Evaluation of an Internet-Based Physical Activity Intervention: A Preliminary Investigation

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ABSTRACT

The Internet has the potential for delivering innovative, interactive physical activity (PA) interventions to large numbers of people. This study was designed to test the efficacy of an Internet intervention that consisted of a Web site plus 12 weekly e-mail tip sheets, compared with a waiting list control group. The Internet intervention was theory based and emphasized clear, graphical presentation of PA information. Sixty-five (30 intervention and 35 control) sedentary adult employees of several large hospitals (9 men and 56 women) were randomly assigned to 1 of the 2 study arms. Of the 65 participants, 57 completed the 1-month follow-up, and 52 completed the 3-month follow-up. At both 1 and 3 months, those in the intervention group were significantly more likely to have progressed in stage of motivational readiness for PA than participants in the control group: 1 month, $\chi^2(1, N = 52) = 4.05$, $p < .05$; 3 months, $\chi^2(1, N = 52) = 6.45$, $p < .01$. We hypothesized that at 1 and 3 months, the intervention group would exhibit significant increases relative to the control group on the number of minutes of moderate activity. At the 1-month assessment, the intervention group did exhibit significant increases, relative to the control group in moderate minutes, $F(1, 54) = 5.79$, $p < .05$; however, at the 3-month assessment this difference was no longer significant. In addition, secondary analyses were conducted to examine total number of minutes of walking reported. At 1 month, the intervention group did exhibit significant increases, relative to the control group, in walking minutes, $F(1, 54) = 12.1$, $p < .001$. At the 3-month assessment, amount of time spent in walking activity continued to be significantly higher for the intervention group compared with the control group, $F(1, 48) = 5.2$, $p < .05$. These findings show that a theoretically based PA Web site and weekly e-mail tip sheets can have a short-term impact on PA motivation and behavior both at 1 and 3 months. As Internet access increases, and as bandwith and other technical attributes of this medium improve, Web site delivered health behavior interventions will become increasingly useful in public health promotion.

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INTRODUCTION

Physical inactivity has been shown to be associated with increased risk of morbidity and premature mortality associated with cardiovascular disease (1,2). Furthermore, a recent meta-analysis found that physical fitness and overall level of physical activity (PA) were associated with decreased risks of cardiovascular disease (3). Participation in regular PA is also associated with a variety of other health benefits, including decreased risk of hypertension, colon cancer, noninsulin-dependent diabetes mellitus, stroke, depression, and anxiety (4,5). Given the broad range of evidence regarding the health effects of physical activity, the Centers for Disease Control and Prevention, the American College of Sports Medicine, the American Heart Association, and the Surgeon General have made statements regarding the recommended levels of PA needed for health benefits. Specifically, the recommendations are that adults participate in 30 min or more of moderate-intensity PA on most, preferably all, days of the week (6). Despite the numerous health benefits of PA, 60% of Americans do not participate in regular PA (5). Approximately 25% of Americans currently meet the recommended levels of PA (7).

Individuals report numerous barriers that impede their ability to be physically active (8). Lack of time and access to facili-

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ties are among the most prevalent barriers that have been identified (9). Given the lack of time and potential access limitations, it is important to find ways, other than face-to-face programs, to provide individuals with information, skills, and knowledge to facilitate behavior change. Therefore, it is important to identify and create different delivery channels of information that can reach a broad range of the population that may not participate in group- or facility-based programs.

One such delivery channel has been print- and mail-based programs. For example, Marcus and colleagues found that individuals who receive PA print materials targeted to their stage of motivational readiness to adopt PA were more likely than participants who received standard PA materials, or no treatment, to positively progress through the stages of change (10,11). Owen et al. (12) found that participants who received tailored information in one mailing became more active than those who received multiple mailings of the same information. These findings can be applied to interventions that make use of other information technologies (e.g., e-mail, the Internet) because these technologies can provide immediate feedback and make information available simultaneously, thus permitting individuals to self-tailor the information for their given needs.

As mentioned earlier, new information technologies, such as the Internet and e-mail, have the promise of being ideal mechanisms for delivering health information. The Internet can serve as a useful tool in providing health information to large numbers of individuals (13,14). Use of the Internet is continually increasing: Recent data indicate that 56% of adults in the United States have Internet access. In addition, it has been found that 56% of Internet users go online daily, and 49% use e-mail each day (15,16). There is evidence that among working-age adults the Internet is increasingly becoming a preferred method of obtaining health information (15,17,18). A recent survey indicated that 55% of Internet users access the Internet for health or medical information (15), and 13% seek information specifically about fitness and nutrition (15). For these reasons, the Internet has considerable potential as a delivery channel for administering PA interventions.

