for Total Sample: Number of Fitness Minutes

Source	df	MS	F
Between Subjects			
Condition (C)	1	58929.32	2.15
Error	63	27412.28	
Within Subjects			
Time (T)	9	4120.47	1.61
C x T	9	3832.40	1.50
Error	567	2552.58	

$p > .05$

Table 8
Analysis of Variance for Total Sample: Number of Weeks Meeting ACSM Minimum Frequency and Duration Goals

Source	df	MS	F
Between Subjects			
Condition (C)	1	2.65	2.34
Error	63	1.13	
Within Subjects			
Time (T)	9	0.86	0.61
C x T	9	0.63	0.45
Error	567	0.14	

$p > .05$

Table 9
Analysis of Variance for Reporters Subsample: Number of Exercise Sessions per Week

Source	df	MS	F
Between Subjects			
Condition (C)	1	84.80	7.74*
Error	45	10.95	
Within Subjects			
Time (T)	9	2.93	1.66
C x T	9	1.59	0.90
Error	405	1.76	

* $p < .01$

Table 10
Analysis of Variance for Reporters Subsample: Number of Minutes of Exercise per Week

Source	df	MS	F
Between Subjects			
Condition (C)	1	115704.60	5.17*
Error	45	22398.29	
Within Subjects			
Time (T)	9	3972.01	1.17
C x T	9	7429.99	2.18*
Error	405	3408.20	

* $p < .05$

Table 11
Analysis of Variance for Reporters Subsample: Fitness Minutes

Source	df	MS	F
Between Subjects			
Condition (C)	1	108169.89	4.32*
Error	45	25030.62	
Within Subjects			
Time (T)	9	6816.13	2.26*
C x T	9	4065.45	1.35
Error	405	3018.58	

* $p < .05$

Table 12
Analysis of Variance for Reporters Subsample: Number of Weeks Meeting Minimum ACSM Goals for Frequency and Duration

Source	df	MS	F
Between Subjects			
Condition (C)	1	5.44	6.03*
Error	45	0.90	
Within Subjects			
Time (T)	9	0.19	1.14
C x T	9	0.07	0.45
Error	405	0.16	

* $p < .05$

Table 13
Analysis of Variance for Reporters Subsample: Number of Weeks Meeting Minimum ACSM Goals for Frequency, Duration and Intensity

Source	df	MS	F
Between Ss			
Condition (C)	1	4.31	4.35*
Error	45	44.64	
Within Ss			
Time (T)	9	0.411	2.66**
C x T	9	0.07	0.51
Error	405	0.15	

* $p < .05$ **$p < .01$

Table 14
Total Sample: Goal Attainment

	Minimal Treatment		Full Treatment			
Variable	M	SD	M	SD	df	t-value
Exercise Frequency	1.66	2.00	3.57	2.87	60.67	-3.13**
Exercise Duration	1.30	1.51	2.31	2.24	59.84	-2.16*

Note: Number of weeks goals were met
*$p < .05$ **$p < .01$

Table 15
Total Sample: Goal Attainment and Goal Setting

	Minimal Treatment	Full Treatment	
Variable	Mean Rank	Mean Rank	z-value
Exercise Frequency and Duration	27.85	37.41	-2.11*
Weeks Goals Set	28.43	36.91	-1.83*

Note: Mann Whitney U test performed due to non-parametric data. Goals for Exercise Frequency and Duration measured in weeks goals were met.
*$p < .05$

Table 16
Reporters Subsample: Goal Attainment

	Minimal Treatment		Full Treatment			
Variable	M	SD	M	SD	df	t-value
Exercise Frequency	2.09	2.18	4.76	2.32	45	-4.03***
Exercise Duration	1.61	1.62	3.11	2.06	45	-2.71**

Note: Number of weeks goals were met
**p < .01 ***p < .001

Table 17
Reporters Subsample: Goal Attainment and Goal Setting

	Minimal Treatment	Full Treatment	
Variable	Mean Rank	Mean Rank	z-value
Exercise Frequency and Duration	17.71	29.08	-2.87**
Weeks Goals Set	19.07	27.98	-2.31*

Note: Mann Whitney U test performed due to non-parametric data. Goals for Exercise Frequency and Duration measured in weeks goals were met.
*$p < .05$ **$p < .01$

Table 18
Relationship of Goal Setting To Exercise Frequency

	n	avg. days per week	df	t-value
TOTAL SAMPLE				
Both Treatments			62	-4.79***
Low Goal Setting	26	1.36		
High Goal Setting	38	2.71		
Minimal Treatment			27	-.98
Low Goal Setting	14	1.70		
High Goal Setting	15	2.11		
Full Treatment			33	-6.42***
Low Goal Setting	12	0.97		
High Goal Setting	23	3.10		
REPORTERS SAMPLE				
Both Treatments			44	-1.97*
Low Goal Setting	11	2.04		
High Goal Setting	35	2.78		
Minimal Treatment			18	-.37
Low Goal Setting	7	1.95		
High Goal Setting	13	2.16		
Full Treatment			24	-1.98*
Low Goal Setting	4	2.20		
High Goal Setting	22	3.15		

*p<.05 **p<.01 ***p<.001

Table 19
Relationship of Goal Attainment To Exercise Frequency

	n	avg. days per week	df	t-value
TOTAL SAMPLE				
Both Treatments			55	-7.00***
Low Goal Attainment	32	1.60		
High Goal Attainment	25	3.24		
Minimal Treatment			24	-3.33**
Low Goal Attainment	20	1.62		
High Goal Attainment	6	3.00		
Full Treatment			29	-5.35***
Low Goal Attainment	12	1.56		
High Goal Attainment	19	3.31		
REPORTERS SAMPLE				
Both Treatments			43	-5.82***
Low Goal Attainment	20	1.76		
High Goal Attainment	25	3.24		
Minimal Treatment			17	-3.50**
Low Goal Attainment	13	1.53		
High Goal Attainment	6	3.00		
Full Treatment			24	-3.11**
Low Goal Attainment	7	2.18		
High Goal Attainment	19	3.31		

*p<.05 **p<.01 ***p<.001

Table 20
Survival Analysis: Four Definitions of Dead- Total Sample

Survival Variable	Events Uncensored	Events Censored	df	χ^2
Dead 1 Week (D1W)			1	10.49**
Minimal	29	1		
Full	20	15		
Dead 3 Weeks (D3W)			1	0.258
Minimal	10	20		
Full	9	26		
Dead ACSM (ACSM)			1	1.44
Minimal	22	8		
Full	19	16		
Dead Fitness (Fit3W)			1	3.95*
Minimal	23	7		
Full	15	20		

*$p < .05$ **$p < .01$

Table 21
Survival Analysis: Four Definitions of Dead- Reporters Subsample

Survival Variable	Events Uncensored	Events Censored	df	χ^2
Dead 1 Week (D1W)			1	10.64**
Minimal	20	1		
Full	11	15		
Dead 3 Weeks (D3W)			1	3.87*
Minimal	3	18		
Full	0	26		
Dead ACSM (ACSM)			1	5.13*
Minimal	15	6		
Full	10	16		
Dead Fitness (Fit3W)			1	6.07*
Minimal	14	7		
Full	6	20		

*$p < .05$ **$p < .01$

Table 22
Survival Analysis: Stage of Change -Total sample

	n	Events Uncensored	Events Censored	df	χ^2
Overall Comparison Statistic				3	10.10*
Stage 2	7	6	1		
Stage 3	19	15	4		
Stage 4	24	13	11		
Stage 5	14	7	7		
Pairwise Comparison				1	1.22
Stage 2	7	6	1		
Stage 3	19	15	4		
Pairwise Comparison				1	5.75*
Stage 2	7	6	1		
Stage 4	24	13	11		
Pairwise Comparison				1	4.13*
Stage 3	19	15	4		
Stage 4	24	13	11		
Pairwise Comparison				1	5.09
Stage 2	7	6	1		
Stage 5	14	7	7		
Pairwise Comparison				1	4.40*
Stage 3	19	15	4		
Stage 5	14	7	7		
Pairwise Comparison				1	.114
Stage 4	24	13	11		
Stage 5	14	7	7		

*$p < .05$

Table 23
Survival Analysis: Stage of Change -Reporters Subsample

	n	Events Uncensored	Events Censored	df	χ^2
Overall Comparison Statistic				3	10.05*
Stage 2	5	3	2		
Stage 3	14	11	3		
Stage 4	18	7	11		
Stage 5	10	4	6		
Pairwise Comparison				1	.020
Stage 2	5	3	2		
Stage 3	14	11	3		
Pairwise Comparison				1	1.85
Stage 2	5	3	2		
Stage 4	18	7	11		
Pairwise Comparison				1	6.48*
Stage 3	14	11	3		
Stage 4	18	7	11		
Pairwise Comparison				1	1.97
Stage 2	5	3	2		
Stage 5	10	4	6		
Pairwise Comparison				1	7.41**
Stage 3	14	11	3		
Stage 5	10	4	6		
Pairwise Comparison				1	.075
Stage 4	18	7	11		
Stage 5	10	4	6		

*$p < .05$ **$p < .01$

Table 24
Survival Analysis: Stage of Change and Treatment - Total Sample

Stages	n	Events Uncensored	Events Censored	df	χ^2
Stage 2				1	.152
Minimal	3	3	0		
Full	4	3	1		
Stage 3				1	3.22
Minimal	9	8	1		
Full	10	7	3		
Stage 4				1	.116
Minimal	10	7	3		
Full	14	6	8		
Stage 5				1	.043
Minimal	8	4	4		
Full	6	3	3		

$p > .05$

Table 25
Survival Analysis: Stage of Change and Treatment - Reporters Subsample

Stages	n	Events Uncensored	Events Censored	df	χ^2
Stage 2				1	.883
Minimal	2	2	0		
Full	3	1	2		
Stage 3				1	7.55**
Minimal	6	6	0		
Full	8	5	3		
Stage 4				1	1.87
Minimal	8	5	3		
Full	10	2	8		
Stage 5				1	.057
Minimal	5	2	3		
Full	5	2	3		

**$p < .01$

Table 26
Intercorrelations Between Exercise Variables

Variable	1	2	3	4	5	6	7
1. Stage	--	.30*	.35**	.02	-.19	.13	-.14
2. Days		--	.88***	.49***	-.12	.45***	-.30*
3. Minutes			--	.58***	-.18	.46***	-.24*
4. Fitness Minutes				--	.20	.21	-.16
5. Perceived Exertion (μ)					--	-.19	-.05
6. Feeling Rating (μ)						--	-.17
7. Bodymass Index							--

*$p < .05$. **$p < .01$. ***$p < .001$

Table 27
Intercorrelations Between Computer Comfort Level and Reporting Compliance

Variable	1	2	3	4
1. Weeks Reporting	--	.04	-.04	-.10
2. Computer Attitude		--	-.25*	.66***
3. Computer Anxiety			--	-.37**
4. Computer Self-Efficacy				--

*$p < .05$. **$p < .01$. ***$p < .001$

Table 28
Comparison of Reporters and Non-Reporters on Computer Variables

	Reporters			Non-Reporters				
Variable	n	M	SD	n	M	SD	df	t-value
Computer Anxiety	46	55.54	6.43	17	55.29	4.89	61	-.14
Computer Attitudes	46	81.17	7.74	17	80.82	7.02	61	-.16
Computer Self-Efficacy	46	124.52	20.19	17	129.64	13.25	61	.97

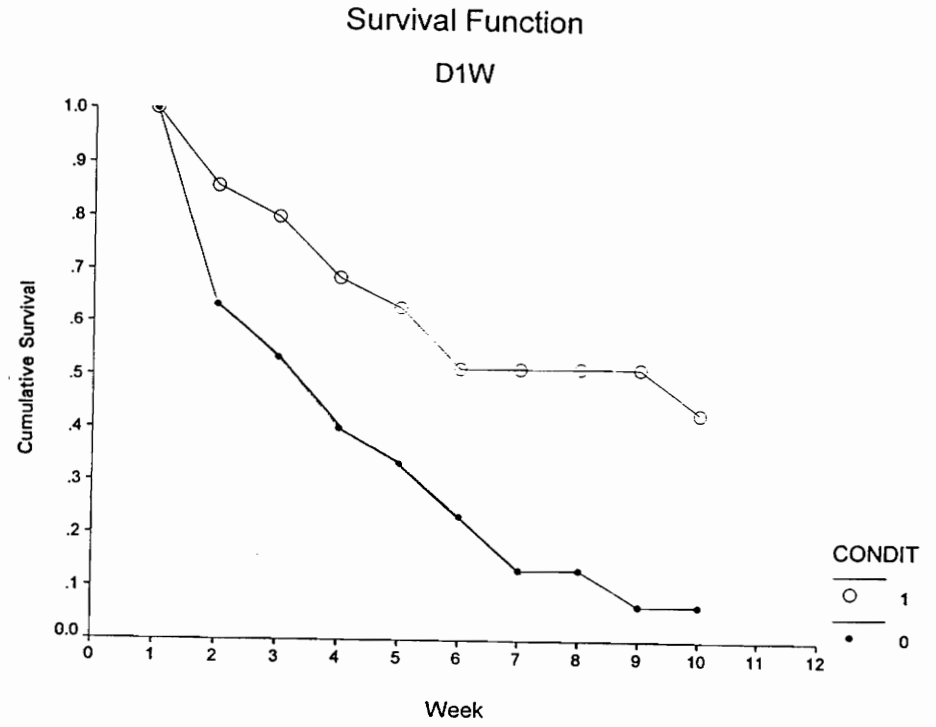
Table 29
Effect Sizes for Significant Outcome Measures

Variable	Effect Size* (ES)
Days per week	.82
Minutes per week	.67
Fitness Minutes per week	.61
ACSM (Frequency & Duration)	.72
Fit ACSM (Frequency, Duration & Intensity >60%HRmax)	.61

* Formulas for Calculation of Effect Size from Lipsey, 1990

Table 30
Comparison of Exercise Outcome Measures Between Studies

Outcome Measure	Lombard, Lombard & Winett (in press)			Present Study			
	Control (no contact)	Infrequent Contact	Frequent Contact	Minimal (entire)	Full (entire)	Minimal (report)	Full (report)
Average exercise sessions per week	1.1	1.9	2.5	1.8	2.3	2.2	3.0
Average minutes walked per week	40	52	98	66	83	76	108



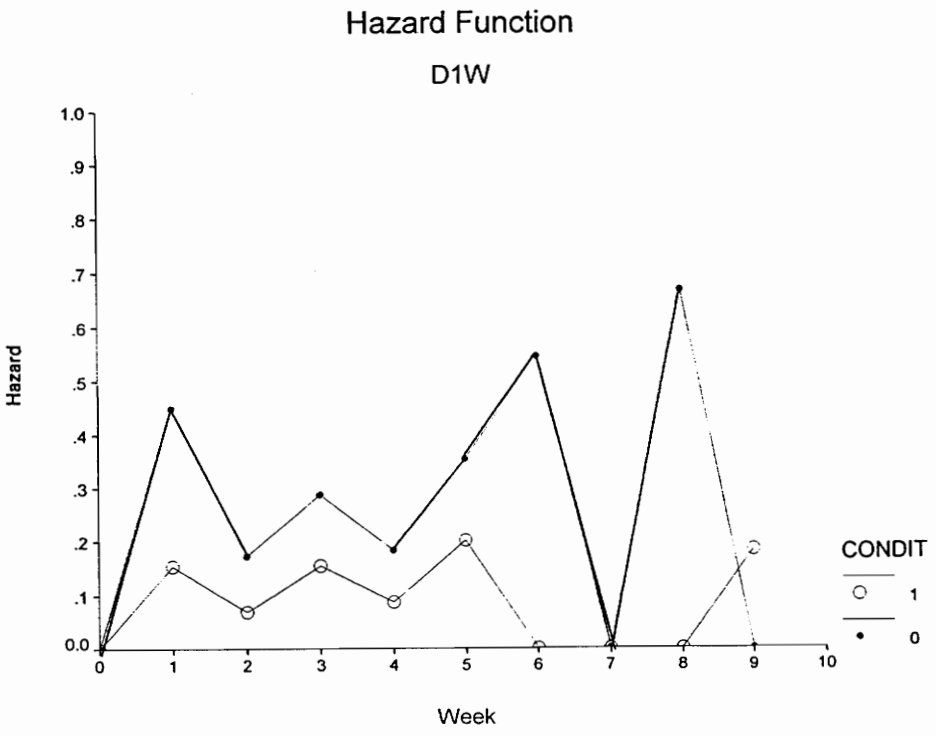
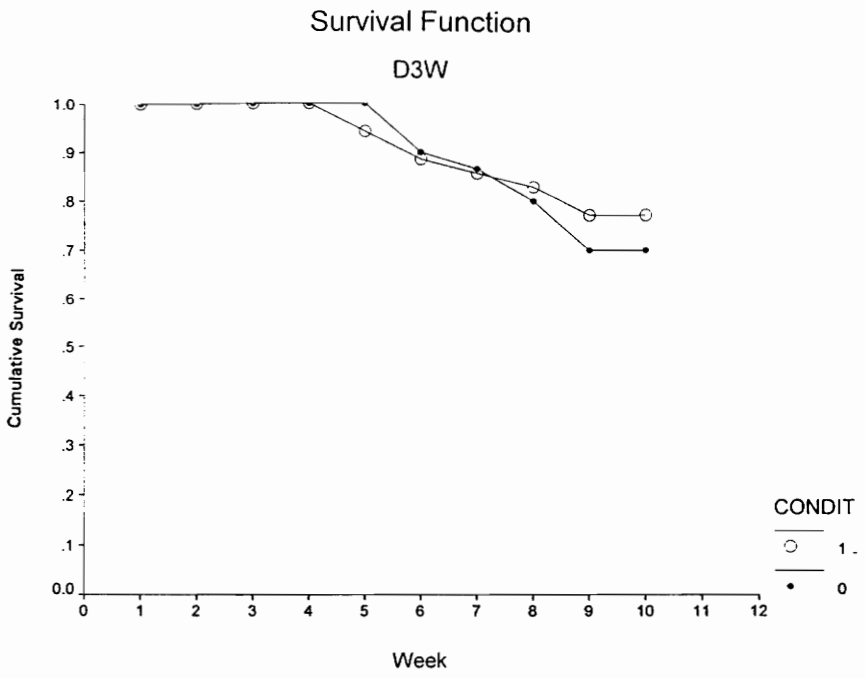


