Can email prompting minimize the decrease in wintertime physical activity levels?

Gary Liguori, PhD; Arupendra Mozumdar, PhD

The authors are affiliated with the Department of Health, Nutrition, and Exercise Sciences at North Dakota State University. **Contact author**: Gary Liguori, Health, Nutrition and Exercise Sciences, North Dakota State University, Bentson Bunker Fieldhouse, Room # 1. Centennial Blvd. Fargo, ND, 58105; Phone: 701-231-8682; Fax: 701-231-8872; Email: Gary.Liguori@ndsu.edu

Submitted February 19, 2007; Revised and Accepted May 15, 2007

Abstract

The primary purpose of this study is to evaluate the effectiveness of using email prompts to attenuate the decrease of physical activity in adults during a winter season. In addition, the secondary purposes were (1) to evaluate the effectiveness of email prompts at increasing motivation towards physical activity and (2) to evaluate the awareness of the email campaign. Extension agents from the state of North Dakota (N=81) participated in a physical activity behavioral intervention study. Participants were grouped into an intervention group (N=39) that received bi-weekly physical activity electronic mail (email) prompts spread over 16 weeks, and a control group (N=42), that did not receive any intervention. Data on physical activity motivation and email message awareness were collected through standard questionnaires. Physical activity levels were measured with the International Physical Activity Questionnaires (IPAQ). Data were collected at two time points: mid-fall or pre-intervention and early spring or post-intervention. Over the winter season, both the control and intervention groups experienced an overall decrease in physical activity as measured by IPAQ (-317.0 MET-min/wk vs. -208.2 MET-min/wk, respectively). However, those in the intervention group who were able to recall the tag line were more active than controls. The significant difference in physical activity level between participants at the two extremes of the awareness levels indicates the potential efficacy of an email intervention campaign toward increasing physical activity.

Key words: *Physical Activity, Intervention Program, Electronic Mail Prompt*

Introduction

Regular physical activity (PA) is a well-documented means of minimizing the incidence of multiple chronic diseases as well as elevating mood states, decreasing menopausal symptoms, and increasing academic performance in school-aged children.[1, 2] Regular PA promotes good health; however environmental conditions often influence regular PA participation. As an example, the 2003 Behavioral Risk Factor Surveillance System (BRFSS) data from US counties noted that in all climatic zones, the number of adults meeting recommended PA levels is consistently lowest during winter season.[3] Globally, seasonal variations also extend to household, occupational, and leisure time PA, along with food intake and body weight.[4-9] These variations continue to remain noticeable throughout the lifespan.[8, 9] Potential reasons for this variation in seasonal PA levels have been attributed to lower ambient temperature, unsafe, inconvenient and inhospitable environmental conditions, and physiological mechanisms such as circannual rhythms and endocrinological responses.[5, 6, 10, 11] Given the harsh environmental conditions during winter in North Dakota and the upper Great Plains, and the evidence stating that adults engage in a lower degree of physical activity during winter, it seems prudent to pursue a health promotion program in this region of the country, designed to attenuate this wintertime decrease in physical activity.

Various health promotion efforts have been used over time to encourage people about the utility of physical activity, especially for those leading a largely sedentary lifestyle. Physical activity promotion efforts are considered an effective way to encourage people to adopt a more physically active lifestyle leading to enhanced well being.[12-14] Face to face health promotion prompts, especially delivered by a physician, have been successful for short-term increases in PA levels; however, this type of effort requires significant time and resources.[15-19] Postal delivery, telephone prompts, and more recently, websites, have also shown some effectiveness for increasing knowledge or behavior towards PA in adults.[20-27] Email can also be used to deliver PA messages, but these messages are usually attached to a website requesting visitation, and not as a sole means of message delivery.[27] Leslie et al.[28] have noted that email prompting visits to websites have limited utility because the vast majority of web visits (77%) occur immediately after the first e-mail is received; in the often-cluttered information environment of workplaces, issues of engagement and retention in website-delivered programs may not be optimal. Efforts to assess the effectiveness of emails on increasing campaign recognition have been regarded as successful.[23-29] Other areas of health promotion have successfully used email as the sole prompt to increase health related knowledge or behavior.[30, 31] Yet few studies have examined e-mail as the sole delivery method for physical activity interventions. Therefore the aim of this study is to determine whether email messages can be effective in promoting physical activity when used as the exclusive mode of message delivery.