Although studies have examined the Internet as a resource tool with diabetes (19), nutrition (20), and other disease information (21), few Internet-based health behavior intervention studies have been conducted. A range of commercial and noncommercial fitness and exercise Web sites can now be found on the Internet. However, these sites typically lack information to enhance behavior modification skills and tend not to be theoretically based (22,23). Therefore, given the growing use of the Internet, particularly for accessing health-related information, we decided to transfer evidence-based information from theoretically based print interventions to develop a Web site (10,12,24). Specifically, the information on the Web site was based on the theoretically based print interventions of Marcus et al. (24) and Owen et al. (12).

We conducted a 12-week randomized, controlled trial designed to compare the efficacy of an Internet Web site plus 12 weekly e-mail tip sheets sent to a waiting list control group. The Internet site was adapted from a study that examined the feasibility of an Internet intervention for increasing PA (25). To our knowledge, this is the first study to test the efficacy of a PA Internet intervention. We hypothesized that participants randomized to the Internet condition would show improvements in moderate-intensity PA and stage of motivational readiness for change at both 1 and 3 months. We also examined walking behavior because this is the preferred mode of PA for most individuals, and that walking is a more acceptable form of exercise (26,27).

METHOD

Recruitment Procedures

Participants were employees of a several hospitals in the northeast United States. Potential participants were recruited through a variety of print, in-person, and electronic channels. Recruitment strategies specifically included e-mail advertisements, flyers, voicemail messages, advertisements in newsletters, advertisements on pay stubs, postings on the worksite's Intranets, and in-person information booths. Individuals eligible for the study were healthy people between the ages of 18 and 65 who were engaging in 120 or fewer min of moderate-intensity PA per week or 60 or fewer min of vigorous-intensity PA per week.

Individuals who were overweight or who were smokers were considered eligible for this study. However, potential participants with medical problems that could make compliance with the study protocol difficult or dangerous were not included. Categories of exclusions included coronary artery disease (history of myocardial infarction or symptoms of angina), stroke, alcoholism or other substance abuse, hospitalization for a psychiatric disorder in the last 3 years or currently suicidal or psychotic, orthopedic problems that could limit exercise participation, and current or planned pregnancy.

The Physical Activity Readiness Questionnaire (PAR–Q) was used to screen participants for cardiac and other health problems (e.g., heart trouble, chest pain, dizziness). Participants who answered *yes* to any of the questions on the PAR–Q were asked to obtain their physician's consent before participating. The PAR–Q is an eight-item measure that was designed to identify individuals for whom PA would be inappropriate or who would require the consent of a medical doctor before engaging in PA (28). Physician consent also was required if potential participants reported having diabetes.

To be eligible, participants also needed to agree to be assigned randomly to either of the conditions and to read and sign an institutionally approved consent form after all their questions were answered.

Participants

Initial interest in the study was expressed by 275 employees. Potential participants were required to participate in a 15-min telephone screening to determine eligibility. Despite numerous contacts via telephone, e-mail, and mail, only 96 participants completed a telephone screening. After this telephone screening, 65 individuals met the study criteria and were randomized into one of two groups (30 Internet, 35 control). Participants were excluded for being too active ($n = 19$), having medical problems ($n =$

2), participating in an Internet weight loss study ($n = 1$), and not being interested ($n = 9$). There were 9 men (14%) and 56 women (86%). The average age of the sample was 42.8 ($SD = 10.0$). See Table 1 for other baseline characteristics of the sample. See Figure 1 for a flow diagram of participants' progress through the trial.

TABLE 1
Selected Baseline Demographic Characteristics

Characteristic	*n (%)*
Married	41 (63)
White	59 (91)
% earning ≥ $50,000	36 (55)
Skill using the Internet[a]	59 (92.2)
Confidence using the Internet[b]	59 (92.2)
Skill using e-mail[a]	61 (95.3)
Confidence using e-mail[b]	63 (98.4)
Body mass index (*M*/*SD*)	26.6/4.29
Completed college or postgraduate work	51 (78)
Stage distribution	
Contemplation	20 (31)
Preparation	45 (69)
Minutes of activity (*M*/*SD*)	
Moderate activity	75.4/69.3
Walking	73.8/136.6

Note. No differences between the intervention and control groups were found on any of these variables. $N = 65$.
[a]Intermediate or above. [b]Somewhat confident and above.

