

# Tailored Versus Standard Internet-delivered Interventions to Promote Physical Activity in Older Women

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## ABSTRACT

**Purpose:** While substantial evidence demonstrates physical activity is effective at reducing risk for cardiovascular and other diseases, the percentage of older women participating in regular activity is low. The Internet offers an alternative method for delivery of a primary prevention intervention. This preliminary study examined the feasibility and effectiveness of using the Internet to deliver behavior change interventions for promoting physical activity in women ages 50-69 years. **Methods:** Thirty-one healthy women ( $56.1 \pm 4.9$  years) were randomly assigned to either tailored or standard newsletter groups. Both groups received 3 Internet-delivered newsletters at baseline, 1 month, and 2 months. Behavioral markers and biomarkers were measured at baseline and postintervention. Post-testing occurred at 3 months (1 month after delivery of the third newsletter). **Results:** Repeated measures ANOVAs revealed improvement in measures of flexibility and perceived barriers to exercise for both groups. For the standard group, improvement occurred in % body fat while  $\text{VO}_2\text{max}$  declined. Women indicated the newsletters were helpful in influencing behavior change. **Conclusion:** Internet-delivered newsletters appeared feasible and promising for favorably influencing perceptions about barriers to physical activity in these women. Self-reported physical activity did not increase although selected biomarkers did improve. Whether tailored or standard messaging was more effective was inconclusive.

**Key Words:** Internet, computer, activity, behavioral intervention, older women

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## INTRODUCTION

Despite the demonstrated benefits of physical activity in lowering risk for cardiovascular and other diseases, the percentage of individuals, especially peri- and postmenopausal women, who participate in regular moderate physical activity is very low.<sup>1,2</sup> Effective, broad scope health promotion interventions are needed in order to meet the Healthy People 2010 goals for physical activity.<sup>1</sup>

Current approaches for promoting physical activity include personal counseling or mediated health interventions by clinicians and others. Despite recommendations that all individuals should receive regular counseling about health-promoting behaviors, few clients including those with a diagnosis of coronary artery disease report receiving prevention counseling by their primary care physicians.<sup>3,5</sup> Increased time demands, insufficient reimbursement, and uncertainty about how to provide effective counseling are cited by physicians as barriers to providing preventive counseling.<sup>4</sup>

Mediated health interventions, which offer behavior change programs through print, telephone, video, or Internet, may provide alternatives to individual counseling because they influence a large group of individuals at a relatively low cost.<sup>6</sup> Theoretical models of behavior change are used within mediated health interventions because they offer a foundation or framework by which to influence health behavior change. Messaging delivered through these interventions uses generic or tailored approaches. Generic or standard messaging provides as much information as possible without consideration for the specific characteristics of the prospective consumers. Tailored messaging offers the advantage of presenting only the most relevant information for each individual, based on data provided in response to assessments or questionnaires.<sup>6-8</sup> Mediated interventions that use theory-based tailoring deliver specific feedback to individuals based upon their perceptions about a given action or behavior, which may be similar to feedback provided in face-to-face interactions. Computers have made it possible to easily incorporate personalized feedback or tailored messages into a print or Internet-generated intervention. Studies have demonstrated the effectiveness of using tailored compared with nontailored messages in studies using computer-tailored print communications to foster behavior change in physical activity.<sup>9-11</sup>

The Internet offers opportunities to provide a cost-effective method to influence behavior change through tailored or nontailored messaging and has been used to successfully deliver primary and secondary physical activity interventions.<sup>12-15</sup> Weight loss occurred in adults at risk for type 2 diabetes who received either basic Internet messages or Internet with e-mail counseling, with the behavioral e-counseling group losing more weight.<sup>12</sup> In a separate study of patients with type 2 diabetes, both control and Internet-

based tailored interventions resulted in moderate improvement in levels of physical activity.<sup>13</sup> Among patients with cardiovascular disease, an Internet-based case management system for secondary prevention resulted in no differences in reported minutes of weekly aerobic exercise between those receiving usual care versus those using the Internet intervention.<sup>14</sup> A study involving 65 sedentary adults found those in the Internet intervention group participated in significantly greater total minutes of physical activity than those in the control group after 1 and 3 months.<sup>15</sup>