The primary purpose of this study was to determine if email prompts promoting lifestyle related physical activity could attenuate the decrease in physical activity typically seen during winter months. In addition, the secondary purposes were to (1) evaluate the effectiveness of email prompts at increasing motivation towards physical activity as measured by participant stage of change and (2) evaluate the effectiveness of email prompts at increasing awareness of physical activities that can be incorporated into daily routines.

Materials and Methods

Participants and Setting

The study population consisted of extension agents and specialists from a Midwestern university that were in attendance at a statewide extension conference during October 2004. Extension agents in North Dakota are employed through the states land-grant university, and are assigned to each county of the state, primarily in rural areas. The principle investigator visited with all of the meeting rooms during the conference to introduce the survey to potential participants, asking for their participation in completing the initial survey (see sub-section 'Questionnaire' under 'Material Method' for instruments used in survey). Participants recruited for this study were unaware that they would be receiving email prompts; instead, everyone was told they would simply fill out a pre-winter and post-winter survey on physical activity. Potential participants were informed that the follow-up surveys would be delivered to their workplace in late February or early March, in an effort to track changes that occurred over winter. Informed consent sheets were available for all interested participants, in compliance with the institutional review board guidelines. The initial survey was distributed to 189 registered attendees of the conference. There were 106 surveys returned, but three were discarded because the consent forms were

not signed. All participants received a letter in mid-November thanking them for their initial participation and reminding them of the post-survey to come in early spring. This same letter was repeated one week prior to the delivery of the post-winter survey. Once the baseline data was collected, the initial 103 participants were divided into intervention (n=52) and control (n=51) groups determined by county of residence. Since extension agents are assigned to a county, all participants within a given county were assigned to either the control or intervention group. This method of group assignment was used to minimize the potential of the email prompts from filtering from the intervention group to the control group. Counties were rank ordered by population, and starting with the most populated county (Cass). Counties were alternately assigned to the control then intervention group, resulting in the final participant distribution.

The Intervention Program

Eight email physical activity prompts were sent to individual email accounts of each participant in the intervention group. The messages were sent to only one participant at a time, instead of through a list serve, to minimize the risk of messages being deleted if they were perceived to be sent as "SPAM". All messages contained the same participant line throughout the intervention ('NDSU Physical Activity Message'), and each message started with the tag line of 'Move to Improve'. The primary information of the messages was to include time efficient, family–friendly, physical activity into a daily routine. There were eight different tips, with one tip contained in each email message (do yard works, pace the sidelines, shovel – don't blow, workout with your television, Simon says, sweeping counts, walk the dog, dancing counts*)*. Information concerning the benefits of PA was contained within each message, and a link to the Centers for Disease Control and Prevention physical activity website was provided at the bottom. The first email was delivered in November, 2004 and continued every other week until the final message was sent in February 2005.

The post-survey was sent to 101 participants (intervention 50 and control 51) in early March, 2005 via email and US postal mail, approximately three weeks after the final email was sent. Participants were informed that they could respond to the survey through either postal or electronic mail. A second email was sent one week later as a reminder to return the post-intervention surveys.

Questionnaires

All participants, regardless of their assigned group, were asked to complete questionnaires measuring (1) motivation towards physical activity, (2) awareness of the email campaign, and (3) physical activity level.

International Physical Activity Questionnaire: Physical activity level of the participants was measured using the 'short last 7 days self-administered' format of the International Physical Activity Questionnaire (IPAQ).[32] The short IPAQ form is recommended for national monitoring and has reliability and validity measures at least as good as other established forms of self-report.[33] The IPAQ was used for each participant during both the pre- and post-intervention survey. The responses were converted to MET-min per week according to the standard IPAQ scoring protocol.[32] MET-min per week was used as a continuous variable indicating how much physical activity was completed during the last seven days, with higher scores indicating greater levels of PA. All scoring of individual IPAQ results was completed after all data collection was complete, thereby eliminating any psychometric influence.