Figure 1 Survival Curve and Hazard Function for Dead 1 Week - Total Sample



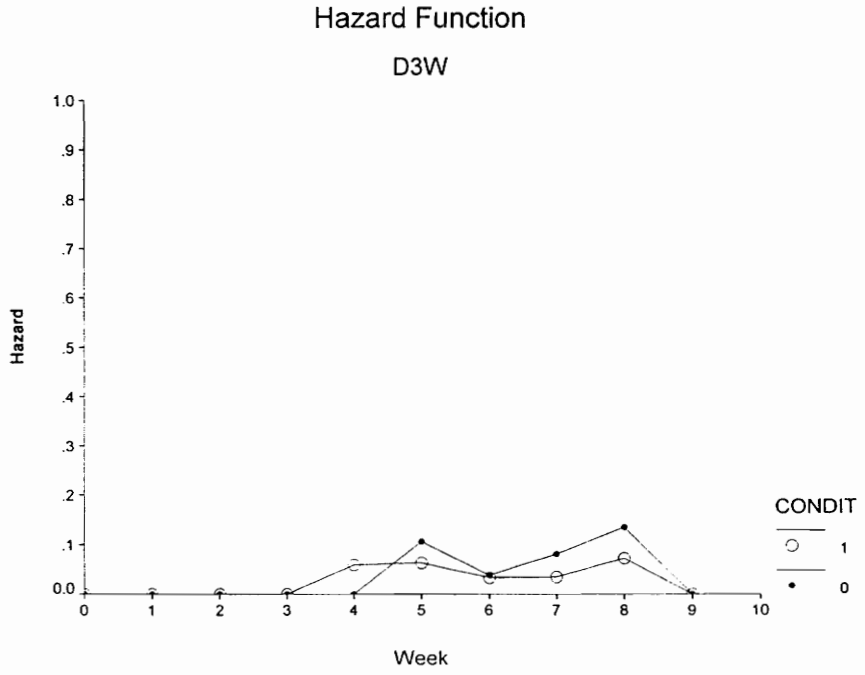


Figure 2 Survival Curve and Hazard Function for Dead 3 Weeks - Total Sample

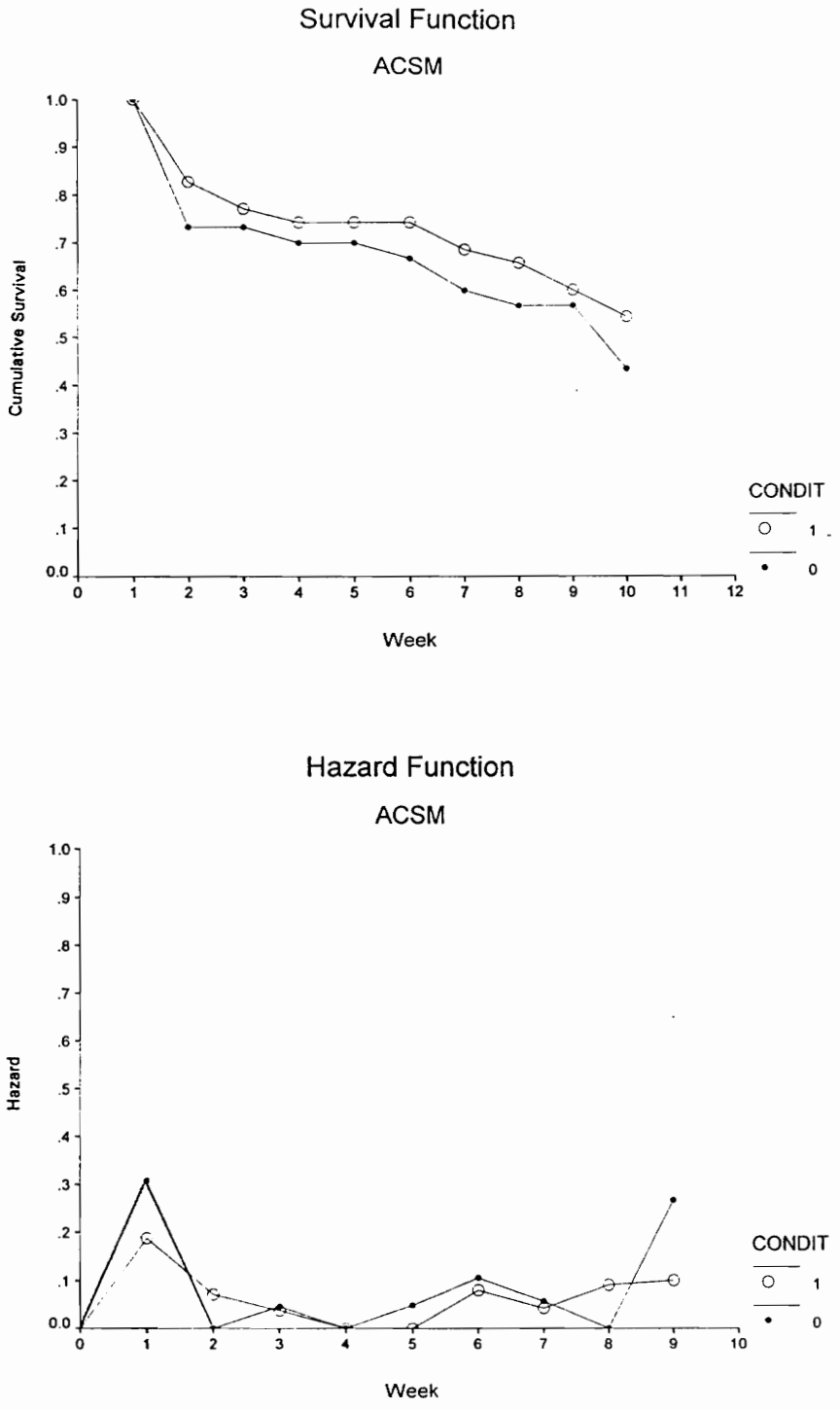


Figure 3 Survival Curve and Hazard Function for Dead ACSM - Total Sample

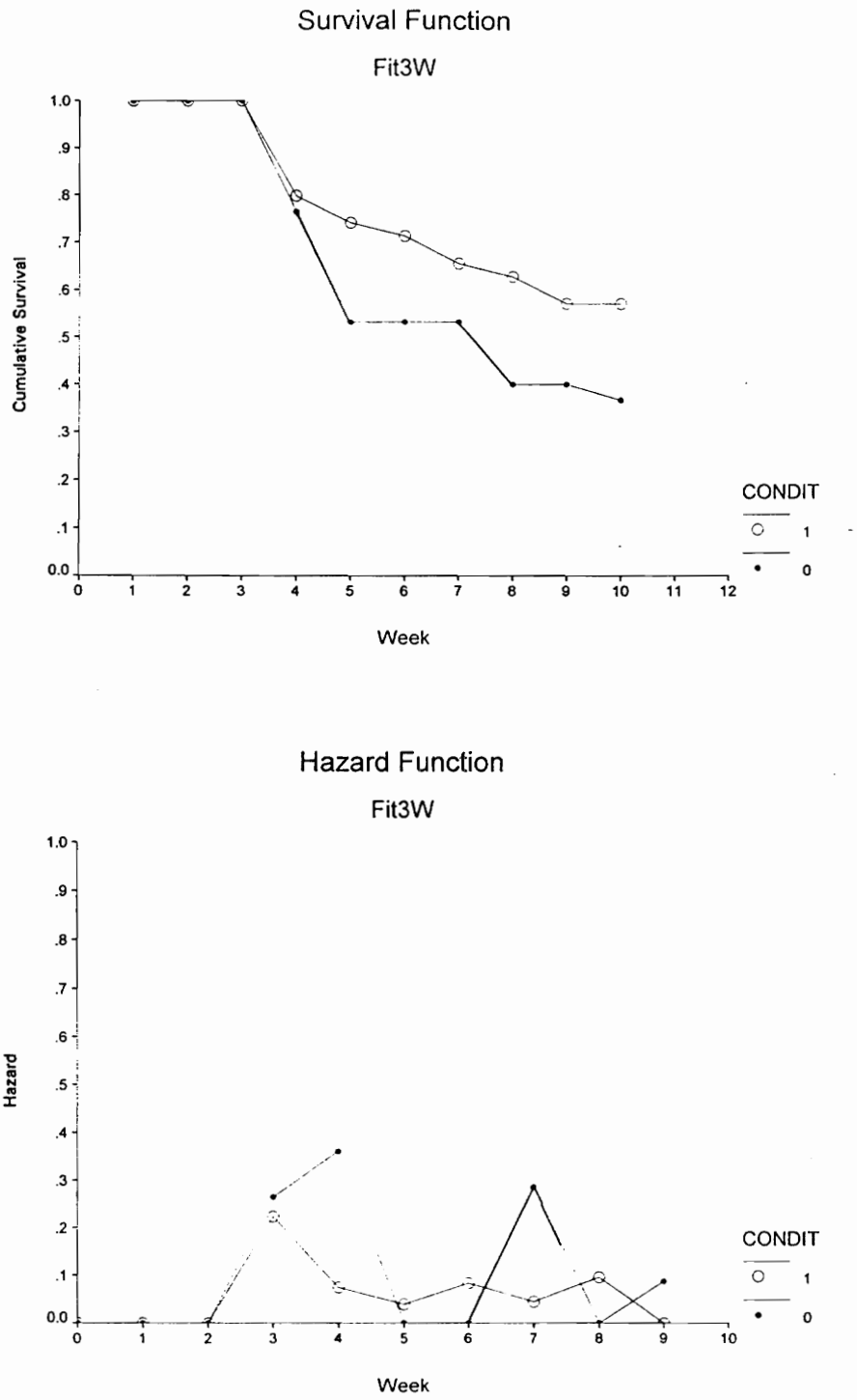
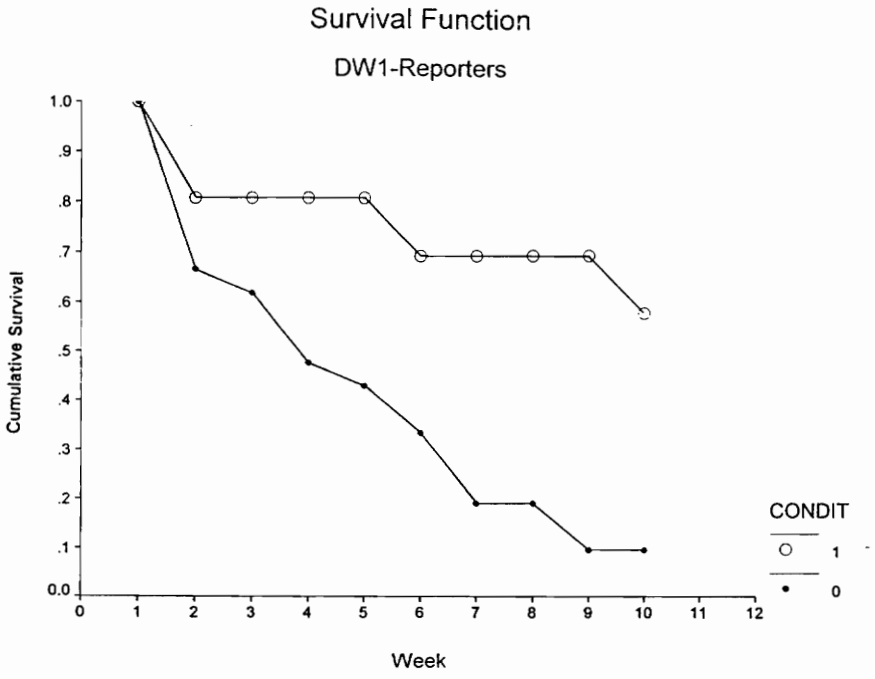


Figure 4 Survival Curve and Hazard Function for Dead Fitness - Total Sample



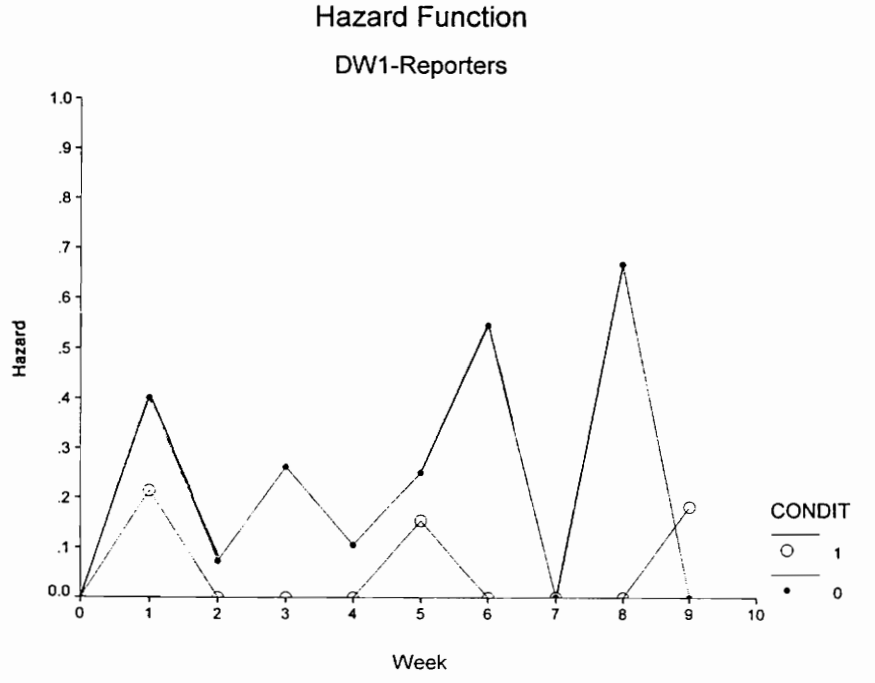


Figure 5 Survival Curve and Hazard Function for Dead 1 Week - Reporters Subsample