Because middle aged and older women increasingly use the Internet as a supplemental source for health information,<sup>16,17</sup> this study was designed to assess the feasibility and effectiveness of using the Internet to deliver a theory-based behavior change intervention to increase physical activity in women ages 50-69. The behavior change intervention was framed by Pender's Health Promotion Model (based on Bandura's social cognitive theory) that has been successfully used for explaining and predicting physical activity in various populations.<sup>18,19</sup> The intervention incorporated 3 cognitive perceptual variables (perceived benefits, barriers, and self-efficacy) from this model because of the empirical evidence supporting their association with the promotion of physical activity.<sup>20-22</sup> We sought to compare the effectiveness of 3 Internet-delivered newsletters, either tailored or standard, in facilitating change in physical activity and behavior-specific influences on activity between baseline and at 3 months (1 month after the delivery of the third newsletter).

## METHODS

This study used a pretest post-test comparison experimental design. An anonymous survey was administered to the participants at the end of the study for a process evaluation. The study was approved by the University of Nebraska Institutional Review Board.

### Participants

A power analysis was performed for a 2 X 2 repeated measures ANOVA to assess change in the specified behavioral and biomarkers of physical activity behaviors. Using VO<sub>2</sub>max results from the literature as the basis for the sample size calculation, we determined that testing at the 0.05 level, two-sided, 130 participants (65 per group) would provide 80% power to detect a difference of 0.25 standard deviations in change in this marker. According to Lackey and Wingate, pilot work may use 10% of the sample required to avoid a Type II error.<sup>23</sup> For our study, this meant 7 subjects per group, 14 total. We anticipated a high attrition rate (up to 50%), so a minimum of 28 women was the target for recruitment.

Participant recruitment occurred through newspaper advertisement. Thirty-one women who met the following inclusion criteria and who provided informed consent enrolled in the study. Inclusion criteria were women who: were aged 50-69 years, were English speaking, had access to a computer with Internet capacity in their home, and answered no to all questions on the Physical Activity Readiness Questionnaire.<sup>24</sup> Women who reported they participated in 30 minutes of moderate physical activity 5 or more days per week for over a 6-month period were excluded

as this suggested they were already at a maintenance phase and thus not able to benefit from the intervention. Women were randomly assigned to the groups.

### Procedure

Upon providing informed consent, participants received an initial assessment of physical activity behavioral markers and biomarkers. At that session, women received instruction on how to retrieve their newsletters from the Internet and demonstrated their knowledge of this by retrieving the first newsletter while supervised. The second newsletter was available at 1 month following baseline, and the third newsletter was available at 2 months. Subjects were notified of the availability of the second and third online newsletters by postcard. The postintervention assessment was scheduled at 3 months following baseline, which was 1 month after the delivery of the third newsletter.

### Outcome Measures

#### Physical activity measures

Physical activity behavior was considered the self-reported time engaged in physical activity and daily energy expenditure as measured by the Modified 7-Day Activity Recall.<sup>25</sup> This instrument was selected because of its sensitivity, construct, and concurrent validity.<sup>20,25</sup>

Cardiorespiratory fitness was measured using the Rockport Fitness Walking Test.<sup>26</sup> This field test, useful for older sedentary individuals, required fast walking over a one-mile distance. Subjects completed this test in an indoor walking track on the University campus. This test has been shown to provide a valid estimate of VO<sub>2</sub>max from variables of weight, age, gender, track walk time, and 15-second final heart rate and it has high test-retest reliability in women ages 50-69.<sup>26-28</sup> Body composition was calculated using bioelectrical impedance analysis following the manufacturer's instructions (Biodynamics Model 310e Body Composition Analyzer, Biodynamics Corporation, Seattle, Wash). Bioelectrical impedance analysis has been recognized as a useful, reliable, and valid technique for estimating body composition when well-defined procedures are followed.<sup>29</sup> A standard clinical scale was used for measures of height and weight. Flexibility was measured using the modified sit-and-reach test that has high test retest reliability for this population and has moderate criterion-related reliability as a test of hamstring flexibility in women.<sup>30,31</sup>