Physical Activity Motivation: Motivation towards physical activity was assessed in all participants during both pre- and post-survey. The assessment was made with a series of questions that allowed for participants to be categorized into one of five stages of change; pre-contemplation, contemplation, preparation, action, or maintenance.[34, 35] The questions, below, were preceded with the following description of physical activity: 'If physical activity is defined as an accumulation of at least 30 minutes of moderate activity on at least 5 days of the week, how would you answer the following questions?'

A. Do you currently engage in regular physical activity?
   Yes No
B. Do you intend to engage in regular PA in the next 6 months?
   Yes No
C. Do you intend to engage in regular PA in the next 30 days?
   Yes No
D. Have you been regularly physically active for the last 6 months?
   Yes No

Participant's motivation towards physical activity was categorized based on the following:

If, A=no, B=no:	pre-contemplation
If, A=no, B=yes, C=no:	contemplation
If, A=no, C=yes:	preparation
If, A=yes, D=no:	action
If, A=yes, D=yes:	maintenance

Assessment of Awareness: Awareness of the physical activity campaign was assessed in both

groups on the pre and post-intervention survey, by asking participants to identify a message tag line that was included on all email prompts. Prior to the pre-intervention survey, none of the participants had any knowledge of the message tag line. Participants were asked, however, to identify the correct tag line ('Move to Improve') from a menu of other potential tag lines ('Exercise Your Right to be Active', 'Just a Bit Gets You Fit', 'Move a Little, Gain a Lot', and 'I don't recall receiving health promotion messages at my office'). Participants in the intervention group then were exposed to the tag line as it was prominently displayed at the top of each of the eight emails they received. Intervention group participants that were able to recognize the tag line were assumed to have gone through the email prompts regularly and were therefore exposed to and aware of the intervention program.

Statistical Analysis

Descriptive statistics of age, salary and total MET-min/ wk data for both intervention and control group was calculated and independent sample t-test was done to determine the difference between the two groups. The comparison of the other demographic variable (gender ratio, marital status, and living with children or not) was done using binomial test for equality of proportions. The frequency distribution of the participants in the intervention and control group according to their motivation towards physical activity was done and the comparison between two groups was made using binomial test for equality of proportions, separately for pre-intervention and post-intervention survey. The pre- and post-intervention survey descriptive statistics of total MET-min/ wk scores was calculated among the participants in intervention group with correct message tag identification, participants in the intervention group with incorrect message tag identification, and participants in the control group. Independent sample t-test was used to compare total MET-min/ wk scores between (1) intervention group correct identifiers and the control group and (2) intervention group correct identifiers and intervention group incorrect identifiers. The significance level for all statistical tests was at 5% or $P \leq 0.05$. All the statistical analyses in this study have been done using Microsoft Excel (version- Professional Edition 2003) and SPSS (version- Release 13.0, 2004) software.

Results

Both the pre and post intervention survey was completed by 39 participants in the intervention group (78% of initial intervention group) and 42 participants from the control group (82% of initial control group). Among the participants who returned completed follow-up surveys, the majority were returned via email (74%). The mean age, gender distribution, average annual salary, number of married participants, and number of participants with children living at home is summarized in Table 1. All participants in the study were Caucasian and had earned at least a four year college degree.

Table 1 also shows no significant difference between intervention and control group in any of the demographic characters. Descriptive statistics of both pre- and post-survey physical activity scores in total MET-min/week showed no difference in between-group comparisons (Intervention pre: 1309.28 $\pm$ 1060.49 MET-min/wk, Intervention post: 1101.08 $\pm$ 799.42 MET-min/wk; Control pre: 1264.90 $\pm$ 985.44 MET-min/wk, Control post: 947.90 $\pm$ 678.17 MET-min/wk). Within-group comparisons of pre- and post-survey mean MET-min/wk scores showed a decrease for both groups.