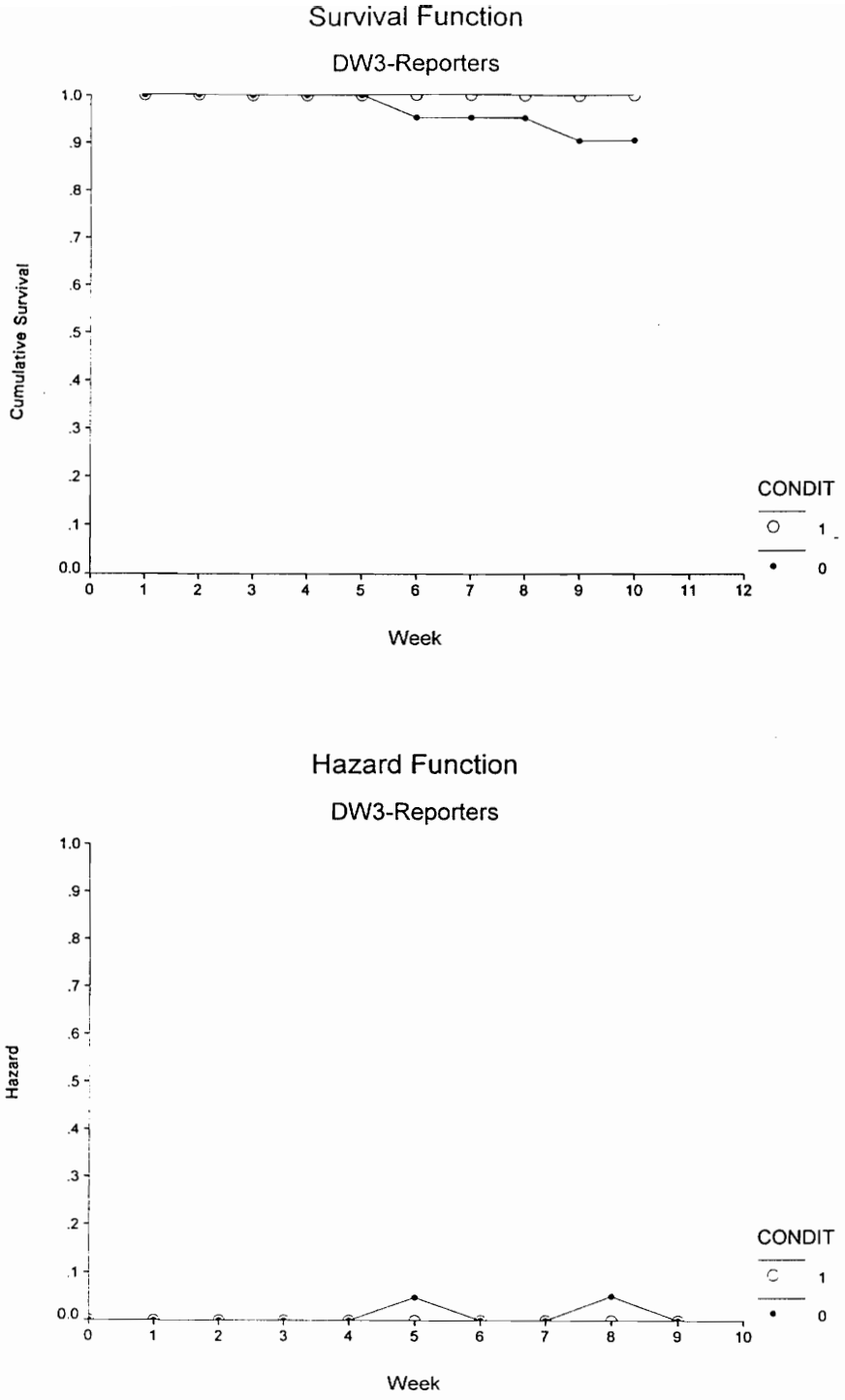
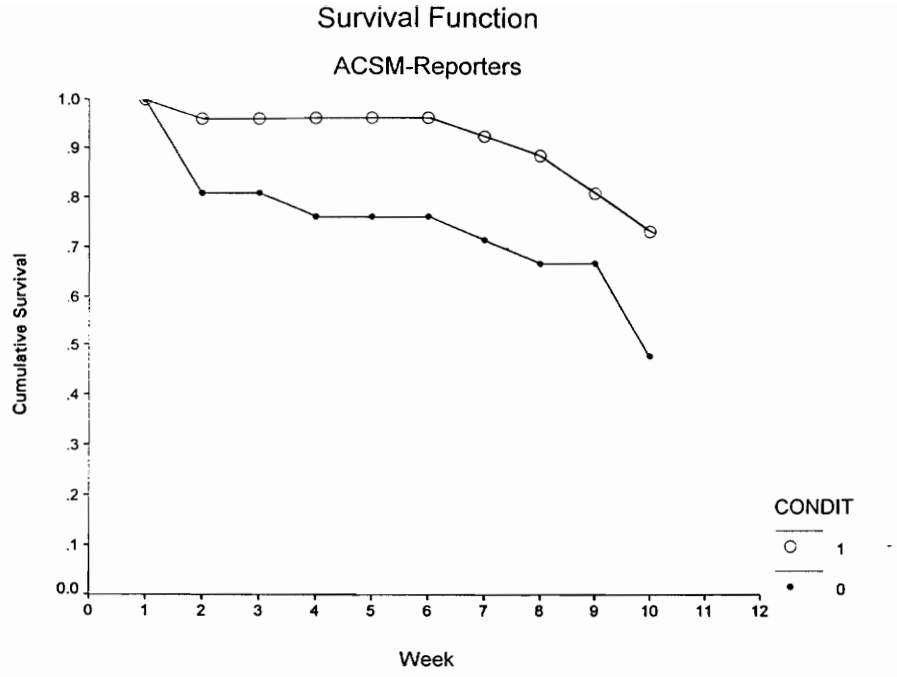


Figure 6 Survival Curve and Hazard Function for Dead 3 Weeks - Reporters Subsample



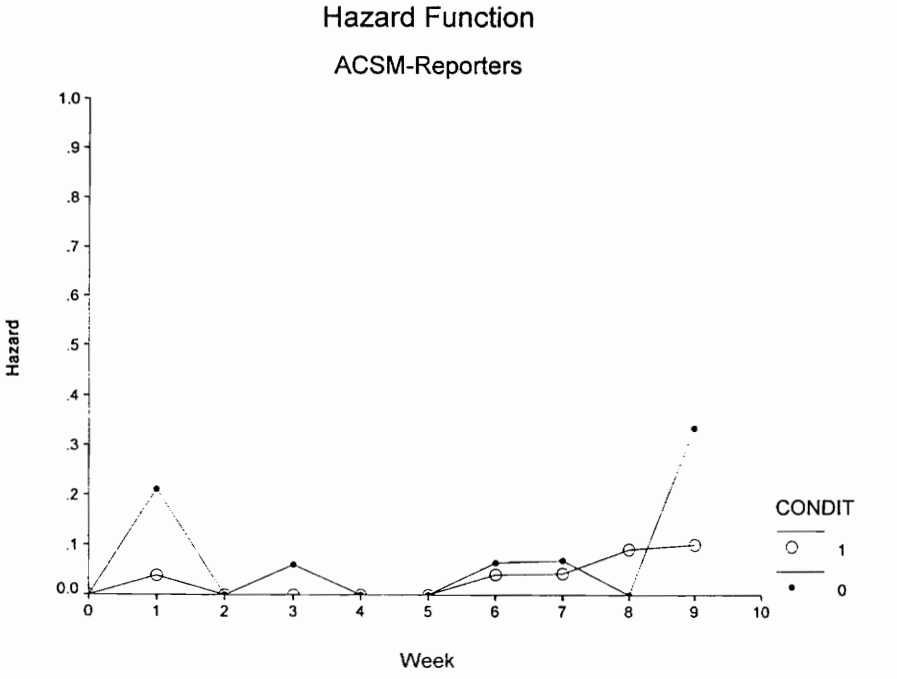
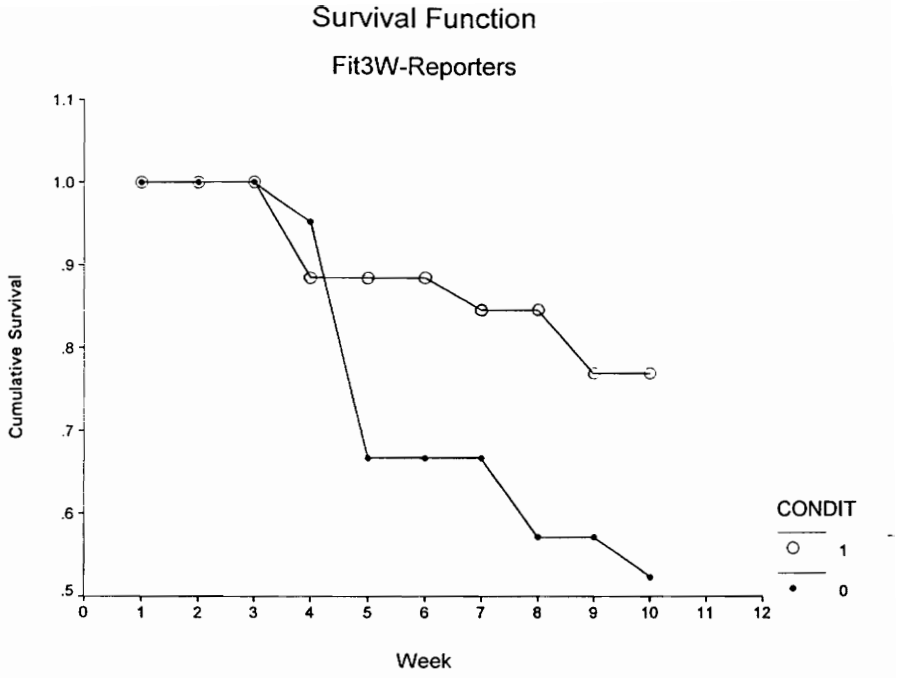


Figure 7 Survival Curve and Hazard Function for Dead ACSM - Reporters Subsample



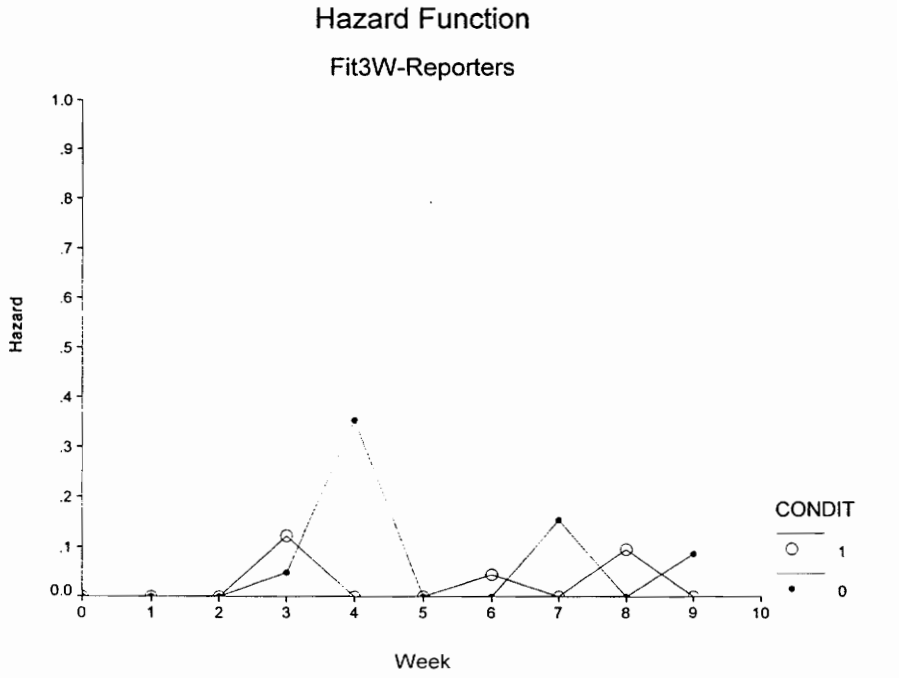
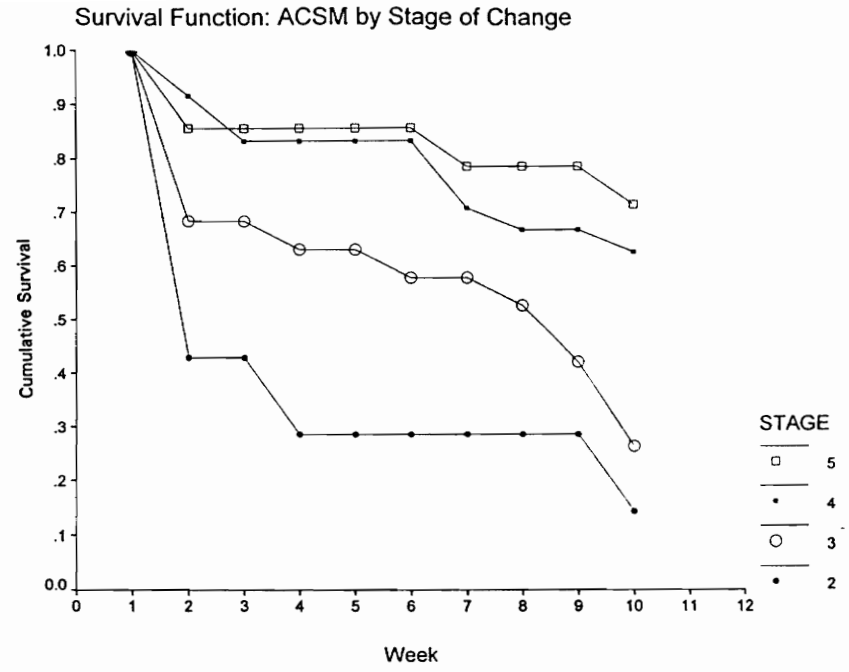


Figure 8 Survival Curve and Hazard Function for Dead Fitness - Reporters Subsample



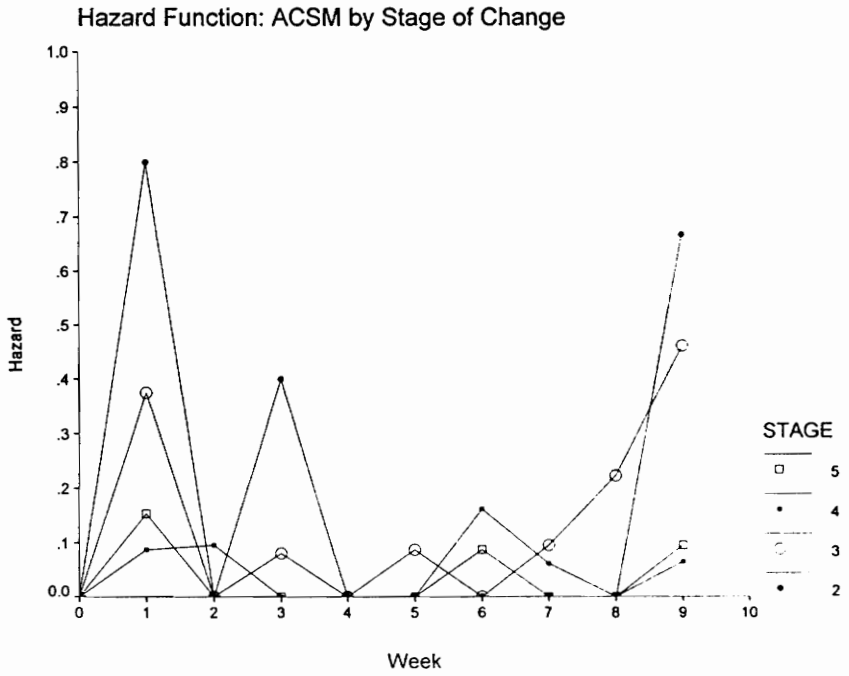
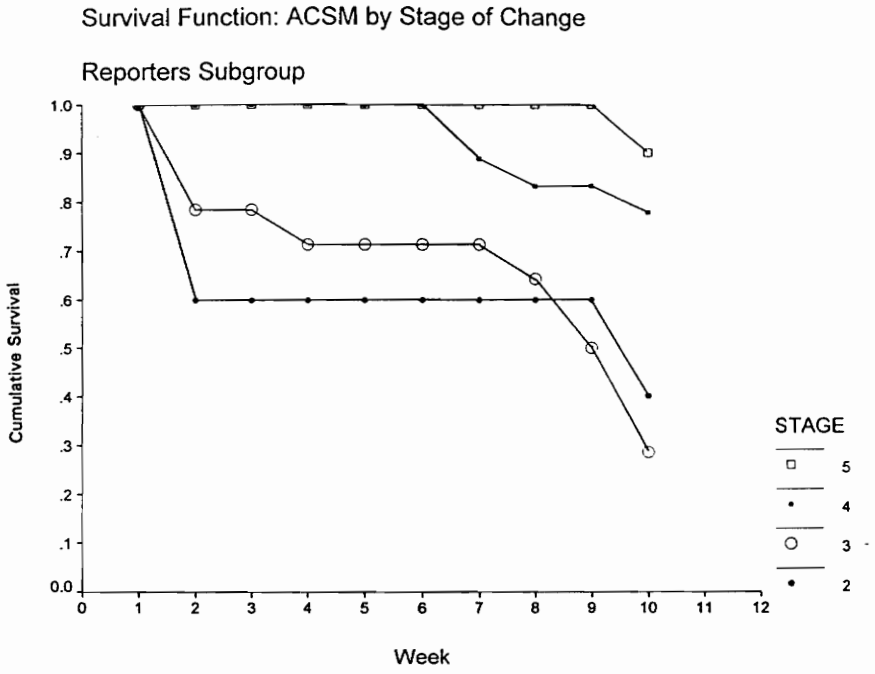


