Experience Analysis of a Practice-Based, Online Pedometer Program

Jeffrey J. VanWormer, MS; Nicolaas P. Pronk, PhD; and Jackie L. Boucher, MS, RD, BC-ADM, CDE

Approximately one-fourth of chronic disease mortality (e.g., diabetes and heart disease) is linked to a sedentary lifestyle.[1] In 2000, it was estimated that physical inactivity cost the United States $76.6 billion in medical expenses alone.[2] In contrast, a physically active lifestyle is associated with multiple health benefits, including improvements in obesity, coronary artery disease, hypertension, and all-cause mortality.[3–6] Regular physical activity may be especially important for individuals at high risk for developing type 2 diabetes; a 2000 calorie/week increase in energy expenditure is associated with a 24% reduction in the risk of developing the disease.[7]

Despite the clear benefits of an active lifestyle, > 60% of U.S. adults do not get enough physical activity, and at least 25% are completely inactive during their leisure time.[8] Technological advancements and changes in the work environment during the past several decades have contributed to a gradual decline in the need for daily physical activity.[9,10] Because of this, many practitioners now recommend a lifestyle approach to physical activity, through which sedentary individuals are encouraged to build more physical activity into their daily routine and leisure time.[8,11]

An increasingly popular tool that can support lifestyle physical activities is the pedometer. Pedometer-based interventions have produced significant improvements in physical activity, weight management, blood pressure, and lipid profiles.[11–14] They have also been effective for increasing walking and improving glucose tolerance or insulin sensitivity among participants with type 2 diabetes.[15–19]

To date, however, most pedometer studies have had limited external validity because of small or narrowly defined at-risk samples. It is unclear how well a large-scale, commercially available pedometer-based walking program performs in the real world. The purpose of this evaluation was to examine whether an online program titled "10,000 Steps," which integrates the use of a pedometer, could help a large worksite population increase their walking and lose weight. Other research questions addressed in this evaluation were: Would enrollees use the pedometer to track their steps? Would completers increase their steps over time? Would completers lose weight by the end of the program? Implications for implementing such programs will also be discussed.

Methods

Participants. Data were collected from the records of employees of HealthPartners, a managed care organization based in Minneapolis, Minn., who enrolled in the 10,000 Steps program between 1 January 2004 and 31 December 2005. Enrollments occurred as a result of an employer-based promotion whereby the program cost was underwritten by HealthPartners, and a $25 gift card was presented to enrollees on program completion. Because this evaluation assessed the program's impact retrospectively, no exclusion criteria were applied, and only aggregate-level results were reported.

Program. 10,000 Steps is an 8-week pedometer program. The program emphasizes increased walking to improve general health conditions related to physical activity (e.g., weight, energy, and mood). All individuals self-enroll via the 10,000 Steps website (http://www.10k-steps.com/). The retail price of the program is $30 per individual.

10,000 Steps enrollees are mailed a valid Yamax Digi-Walker (model SW-200) pedometer[20] and an instructional booklet and given online access to set up a personal website. The website provides information and interactive tools for tracking steps, healthy eating and muscle conditioning and a checklist of behavior change techniques. Participants also receive daily e-mails for 8 weeks that provide motivational tips for increasing steps and maintaining activity gains. The program is self-paced with no formal professional contact, but participants have the option to e-mail a health educator with any questions related to physical activity or other program components.

Outcomes. The primary outcome was daily pedometer steps, as recorded in the online step logs. In addition, enrollees were requested to complete a baseline and postprogram survey on the website. Both surveys assess body weight and BMI, and the postprogram survey also assesses confidence for increasing/maintaining current physical activity levels and willingness to refer the program to a friend. All measures are self-reported.

Analysis. Analyses were conducted according to a quasi-experimental, pre-post design. Baseline differences between completers and noncompleters were analyzed using Student's t tests and Pearson's χ^2 tests. Given the novelty of Internet-based pedometer programs and the absence of a randomized comparison group, a treatment-received analysis (i.e., completers only) was conducted, and nonparametric Wilcoxon signed-Rank tests were used to compare ranked sums (i.e., pre-post change scores) for each outcome. All analytical procedures were performed using JMP-In version 4.0.4 (SAS Institute; Cary, N.C.) with a 0.05 a-level as the criterion for determining statistical significance.