Measures

Assessments for this study were brief and occurred over the telephone. Therefore, the measures were chosen carefully to maximize the amount of information gathered and minimize participant burden. The measures included in the study were the PAR–Q, demographics questions, questions regarding computer usage, and questions regarding comfort and skill with using the Internet and e-mail. The primary PA measures were the Physical Activity Stage of Change (29) and the Behavioral Risk Factor Surveillance System (BRFSS) PA items (30). The kappa index of reliability over a 2-week period was .78 for the stages-of-change instrument (31). The BRFSS has demonstrated test–retest reliability for days per week ($R = .61$), minutes per week ($R = .44$) and metabolic equivalent minutes per week ($R = .42$, $p < .001$) and concurrent validity for days per week ($R = .38$), minutes per week ($R = .44$, $p < .001$) when compared to PA logs (i.e., self-monitoring of PA each day) (30). Reliability and validity data regarding other subscales of the BRFSS are currently being evaluated by the Centers for Disease

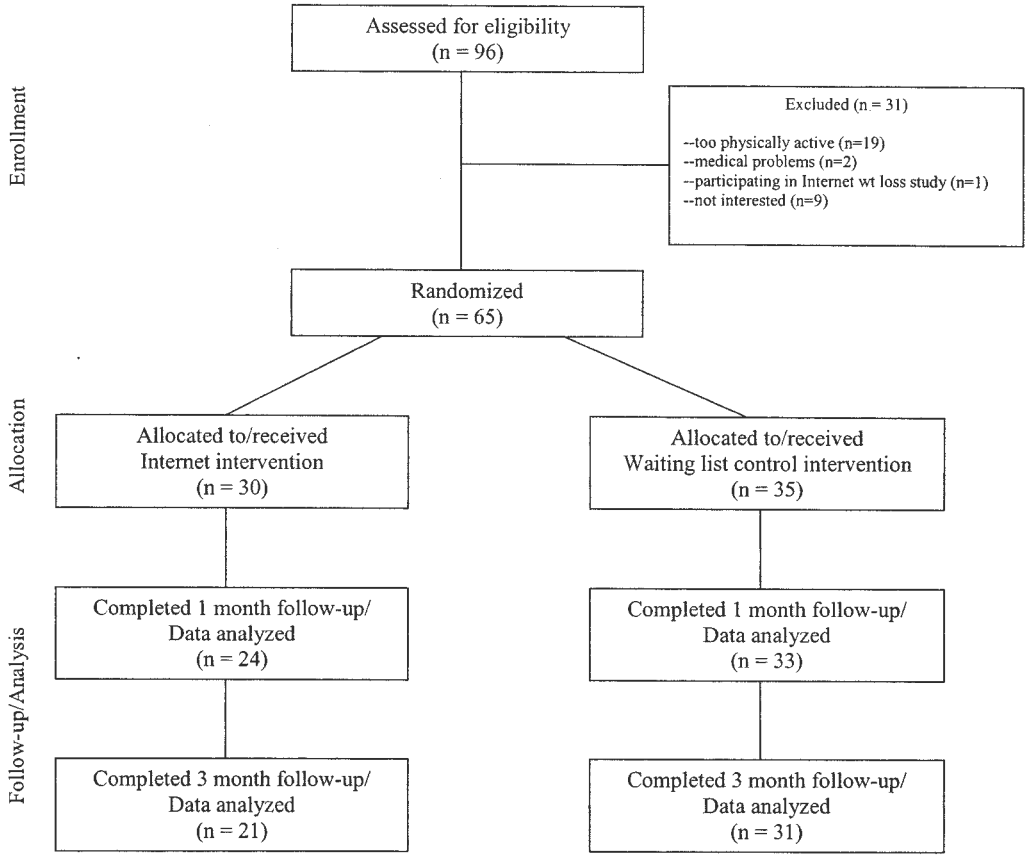

FIGURE 1 Flow diagram of participants' progress. wt = weight.

Control (S. Ham, personal communication, February 12, 2000). Assessments occurred 1 month into the trial and again at 3 months. No incentives were provided for completing measurement time points.

Intervention

Internet intervention. Participants in the Internet condition received access to the Web site for 3 months, along with weekly e-mail tip sheets. The Web site was based on social cognitive theory and was targeted toward the stages of motivational readiness. In addition, the Web site emphasized research-based PA information. The main sections were entitled Activity Quiz, Safety Tips, Becoming Active, Physical Activity and Health, Overcoming Barriers, Planning Activity, and Benefits of Activity. A link to browse the other Web site sections also appeared on the screen. Participants were not required to use a password to log into the Web site, and they accessed the site from either home or work. See Figure 2 for an overview of the Web site.

Sample tip sheet topics included getting started, monitoring your progress, setting goals, rewarding yourself, and getting support. The tip sheet topics were delivered in the same order for all participants. Tips were approximately six sentences in length and contained a link back to the study Web site. The first e-mail tip sheet, for instance, contained a welcome, specific physical activity recommendations, and the hyperlink to the Web site.