Table 2 shows the distribution of the participants according to their motivation towards physical activity during pre and post intervention surveys. Regardless of group assignment, most of the participants remained in their initial motivation level between the two surveys. In the intervention group, nine participants reported an increase in motivation, and two participants reported a decrease. In the control group, 11 participants decreased their motivation level and four participants reported an increase.

Participants were then grouped as 'inactive ('pre-contemplation', 'contemplation' and 'preparation') or 'active' ('active' and 'maintenance') to further assess changes between surveys. There was no difference in the proportion of participants categorized as 'active' during the pre-intervention survey between intervention and control groups ($P = 0.456$). The post-intervention survey showed a significant difference between the groups ($P < 0.001$), with 62% of the intervention group and 24% of the control group rated 'active'.

The distribution of the participants of the intervention group according to incorrect and correct identification of the message tag line is displayed in Table 3. About 25% of the participants of both groups had chosen the correct tag line on the pre-intervention survey. After the intervention program about 70% of participants from intervention group and 10% from the control group were able to correctly identify the message tag ($P < 0.001$). Within the intervention group, 69% of participants

were able to correctly identify the message tag line on the post-survey, indicating a significant increase in awareness towards the PA campaign ($P<0.001$). The proportion of participants in the control group able to correctly identify the message tag line in the post-survey decreased to 9.5%.

Two separate comparisons were done on both pre- and post-survey total MET-min/wk data; one between the 'correct identifiers' of the intervention group and the controls, and one between the 'correct identifiers' and the 'incorrect identifiers' of the intervention group. These analyses were done in an attempt to distinguish the effect of the campaign on those able to recall the tag line compared to all other participants. This analysis required the assumption that the 'correct identifiers' in the intervention group had been properly exposed to the message tag line, and therefore, to the intervention as well (Table 4). Participants in the intervention group that were unable to recall the message tag line were assumed to be not properly exposed to the intervention, similar to the controls. The pre-survey showed no difference in total MET-min/wk scores between the 'correct identifiers' and the control group. However, the 'correct identifiers' reported significantly higher total MET-min/wk scores than the control group on the post-survey ($P=0.013$). Comparison of total MET-min/wk scores between 'correct identifiers' and 'incorrect identifiers' within the intervention group, showed significantly higher total MET-min/wk scores for the 'correct identifiers' on both the pre- and post-survey.

Further, the 'incorrect identifiers' of the intervention group were pooled with the control group, as it was assumed that neither had been exposed to the intervention. This pooled group was then compared to the 'correct identifiers' of the intervention group, or those assumed to be exposed to the intervention, for total MET-min/wk. There was no significant difference in total MET-min/wk scores between the 'correct identifiers' and the pooled group on the pre-survey ($P=0.055$). However, on the post-survey, the total MET-min/wk score of the 'correct identifiers' was significantly higher than the pooled group (1390.07 vs. 837.44 MET-min/wk, respectively; $P=0.001$)

Discussion

There is a noticeable decrease in physical activity levels during the winter season and even more so in bitterly cold climates.[3-9] In harsh winter climates it may be more reasonable to attenuate the wintertime decrease in PA rather than attempting to maintain or increase recommended PA levels. The present study aimed to assess the impact of email prompts on motivation, awareness, and behavior towards PA among working class adults of North Dakota, which is known for its long, harsh winters. Data were collected on 81 extension agents via electronic mail, in mid-fall and early spring, to assess the changes brought about by the winter season. Intervention participants then received eight bi-weekly email's prompting increased PA, while the controls did not receive any such information.

Participants at this university reported physical activity levels well in excess of national recommendations (Table 1). This increased level of PA may be due to a number of factors including high education levels (every participant has at least a 4-year college degree), ethnic background (Caucasian), and frequent exposure to health promotion programs through their employer. Results of this study indicate that there may be some potential benefits for PA campaigns delivered exclusively through email, to attenuate the decrease in wintertime PA levels. Also, the intervention group showed an enhancement of motivation towards PA and an increase in recognition of the message tag line, or campaign awareness.