#### Behavioral influences

Perceived benefits of action are positive outcome expectations that an individual believes will occur from engaging in a behavior whereas perceived barriers are negative outcome expectations that inhibit an individual's involvement in an activity. The 29-item Benefits Scale and the 14-item Barriers Scale of the Exercise Benefits/Barriers Scales were used to measure the perceived benefits and perceived barriers to physical activity, respectively.<sup>32</sup> Both surveys use a 4-point Likert-like response format ranging from (4) strongly agree to (1) strongly disagree. Both scales have been shown to have construct validity and test-retest reliability.<sup>32</sup> Alphas in this sample were 0.93 and 0.76, respectively.

Perceived self-efficacy, described by Bandura, is the conviction that one is able to execute successfully the behavior necessary to produce the desired outcomes.<sup>19</sup> Self-efficacy for physical activity was measured by the 12-item Self-Efficacy for Exercise Habits Scale, which uses a 5-point Likert-like scale ranging from (1) I know I cannot to (5) I know I can.<sup>33</sup> Using this scale, subjects rated how confident they were to exercise consistently for at least 6 months in a variety of situations. This instrument demonstrates construct validity, test-retest reliability, and predictive criterion-related validity.<sup>33,34</sup> The alpha for this sample was 0.90.

All participants were asked to prioritize their top 3 perceptions of both benefits and barriers to exercise in addition to their top 3 perceptions of situations where they lacked confidence or self-efficacy to exercise. This information was used solely to generate messaging for those in the tailored intervention group. Information about initial goals for physical activity and stretching obtained at baseline also was used to generate messaging for the tailored group.

### Intervention

The intervention consisted of a total of 3 newsletters because previous research demonstrated limited improvement in self-reported physical activity following a one-time delivery of intervention materials.<sup>9-11</sup> In addition, we believed that an intervention of 3 newsletters would be feasible for health care providers to implement as part of their practices. Three newsletters were delivered to the women via the Internet at baseline, at 1 month, and at 2 months. To assure confidentiality, each subject received her own ID and password to access her newsletter on the Internet. Newsletter content for both groups encouraged the participants to meet the Healthy People 2010 goals for physical activity and flexibility.<sup>1</sup> Both tailored and standard nontailored newsletters were similar in layout, type face, and length (equivalent to 4 printed pages) to minimize differences in appearance.

Tailoring was accomplished by creating a library of 350 text messages that corresponded to individual responses obtained at the baseline assessment related to level of self-reported physical activity, benefits and barriers to activity, and self-efficacy and initial goals for activity. Computer algorithms were established to access the appropriate text pieces to generate individually tailored newsletters based on responses to baseline computer assessments.

Each newsletter, whether tailored or standard, had a content template of 5 to 7 brief articles on physical activity goals, benefits and barriers to activity, and self-efficacy for activity. Tailored and standard newsletters differed in that standard newsletters included general information about each content area that might or might not be relevant to recipients, whereas tailored newsletters included content solely based upon the individual recipient's responses to the baseline assessment. For example, for content on barriers to activity, recipients of tailored messages received information solely related to their baseline responses concerning their top 3 barriers to activity whereas the standard group received information about multiple barriers to activity which may or may not have been of interest to them personally.

### Process Evaluation by Participants

At the 3 month assessment, participants completed an anonymous paper survey to evaluate the ease of retrieval of Internet newsletters, percentage of newsletters read, and the effectiveness of the newsletters related to physical activity behavior change.

### Data Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) version 10.1 for Windows software. A series of two-way analyses of variance for repeated measures (time: at baseline and at 3 months, corresponding to 1 month post-intervention) were conducted to determine differences in the outcomes of the two groups. Post-hoc analyses were completed using the Bonferroni adjustment for multiple comparisons. Significance level was set at  $P \leq 0.05$ , but effect sizes and power were also examined as appropriate for a preliminary study.