Figure 9 Survival Curve and Hazard Function for Stages of Change - Total Sample



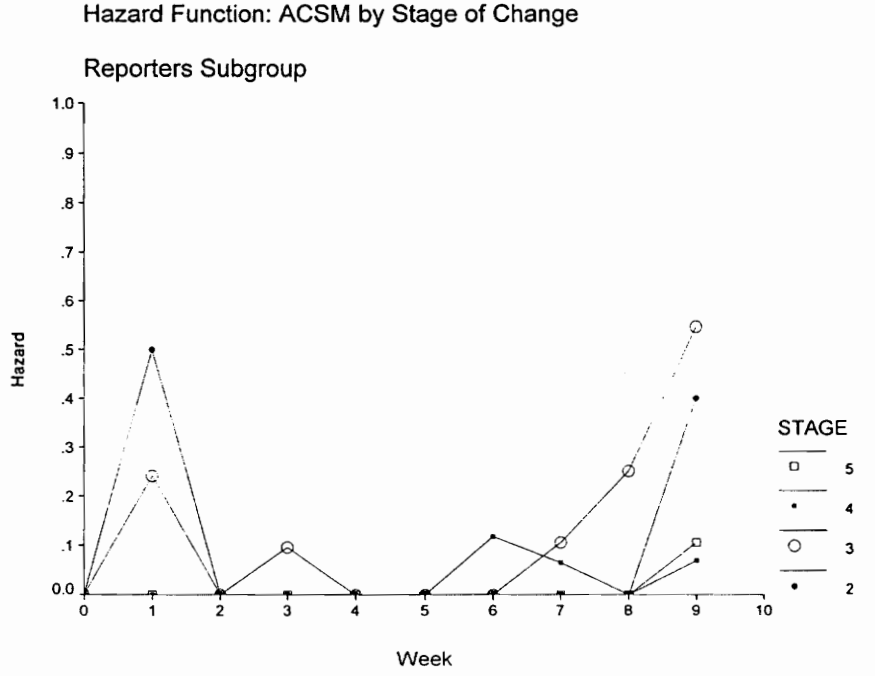
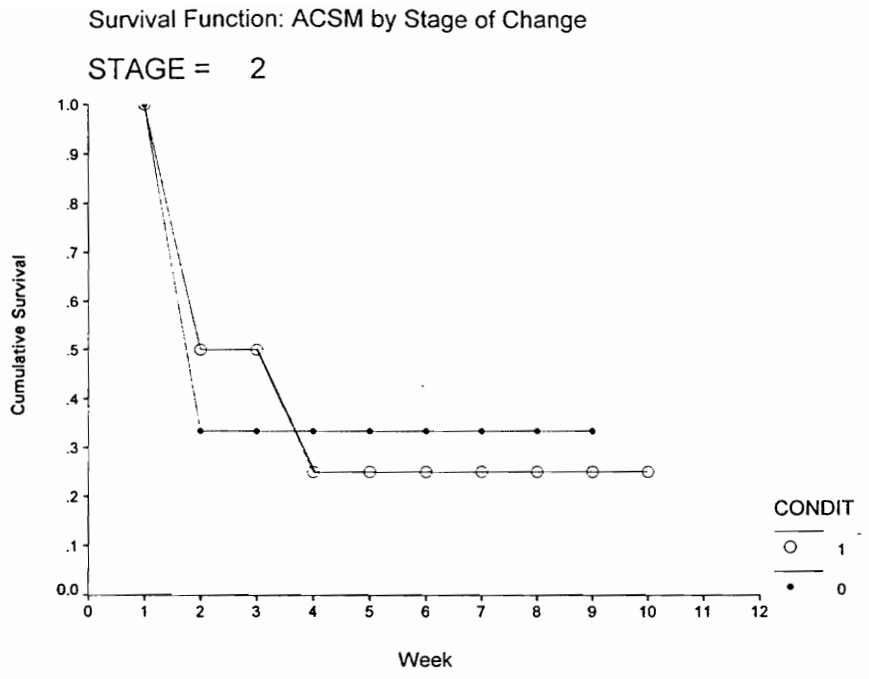


Figure 10 Survival Curve and Hazard Function for Stages of Change - Reporters Subsample



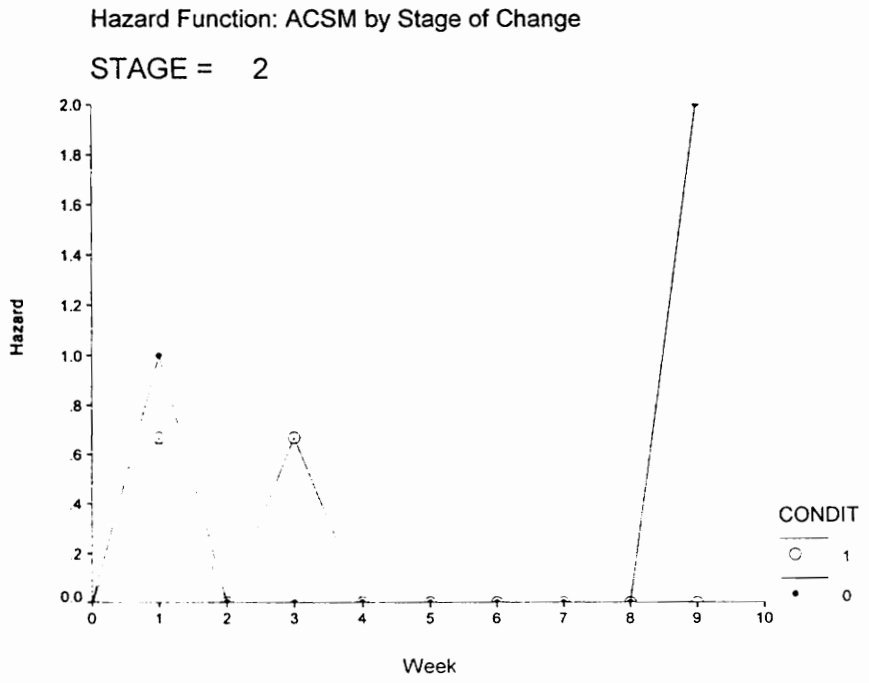
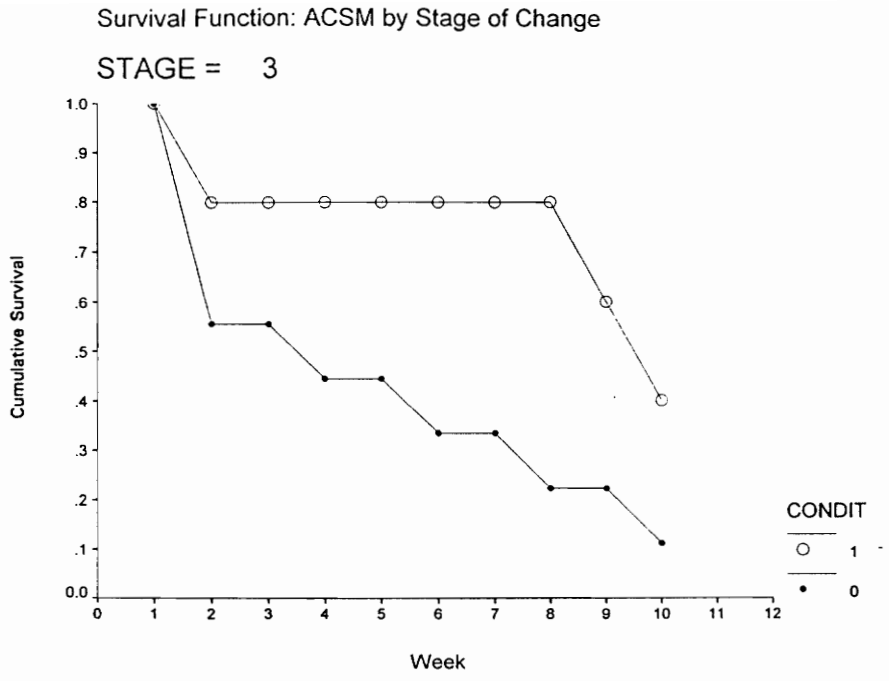


Figure 11 Survival Curve and Hazard Function Stage 2 - Total Sample



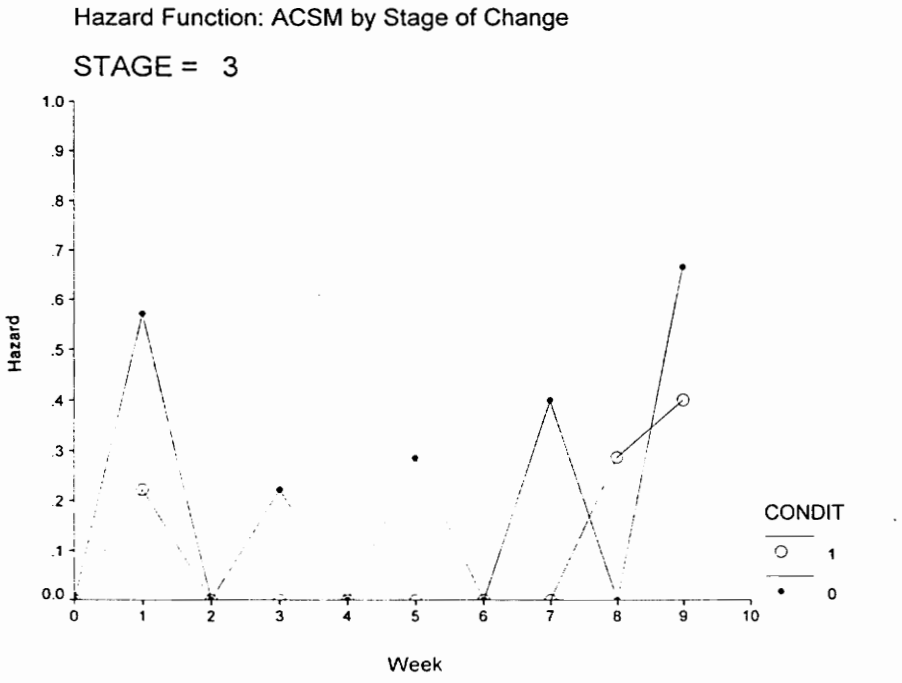
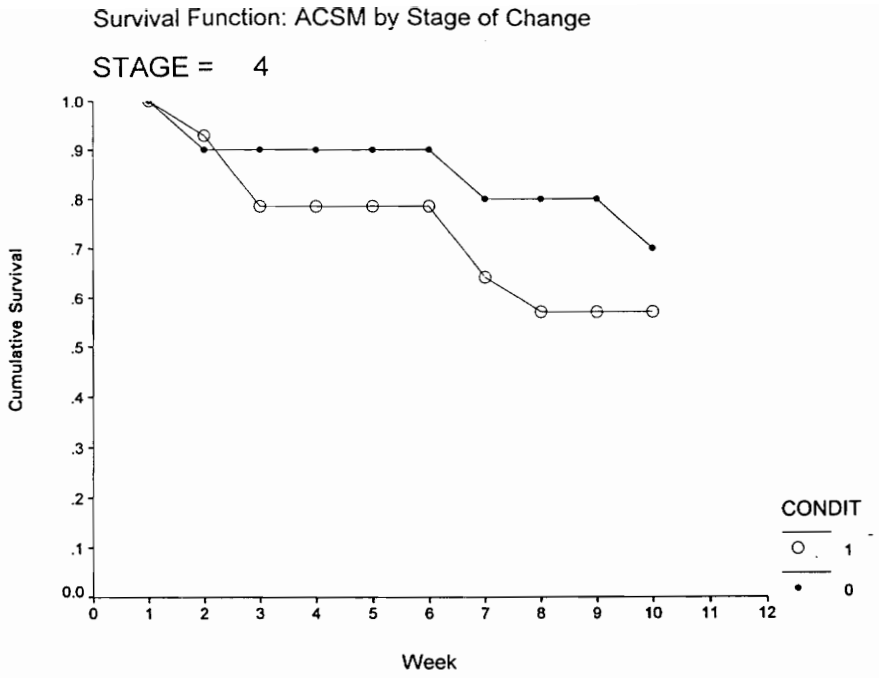


Figure 12 Survival Curve and Hazard Function Stage 3 - Total Sample



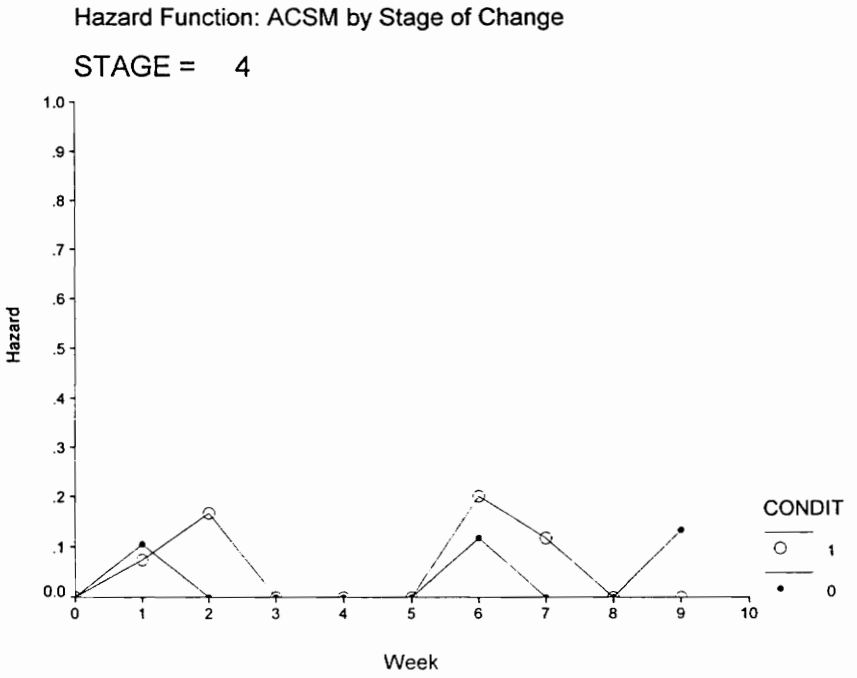
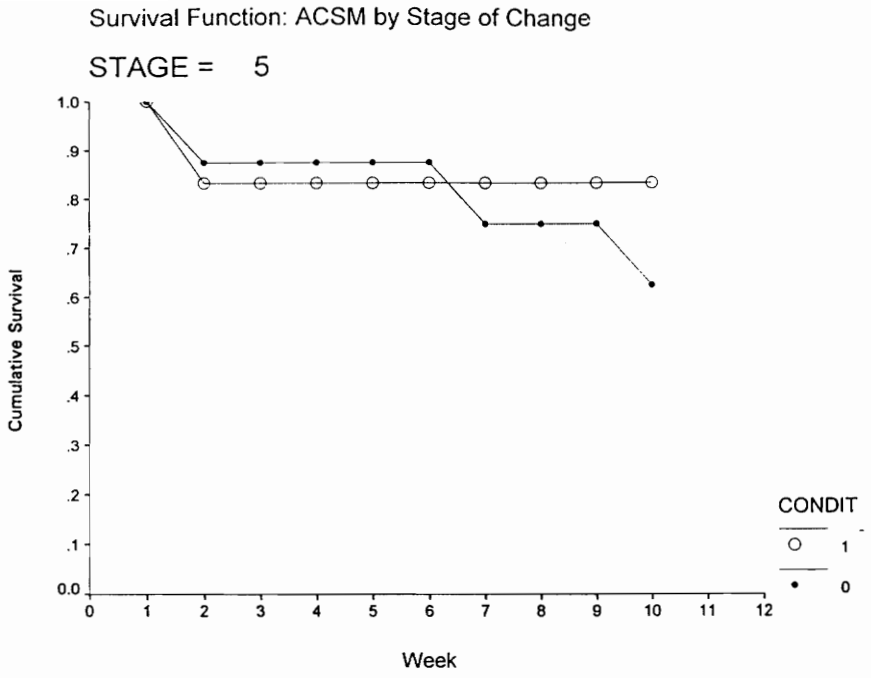