The e-mail tip sheets encouraged participants to access the Web site. No other instructions were given regarding required login frequency. Each time participants accessed the Web site, they were required to completed a quiz that assessed stage of change. On the basis of their answers, they were guided to a stage-of-change targeted section on the Web site. Even though participants were provided with access to targeted information, they were not limited on the basis of stage of change, or any other variable, as to the sections to which they had access.

Participants were instructed both by the tip sheets (i.e., the goal was listed on each e-mail tip sheet) and the Web site that their goal was to engage in moderate-intensity activity on at least 5 days a week. The e-mail tip sheets, as well as sections on the Web site, provided the basis for the guidance an information for participants to reach their PA goal over time (e.g., use of social support, rewards, planning in activity; see Figure 2). Participants were also given an e-mail address and a telephone number with which they could contact the study Helpline in case they had questions, concerns, or problems.

Waiting list control. Participants in the waiting list control group were told that they would have to wait 3 months to participate. They completed assessments at 1 and 3 months, similar to participants in the Internet condition. After their 3-month assessment, they were sent the welcome e-mail described earlier.

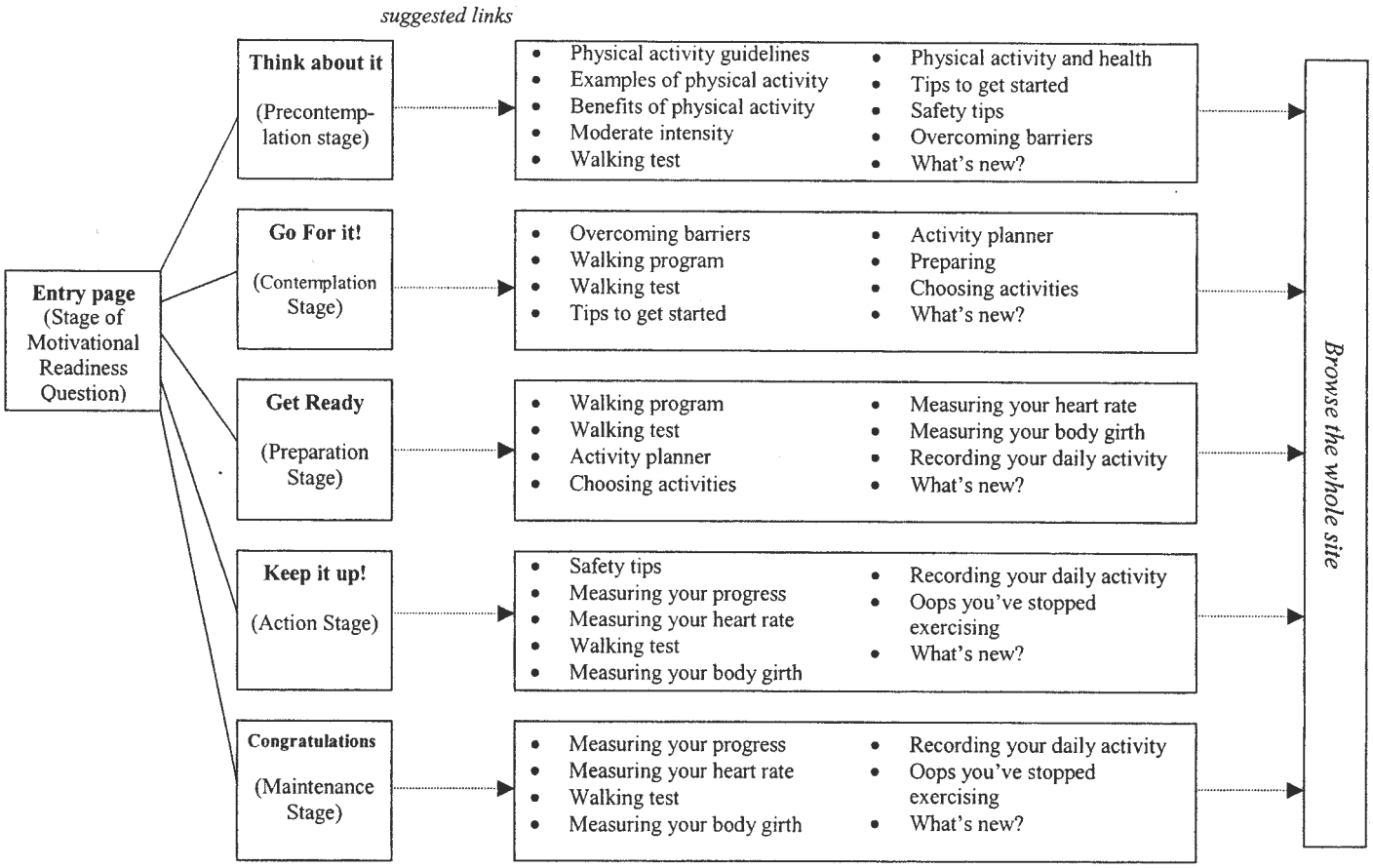

FIGURE 2 Overview of the Web site.