Results

Total enrollment during the evaluation period was 1,373 individuals. Of these, 1,032 completed the program (defined as recording pedometer steps on more than half of the available days during the 8-week program), giving an overall attrition rate of 25%. As outlined in Table 1, most enrollees were female (90%) and, on average, middle aged (41.1 years) and overweight (27.4 kg/m^2). Compared with noncompleters, completers were significantly older (41.9 vs. 38.8 years, $t = 4.607$, $P < 0.001$).

Mean daily steps increased by 21% during the program (Figure 1), and the mean increase in steps between week 1 and week 8 was significant (1,163 steps, $n = 934$, signed-rank = 112,845, $P < 0.001$). By the end of week 8, 75% of completers were still logging their steps. Of the 1,032 completers, 596 (58%) reported their weight at baseline and postprogram. Mean weight loss was modest but significant (−3.5 pounds [−0.6 kg/m^2], signed-rank = 40,532, $P < 0.001$). Forty-two percent reported losing at least 4 lb during the program.

Of the 817 completers who responded to the postprogram survey, 551 (67%) indicated they were very confident that they could increase or maintain their current physical activity level. In addition, 794 (97%) indicated they would refer the program to a friend.

Discussion

The 10,000 Steps program was effective in promoting a moderate increase in short-term physical activity. Although the baseline activity level of this sample was higher than that of the typical American,[21] participants managed to increase their ambulatory activity by 21% or ~ 1,163 steps per day over 8 weeks. This corresponds to ~ 12 extra minutes of walking each day, or an extra 1.5 hour/week.[22] Attrition was low compared with similar real-world programs,[23,24] but this may have been driven, at least in part, by the incentive for program completion. As indicated by a strong willingness to refer others to 10,000 Steps, program satisfaction was high.

Table 1. Enrollment Characteristics

	All Enrollees	Completers	Noncompleters
n	1,373	1,032	341
Age (years)	41.1 ± 0.3	41.9 ± 0.3	38.8 ± 0.6*
Sex			
Male	141 (10)	115 (11)	26 (8)
Female	1,232 (90)	917 (89)	315 (92)
Weight (lb)	167.4 ± 1.2	166.4 ± 1.4	170.5 ± 2.5
BMI (kg/m^2)	27.4 ± 0.2	27.2 ± 0.2	27.9 ± 0.4

Data are the means ± SE or frequency counts (percentage of column total). Completers include the subset of all enrollees who recorded pedometer steps on more than half (i.e., > 28) of available days during the 8-week program. Noncompleters include the subset of all enrollees who did not record pedometer steps on more than half (i.e., ≤ 28) of available days during the 8-week program.
*Significantly different from completers ($P < 0.05$).