Figure 13 Survival Curve and Hazard Function Stage 4 - Total Sample



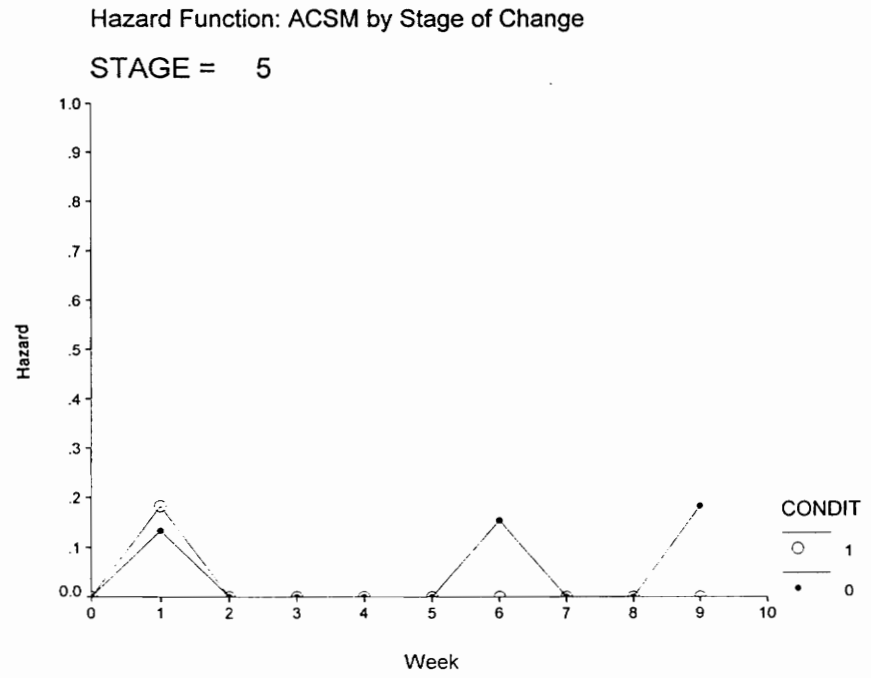


Figure 14 Survival Curve and Hazard Function Stage 5 - Total Sample

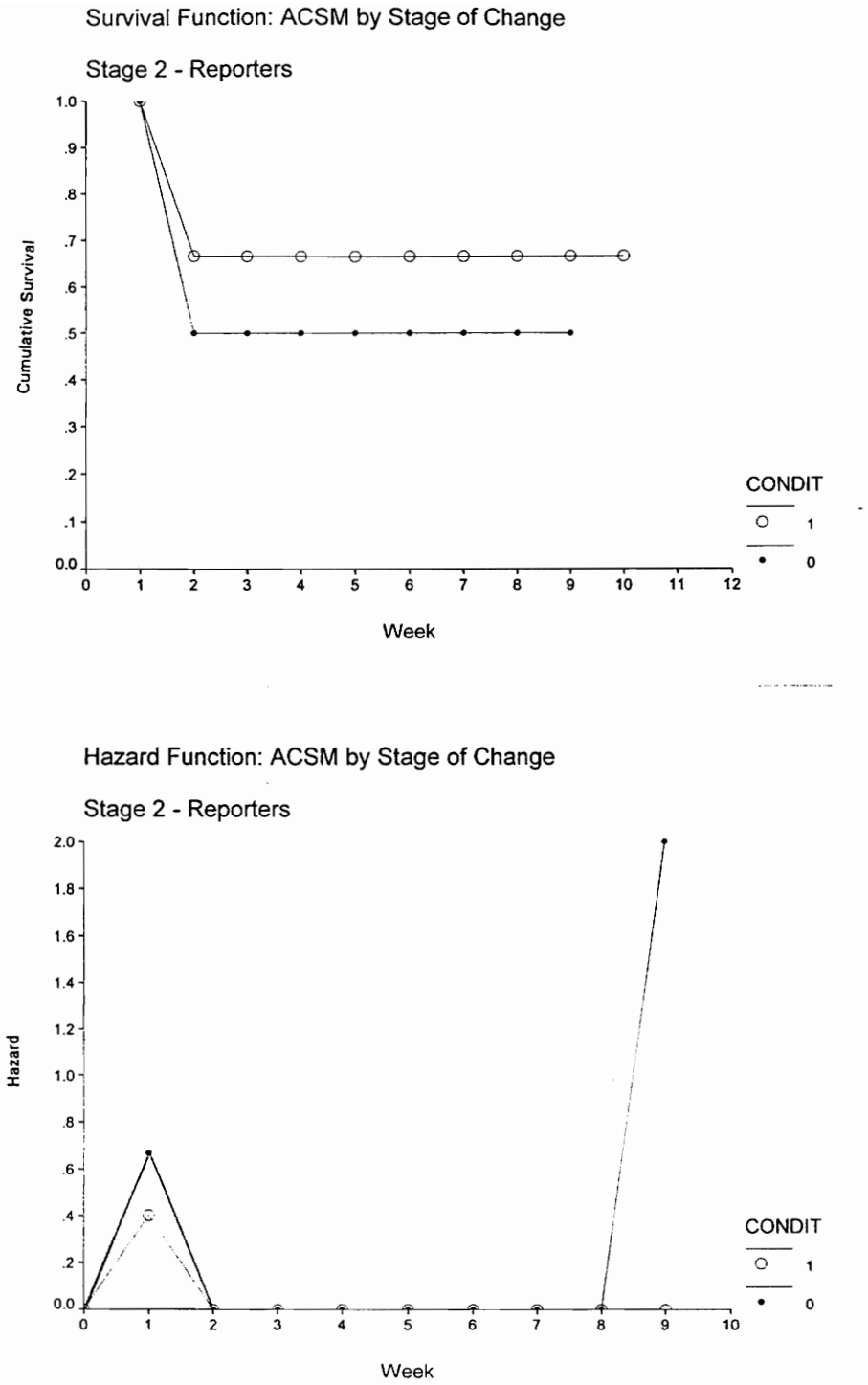
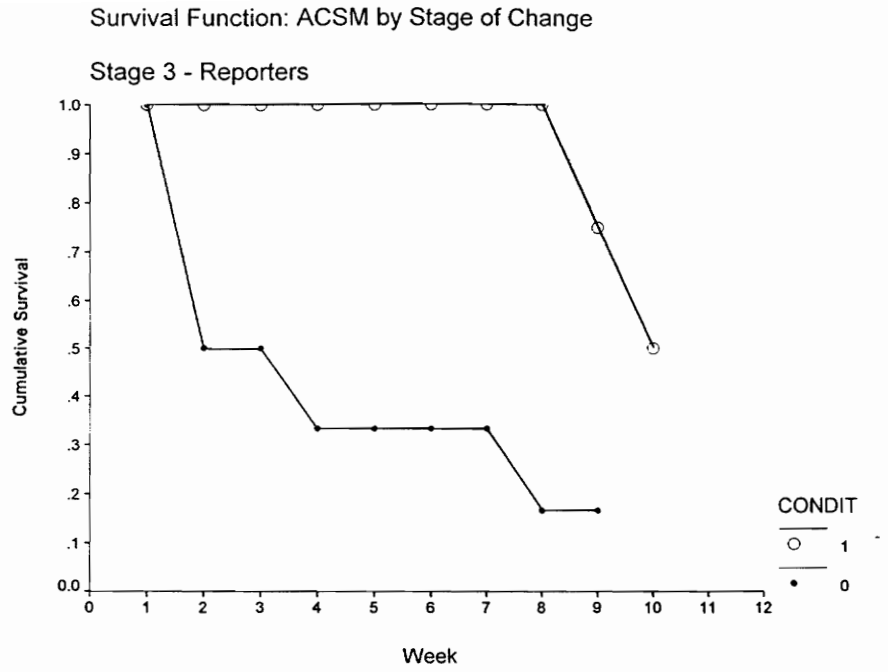


Figure 15 Survival Curve and Hazard Function Stage 2 - Reporters Subsample



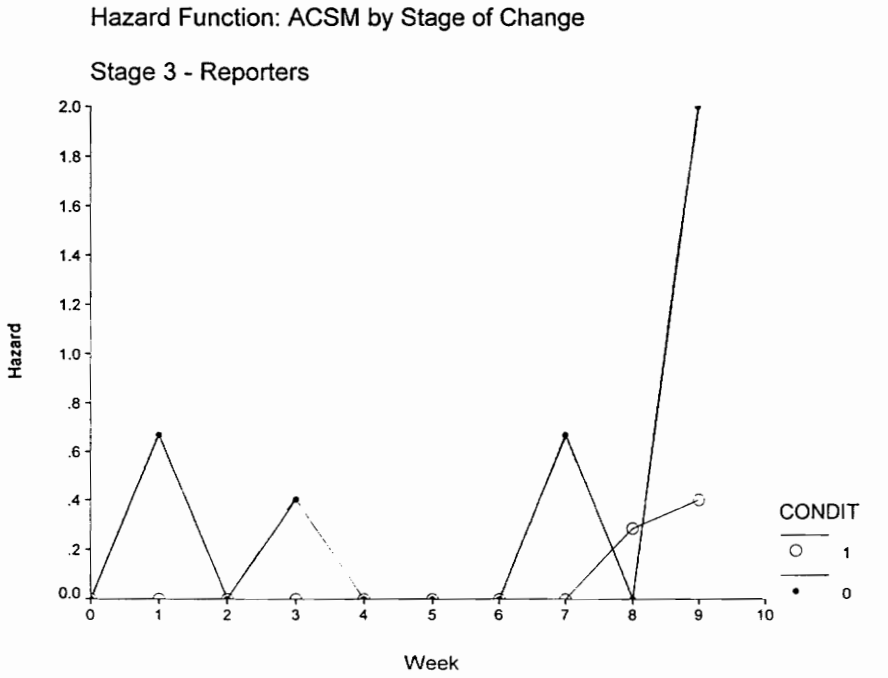
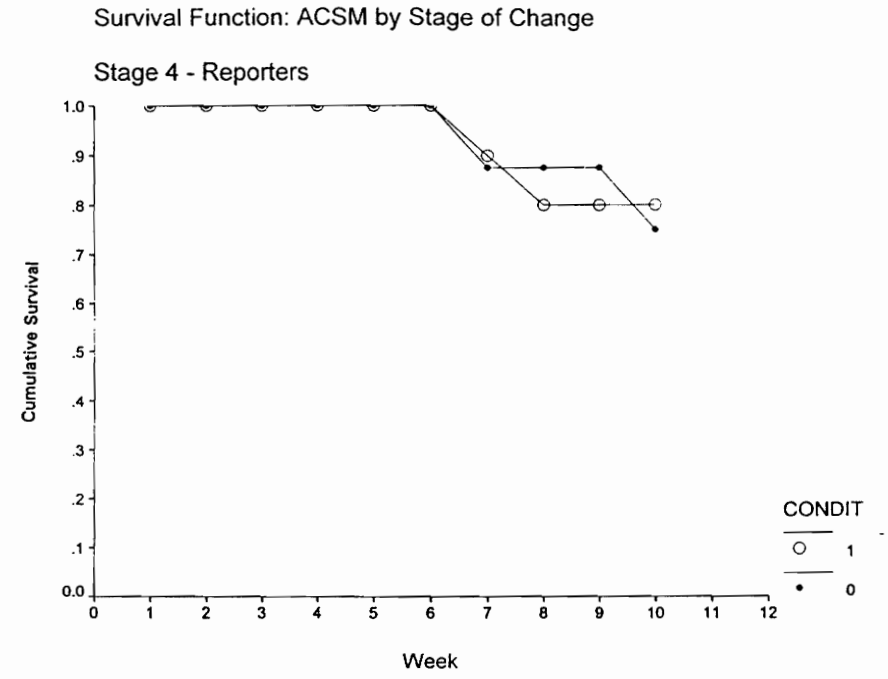


Figure 16 Survival Curve and Hazard Function Stage 3 - Reporters Subsample



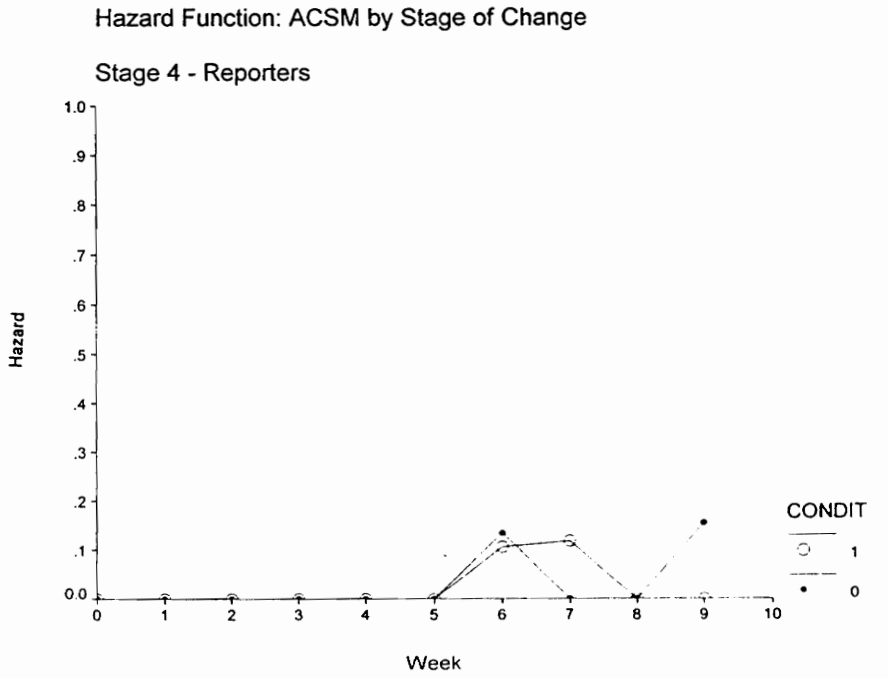
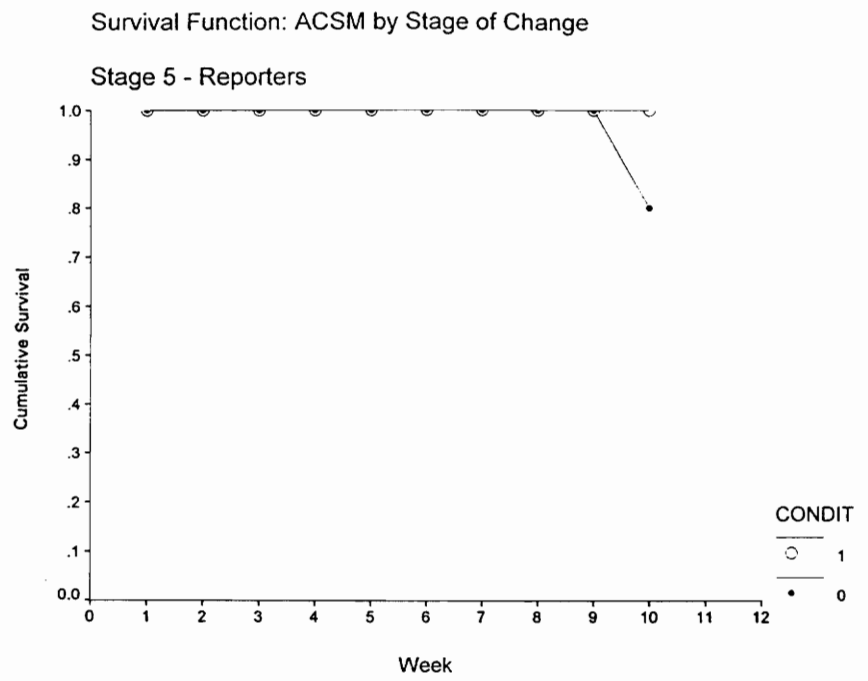


Figure 17 Survival Curve and Hazard Function Stage 4 - Reporters Subsample



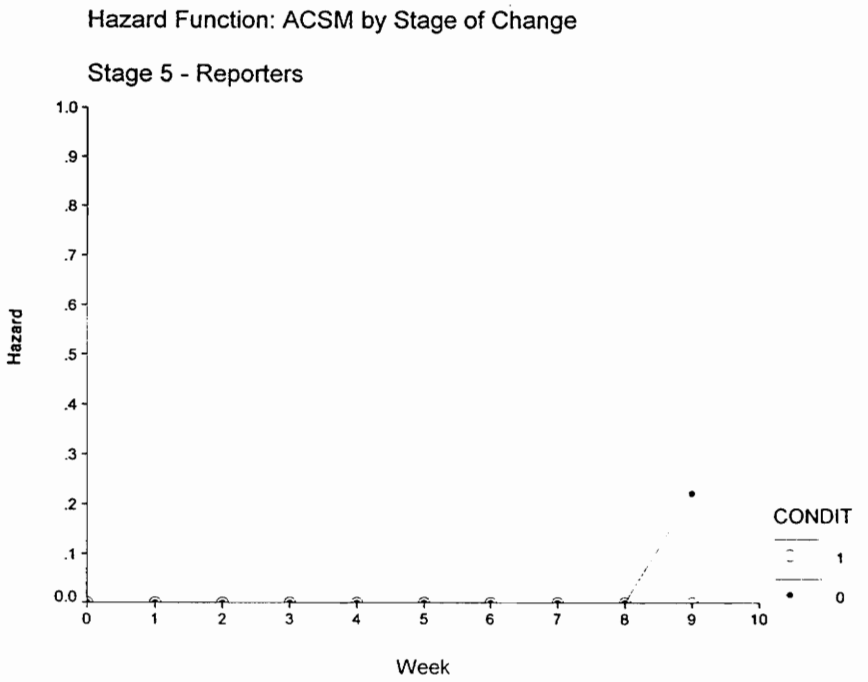


Figure 18 Survival Curve and Hazard Function Stage 5 - Reporters Subsample

Appendix A
Advertisements of Program

The

SPECTRUM

Walking to be promoted through computer network

A free Health Habits Walking for Fitness program will begin in early February for the faculty, staff, graduate students, and community residents with access to the Tech network or the Blacksburg Electronic Village.