Data Analysis

Data were analyzed on the basis of whether participants regressed (cycled down a stage/stayed the same) or progressed (cycled up one or more stages). We collapsed data in this manner because of the small sample size in some of the cells. For the BRFSS, the results reported in this article include moderate minutes as the primary hypothesis and examine walking minutes as a secondary hypothesis. *Moderate minutes* included brisk walking as one of the examples; however, there a separate question focused only on walking. Participants were instructed for the walking questions that they were able to repeat and include some of the activities they reported for moderate activities. In addition, because of the skewed nature of the PA data, we log transformed the number of minutes prior to analyses. We conducted chi-square tests to investigate stage progression and regression. We conducted analyses of covariance to investigate difference between the groups in number of minutes at each time point, based on BFRSS, while covarying for baseline levels of PA.

RESULTS

One-Month Outcome

Fifty-seven participants (24 intervention and 33 control) completed the 1-month assessment (88% retention rate). When analyses were conducted to detect differences between participants who remained in the study, and those who did not (including stage of change), those with higher body mass index ($p < .06$) and higher confidence using e-mail ($p < .05$) were more likely to remain in the study. However, after using a Bonferroni correction to control for multiple *t* tests, we observed that these differences were no longer significant. Proportionately more men could not be reached for follow-up than women; however, this difference was not statistically significant. There was also a trend, $\chi^2(1, N = 65) = 3.06$, $p = .09$, for more people in the intervention group to drop out of the study compared with those in the control group. Participants in the intervention group were significantly more likely to have progressed in stage of motivational readiness than were participants in the control group, $\chi^2(1, N = 52) = 4.05$, $p < .05$ (see top panel of Figure 3 for the Stage × Group distribution). Compared with the control group, the Internet intervention group exhibited higher levels of moderate minutes, $F(1, 54) = 5.79$, $p < .05$. In addition, for secondary analyses, the Internet intervention group exhibited higher levels of walking minutes, $F(1, 54) = 12.1$, $p < .001$ (see Table 2).

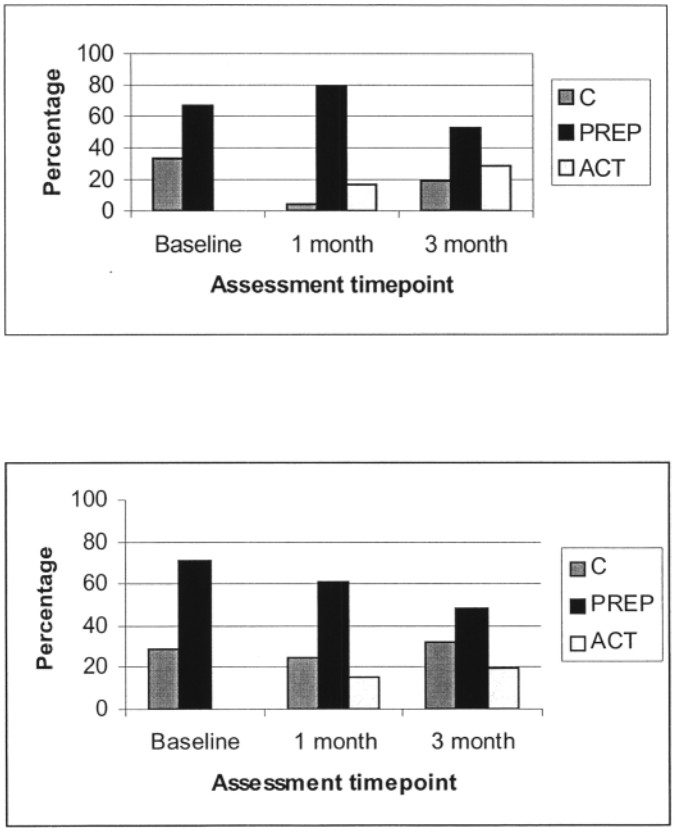

FIGURE 3 Group × Stage breakdown for the intervention group (top panel) and control group (bottom panel). C = contemplation; PREP = preparation; ACT = action.