### RESULTS

Of the 31 women who enrolled, 30 participated in post-testing and complete data were obtained for all variables on 28 women. Descriptive characteristics of the sample are included in Table 1. The majority of subjects in both groups were married, highly educated, employed, and had moderate or higher income levels.

The means, standard deviations, and percentage of change in each of the physical activity outcomes and the behavioral influences over time are shown in Tables 2 and 3, respectively. Repeated measures analysis of variance (RM-ANOVA) F ratios for time, newsletter group, and newsletter

**Table 1. Characteristics of Women in Tailored and Standard Newsletter Groups**

Characteristics	Tailored (n = 15)		Standard (n = 16)	
	n	%	n	%
<b>Ethnic - Racial Background</b>				
White	13	86.7	16	100.0
Black	1	6.7		
Asian or Pacific Islander	1	6.7		
<b>Marital Status</b>				
Married	10	66.7	13	81.3
Widowed			1	6.3
Divorced/separated	3	20.0	2	12.5
Never married	2	13.3		
<b>Education Level</b>				
High school graduate	2	13.3	3	18.8
Some college	5	33.3	5	31.3
College graduate or higher	8	53.3	8	50.1
<b>Employment Status</b>				
Full time	11	73.3	5	31.3
Part time	1	6.7	3	18.8
Homemaker	1	6.7	3	18.8
Retired	1	6.7	4	25.0
Unemployed	1	6.7	1	6.3
<b>Yearly Income</b>				
20 K to 39 K	4	26.7	3	18.8
40 K to 59 K	3	20.0	7	43.8
60 K or above	5	33.3	4	25.0
Prefer not to answer	3	20.0	2	12.5

**Table 2. Comparison of Pre- and Postintervention Physical Activity Outcomes**

Variable	Baseline Mean + SD	3-Months Mean + SD	Change
Rockport Fitness Walking Test			
VO <sub>2</sub> max (ml/kg/min)			
Tailored (n = 13)	26.69 + 6.2	27.52 + 9.3	3.1% increase
Standard (n = 15)	25.59 + 7.4	23.59 + 9.3	7.8% decrease*
Modified Sit-and-Reach (cm)			
Tailored (n = 15)	27.63 + 4.3	29.50 + 7.0	6.7% increase*
Standard (n = 15)	29.57 + 6.3	32.76 + 7.6	10.8% increase*
Body Fat (%)			
Tailored (n = 15)	33.72 + 4.9	32.96 + 6.3	0.7% decrease
Standard (n = 15)	34.10 + 5.6	30.81 + 7.8	9.6% decrease*
Modified 7-Day Activity Survey			
Kcal/Kg/Day			
Tailored (n = 15)	28.70 + 5.0	26.54 + 4.98	7.6% decrease
Standard (n = 15)	28.89 + 5.7	27.34 + 4.62	5.4% decrease
Calories Expended Daily			
Tailored (n = 15)	2076.29 + 567.3	1910.08 + 457.5	8.0% decrease
Standard (n = 15)	2173.11 + 518.1	2070.55 + 395.9	4.7% decrease
Moderate or Greater Physical Activity in Past Week (min)			
Tailored (n = 15)	937.63 + 616.5	672.53 + 643.9	8.0% decrease
Standard (n = 15)	1228.06 + 1194.7	906.00 + 775.8	4.7% decrease

\* = Significant change over time

**Table 3. Comparison of Pre- and Postintervention Behavioral Influences from the Health Promotion Model**

Variable	Baseline Mean ± SD	3-Months Mean ± SD	Change
Perceived Benefits of Exercise			
Tailored (n = 15)	3.20 ± 0.4	3.29 ± 0.4	2.8% increase
Standard (n = 14)	3.16 ± 0.3	3.18 ± 0.3	0.6% increase
Perceived Barriers to Exercise			
Tailored (n = 15)	2.22 ± 0.4	2.11 ± 0.3	4.9% decrease*
Standard (n = 14)	2.26 ± 0.3	2.07 ± 0.2	8.2% decrease*
Perceived Self-Efficacy for Exercise			
Tailored (n = 15)	3.41 ± 0.6	3.13 ± 0.6	8.1% decrease*
Standard (n = 14)	3.67 ± 0.8	3.90 ± 0.8	6.3% increase

\* = Significant change over time

group x time as well as effect sizes and observed power for the outcomes and behavioral influences are shown in Table 4.

