Abstract

Purpose. To evaluate the effects of a 12-week e-mail intervention promoting physical activity and nutrition, and to describe participant use and satisfaction feedback.

Design. A longitudinal, randomized trial.

Setting. Five large workplaces in Alberta, Canada.

Participants. One thousand forty-three participants completed all three assessments, and 1263 participants in the experimental group provided use and satisfaction feedback after receiving the 12-week intervention.

Intervention. Paired physical activity and nutrition messages were e-mailed weekly to the experimental group. The control group received all messages in bulk (i.e., within a single e-mail message) at the conclusion of the intervention.

Measures. Self-report measures of knowledge, cognitions, and behaviors related to physical activity and nutrition were used. Satisfaction with e-mail messages was assessed at Time 2.

Analysis. Planned contrasts compared the experimental group measures at Time 3 with those reported at Time 2 and with control group measures reported at Time 3. Control group measures at Time 2 were also compared with control group measures at Time 2.

Results. The small intervention effects previously reported between Time 1 and Time 2 were maintained at Time 3. Providing the e-mail messages in bulk also had a significant positive effect on many of the physical activity and nutrition variables.

Conclusions. E-mail offers a promising medium for promoting health-enhancing knowledge, attitudes, and behaviors. Additional research is needed to determine optimal message dose and content. (Am J Health Promot 2010;24[4]:255-259.)

Key Words: Physical Activity, Workplace, E-mail Interventions.

PURPOSE

Given the low proportion of adults who meet current physical activity and nutrition recommendations, there is need for cost-effective, wide-reaching, and efficacious interventions that facilitate sustainable, health-enhancing lifestyles. More than 67% of Canadian adults access the Internet, and of internet users, 84% report having access to e-mail with 39% using it everyday and 25% making use of it at least once a week. The prevalent nature of e-mail suggests that it may be a useful medium for promoting health-enhancing behaviors. Furthermore, e-mail communication can be implemented at reasonable cost, offers asynchronous and flexible timing of message delivery, and provides a convenient data collection mechanism for feedback and evaluation purposes. Thus, researchers have begun to examine the effectiveness of health-related behavioral interventions that use e-mail for primary message delivery.

E-mail intervention research suggests that electronic delivery of physical activity and nutrition promotion holds promise for making small, short-term improvements in health-related attitudes and behaviors. However, few studies have examined more lasting effects of these types of interventions. Furthermore, the potential effect of varying the dose (i.e., frequency and length) of health-promoting e-mail messages has not been sufficiently explored, nor have participant use and satisfaction with characteristics of e-mail messages that promote healthy behaviors been extensively studied.
Plotnikof et al. previously reported results of a 12-week e-mail intervention that involved delivery of paired physical activity and nutrition messages to Canadian employees. The intervention slightly enhanced physical activity and nutrition-related cognitions and behaviors 1 week after the intervention compared with a control group who received no e-mails. Group differences were statistically significant, but the effect sizes were generally small.

This study extends the above findings, examining the effect of providing all of the intervention e-mail content in bulk to the control group, and describes previously unreported data concerning participant use and satisfaction with the messages. Specifically, the study’s objectives were as follows:

1. To determine if the small effects that were previously observed 1 week postintervention by the experimental group were maintained 6 months postintervention;
2. To determine if original control group participants’ knowledge, cognitions, and behaviors changed 6 months after receiving all 12 paired messages in bulk;
3. To compare knowledge, cognitions, and behaviors of the two groups at 6 months of follow-up; and
4. To describe feedback provided by the original experimental group regarding the use and satisfaction with frequency, length, and content of the e-mail messages.