Participants will receive access to a well-tested exercise program which was successfully run at Virginia Tech last year.

According to Richard Winnett, professor of psychology and director of the Center for Research in Health Behavior, walking is ideal for beginning consistent exercise because it is accessible to almost everyone, requires no training, and has a low risk for injuries. "Although many people do not consider walking to be exercise, a good brisk walk three times per week can offer some real health benefits and is a great place to start," Winett says.

The project "is a first step to see if proven health promotion interventions can be successfully transferred to computer networks," says Winett. Messages and prompts to encourage participants to continue in the program will be sent via computer.

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Faculty, Staff & Graduate Students

Shape Up For

Join

HEALTHY HABITS

WALKING FOR FITNESS

Computerized Exercise Program

It's Free !
Call Today...231-8747 for information.

Offered by The Center for Research in Health Behavior

Faculty, Staff & Graduate Students

Need to Shape
Up Your
MAINFRAME
After the
Holidays ?

A Computerized Exercise Program
Is the Answer

join

HEALTHY HABITS

WALKING FOR FITNESS

It's Free!

Call Today...231-8747..For Information

Offered by The Center For Research In Health Behavior

Attention: Faculty and Staff

Exercise

Promoted Through E-mail !

TAKE ADVANTAGE OF NEW FITNESS TECHNOLOGY...

join

HEALTHY HABITS

Walking for Fitness Program

- A Free Program
- Uses Campus Computer E-Mail or the Blacksburg Electronic Village (BEV)
- For Information Call 231-8747 or Send E-Mail to dtate@vt.edu

CALL TODAY - Program Starting Soon!

Be ♥ Smart !

Program offered through The Center for Research in Health Behavior

Appendix B
Walking Information Booklet

HEALTHY HABITS

WALKING FOR FITNESS PROGRAM

The Center for Research in Health Behavior
Virginia Polytechnic Institute & State University
Blacksburg, VA 24060

Program Coordinator: Deborah Tate
Phone: (703)231-8747
Email: dtate@vt.edu

THE BENEFITS OF WALKING

A STEP IN THE RIGHT DIRECTION:

You have made an important step toward improving your health...you've decided to increase your activity. In making the decision to join a walking program you may have asked yourself...

WHY SHOULD I START EXERCISING?...

...I don't have much time...
...I'll feel sore...
...I haven't exercised in years...
...I'm too tired ...
...I'm too fat...
...Exercise takes too long...
...Exercise is boring...

A FEW REASONS FOR EXERCISE:

Regular physical activity can help:
- reduce risk of coronary heart disease
- reduce risk of hypertension
- reduce risk of some forms of cancer
- lessen the severity of osteoporosis
- lower your cholesterol level
- manage weight
- improve muscle tone
- increase strength & flexibility
- improve respiratory capacity
- relieve stress and depression
- give you more energy

As you can see, there are many important reasons to make exercise a regular part of your life. This program is designed to help you begin and maintain a Healthy Habit --- Walking for Fitness!

WHY IS WALKING A GOOD FORM OF EXERCISE?

Walking is a very beneficial and enjoyable form of exercise. It improves cardiovascular endurance and muscle tone yet is low impact which means it has a low risk for injuries. Anyone can begin walking for exercise, without any special instruction or equipment. There are no scheduled classes or gym hours, so you can walk at any time of day and anywhere to make it convenient for you. There are places all over campus, both indoors and outdoors, that are perfect walking courses. And walking is an exercise that can be tailored to each individual's fitness level. You can start out at a slow or moderate pace and shorter distance and build speed and duration as your fitness improves. Walking is also an exercise that can be enjoyed in a group which may help to pass the time, make exercise more enjoyable, and give you the support you need to keep walking on days when you might be inclined to skip your workout.

Fitness Facts

Muscles contract 1500 - 3000 times for each mile you walk - - almost more than any other form of exercise...

WALKING FORM

It is important to develop the habit of walking with good form...Good form is one key ingredient in an injury free walking program.

☑ **Check Your Form:**

- Walk tall keeping a straight posture (Don't lean forward or backward).
- Keep your shoulders relaxed.
- Keep your feet pointed straight ahead of you (Don't point toes out or in).
- Use a comfortable stride - not too long or too short.
- For each step, your foot should follow a pattern with weight placed on the heel, ball of the foot, and then toes.
- Try to avoid bouncing or coming down hard on the heel -- aim for a smooth, graceful stride.
- Let your arms swing naturally at your sides or bend 90^{0} at your elbow.

WALKING SHOES...

You should select walking shoes that are comfortable and provide enough support for your foot and ankles. In general, walking shoes should:

- ✓ have a thick cushion sole
- ✓ be flexible
- ✓ have a good arch support
- ✓ not be too tight (about ½ inch from end of toes to shoes)

You may want to look at exercise magazines for shoe comparisons and reviews or consult with an athletic shoe store for more information.

WHAT TO WEAR...

Layers of clothing are essential for cold weather workouts because you can easily remove an outer layer as needed and carry it along with you. You may need to put the outer layer back on again after the cool down period to prevent a chill. When it is very cold, it may be a good idea to exercise indoors. If you decide to walk outside, warm up indoors before going out, wear a coat, hat and mittens. In snow or rain, you may want to walk in boots to keep your feet dry and protect your walking shoes.

As the weather warms, shorts or sweatpants and T-shirts will be appropriate. Again, layering a T-shirt and sweatshirt (and/or shorts with sweatpants) at the start of your walk may be appropriate.

INCREASING YOUR EXERCISE

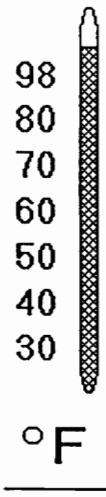
How often, how far, and how fast you walk will be based on your own individual fitness level. How rapidly you increase your exercise program will depend on how much activity you are used to, how much you walk each week, and what you hope to accomplish.

SOME SUGGESTIONS FOR THE BEGINNING WALKER:

Weeks of the Program	Duration of Walks	Frequency of Walks
1-2	10-15 minutes	3-4 times per week
3-4	20-25 minutes	3-4 times per week
5-6	30-35 minutes	3-4 times per week
7-8	40-45 minutes	3-4 times per week
9-10	50-55 minutes	3-4 times per week

* Walking workouts listed above **do not** include 5 minute warm-up and 5 minute cool-down periods which are essential for allowing your body to adjust to exercise and return to resting state following exercise.

** Before increasing your walking workout you should feel comfortable and not out of breath at your current walking level.



Warming Up and Cooling Down

Warm up and Cool down periods are essential parts of your workout. If you are short on time it is important to do less of your "walking workout" rather than skip warmup or cool down.

Warming up for Waking:
Warming up increases the blood supply to the tissues which will be working. One of the best ways to prepare for a walking workout is to spend 5 minutes walking -- working up from a leisurely stroll to a moderate pace (not as fast as your workout). You will have warmed up the muscles you will be using and can then begin to walk at your workout pace.

Cooling Down After Walking:
Walk slowly for a few minutes after your workout to allow your body to return to your normal rest state. You may want to do a few slow stretches for your thighs, buttocks, lower back and calves during your cool down period.

PICKING UP THE PACE

If you are already a seasoned walker you are probably walking 3-4 times per week for 40 minutes or more. Now, you will want to work on increasing the pace of your walk to improve your cardiovascular workout. To do this:

★ Chose a pace that you can comfortably sustain for the entire distance.

★ You should not feel breathless. A good test -- see if you can easily converse with your walking partner!

SETTING GOALS FOR YOURSELF:

When beginning an exercise program almost everyone has a long term goal in mind. Long term goals are things like...

...I want to get in shape !
...I want to lose weight !
...I want to feel stronger !
...I want to feel better !
...I want to be more healthy !
...I want to walk the length of the Appalachian trail in Virginia !

It is helpful to break down your long term goals into smaller goals which you can more easily accomplish. These smaller goals are called short term goals. Setting short term goals allows you to take note of the progress you are making along the way to meeting your larger long term goal.

Here's an Example:

"WENDY WALKER"

Wendy is 38 years old and has not really exercised much in the past 10 years. Wendy wants to lose 15 pounds. She also hopes to strengthen her muscles through weight bearing exercise, which she has heard will help to prevent osteoporosis. Wendy may be able to meet her long term goals by developing some Healthy Habits.

Wendy might get discouraged if she doesn't see results right away. Setting short term goals (i.e. weekly) will allow her to chart her progress and to celebrate along the way!

A Good Weekly Goal Might Be:

I'll walk for 20 minutes four times this week.

PREVENTING INJURIES

Although walking has low risk for injuries, doing TOO much TOO soon can lead to injuries. The key to an injury free exercise program is PREVENTION!!

Take the following precautions to minimize your risk of injury:

* warm-up
* increase speed and distance gradually
* cool down slowly
* don't exercise when injured
* stretch muscles after workouts
* monitor your heart rate
* slow down if you need to

Injuries can take the fun out of exercise. If you do get hurt, we strongly recommend that you see a doctor. You should not continue to exercise unless a physician tells you that it is okay to return to your workouts.

What About Minor Injuries??

Blisters: Blisters are caused by repeated friction while walking.
How To Prevent Them:
- Make sure shoes fit comfortably
- Wear a pair of thin socks inside your sport socks
- Use band-aids to cover points of friction
- Rub petroleum jelly under toes and around heel

Shin Splints: Pain along the front of the lower leg caused by inflammation & overuse of the muscles.
How to Prevent Them:
- Gradually increase your workouts
- Stretch your calves before exercising
- Wear shoes with good arch support

To Treat Them: Rest and apply ice for 20 minutes at a time.

Stretching Properly Helps To Prevent Injury...

You should stretch the muscles used for exercise. Stretching before exercise helps to prepare your muscles and joints for the workout. Stretching after exercise helps to increase your flexibility and prevent stiffness.

Stretch slowly and hold each stretch for 30 seconds. Stretching should only be to the point of mild tension. "Overstretching" can cause injury too! Don't force yourself to stretch further than a feeling of gentle tension.

MONITORING YOUR PROGRESS
Heart Rate

When beginning an exercise program you will want to exercise at the Low End of your Target Heart Rate Zone and then gradually increase the intensity of your workout. We would like you to monitor your heart rate during this program. At the peak of your workout (point of sustained maximum activity), stop to take your 10 second heart rate. Use two fingers to take your pulse at your carotid artery (on the side of your neck) for 10 seconds, then complete your walking workout. We ask you to record your 10 sec heart rate and to report this information to us each week.

To Calculate your Target ❤ Rate Zone:

1st	220 - your age (years) = Age Adjusted Heart Rate Maximum
	220 - _____ = _____(HR max)

2nd	.60 x (HR max) =Low End of Target Heart Rate Zone
	.60 x _____ = _____

3rd	.75 x (HR max) = High End of Target Heart Rate Zone
	.75 x _____ = _____

Record ❤ Rate Info Here:

Heart Rate Max _____ Low End THR_____ High End THR _____

Compare your 10 Sec ❤ rate During Exercise to your Target Heart Rate Zone:

1st (your 10 sec ❤ rate) x 6 2nd Compare to your THR

If your actual heart rate is GREATER than your High End THR you should SLOW DOWN, but if your heart rate is LESS than your Low End THR you may want to SPEED up a bit to get health benefits from your workout.

MONITORING YOUR PROGRESS
Exertion & Feelings

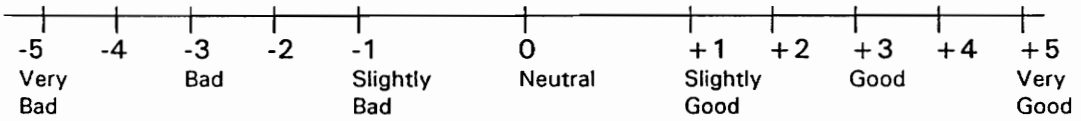
BORG'S PERCEIVED EXERTION SCALE

The Perceived Exertion Scale is a self-report scale which was developed to assess your perceptions of physical workload or exertion during exercise - how "hard or heavy" you felt you exercised. After your walking workouts we would like you to record a number from this scale which best matches your perceived exertion at the peak of your workout. This scale, combined with your heart rate information, will help us to monitor your physical exertion during the exercise program.

6	No exertion at all
7	Extremely light
8	
9	Very light
10	
11	Light
12	
13	Somewhat hard
14	
15	Hard (heavy)
16	
17	Very hard
18	
19	Extremely hard
20	Maximal exertion

THE FEELING SCALE

In order for us to keep up with how you feel while exercising we will ask you to use a simple method of reporting this to us. The Feeling Scale is an 11 point scale which ranges from very good (+5) to very bad (-5). You should record a number which indicates how you felt while you were exercising. It is not necessary to write this down in the middle of your workout, just think about it and jot it down when you have finished. You may feel good about some workouts and not so good about others so your ratings on the feeling scale may vary.



MONITORING YOUR PROGRESS
Walking Logs

Maintaining walking records helps people chart their progress and is an easy way to see if you have met your goals each week. We will ask you to keep track of your exercise each week and to let us know by sending a weekly Email message. You can use the Email system you are most familiar with to send your message. Send a message to the program coordinator which contains the following information:

- ◊ Walking Data for that Week
- ◊ Goals for the Next Week
- ◊ Comments or Questions

A computer has been programmed to "collect" this information so that we can keep accurate records of how everyone is progressing. In order for the computer to read the information you send, it must be in a specific sequence and format.

WALKING DATA:

In your email message, precede each line of walking information with the word "DATA" and type your information in the following sequence:

Day of Week (abbr.)	# of minutes walked (i.e. hh:mm)	# of miles walked (i.e. 1.2)	10 second ♥ Rate	Perceived Exertion (6-20)	Feeling Scale (-5 to +5)	Partners email or phone #

Example: **DATA Wed 0:30 2.0 17 11 5 smith@vt.edu, dave johnson 1-8746**

This Means: You walked on Wednesday for 30 minutes and went 2 miles. Your 10 sec. heart rate was 17, perceived exertion rating was 11, and feeling scale rating +5. You walked with Barb Smith and Dave Johnson.

Important:

- ★ Be sure to type "DATA" before each different day of walking record info.
- ★ Insert a blank space between each part of the record.
- ★ If you walk with more than one partner, separate their e-mail addresses or phone numbers with a comma (,) and a space. If you do not walk with a partner type "NO PARTNER".
- ★ See sample message shown in program booklet.

GOALS FOR NEXT WEEK:

After your walking data, please type the goal you have made for the next week of the program. In your email message, precede each line of goal information with the word "GOAL" and type your information in the following sequence:

DAYS # of days you plan to walk next week	TIME # of minutes planned for each outing (i.e. hh:mm)	DISTANCE # of miles planned for each outing (i.e. 1.2) (optional)

Example: **GOAL 3 0:30 2.0**

This Means: Your goal is to walk 3 times next week for 30 minutes each. You plan to cover 2 miles each time you walk.

Important:

★ Be sure to type "GOAL" before you type your goal information

★ Insert a blank space between each part of the record.

★ Some people may not choose to set goals in terms of how far they will walk but will prefer to increase only frequency and duration of your workouts. We want your goals to work best for you, so the distance part of the goal statement is optional. Please tell us how far you plan to go if you are working on increasing the pace of your walks!

COMMENTS / QUESTIONS / MESSAGES:

You may send comments or questions with your walking information. Simply type: "MESSAGE" and then continue with your question or comment.