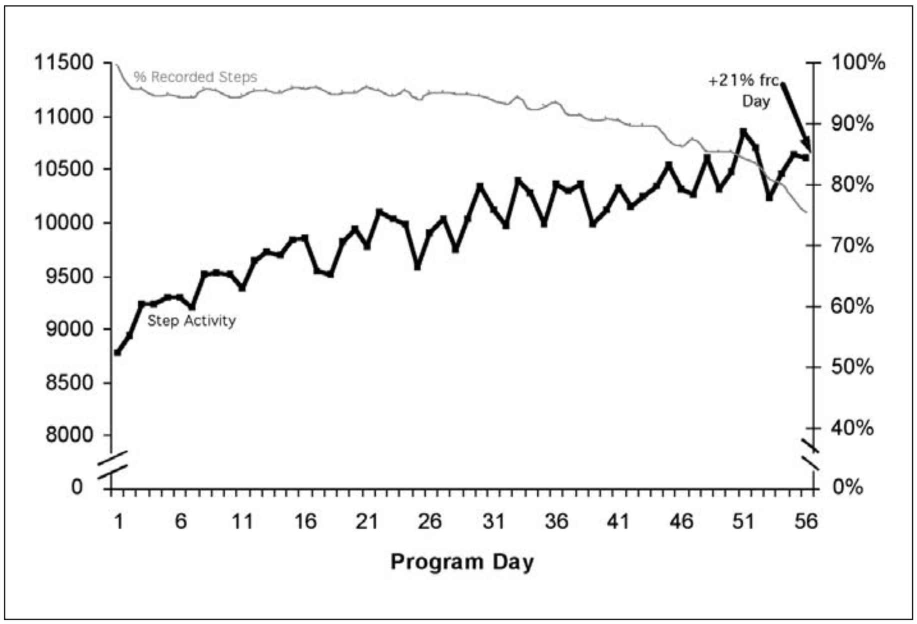

Figure 1. Pedometer activity and step-tracking attrition

Participants lost an average of 3.5 lb during the program, and 42% lost ≥ 4 lb. Such results are encouraging in the context of the Task Force on Community Preventive Services' findings that indicated a weight loss of > 4 lb is associated with significant health benefits.[25] It is also important to note that improving physical activity, not weight loss, was the primary focus of the program, so it is likely that many participants lost weight without intending to do so.

Although the program was not specifically targeted toward individuals at high risk for developing type 2 diabetes, it may be useful in such a population because physical inactivity and excess body weight are among the most important modifiable risk factors.[7] In addition, even modest increases in physical activity have been shown to help individuals with existing diabetes manage their blood glucose level.[26]

In terms of its potential to aid in diabetes or other chronic disease prevention, perhaps the most impressive aspect of 10,000 Steps is its scalability and sustainability. Based on the product design, 10,000 Steps is relatively inexpensive (~ $0.50 per day over 8 weeks), can be implemented across a variety of settings (e.g., worksites, clinics, and community), and does not rely on external funding or grant support to be operational. Most importantly, the program is focused on the most convenient form of leisure time activity, walking.[8] As such, it has the potential to reach broad segments of the population. It also has a strong potential to reduce health care costs. A recent study by Martinson et al.[27] found a mean reduction in annual health care charges of $2,202 for older adults who added as little as 1 hour/week of physical activity.

There were several limitations associated with this evaluation. The 8-week program duration was short. Some investigators have suggested that pedometer programs can provide a strong impetus for the initiation of physical activity, but other strategies are needed to help individuals maintain a regularly active lifestyle.[17,24] At the least, pedometers seem to provide a viable long-term feedback tool for individuals committed to increasing their physical activity level.[28] Another limitation involves the use of pedometer data as an outcome measure. Although it is objective, it is ultimately self-reported in the online step-tracking logs. As such, participant error and nonadherence is difficult to curb and can bias the results. Providing incentives for program completion based on the number of days steps are recorded and sending regular e-mail reminders to use the step-tracking logs may help to minimize such biases.

The nature of real-world pedometer programs also presents some unique analytical challenges. Change score calculations for pedometer steps may be a conservative estimate of the real effect because a true baseline is cumbersome to establish. Blinded step data (obtained before program initiation) would be ideal but unrealistic in the practical setting. Program designers should use other assessment tools to complement the evaluation of physical activity (Table 2). It is important to emphasize, however, that practice-based programs are not the same as interventions designed to be tested in research trials. The data collection process in a real-world program has many more voluntary components. Hence, any assessment instrument must be easy and efficient to minimize measurement burden and ensure good compliance.

The limitations of this evaluation should be balanced against its strengths. Data were included from a large sample of worksite employees across a wide time frame, allowing for reasonably unbiased conclusions to be drawn. It also lays out important program design features to determine scalability, sustainability, and other measures of overall impact.[29] A search of the PubMed database clearly indicates an increase in pedometer research, and it seems worksite-based pedometer programs are becoming increasingly popular.[8] The 10,000 Steps program may provide a model of how to gather effective behavior change support for a simple, minimal-contact, low-cost intervention that, given widespread access to the Internet,[30] can touch many underactive people. Such programs may be especially helpful for people at high risk for developing diabetes and other groups affected by the sequelae of a sedentary lifestyle.