Changes occurred in some of the physical activity biomarkers. Significant time effects were found in the sit-and-reach test, with both groups improving in flexibility from pre- to postintervention ( $F(1,27) = 6.13, P = 0.02$ ). Significant time x group interactions were observed for VO<sub>2</sub>max ( $F(1,26) = 4.37, P = 0.047$ ) and % body fat ( $F(1,28) = 6.46, P = 0.017$ ). Post-hoc comparisons revealed that VO<sub>2</sub>max and % body fat decreased in the standard group ( $P = 0.039$ ) and did not change in the tailored group. There were no significant group effects for any of the self-reported activity outcomes.

Changes were also found in some of the behavior-specific influences on activity. Significant time effects were found for perceived barriers ( $F(1,27) = 5.62, P = 0.025$ ), with both groups declining in perception of barriers from pre- to postintervention. Significant time x group interaction was demonstrated for self-efficacy ( $F(1,27) = 4.55, P = 0.042$ ). Post-hoc comparisons revealed that self-efficacy changed over time in both newsletter groups, but that it increased in the standard group ( $P = 0.510$ ) and decreased in the tailored group ( $P = 0.018$ ). No change in perceived benefits of activity was observed.

Fifty percent (n = 15) of the participants indicated on the evaluation survey that they read the Internet-delivered newsletters online. Eighty-three percent (n = 25) of the women reported that they printed out a hard copy of each newsletter. The assistance provided by the research assistant in helping the women learn to retrieve the first newsletter from the Internet was considered very helpful by 73% (n = 22) of the subjects. Eighty-three percent (n = 25) reported they read all of the newsletters and 63% (n = 19) indicated that the Internet newsletters were helpful in making them more aware of ways to increase their physical activity. Fifty percent (n = 15) of the subjects indicated that the newsletters were helpful to them in changing their physical activity and 53% (n = 16) reported that they would not have made changes had they not received the information in this project.

**Table 4. 2 x 2 Repeated Measures Analysis of Variance F Ratios for Group x Time**

Outcome Variable	df	ANOVA						
		Time (T)	Group (G)	T x G	Effect Size (Cohen's F)		Observed Power <sup>a</sup>	
		F(p)	F(p)	F(p)	T	T x G	T	T x G
VO <sub>2</sub> max (ml/kg/min)	1,26	0.76 (0.393)	0.85 (0.365)	4.37 (0.047)	0.18	0.40	0.13	0.52
1 mile walk time (min)	1,26	2.10 (0.159)	0.17 (0.687)	1.84 (0.186)	0.29	0.27	0.29	0.26
Kcal/Kg/day in last week	1,28	3.68 (0.065)	0.10 (0.757)	0.10 (0.756)	0.37	0.00	0.46	0.06
Calories expended daily in last week	1,27	3.30 (0.080)	0.60 (0.446)	0.19 (0.670)	0.35	0.10	0.42	0.07
Moderate or > intensity activity in last week (min)	1,29	3.82 (0.060)	0.98 (0.330)	0.04 (0.851)	0.37	0.00	0.47	0.05
% Body fat	1,28	4.83 (0.036)	0.03 (0.860)	6.46 (0.017)	0.42	0.48	0.56	0.69
Sit-and-reach (cm)	1,28	6.13 (0.020)	1.50 (0.231)	0.43 (0.520)	0.47	0.14	0.67	10
Perceived benefits	1,27	0.90 (0.352)	0.42 (0.523)	0.32 (0.579)	0.18	0.10	0.15	0.08
Perceived barriers	1,27	5.62 (0.025)	0.00 (0.972)	0.42 (0.522)	0.45	0.14	0.63	0.10
Self-efficacy	1,27	0.08 (0.775)	4.55 (0.042)	10.37 (0.003)	0.00	0.62	0.06	0.87