Example: **MESSAGE**
The content of your message would be typed here.

At the end of your message type "STOP".
(before any signature if you have one attached to your email messages)

Send your message EVERY MONDAY to:
walkbot@vt.edu

SAMPLE MESSAGE

To: walkbot@vt.edu
Subject: (optional)

DATA Mon 0:40 1.5 17 12 5 smith@vt.edu
DATA Wed 0:20 1.0 16 12 4 dave brown 1-6000, smith@vt.edu
DATA Fri 0:40 1.8 16 13 4 NO PARTNER

GOAL 3 0:25 1.6

MESSAGE
I am having trouble taking my heart rate.

STOP

REWARDING YOURSELF

Because you have decided to exercise you will give yourself a reward -- Better Health. Along the way you should reward yourself in other ways too!

You may want to reward yourself for:

- meeting your weekly goal;
- exercising 3 times per week for 2 weeks in a row;
- exercising for a month, or two, or three...; or
- logging 25 miles.

The possibilities are endless. You should decide how much incentive you will need and then give yourself rewards for a job well done! You may want to set up some smaller rewards for meeting weekly goals and some larger rewards for meeting goals which are long term.

SOME IDEAS...

- new walking shoes
- fresh flowers or a plant
- an evening out
- movie or theater tickets
- a magazine subscription
- a manicure
- a new fishing rod
- a health club membership
- a bubble bath
- a foot massage
- a new bike
- a new walking outfit

Since you will be burning more calories with your increased activity maybe a frozen yogurt or going out for dessert would be appropriate.

BURNING CALORIES A 150 lb. person	Pace	Equal To	Burns
	3 mph	20 minutes/mile	275 calories/hour
	4 mph	15 minutes/mile	365 calories/hour
	5 mph	12 minutes/mile	585 calories/hour

Just remember, if you're hoping to lose weight with your walking program, "sweet" rewards should be used less frequently!!

ORGANIZE A WALKING GROUP...

Some people feel that walking in a group of two, three, or four people helps them to pass the time while exercising. Many people have reported that walking with friends makes it seem like not exercising at all! Walking Group participants also suggest that having other people to meet for daily walks helps them to be consistent and continue even on days they might be inclined to skip their workout. The support you will receive from walking partners can help your exercise program.

What time of day and which days of the week should we walk?

One of the greatest things about walking for exercise is that you can do it anywhere and anytime. You will need to assess your schedule to find a time that you can consistently set aside for yourself. You may find it convenient to walk during your lunch hour, or before or after work. If your weekly schedule is very busy you can walk both days on the weekends and one day during the week. If you prefer weekends free, you can walk several times during the week. Some parents find that when they drop their kids off at after school activities it is the perfect time to go for a walk either with a spouse or with other parents waiting for their children. It doesn't matter when you walk, only that you plan and schedule time to walk each week.

OR ...

...Walk to Music

Some people find that walking to music helps to pass the time while walking. The right music may also help you keep a good walking pace.

...Listen to a Book on Tape

Check out a book on tape from the library . It will take several walks to get to the end of the book!

...Walk your dog
...Compose a letter in your head
...Vary your routes
...Learn to identify trees or flowers

★ **Remember:** Be careful if you use headphones when you walk. For safety, you need to be aware of things around you...cars, bikes, people...

WHAT IF...?

What problems might keep you from continuing your new HEALTHY HABIT? And what can you do?...

IF: THE WEATHER IS BAD...

Try walking indoors...Walk the halls of some campus buildings, try the field house, or the mall!

IF: YOUR PARTNER CANNOT WALK WITH YOU...

Take it as an opportunity to spend some time on your own... or try walking with music or ask another friend to join you...

IF: YOU'RE TOO BUSY...

Make a commitment to make some time for YOURSELF! Exercise is important. It makes you feel better, gives you energy, helps you cope with your busy schedule...

IF: YOU FEEL DISCOURAGED...

Occasionally everyone has a bad day, or feels like they aren't improving as fast as they would like to...Your body is improving in ways you can't see. Take time to reflect on the progress you have made...Keep going, the improvement you're looking for is on the way...

IF: IT'S TOO HARD FOR YOU...

Slow down. Don't push yourself as hard. Remember, gradual increases in your exercise program help to prevent injury!

IF: YOU'RE BORED...

Try one of the "Making it Fun" suggestions. Variety is the key to ending boredom. Try a new time of day or walking route...

IF: YOU DON'T FEEL LIKE IT...

Go for a short walk...Once you get started you may decide to do a regular workout... The fresh air and sunshine can do wonders...You'll probably feel better and be glad you did it!

INDOOR

When the weather is not cooperating or for a change of pace, why not try an indoor walking route! Some Suggestions Follow:

THE FIELD HOUSE - Virginia Tech Campus

Hours:	8:00 am -	1:00 pm	Monday - Friday
	10:00 am -	1:00 pm	Sunday
	4:00 pm -	6:00 pm	Sunday

Distance Equivalents: 17 times around the track = 3 miles
so, 5½ times around = approx. 1 mile

ACADEMIC BUILDINGS - Virginia Tech Campus

Hours: Most buildings are open until at least 9 pm.

Try walking in Derring or McBryde after 5 pm. Both of these buildings form "loops" on certain levels. Experiment...find a new course!

NEW RIVER VALLEY MALL - Christiansburg, Virginia

Hours: Regular Mall Hours -

10:00 am -	9:00 pm	Monday - Saturday
1:00 pm -	6:00 pm	Sunday

Special Mall Walkers Hours-To take advantage of extended hours, sign up for Hearts In Motion at Mall Information desk)

7:00 am - 10:00 pm	Monday - Friday
9:30 am - 10:00 pm	Saturday
7:00 am - 7:00 pm	Sunday

Distance Equivalents:
Two "Loops" = approx. 1 mile.
See Suggested Route .

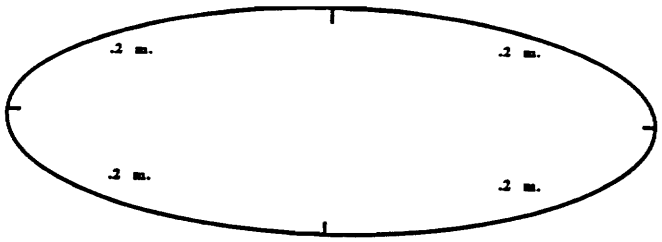
UNIVERSITY MALL - Blacksburg, VA (Roses Shopping Center)

Hours:	10:00 am -	9:00 pm	Monday - Saturday
	1:00 pm -	6:00 pm	Sunday

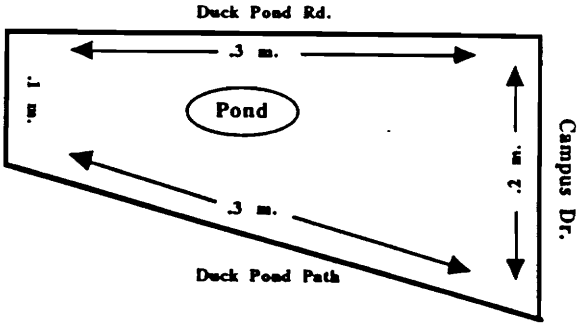
Distance Equivalents: 7 times around the "loop" = approx. 1 mile

OUTDOOR

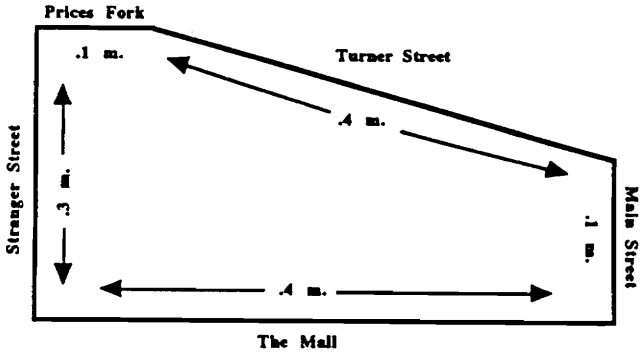
The Drill Field Loop
1 loop = 0.8 miles



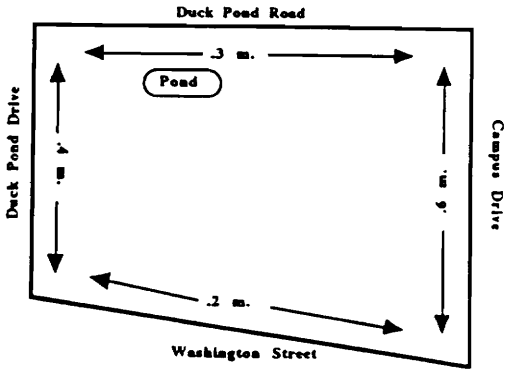
The Duck Pond Loop
1 loop = 0.9 miles



The Tech Mall Loop
1 loop = 1.3 miles

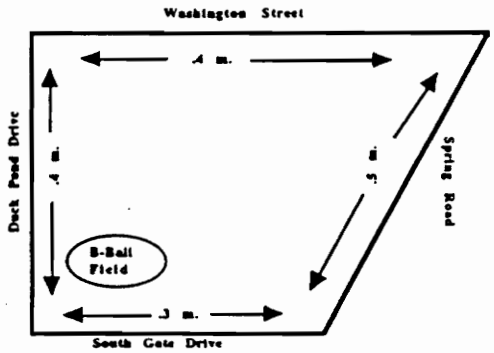


The Long Duck Pond Loop
1 loop = 1.5 miles

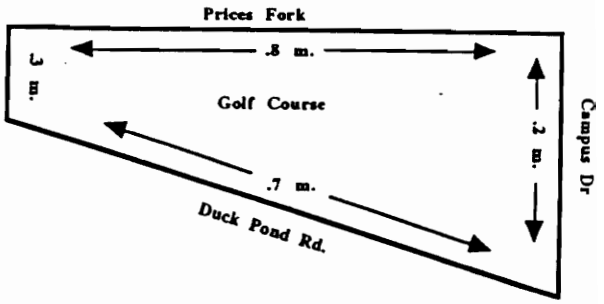


OUTDOOR

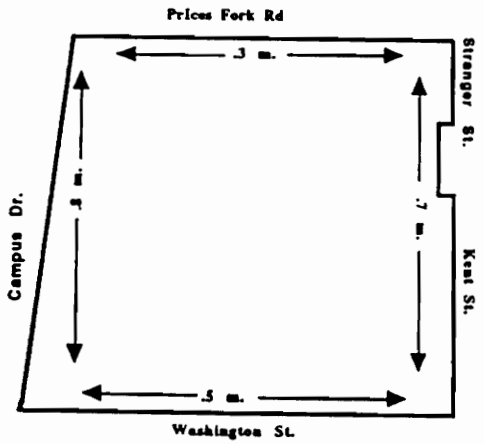
The Baseball Field Loop
1 loop = 1.7 miles



The Golf Course Loop
1 loop = 2.0 miles



The Campus Loop
1 loop = 2.3 miles



Appendix C
Example of Feedback Algorithms and Content

FEEDBACK

BASIC.MSG CRITERION: Everyone Receives This Message

Week of March 7-March 13:
Congratulations - You have completed Week 1 of the Healthy Habits Walking for Fitness Program. We have received your walking information and it has been recorded. Now that you're establishing a regular habit of exercise, don't push too hard too fast --take time to enjoy steady progress toward your fitness goals. Hang in there - Spring is on the way.

LOGDAYS.3 CRITERION: Walked 3 times or more

You're off to a fantastic start...You didn't even let the bad weather keep you from walking three or more times this week. Keep on walking and make next week just as good or better! Remember to make time for yourself and your exercise program - You deserve it!

LOGDAYS.2 CRITERION: Walk 2 times

Good job - you walked two times this week. The weather wasn't so great to start off but the weekend probably made up for it! Every step you take toward making exercise a regular part of your life is an important step! Keep it up and make next week just as good or better! Remember to make time for yourself and your exercise program - You deserve it!

LOGDAYS.1 CRITERION: Walk 1 time

You made an important 1st step...You walked once this week. With the weather in March being unpredictable you've got to make the most of the good days and don't let a the bad one's get you down...Bundle up, choose an indoor course if the weather isn't cooperating or plan to walk every sunny milder day if your schedule is flexible! Every step you take toward making exercise a regular part of your life is an important step! Keep on walking and make next week just as good or better! Remember to make time for yourself and your exercise program - You deserve it!

LOGDAYS.0 CRITERION: No Walking - Sent Log

Thank you for sending a log so we know you are still planning to start your walking program. With the weather in March being unpredictable you've got to make the most of the good days and don't let a the bad one's get you down...Bundle up, choose an indoor course if the weather isn't cooperating or plan to walk every sunny milder day if your schedule is flexible! Every step you take toward making exercise a regular part of your life is an important step! Just give it a try and start walking -

you may find it's easier than you think! Remember to make time for yourself and your exercise program - You deserve it!

LOGDAYS.NO CRITERION: No Log Sent

Week of March 7 - March 13:

Our records show that we didn't get a walking log from you this week. If you were out of town or forgot to send your log, please send it as soon as you can!

If you were not able to walk please send:
MESSAGE
I didn't walk this week.

If you didn't get this before the end of the week please send your log to dtate@vt.edu.

HAPPY.3 CRITERION: IF PE > 16 and FG < 0

Your perceived exertion rating seemed to indicate that you felt like you were working hard and you didn't feel very good while exercising. Maybe you should slow down a bit so that you aren't overly exerted. Remember: Exercise should NOT be to the point of discomfort.

HAPPY.2 CRITERION: IF PE > 16

Your perceived exertion rating seemed to indicate that you felt like you were working hard. It's fine to work out hard, just remember to check your heart rate to keep within your target zone and not to push to the point of discomfort.

HAPPY.1 CRITERION: IF FG < 0

There will be days when you don't feel so great when exercising. Maybe you should try one of the Making It Fun suggestions. Remember: Exercise should not be to the point of discomfort.

HAPPY.0 CRITERION: ELSE

Your perceived exertion rating and feeling scale rating indicate that things seem to be going well ! You are not feeling any distress or discomfort while exercising. That is great news !

HRATE.LO CRITERION: HR < 60% HRmax

On one or more of the days you exercised your heart rate appeared to be below your age adjusted low end target heart rate zone. This indicates that you might want to walk a bit faster next time to get your heart rate up...Not too fast though you need to keep it below your high end target heart rate!

HRATE.HI CRITERION: HR > 75% HR max

On one or more of the days you exercised your heart rate appeared to be above your age adjusted high end target heart rate zone. This indicates that you should slow down and let your heart rate return to a level which is between your low end and high end target heart rate zone.

GOAL.4 CRITERION: Goals for days, minutes and miles met

You deserve to reward yourself for sticking to your plan of action. You met all parts of your fitness goals for this week! You met your goal for frequency, duration and distance. Continuing to challenge yourself by setting new goals can be a good way to increase your exercise -- keep up the good work!

GOAL.3 CRITERION: Goals for days and distance met

You met your goal for frequency of exercise and your goal for distance. Goals are an important part of developing a regular fitness program -- keep up the good work!

GOAL.2 CRITERION: Goals for days and minutes met

You met your goal for frequency and duration of exercise. That's great because goals are an important part of developing a regular fitness program -- keep up the good work!

GOAL.1 CRITERION: Goals for days met

Good job meeting your goal for the number of days you planned to walk this week! Your next step is to work toward meeting your goal for the number of minutes you average per walk. Keep up the good work!

GOAL.0 CRITERION: Goals days not met

Keep up the good work toward meeting your goal for the number of days that you walk each week. Setting weekly goals is a great way to motivate yourself for working out regularly! Remember to plan a time to workout and contingencies for the unavoidable things that may come up!

GOAL.NO CRITERION: No goal submitted

Our records show that you didn't submit a goal for next week. Weekly goals are very valuable. Making a goal is a commitment and a plan that you have made for yourself. Goals can be helpful for establishing regular activity and for increasing your exercise. Please try to set a goal for the next week of activity when you submit your next log.

Note: Since no goals were set prior to the 1st walking week, exemplars of goal feedback were from week 2 feedback - otherwise feedback example was participant feedback received after week 1

Appendix D
Preprogram/Baseline Measures

DEMOGRAPHIC INFORMATION SHEET

Age:_____ Weight:_____ Height:_____ Gender:_____

Phone Numbers: office: _____

e-mail: _____

home: _____

Department:_____

Marital Status: _____Married _____Divorced Number of Children:____

_____Single _____Widowed

Are you presently taking any medications? _____Yes _____No

If yes, please list them:

1)_____ 2)_____ 3)_____

Do you smoke? _____Yes _____No

If yes, how many packs per day?_____

Did you participate in a walking program offered last year through the department of psychology: _____Yes _____No

If yes, how often did you receive phone calls?