### METHODS

#### Design

The study method is detailed in the original study. Participants were randomly assigned to either an intervention or control group, and they completed questionnaires 1 week prior to the intervention (Time 1), 1 week after the intervention (Time 2), and at 6 months follow-up (Time 3). The intervention involved 12 physical activity and 12 nutrition messages (i.e., one set of paired messages per week) sent to the workplace e-mail addresses of participants in the experimental group. The control group was provided with all intervention message content, in bulk within a single e-mail, at the conclusion of the initial 12-week study period. Both physical activity and nutrition messages (available at http://www.chps.ualberta.ca/paphresources.cfm) were operationalized based on key constructs (Table 1) from major social-cognitive theories (i.e., Social Cognitive Theory, Trans-theoretical Model, Protection Motivation Theory, and Theory of Planned Behavior). The experimental group also provided feedback regarding satisfaction with the e-mail messages at

<table>
<thead>
<tr>
<th>Variable</th>
<th>Experimental Group (n = 1175)</th>
<th>Control Group (n = 415)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T1 Mean (SD)</td>
<td>T2 Mean (SD)</td>
</tr>
<tr>
<td>Physical activity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Weekly MET minutes</td>
<td>675.8 (724.7)</td>
<td>719.9 (711.3)</td>
</tr>
<tr>
<td>Workplace activity status</td>
<td>1.32 (0.57)</td>
<td>1.35 (0.58)</td>
</tr>
<tr>
<td>Self-efficacy</td>
<td>3.15 (0.86)</td>
<td>3.27 (0.87)</td>
</tr>
<tr>
<td>Pros</td>
<td>3.92 (0.74)</td>
<td>4.01 (0.75)</td>
</tr>
<tr>
<td>Cons</td>
<td>2.08 (0.71)</td>
<td>1.96 (0.67)</td>
</tr>
<tr>
<td>Vulnerability</td>
<td>3.95 (1.09)</td>
<td>4.06 (1.09)</td>
</tr>
<tr>
<td>Behavioral intention</td>
<td>7.09 (2.56)</td>
<td>7.19 (2.60)</td>
</tr>
</tbody>
</table>

| Nutrition | | | | | | |
| Healthy eating practices | 3.46 (0.82) | 3.76 (0.74) | 3.34 (1.13) | 3.45 (0.77) | 3.58 (0.77) | 3.20 (1.20) |
| Balance food intake with physical activity | 3.33 (1.03) | 3.63 (0.94) | 3.67 (0.92) | 3.27 (1.03) | 3.41 (0.99) | 3.52 (0.94) |
| Enjoyment (enjoy cooking) | 3.43 (1.18) | 3.45 (1.15) | 3.39 (1.16) | 3.44 (1.15) | 3.41 (1.16) | 3.42 (1.16) |
| Enjoyment (mealtime) | 3.91 (0.86) | 3.97 (0.82) | 4.00 (0.79) | 3.92 (0.82) | 3.92 (0.81) | 3.95 (0.82) |
| External cues | 2.97 (1.22) | 2.68 (1.18) | 2.70 (1.18) | 2.90 (1.22) | 2.71 (1.21) | 2.67 (1.18) |
| Variety | 3.99 (0.91) | 4.05 (0.89) | 4.12 (0.83) | 3.96 (0.93) | 3.96 (0.96) | 4.06 (0.93) |
| Desire to change | 4.23 (0.79) | 4.13 (0.75) | 4.02 (0.76) | 4.23 (0.84) | 4.07 (0.78) | 3.98 (0.84) |
| Knowledge | 4.77 (0.67) | 4.92 (0.29) | 4.88 (0.38) | 4.74 (0.74) | 4.85 (0.42) | 4.85 (0.39) |
| SOC† (buying) | 4.12 (1.47) | 4.23 (1.35) | 4.26 (1.40) | 4.09 (1.50) | 4.04 (1.55) | 4.17 (1.45) |
| SOC† (cooking) | 4.32 (1.31) | 4.51 (1.05) | 4.52 (1.11) | 4.35 (1.31) | 4.35 (1.30) | 4.46 (1.23) |
| SOC† (preparation: garnishing) | 4.17 (1.39) | 4.36 (1.19) | 4.43 (1.19) | 4.18 (1.40) | 4.23 (1.40) | 4.33 (1.35) |
| SOC† (general diet) | 3.82 (1.52) | 4.14 (1.30) | 4.19 (1.31) | 4.78 (1.54) | 3.92 (1.48) | 4.14 (1.39) |

T1, Time 1; SD, standard deviation; T2, Time 2; T3, Time 3; MET, Metabolic Equivalents; SOC, stage of change.