F ratios are Wilks' approximation of F values  
 Significant findings ( $P < 0.05$ ) are shown in italics  
<sup>a</sup> Computed using alpha = 0.05

## DISCUSSION

This study investigated the feasibility and effectiveness of using 3 Internet-delivered newsletters, either tailored or standard, for facilitating change in physical activity and behavior-specific influences on activity. The outcomes and process evaluation results support the use of Internet-delivered newsletters as a feasible method for promoting physical activity in women ages 50 to 69. There was low attrition, with 30 of the 31 women participating in the post-testing. Most women reported they read all 3 newsletters and found the intervention helpful in making behavior change. We did not count the women's hits on the Web site, but would recommend tracking hits in a future study.

Both groups improved in flexibility but neither group increased in self-reported time in physical activity. It is possible that the lack of increased time in activity could have been influenced by the weather, as the study started in June and concluded in early September when the weather was hotter and more humid. While the tailored group showed no changes in either  $VO_2$ max or % body fat, the standard group displayed a lack of consistency in the direction of change with a decrease in % body fat but also a decrease in  $VO_2$ max. With a mean reduction of 9.6% body fat in the standard group, we would have expected an increase in  $VO_2$ max in that group. As no information on diet was provided to either group, the reason for this reduction in body fat was unclear.

That change occurred within a 3 month period in physical activity measures for both tailored and standard groups is similar to the findings of others who used computer generated or Internet delivered tailored and standard newsletters.<sup>10-11,13,15</sup> That standard information can result in change would seem to have an economic advantage, in that messages would be less costly to produce than individualized tailored messaging. McKay and colleagues suggest that individual initiative affects the quality of the support offered through tailored messaging because tailoring of advice is only as good as the information available for tailoring.<sup>13</sup> They suggest that individuals who are more likely to disclose personal information might receive tailoring that was more appropriate to their situation. Further study over a longer period of time may clarify the effectiveness of standard versus individualized tailored messaging in changing physical activity behavior.

Of the behavior-specific influences on physical activity that were examined, both groups decreased as desired for perceived barriers to activity. Previous studies have reported improvement on behavioral influences such as perceived benefits or barriers to exercise in both tailored and standard groups.<sup>10-11</sup> The standard group increased self-efficacy as desired, while the tailored group unexpectedly decreased self-efficacy. The group differences might be due to individuals of the standard group receiving a wider array of motivational messages as compared to those of the tailored group who received information solely about their baseline self-reported top 3 areas in which they lacked confidence.

A strength of this study was that it included both self-reported activity as well as biomarkers as outcome measures. Previous studies using tailored messaging examined only self-reported activity, which often does not correlate well

with biomarker measures.<sup>10,13,15</sup> We found changes in flexibility and % body fat whereas no changes were observed in self-reported activity. One possible reason for this may be due to the difficulty for individuals to accurately recall their level of activity. Although it might be anticipated that the women's participation in the research study would influence their self-reported physical activity, no change in self-reported physical activity was found.

Of concern in Internet-delivered interventions is that they would be available only to individuals from a higher socioeconomic background.<sup>13,16-17</sup> The women recruited in this study were mostly white, higher income, and educated women, which supports that concern. Further studies might address this issue through a more random recruitment method, such as random-digit dialing.

The majority of women suggested the Internet intervention was helpful; however, we did not separate tailored versus standard group responses and would recommend this for future studies. While this preliminary study offered a limited intervention, changes were noted in both groups and the effect sizes for outcomes obtained over 3 months suggest that even greater change may be possible with a longer period of intervention.

## CONCLUSIONS

Based upon the outcomes of this study, Internet-delivered behavior change interventions appear feasible to influence improvement in measures of flexibility, % body fat, and perceptions about barriers to activity in these older women. The effect sizes for outcomes obtained over 3 months suggest that even greater change may be possible with a longer or more intensive intervention. Whether tailored or standard messaging was more effective was inconclusive. Clinicians and others may find this approach helpful as an independent or supplemental primary prevention method.

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