Three-Month Outcome

Fifty-two participants (21 intervention and 31 control) completed the 3-month assessment (80% retention rate). Except for gender, there were no differences between participants who remained in the study and those who could not be contacted for follow-up, including stage of change. Fewer women than expected dropped out of the study, and more men than expected dropped out of the study, primarily because of the small sample size, $\chi^2(1, N = 65) = 8.25$, $p < .01$. There was also a trend, $\chi^2(1, N = 65) = 3.48$, $p = .06$, for more participants in the intervention group to drop out of the study compared with those in the control group. Participants in the intervention group were more likely than participants in the control group to significantly progress in

TABLE 2
Baseline Means and Changes in Behavior Risk Factor Surveillance System Minutes of Physical Activity

	Intervention						*Control*					
	Baseline		*1 Month*		*3 Month*		*Baseline*		*1 Month*		*3 Month*	
Physical Activity	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Moderate	68.79	58.1	98.33	53.9	112	75.7	80.86	77.8	96.82	93.7	82	87.3
Walking	57.24	56.9	87.29	46.0	99.75	68.3	87.57	177.4	83.79	121.1	68.39	85.2

stage of motivational readiness, $\chi^2(1, N = 52) = 6.45$, $p < .01$, when compared to baseline. There were no differences on stage movement from 1 to 3 months. See bottom panel of Figure 3 for Stage × Group distribution. When compared to the 1-month outcome data, only walking minutes remained significant, $F(1, 48) = 5.2$, $p < .05$ (see Table 2).

DISCUSSION

After 1 month of intervention, sedentary individuals given access to a theoretically based PA Web site and receiving weekly e-mail tip sheets showed significantly greater forward progression on PA stage of change and amount of PA than the control group. These results indicate that a theoretically based Internet Web site, which also included research-based PA information plus weekly e-mails, can result in a change in both moderate-intensity PA and motivation to be physically active. The most significant differences occurred during the 1st month of intervention; however, differences between the groups in walking minutes were sustained over time.

Most of the changes in PA occurred from baseline to 1 month; therefore, we questioned whether participants continued to receive a weekly dose of intervention after 1 month. Participants told us anecdotally that because the Web site was static and did not change over time, they did not feel the need to return to the Web site after the 1st month. On receiving this feedback, we provided the Web site with monthly updates on local events and environmental opportunities for being physically active (i.e., the What's New section). These maintenance strategies and updates were minimal, but we did receive qualitative reports that participants enjoyed the What's New section of the Web site. These reports support the notion of creating enhanced Web sites that provide more individualized, up-to-the-minute feedback and information.

It is interesting that there was a trend for more individuals in the intervention group to not be reached for follow-up than those in the control group. It is possible that individuals may have felt discouraged about not doing well and could therefore not be reached for follow-up. It is also possible that more participants dropped out of the intervention group because they felt that they had accessed all parts of the Web site that would be useful to them. Actual login rates were not available; however, all participants in the intervention group were asked (at 1 and 3 months) how often they had accessed the Web site over the previous month. There were no differences in login rates by month. Although the exact frequency was not collected, on average, most participants reported accessing the site more than once (1 month, 83%; 3 months, 81%). Participants could have been accessing the Web site for the What's New information and not for the skills and knowledge-based topics.

We also explored the possibility that participants were not interested in the material, or did not find it helpful, by asking qualitative questions about the Web site (see 32). Participants were asked at 1 and 3 months how helpful they found the Web site. At 1 month, 92% of participants found the Web site to be "somewhat to very" helpful; at 3 months, 85% found the Web site to be "somewhat to very" helpful. Finally, another hypothesis that we explored regarding the trend toward differential rates of attrition was level of motivation or stage of change. We did not find any differences on stage of change between individuals who remained in the study and those who could not be contacted for follow-up.

Another hypothesis to explain the trend for differential attrition was that the participants in the control group were told that they would receive the intervention after waiting for 3 months. For participants in the control group, the option of receiving the intervention after waiting for only 3 months may have motivated them to complete the follow-up assessments so that they would receive the full intervention.

Although the results from this study are promising, the sample size was small, which limits the generalizability of the results. Therefore, future studies should include a larger sample size and a more diverse sample. In addition, future studies should consider including other measures of PA behavior, such as interviewer-administered assessment methods (i.e., 7-day Physical Activity Recall [33]), objective monitors of PA (e.g., Actigraph), and fitness testing.

A further limitation of this study was the lack of information we had regarding the number of actual hits to the Web site. This was due to the fact that we did not have a password that was linked to each participant. Unfortunately, we also do not have information regarding whether the e-mails were received and opened, although approximately 96% of the participants reported receiving the e-mail tip sheets every week. These two variables would be important to collect in future studies to assess compliance and the dose of the intervention that each participant received.