Choosing the correct message tag line from among the four choices had a probability of one in four, or 25%, which is consistent with the findings of both intervention and control groups. This result indicated lack of bias among participants over the choice of correct message tag prior to intervention, especially given that no participants had any prior knowledge of the campaign. Therefore, the significant increase in correct identification of the message tag for the intervention group may be considered as an effect of the intervention. This finding of increased message awareness through regular exposure is consistent with earlier work.[29, 30, 36]

While most PA campaigns intend to increase or maintain activity levels[20-27], the realities of life in the upper Great Plains is such that attenuating the decrease may be a more realistic objective. In the present study, as expected, there was a significant decrease in PA for both groups. Our hypothesis, however, was that the decreased PA in the intervention group would be less than the controls. Therefore, an attempt was made to examine the effect of the intervention on those participants who were assumed to have read the messages. First, a comparison was done between intervention participants who correctly identified the tag line ('correct identifiers') and the controls, who were not

at all exposed to the intervention. The two groups had similar baseline PA levels, however, after the winter, the 'correct identifiers' reported significantly higher PA scores compared to the controls. Second, within the intervention group there were both 'correct identifiers' (70%) and 'incorrect identifiers (30%) of the message tag line. The 'incorrect identifiers' were grouped with the controls (unexposed), assuming neither had been exposed to the intervention, and compared to the 'correct identifiers' (exposed) for PA scores. There was no difference between the groups in baseline PA scores. However, the exposed group reported higher levels of physical activity on the post-survey compared to the unexposed group. Therefore, based on the results at hand, it can be concluded that a significant difference in physical activity level between the groups with and without exposure to the email prompt intervention has been noticed. This finding is similar to Bauman et al.[36] who noted that participants able to recall a message tag line were more than twice as likely to have increased their activity than those not able to recall the tag line.

Results of the present study have been found to be corroborative with a few earlier intervention studies of behavior change intended to increase motivation, recognition, or behavior towards physical activity.[20-27] Other areas of health promotion also have been successful in using this technique of exclusive email prompting. For example, Fox et al.[31] found that email prompts were a highly effective reminder for women taking oral contraceptives, producing high rates of daily compliance.

The present study was faced with certain limitations. The present study is based on a small sample, making it difficult to draw a final conclusion. Also, regular and reliable computer access is necessary for this program to work. Further studies are needed to include more individuals, and a wider range of ages, ethnic and socio-economic background to establish the efficacy of the email prompt towards the behavior changes noted.

The decrease in physical activity level during the winter season is a common behavior pattern that can be noticed throughout the world, and even more so in bitterly cold climates. Since decreased physical activity levels are associated with health problems, attenuating the wintertime decrease may be essential for long-term maintenance of recommended PA levels. Health promotion campaigns attempt to increase awareness and prompt healthier behavior, and e-mail may be a medium that can accomplish this in a relatively low cost and time efficient manner.

These results are promising in regards to PA promotion, particularly in rural areas. Email may be an effective alternative to other types of health promotion, in that it is an inexpensive, simple, and quick method of delivering physical activity prompts to a large population distributed over a wide geographic region.

Acknowledgements

The authors are grateful to all the participants in this study for their kind cooperation. The authors are also thankful to Bradford Strand, North Dakota State University, Fargo, ND; Subrata K. Roy, Indian Statistical Institute, Kolkata, India; Christopher B. Scott, University of Southern Maine, Goreham, ME; and Katrina DuBose, East Carolina University, Greenville, NC, who all provided many useful suggestions and reviews of the manuscript.

Both authors participated in the study design, data analysis, and the writing of the manuscript. GL collected the data for the present study. Neither author had any financial or personal conflicts of interest in the organization that supported the research.