Table 2. Design Considerations for Internet-Based Pedometer Programs

- Make it fun. The Internet provides a convenient medium for communicating effective messages and putting a unique, interactive spin on traditional self-directed behavior change techniques (e.g., self-monitoring and goal setting). Program components will probably be underutilized, however, if they are not appealing.
- Minimize participants' response effort. Increasing steps requires additional work, so make sure the interactive activities, such as step trackers and goal-setting worksheets, do not require so much effort that they become a barrier to progress.
- Provide at least some connection to an exercise professional, even if it is optional. At minimum, provide access to an e-mail Q&A box so participants can ask questions and get advice on difficulties they may be experiencing (e.g., using a pedometer or converting steps to distance).
- Provide incentives for program completion. Rewarding participants for completing the program will likely increase both participation and completion rates. In turn, it may even be associated with better physical activity results. This may be especially important for certain groups that are more likely to drop out.
- Collect data on more than just steps. Relying solely on self-recorded pedometer steps as the marker of success can be problematic because they are part of the treatment and the outcome. A true baseline step count may be impossible to measure, and participants who are not diligent about recording steps will be excluded (regardless of whether they increase their physical activity). Consider using a brief pre-post survey to complement the evaluation.
- Keep outcome expectations realistic. By design, pedometer programs are convenient and low in cost. As such, they are highly scalable and have the potential for broad outreach. But given their low intensity, population-level physical activity improvement tends to be modest.

References

1. Hahn RA, Teutsch SM, Rothenberg RB, Marks JS: Excess deaths from nine chronic diseases in the United States, 1986. *JAMA* 264:2654–2659, 1990

2. Centers for Disease Control and Prevention: Lower direct medical costs associated with physical activity [article online]. Available from http://www.cdc.gov/od/oc/media/pressrel/r2k1006a.htm

3. Berlin JA, Colditz GA: A meta-analysis of physical activity in the prevention of coronary heart disease. *Am J Epidemiol* 132:612–628, 1990

4. Blair SN, Kohl HW 3rd, Paffenbarger RS Jr, Clark DG, Cooper KH, Gibbons LW: Physical fitness and all-cause mortality: a prospective study of healthy men and women. *JAMA* 262:2395–2401, 1989

5. Paffenbarger RS Jr, Hyde RT, Wing AL, Lee IM, Jung DL, Kampert JB: The association of

changes in physical-activity level and other lifestyle characteristics with mortality among men. *N Engl J Med* 328:538–545, 1993

[6]Williamson DF, Madans J, Anda RF, Kleinman JC, Kahn HS, Byers T: Recreational physical activity and ten-year weight change in a US national cohort. *Int J Obes Relat Metab Disord* 17:279–286, 1993

[7]Helmrich SP, Ragland DR, Paffenbarger RS Jr: Prevention of non-insulin-dependent diabetes mellitus with physical activity. *Med Sci Sports Exerc* 26:824–830, 1994

[8]U.S. Department of Health and Human Services: *Physical Activity and Health: A Report of the Surgeon General.* Atlanta, Ga., U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, 1996. (Publ. no. 017-023-00196-5)

[9]French SA, Story M, Jeffery RW: Environmental influences on eating and physical activity. *Annu Rev Public Health* 22:309–335, 2001

[10]Saelens BE, Sallis JF, Frank LD: Environmental correlates of walking and cycling: findings from the transportation, urban design, and planning literatures. *Ann Behav Med* 25:80–91, 2003

[11]Lindberg R: Active living: on the road with the 10,000 Steps program. *J Am Diet Assoc* 100:878–879, 2000

[12]Dunn AL, Andersen RE, Jakicic JM: Lifestyle physical activity interventions: history, short- and long-term effects, and recommendations. *Am J Prev Med* 15:398–412, 1998