In addition, although these findings show promise, there is no information regarding the effective components of the intervention. For instance, it is not clear whether it was the targeted, theory-based Web site, or the weekly e-mail contact and tip sheets, or a combination of the two, that were associated with changes. Future studies could also investigate Web sites that change over time and are more interactive. A more interactive Web site that varies over time and provides iterative feedback based on participant responses to content and on reported progress may result in a larger magnitude of changes both at 1 and 3 months and perhaps even for longer term maintenance.

Our results demonstrate that the Internet is a powerful tool for changing health behavior. The Internet is potentially a low-cost intervention and can be used in the widespread dissemination of PA advice and information (e.g., regarding physicians or community health organizations to refer patients for information). Other populations, such as children and adolescents, may also benefit from Internet-based interventions and should be targeted in future studies.

Compared with face-to-face programs, this type of intervention has the potential to reach larger numbers of people and offers flexibility within which participants can read, digest, and use the information of their choice (34). For instance, individuals were given a choice of when they wanted to interact with the Web site and read the e-mail tip sheets. They could, for example,

read it when they had their lunch break, or they could read it later in the evening. This level of flexibility addresses the barriers to participation (e.g., time, location of facilities) that have been shown in numerous studies (8,35).

Our findings show a significant immediate and medium-term (i.e., 3-month) impact for a Web-site-delivered PA intervention. Like earlier trials of paper-based computer-targeted interventions, these outcomes suggest that participants in stage-based self-help PA programs can adopt PA by using potentially cost-effective mediated approaches (11). There is considerable potential for future studies to make use of new interactive health communication tools that are being developed and disseminated (13,18). In particular, it may be possible to provide attractive and effective tailored, personalized feedback based on individuals' attributes (34), participants' responses to the program, and their progress on motivational readiness and behavior. The Internet provides the opportunity for low-cost, widely disseminable interventions as an adjunct or complement to face-to-face counseling. Furthermore, interactive health communication technologies have considerable potential to enhance the delivery of a range of health behavior change interventions. Given increasing health care costs, evidence-based low-cost interventions to promote health are essential for improving public health.

REFERENCES

(1) Kujala UM, Kaprio J, Sarna S, Koskenvuo M: (1998). Relationship of leisure-time physical activity and mortality: The Finnish Twin Cohort. *Journal of the American Medical Association.* 1998, *279:*440–444.

(2) Powell KE, Blair SN: The public health burdens of sedentary living habits: Theoretical but realistic estimates. *Medicine and Science in Sports and Exercise.* 1994, *26:*851–856.

(3) Williams PT: Physical fitness and activity as separate heart disease risk factors: A meta-analysis. *Medicine & Science in Sports & Exercise.* 2001, *33*:754–761.

(4) Hu FB, Stampfer MJ, Colditz GA, et al.: Physical activity and risk for stroke in women. *Journal of the American Medical Association.* 2000, *283*:2961–2967.

(5) U.S. Department of Health and Human Services: *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA: Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996.

(6) Pate RR, Pratt M, Blair SN, et al.: Physical activity and public health: A recommendation from the Centers for Disease Control and Prevention and the American College of Sports Medicine. *Journal of the American Medical Association.* 1995, *273:*402–407.

(7) Centers for Disease Control: Physical activity trends: United States, 1990–1998. *Morbidity and Mortality Weekly Report.* 2001, *50*:166–168.

(8) Napolitano MA, Marcus BH: Breaking barriers to increased physical activity. *The Physician and Sports Medicine*. 2000, *28*:88–89.

(9) Sallis JF, Owen N: *Physical Activity and Behavioral Medicine*. Thousand Oaks, CA: Sage, 1999.

(10) Marcus BH, Banspach SW, Lefebvre RC, et al.: Using the stage of change model to increase the adoption of physical activity among community participants. *American Journal of Health Promotion*. 1992, *6*:424–429.

(11) Marcus BH, Emmons KM, Simkin-Silverman LR, et al.: Evaluation of motivationally tailored vs. standard self-help physical activity interventions at the workplace. *American Journal of Health Promotion*. 1998, *12*:246–253.

(12) Owen N, Lee C, Naccarella L, Haag K: Exercise by mail: A mediated behavior-change program for aerobic exercise. *Journal of Sport Psychology.* 1987, *9*:346–357.

(13) Gustafson DH, Robinson TN, Ansley D, et al.: Consumers and evaluation of interactive health communication applications. *American Journal of Preventive Medicine*. 1999, *16*:23–29.