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Table 1. Demographic characteristics and physical activity scores of the study participants; comparison between intervention and control group

	Pooled	Intervention	Control	
	N=81	n=39	n=42	*P*
Demographic variables				
Age in years	44.9±9.0	44.5±9.4	45.3±8.6	0.690
Females (n)	55	28	27	0.469
Mean Salary	$34,277	$33,588	$34,873	0.709
Married	88.9%	87.2%	90.5%	0.458
Children	59.3%	59.0%	59.5%	0.943
Physical activity scores (MET-min/wk) (Mean + SD)				
Pre-intervention	1286.27 ± 1015.57	1309.28 ± 1060.49	1264.90 ± 985.44	0.846
Post-intervention	1021.65 ± 738.37	1101.08 ± 799.42	947.90 ± 678.17	0.354

Table 2. Distribution of the participants in intervention and control group according to their motivation towards physical activity during pre-intervention and post-intervention survey

	Intervention group					Control group			
Motivation status	N = 39					N = 42			
	Pre		Post			Pre		Post	
	N	%	N	%		N	%	N	%
Pre-contemplation	4	10.26	3	7.69		6	14.29	7	16.67
Contemplation	3	7.69	1	2.56		3	7.14	1	2.38
Preparation	13	33.33	11	28.21		16	38.10	24	57.14
Action	2	5.13	7	17.95		1	2.38	1	2.38
Maintenance	17	43.59	17	43.59		16	38.10	9	21.43
	Intervention group					Control group			
	N		%			N		%	
Unchanged	28		71.79			27		64.29	
Decrease	2		5.13			11		26.19	
Increase	9		23.08			4		9.52	
	Intervention group					Control group			
Physical activity Status	Pre [a]		Post [b]			Pre [a]		Post [b]	
	N	%	N	%		N	%	N	%
Inactive	20	51.28	15	38.46		25	59.52	32	76.19
Active	19	48.72	24	61.54		17	40.48	10	23.81

[a] Non significant difference between intervention group and control group in pre-intervention survey (binomial test for equality of proportions, Z = 0.746, *P* = 0.456)

[b] Significant difference between intervention group and control group in post-intervention survey (binomial test for equality of proportions, Z = 3.438, *P* < 0.001)

Table 3. Distribution of the participants according to incorrect and correct identification of the message tag in pre and post intervention survey

	Intervention group				Control group			
Identification of message tag	Pre [a]		Post [b]		Pre [a]		Post [b]	
	N	%	N	%	N	%	N	%
Incorrect	29	74.36	12	30.77	32	76.19	38	90.48
Correct	10	25.64	27	69.23	10	23.81	4	9.52
	N		%		N		%	
Unchanged	22		56.41		36		85.71	
Correct > incorrect	0		-		6		14.29	
Incorrect > correct	17		43.59		0		-	

[a] Non significant difference between intervention group and control group in pre-intervention survey (binomial test for equality of proportions, Z = 0.191, *P* = 0.848)

[b] Significant difference between intervention group and control group in post-intervention survey (binomial test for equality of proportions, Z = 5.524, *P* < 0.001)

Significant difference between pre and post intervention survey results in intervention group according to correct message tag identification (binomial test for equality of proportions, Z = 3.855, *P* < 0.001)

Table 4. Comparison of pre and post intervention physical activity scores between participants in intervention group with correct message tag identification, participants in control group, and participants in intervention group with incorrect message tag identification on the pre and post intervention survey

	Pre				Post		
	N	Mean	SD		N	Mean	SD
Correct indentifiers	27	1592.04 [a, ,b]	1108.34		27	1390.07 [c, d]	736.24
Incorrect indentifiers	12	673.08 [a]	586.33		12	450.83 [c]	510.17
Controls	42	1264.90 [b]	985.44		42	947.90 [d]	678.17
Correct identifiers	27	1592.04 [e]	1108.34		27	1390.07 [f]	736.24
Incorrect identifiers & controls	54	1133.39 [e]	939.54		54	837.44 [f]	673.28

[a] Significant difference; t = 2.731, df = 37, P = 0.01

[b] Non significant difference; t = 1.282, df = 67, *P* = 0.204

[c] Significant difference; t = 3.999, df = 37, *P* < 0.001

[d] Significant difference; t = 2.556, df = 67, *P* = 0.013

[e] Non significant difference; t = 2.556, df = 67, *P* = 0.055

[f] Significant difference; t = 3.375, df = 67, *P* = 0.001