† Stages of change are scored on 5-point response option scales that range from 1 (no intention to reduce eating high-fat foods within the next 6 months) to 5 (has consistently avoided eating high-fat foods for more than 6 months). All scales are 5-point Likert-type measures (i.e., 1 = lower value and 5 = higher value), with the following exceptions: the physical activity of behavioral intention was scored on an 11-point scale (that ranged from 0% to 100%) and the workplace activity status was measured by using a 4-point scale (in which sedentary = 1 and very active = 4).

* Single df contrast p < 0.01.
** Single df contrast p < 0.05.
Thus, the final sample consisted of those who completed the baseline assessment, 1643 (77.5% of Time 2 responders) provided data 6 months after the intervention. Across the three assessments, 60 participants who reported values of leisure time physical activity greater than 3.29 standard deviations above the overall mean were excluded from the analyses to minimize the impact of outliers. Thus, the final sample consisted of 1590 individuals (experimental group, n = 1175; control group, n = 415). The sample’s mean age was 45.2 (± 5.9) years, 74% were female, and the mean body mass index was 27.2 kg/m^2 (± 5.8 kg/m^2). The demographic characteristics between the two study groups were congruent. Of the 1566 participants in the original experimental group, 1263 (80.6%) provided use and satisfaction feedback at the conclusion of the intervention.

**Sample**

The sample was drawn from five large Canadian workplaces. The participant recruitment procedure and study response rates are detailed elsewhere. Of the 2597 employees that completed the baseline assessment, 1643 (77.5% of Time 2 responders) provided data 6 months after the intervention. Across the three assessments, 60 participants who reported values of leisure time physical activity greater than 3.29 standard deviations above the overall mean were excluded from the analyses to minimize the impact of outliers. Thus, the final sample consisted of 1590 individuals (experimental group, n = 1175; control group, n = 415). The sample’s mean age was 45.2 (± 5.9) years, 74% were female, and the mean body mass index was 27.2 kg/m^2 (± 5.8 kg/m^2). The demographic characteristics between the two study groups were congruent. Of the 1566 participants in the original experimental group, 1263 (80.6%) provided use and satisfaction feedback at the conclusion of the intervention.

**Measures**

The construct items, psychometric details, and information that support the measures are detailed in the initial study and in the note in Table 1. In summary, self-reported leisure time behavior was assessed by using a modified version of the Godin Leisure Time Exercise Questionnaire to calculate weekly MET (Metabolic Equivalents) minutes and a single self-report item-assessed workplace activity status. Physical activity-related self-efficacy, perceived pros, cons, and intention; and vulnerability to health problems, if inactive, were assessed. Dietary variables that were measured included healthy eating practices; enjoyment; external cues; variety; desire to eat healthier; dietary knowledge; and stage of change related to food purchasing, cooking, preparation (garnishing), and general diet.

At the conclusion of the intervention, experimental group participants were asked for feedback regarding the number and time spent reading the e-mails, reasons for behavioral responses or nonresponses to messages, preferences for message length and frequency of delivery, preferred types of content, and preferred mode of health-promoting message delivery.

**RESULTS**

**Preliminary Analysis**

Participants who did not complete all three assessments (i.e., those excluded from the planned contrast analyses) reported lower baseline levels of physical activity (mean_diff = 110.9, t(1739) = 1.77, p = .08) compared to those who completed all three assessments. Further, this group also had lower physical activity self-efficacy (mean_diff = .14, t(1738) = 1.88, p = .06), and general healthy eating practices (mean_diff = .15, t(1588) = 2.05, p = .04), than those who completed all three assessments.

**Six-Month Assessment**

Table 1 presents results that address the study’s first three objectives. Leisure-time physical activity increased between Time 2 and Time 3 for both the experimental and control groups, although workplace physical activity did not change for either group. There were no significant differences between experimental and control...
groups for both the physical activity measures at Time 3. Physical activity-related self-efficacy, pros, and cons did not significantly change for the experimental group between Time 2 and Time 3. Of these variables, only the pros variable increased for the control (i.e., bulk message) group. Perceived vulnerability if inactive and physical activity intention increased for both groups between Time 2 and Time 3. There were no significant differences between the groups on any of the Time 3 physical activity-related cognitions.