(14) Robinson TN, Patrick K, Eng, TR, Gustafson D: An evidenced-based approach to interactive health communication. *Journal of the American Medical Association*. 1998, *280*:1264–1269.

(15) Fox S, Rainie L, Horrigan J, et al.: *The online health care revolution: How the Web helps Americans take better care of themselves.* Retrieved July 31, 2001 from http:// www.pewinternet.org

(16) Rainie L, Packel D, Fox S, et al.: *More online, doing more: 16 million newcomers gain Internet access in the last half of 2000 as women, minorities, and families with modest incomes continue to surge online*. Retrieved July 31, 2001 from http:// www.pewinternet.org

(17) Fotheringham MJ, Bauman A, Leslie E, Owen N: Computer use—A barrier to physical activity? 22nd annual meeting of the Society of Behavior Medicine. Seattle, WA: 2001.

(18) Fotheringham MF, Wonnacott RL, Owen N: Computer use and physical inactivity in young adults: Public health perils and potentials of new information technologies. *Annals of Behavioral Medicine*. 2000, *22*:269–275.

(19) McKay HG, Feil EG, Glasgow RE, Brown JE: Feasibility and use of an Internet support service for diabetes self-management. *The Diabetes Educator.* 1998, *24*:174–179.

(20) Kolasa K, Poehlman G, Jobe A: Virtual seminars for disseminating medical nutrition education curriculum ideas. *American Journal of Clinical Nutrition*, *71*, 1403–1404.

(21) Berlan GK, Elliott MN, Morales LS, et al.: Health information on the Internet: Accessibility, quality, and readability in English and Spanish. *Journal of the American Medical Association.* 2001, *285:*2612–2621.

(22) Tate DF, Wing RR, Winett RA: Using Internet technology to deliver a behavioral weight loss program. *Journal of the American Medical Association.* 2001, *285*:1172–1177.

(23) Whiteley JA, Winett RA, Anderson ES, Wojcik J: Internet-based cognitive behavioral walking program for women. Annual meeting of the association of the Advancement of Behavior Therapy. New Orleans, LA: 2000.

(24) Marcus BH, Bock BC, Pinto BM, et al.: Efficacy of an individualized, motivationally-tailored physical activity intervention. *Annals of Behavioral Medicine*. 1998, *20:*174–180.

(25) Fotheringham MF: PA Web: Evaluation of an Internet-based physical activity behavior change program. Annual meeting of the Society for Behavioral Medicine, *Interactive Health Communication in Health Behavior Change Symposium.* Seattle, WA: 2001.

(26) Manson JE, Hu FB, Rich-Edwards JW, et al.: A prospective study of walking as compared with vigorous exercise in the prevention of coronary heart disease in women. *New England Journal of Medicine.* 1999, *341*:650–658.

(27) Stofan JR, DiPietro L, Davis D, et al.: Physical activity patterns associated with cardiorespiratory fitness and reduced mortality: The aerobics center longitudinal study. *American Journal of Public Health.* 1998, *88*:1807–1813.

(28) American College of Sports Medicine: *ACSM's Guidelines for Exercise Testing and Prescription* (6th ed.). New York: Lippincott, Williams, & Wilkins, 2000.

(29) Marcus BH, Rossi JS, Selby VC, et al.: The stages and processes of exercise adoption and maintenance in a worksite sample. *Health Psychology.* 1992, *11*:386–395.

(30) Jones DA, Ainsworth BE, Macera CA, et al.: Reliability and validity of walking questions in the Behavioral Risk Factor Surveillance System (BRFSS). *Medicine and Science in Sports and Exercise*. 1999, *31*:S232.

(31) Marcus BH, Selby VC, Niaura RS, Rossi JS: Self-efficacy and the stages of exercise behavior change. *Research Quarterly for Exercise and Sport*. 1992, *63*:60–66.

(32) Sciamanna CN, Lewis B, Tate D, et al.: User attitudes toward a physical activity promotion Website. Manuscript submitted for publication.

(33) Blair SN, Haskell WL, Ho P, et al.: Assessment of habitual physical activity by seven-day recall in a community survey and controlled experiments. *American Journal of Epidemiology.* 1985, *122*:794–804.

(34) Marcus BH, Nigg CR, Riebe D, Forsyth LH: Interactive communication strategies: Implications for population-based physical activity promotion. *American Journal of Preventive Medicine*. 2000, *19:*121–126.

(35) Dunn AL, Andersen RE, Jakicic JM: Lifestyle physical activity interventions: History, short- and long-term effects and recommendations. *American Journal of Preventive Medicine*. 1998, *15:*398–412.