_____once per week _____once every 3 weeks _____not at all

Are you participating in the Common Health Walking Program? _____Yes ___No

Is your walking partner participating in this program?_____Yes _____No

If yes, please list name(s):

_____

EXERCISE QUESTIONNAIRE

Please indicate which of the following best describes your current feelings about exercise:

_____ I am not thinking about beginning any kind of exercise program.

_____ I am thinking about beginning an exercise program in the next six months.

_____ I have decided to begin an exercise program within the next few weeks.

_____ I have started an exercise program but have not been exercising regularly for 6 months.

_____ I exercise three times per week and have been doing so for the past 6 months.

Please indicate how strongly you agree or disagree with each item by entering one of the following numbers in the blank spaces.

(1) Strongly Disagree (2) Disagree (3) Undecided (4) Agree (5) Strongly Agree

_____ Computers are difficult to understand and frustrating to work with.

_____ Computers will never replace human life.

_____ Computers are lessening the importance of too many jobs.

_____ People are becoming slaves to computers.

_____ Computers are bringing us into a bright new era.

_____ Computers are dehumanizing to society.

_____ The overuse of computers may be harmful and damaging to humans.

_____ Computers intimidate me because they seem so complex.

_____ Computers are responsible for many of the good things we enjoy.

_____ Soon our world will be completely run by computers.

_____ Computers will replace the need for working human beings.

_____ Computers make me uncomfortable because I don't understand them.

_____ Computers turn people into just another number.

_____ The use of computers is enhancing our standard of living.

_____ Life will be easier and faster with computers.

_____ Computers are a fast and efficient means of getting information.

_____ There are unlimited possibilities of computer applications that haven't even been thought of yet.

_____ Computers can eliminate a lot of tedious work for people.

_____ I feel intimidated by computers.

_____ Soon our lives will be controlled by computers.

_____ I hesitate to use a computer for fear of making mistakes that I cannot correct.

_____ I do not think I would be able to learn a computer programming language.

_____ I feel apprehensive about using computers.

_____ I have avoided computers because they are unfamiliar and somewhat intimidating to me.

_____ I feel insecure about my ability to interpret a computer printout.

_____ Anyone can learn to use a computer if they are patient and motivated.

_____ It scares me to think that I could cause the computer to destroy a large amount of information by hitting the wrong key.

_____ I have difficulty in understanding the technical aspects of computers.

_____ You have to be a genius to understand all the special keys contained on most computer terminals.

(1) Strongly Disagree (2) Disagree (3) Undecided (4) Agree (5) Strongly Agree

_____ I dislike working with machines that are smarter than I am.

_____ I am sure that with time and practice I will be as comfortable working with computers as I am in working with a typewriter.

_____ I am afraid that if I begin to use computers I will become dependent upon them and lose some of my reasoning skills.

_____ I feel computers are necessary tools in both educational and work settings.

_____ The challenge of learning computers is exciting.

_____ I am confident that I can learn computer skills.

_____ I look forward to using a computer on my job.

_____ Learning to operate computers is like learning any new skill-the more you practice, the better you become.

_____ If given the opportunity, I would like to learn about and use computers.

_____ I feel that I will be able to keep up with the advances happening in the computer field.

_____ I feel confident escaping/exiting from a program or software.

_____ I feel confident entering and saving data (numbers or words) into a file.

_____ I feel confident understanding the three stages of data processing: input, processing, output.

_____ I feel confident understanding terms/words relating to computer software.

_____ I feel confident learning to use a variety of programs (software).

_____ I feel confident storing software correctly.

_____ I feel confident handling a floppy disk correctly.

_____ I feel confident troubleshooting computer problems.

_____ I feel confident using the computer to analyze number data.

_____ I feel confident learning advanced skills within a specific program (software).

_____ I feel confident using the computer to organize information.

_____ I feel confident making selections from an on screen menu.

_____ I feel confident understanding terms/words relating to computer hardware.

_____ I feel confident logging onto a mainframe computer system.

_____ I feel confident copying an individual file.

_____ I feel confident moving the cursor around the monitor screen.

_____ I feel confident explaining why a program (software) will or will not run on a given computer.

_____ I feel confident working on a personal computer (microcomputer).

_____ I feel confident copying a disk.

(1) Strongly Disagree (2) Disagree (3) Undecided (4) Agree (5) Strongly Agree

_____ I feel confident adding and deleting information from a data file.

_____ I feel confident describing the function of computer hardware (keyboard, monitor, disk drives, computer processing unit).

_____ I feel confident getting software up and running.

_____ I feel confident organizing and managing files.

_____ I feel confident writing simple programs for the computer.

_____ I feel confident using the user's guide for help for problems in the computer system.

_____ I feel confident calling up a data file to view on the monitor screen.

_____ I feel confident logging off the mainframe computer system.

_____ I feel confident using a printer to make a "hardcopy" of my work.

_____ I feel confident working on the mainframe computer.

_____ I feel confident getting rid of files when they are no longer needed.

THE PHYSICAL ACTIVITY READINESS QUESTIONNAIRE (PAR-Q)

PAR-Q is designed to help you help yourself. Many health benefits are associated with regular exercise, and the completion of PAR-Q is a sensible first step to take if you are planning to increase the amount of physical activity in your life.

For most people physical activity should not pose any problem or hazard. PAR-Q has been designed to identify the small number of adults for whom physical activity might be inappropriate or those who should have medical advice concerning the type of activity most suitable for them.

Common sense is your best guide in answering these few questions. Please read them carefully and circle the YES or NO for each question as it applies to you.

1.	Has your doctor ever said you have heart trouble?	YES	NO
2.	Do you frequently have pains in your heart and chest?	YES	NO
3.	Do you often feel faint or have spells of severe dizziness?	YES	NO
4.	Has your doctor ever said your blood pressure was too high?	YES	NO
5.	Has your doctor ever told you that you have a bone or joint problem such as arthritis, that has been aggravated by exercise, or might be made worse with exercise?	YES	NO
6.	Is there a good physical reason, not mentioned here, why you should not follow an activity program even if you wanted to?	YES	NO
7.	Are you over age 65 and not accustomed to vigorous exercise?	YES	NO

IF YOU ANSWERED <u>YES</u> TO <u>ONE OR MORE</u> QUESTIONS:

If you have not recently done so, consult with your physician by telephone or in person BEFORE increasing your physical activity and/or taking a fitness test. Tell him or her what questions you answered YES.

After a medical evaluation, seek advice from your physician as to your suitability for:

- unrestricted physical activity, probably on a gradually increasing basis or
- restricted and supervised activity to meet your specific needs, at least on an initial basis. Check in your community for special programs or services.

IF YOU ANSWERED <u>NO</u> TO <u>ALL</u> QUESTIONS:

If you answered the questions on the PAR-Q accurately, you have reasonable assurance of your present suitability for:

- A GRADUATED EXERCISE PROGRAM - a gradual increase in proper exercise promotes good fitness development while minimizing or eliminating discomfort.
- AN EXERCISE TEST - Simple tests of fitness may be undertaken if you desire.

POSTPONE EXERCISE OR EXERCISE TESTING:

- If you have a temporary minor illness, such as a common cold.

VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY

Informed Consent Form

Project: Using Computer E-Mail to Improve Exercise Adoption and Reporting Compliance: Effects of Feedback Source

Principal Investigator: Deborah F. Tate

Experiment #: 94-009

Purpose Of Experiment:

You are invited to participate in a study about beginning exercise and maintaining a consistent, regular exercise routine. The primary objective of this study is to help you begin and maintain a walking program for 12 weeks. This research also involves testing the effectiveness of different strategies using computers for exercise promotion and adherence.

Procedure To Be Followed In This Study:

As a participant in this study, you have been given a packet containing information on the benefits of exercise, how to start a walking group, walking maps, and information about the e-mail contact in this program. In order to evaluate different intervention strategies for exercise promotion, different participants will receive different interventions. You will be randomly assigned to receive either 1) a reminder to return walking logs and weekly contact including feedback given by the researchers; 2) a reminder to return walking logs and weekly contact including feedback given by a computer program; or 3) a reminder to return walking logs only.

To accomplish the goals of the study you will be asked (or have been asked) to do the following:

- attend a short 20 minute training/information session;
- keep a weekly log of your exercise which may be verified by the researcher;
- send your log via e-mail to the researcher each week; and
- organize a group of friends or coworkers or a walking partner to walk with you.

Discomforts And/Or Risks From Participating In This Study:

Persons who have been less active, in recent years, will find that participation in this walking program may produce some initial discomfort including stiff or sore muscles, minor joint pain, and/or shortness of breath. For these reasons it may not be advisable for some individuals to participate. If you answered "yes" to any question on the Physical Activity Readiness Questionnaire (PARQ), you should consult with your physician about participating in this exercise program. Visits with physicians are not covered by this program and, if necessary, will be incurred at your own cost.

Discomforts associated with initiation of a walking program include stiff or sore muscles, minor joint pain and/or shortness of breath. We strongly encourage you to gradually increase the number of minutes you walk and the number of days that you walk each week. If participants follow these recommendations and the goals of the program set forth in the informational packet, potential risks will be minimized. If you encounter any health problems while participating in this study, please notify the program coordinator so that we may assist you in finding a physician specializing in sports medicine, or with modifying your walking program.

Expected Benefits:

The benefits from this program include the possibility of increased stamina, decreased body fat, weight control, increased muscle tone, and decreased risk for following: coronary heart disease, hypertension, non-insulin dependent diabetes, colon cancer and osteoporosis. Regular exercise may also reduce stress or tension and promote positive moods.

Confidentiality of Results:

The data collected in this project will be held confidentially and will be used for research purposes only. Your name will not be revealed at any time. The exercise data that you provide will have your name removed and only a subject ID number will identify you during data analyses and any presentation of this research.

Freedom to Withdraw:

You are free to withdraw from the experiment, or stop participating in any part of this study, at any time.

Use of Research Data:

The information from this research may be used for scientific or educational purposes. It may be presented at scientific meetings and/or published in professional journals or books, or used for any other purpose that Virginia Tech's Department of Psychology considers proper in the interest of education, knowledge or research.

Approval of Research:

This research has been approved by the Human Subjects Committee of the Department of Psychology and by the Institutional Review Board of Virginia Tech.

Subjects Permission:

I understand that if I participate in this study that I may withdraw, or stop participating in any part of the study, at any time.

I understand that the program coordinator may contact one of my walking group partners to review the accuracy of the walking logs at various points throughout the 12 week program.

I understand that I am responsible for informing the program coordinator of any medical conditions which may prevent or limit my participation in this study. I have been advised that if I am taking any medications, I must notify the program coordinator. I understand that I will be financially responsible for any and all physicians visits or medical assistance during this program.

I understand that participation in this project requires me to start walking - a mild or moderately intense exercise. Although the risk of injury is minimal, I agree not to hold Virginia Polytechnic Institute and State University, or the program coordinator responsible for any injuries or financial costs resulting from my participation in this program.

To the best of my knowledge, I do not now, and have not in the past, had any medical or psychological conditions which would limit or preclude my participation in this program.

I have read and understand the above description of the study. I have had the opportunity to ask questions and have had them all answered. I hereby acknowledge the above and give my voluntary consent for participation in this study.

I understand that should I have any questions regarding this research and its conduct, I should contact any of the persons named below:

Primary Researcher:	Deborah Tate	231-8747
Faculty Advisor:	Dr. Richard Winett	231-8747
Chair, HSC:	Dr. Robert Harvey	231-7030
Chair, IRB:	Dr. Ernest Stout	231-9359

Subject' Signature: _____Date: _____

Subject's SS #: _____

Appendix E
Curriculum Vita

Curriculum Vita
Deborah F. Tate

Home Address:

441 Turner Street
Blacksburg, VA 24060
(703)951-9637

Personal Information:

Date of Birth: July 19, 1967
Place of Birth: Havre de Grace, MD
Marital Status: Married

Education:

Aug 1992-Present — Virginia Polytechnic Institute and State University
Location: Blacksburg, VA
Degree: Master of Science (1995)
Program: Psychology
Masters Thesis Title: Promoting Exercise Adoption Through Computer Networks

Aug 1985-May 1989 — The College of William and Mary
Location: Williamsburg, VA
Degree: Bachelor of Arts (1989)
Major: English
Minor: Psychology

Clinical Experience:

May 1994-Present — Virginia Polytechnic Institute and State University
Graduate Clinician, Psychological Services Center
Conducted assessments and developed treatment plans for clients exhibiting difficulties including: depression, stress, marital distress, substance dependence, separation/adjustment disorder, learning disability. Conducted intellectual/cognitive assessments using a variety of instruments including the WISC-IIIR, WAIS-R, WPPSI-R, Woodcock-Johnson Achievement Battery, and WIAT.
Supervisors: Richard Eisler, Ph.D., Ellie Sturgis, Ph.D., Thomas Ollendick, Ph.D.

Teaching Experience:

Aug 1992-
May 1993

Graduate Teaching Assistant, Introductory Psychology (PSYC 2004)
Virginia Polytechnic Institute and State University
Laboratory Instructor
Responsible for teaching 4 sections of Introductory Psychology laboratories with 35 students per section. Gave lectures, organized and lead discussions, class demonstrations, and wrote quizzes.

Aug 1993-
May 1994

Graduate Teaching Assistant, Introductory Psychology (PSYC 2004)
Virginia Polytechnic Institute and State University
Lecture Teaching Assistant
Took "official" lecture notes and assisted students with questions regarding the lecture material (~1000 students each semester). Provided lecture assistance to the instructors, wrote exam questions based upon lectures, participated in exam review sessions and assisted with exam administration.
Professors: Philip Zeskind, Ph.D., Roseanne Foti, Ph.D., David Harrison, Ph.D., E. Scott Geller, Ph.D.

Aug 1994-
Present

Graduate Teaching Assistant, Introductory Psychology (PSYC 2004)
Virginia Polytechnic Institute and State University
Introductory Psychology Office Assistant
Assist Introductory Psychology Coordinator with course administration and provide assistance to approximately 1200 (Fall) and 900 (Spring) students.

Research Experience:

Jan 1993-
Jan 1995

Masters Thesis: "Promoting Exercise Adoption Through Computer Networks"
Advisor: Richard Winett, Ph.D.
Trained and monitoring 65 subjects for 10 weeks during a cognitive-behavioral intervention to promote exercise adoption.

Aug 1994-
Present

Graduate Research Assistant, HIV Prevention Project
Supervisors: Richard Winett, Ph.D., Eileen Anderson Ed.D.
Assist with participant recruitment, assessment, intervention delivery and data collection for a multi-site community-based HIV prevention project for women in inner city housing developments. Intervention consists of cognitive-behavioral techniques including: information,

condom skills training, social diffusion, communication and negotiation skill development.

May 1994- Present
Graduate Research Assistant, Skin Cancer Prevention Project
Supervisors: Richard Winett, Ph.D., Bonnie Cleveland, M.S.
Assisted with intervention planning, delivery, and data collection for a community skin cancer prevention project funded by the American Cancer Society. Currently conducting data analysis.

March 1994- Dec 1994
Research Assistant
Exercise Promotion in Senior Citizens
Assisted Ph.D. student with all phases of dissertation research project including: initial project recruitment, baseline assessment, intervention delivery, and data collection.

Feb 1988 - Dec 1988
Undergraduate Research Assistant
College of William and Mary, Williamsburg, Virginia
Monitored and interviewed student participants in a social psychological study of social interaction, interpersonal style and fragrance use. Study was funded by a national fragrance foundation. Aided in data collection and computer data entry.

Grants:

March 1994
Graduate Research Development Project Grant (GRDP)
Awarded: $145.00 grant for Masters Thesis Research.

July 1994
Grant Development - Cancer Prevention in Rural Sites
Assisted with grant development activities at the Center for Research in Health Behavior, Blacksburg, VA.
Principal Investigator: Richard Winett, Ph.D.

Coursework:

Graduate Core Courses:

Proseminar in Bio Bases/Developmental
Proseminar in Social/Personality
Proseminar in Learning
Research Methods
Statistics for Social Science Research I
Statistics for Social Science Research II

Applied Psychology Courses:
Sensory Processes

Clinical Psychology Courses:
Psychopathology
Health Psychology
Assessment of Human Intelligence
Epidemiology

Honors/Awards:
Honor Society of Phi Kappa Phi - Virginia Polytechnic Institute and State University

Other Professional Activities:
1994 Guest Reviewer - Journal of Applied Behavior Analysis