The experimental group reported a higher mean at Time 3 than at Time 2 for the item "I eat a wide variety of different foods." However, this group reported significantly lower means between the two respective time points for general eating healthy practices, cooking enjoyment, desire to eat healthier, and belief that healthy eating is important for disease prevention.

For the original control group (i.e., those who received the e-mail messages in bulk at Time 2), five nutrition variables showed significant increases between Time 2 and Time 3 (i.e., balance intake with activity, eating a variety of foods, buying low-fat foods, cooking with low-fat techniques, and generally avoiding high-fat foods), whereas the mean levels for two measures (i.e., general healthy eating practices and desire to eat healthier) significantly declined during this period.

At Time 3, the only significant differences between the two groups were the increased scores for the experimental group on general healthy eating practice and on balancing food intake with physical activity.

**Participant Satisfaction**

The majority of participants read all 12 weekly messages, spent less than 10 minutes per week reading the messages, perceived the e-mails to be of appropriate length, preferred once-per-week message frequency, and favored health prompts received via e-mail versus by paper or Web site access (Table 2). Behavioral responses and nonresponses were attributed to thought-provoking messages and to uninteresting or uninspiring message content, respectively.

**DISCUSSION**

Our findings are somewhat encouraging regarding the potential for e-mail communications to contribute to health promotion program effectiveness. For physical activity, virtually all of the small positive effects observed immediately following the original intervention were maintained, or were additionally increased, 6 months later. Most notably, both physical activity
intention and behavior were substantially higher at Time 3 than at Time 2. Results for the healthy eating variables were also favorable, as 8 of 12 measures either maintained or increased in the desired direction compared with levels reported at Time 2.

Interestingly, provision of all of the e-mail health promotion content to the control group in bulk appeared to have a similar impact on knowledge, cognitions, and behaviors as did the more structured, 12-week intervention. After 6 months, only two variables favored the experimental group. Thus, it appears that obtaining the small effects exhibited in this study was not dependent upon the specific dose structure of the health promotion messaging. Therefore, a logical extension to this study would be to increase the message dose (i.e., frequency and length) in hopes of simultaneously increasing the magnitude of positive effects. Although participants in the experimental group expressed a preference for receiving weekly messages, the actual impact on knowledge, cognitions, and behaviors was similarly effective for those with one-time bulk message exposure. This finding, in combination with those recently reported by Franklin et al.,10 indicating that U.S. adults were receptive to receiving daily health promotion e-mail messages for a period of 6 months, suggests that it may be feasible to increase the frequency and overall amount of health-promoting message delivery. Thus, along with continual refinement of message content, increases in message dose might additionally improve the effectiveness of interventions that rely on e-mail communications.

It is encouraging that approximately 70% of the participants in the experimental group reported reading all 12 weekly message pairs, and 87% reported reading more than half of them. Furthermore, nearly 90% indicated a preference for e-mail communications compared with either paper or Web site health promotion prompts. These results suggest that a substantial portion of the population is receptive to receiving health-promoting information via e-mail. It is also apparent that the quality and relevance of the e-mail content is critically important. More than 41% of experimental group respondents indicated that they did not take action because the messages did not interest or inspire them. Likewise, when e-mail recipients did take action, more than 46% indicated that it was because the message content was thought provoking. Thus, additional inquiry aimed at improving the understanding of the type of content that is likely to inspire and influence health-enhancing knowledge, attitudes, and behavior among e-mail recipients is needed.

Study limitations include the self-report method of data collection, the use of generic messages that were not tailored to specific needs of individuals or population subgroups, and the lack of accounting for (in our analyses) the degree of attention recipients gave to the e-mail messages. Because detailed feedback regarding the e-mails was obtained only from participants in the experimental group, we were also unable to conduct satisfaction-related comparisons of this group with those who received e-mail content in bulk. In addition, the intervention effectiveness could not be evaluated for those who did not complete all three assessments. Finally, the current design could not fully assess the true longitudinal impact of the intervention, because the control group received the bulk messages after Time 2 (rather than after the 6-month follow-up). These issues deserve specific attention within future inquiry. Regardless, the results do suggest that e-mail messaging holds promise as a cost-effective and wide-reaching health promotion tool with some potential for lasting effectiveness.

Acknowledgments

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References