[13]Moreau KL, Degarmo R, Langley J, McMahon C, Howley ET, Bassett DR Jr, Thompson DL: Increasing daily walking lowers blood pressure in postmenopausal women. *Med Sci Sports Exerc* 33:1825–1831, 2001

[14]Sugiura H, Sugiura H, Kajima K, Mirbod SM, Iwata H, Matsuoka T: Effects of long-term moderate exercise and increase in number of daily steps on serum lipids in women: randomised controlled trial. *BMC Womens Health* 2:3, 2002

[15]Yamanouchi K, Shinozaki T, Chikada K, Nishikawa T, Ito K, Shimizu S, Ozawa N, Suzuki Y, Maeno H, Kato K, Oshida Y, Sato Y: Daily walking combined with diet therapy is a useful means for obese NIDDM patients not only to reduce body weight but also to improve insulin sensitivity. *Diabetes Care* 18:775–778, 1995

[16]Bjorgaas M, Vik JT, Saeterhaug A, Langlo L, Sakshaug T, Mohus RM, Grill V: Relationship between pedometer-registered activity, aerobic capacity and self-reported activity and fitness in patients with type 2 diabetes. *Diabetes Obes Metab* 7:737–744, 2005

[17]Tudor-Locke C, Bell RC, Myers AM, Harris SB, Ecclestone NA, Lauzon N, Rodger NW: Controlled outcome evaluation of the First Step Program: a daily physical activity intervention for individuals with type II diabetes. *Int J Obes Relat Metab Disord* 28:113–119, 2004

[18]Swartz AM, Strath SJ, Bassett DR, Moore JB, Redwine BA, Groer M, Thompson DL: Increasing daily walking improves glucose tolerance in overweight women. *Prev Med* 37:356–362, 2003

[19]Sone H, Katagiri A, Ishibashi S, Abe R, Saito Y, Murase T, Yamashita H, Yajima Y, Ito H, Ohashi Y, Akanuma Y, Yamada N; JD Study Group: Effects of lifestyle modifications on patients with type 2 diabetes: the Japan Diabetes Complications Study (JDCS) study design, baseline analysis, and three year-interim report. *Horm Metab Res* 34:509–515, 2002

[20]Tudor-Locke CE, Williams JE, Reis JP, Pluto D: Utility of pedometers for assessing physical activity: convergent validity. *Sports Med* 32:795–808, 2002

[21]Tudor-Locke C, Bassett DR Jr: How many steps/day are enough? Preliminary pedometer indices for public health. *Sports Med* 34:1–8, 2004

[22]Tudor-Locke C, Sisson SB, Collova T, Lee SM, Swan PD: Pedometer-determined step count guidelines for classifying walking intensity in a young ostensibly healthy population. *Can J Appl Physiol* 30:666–676, 2005

[23]Davis MJ, Addis ME: Predictors of attrition from behavioral medicine treatments. *Ann Behav Med* 21:339–349, 1999

[24]Stovitz SD, VanWormer JJ, Center BA, Bremer KL: Pedometers as a means to increase ambulatory activity for patients seen at a family medicine clinic. *J Am Board Fam Pract* 18:335–343, 2005

[25]Katz DL, O'Connell M, Yeh MC, Nawaz H, Njike V, Anderson LM, Cory S, Dietz W; Task Force on Community Preventive Services: Public health strategies for preventing and controlling overweight and obesity in school and worksite settings: a report on recommendations of the Task Force on Community Preventive Services. *MMWR Recomm Rep* 54:1–12, 2005

[26]Castaneda C: Diabetes control with physical activity and exercise. *Nutr Clin Care* 6:89–96, 2003

[27]Martinson BC, Crain AL, Pronk NP, O'Connor PJ, Maciosek MV: Changes in physical activity and short-term changes in health care charges: a prospective cohort study of older adults. *Prev Med* 37:319–326, 2003

[28]Tudor-Locke C, Bassett DR, Swartz AM, Strath SJ, Parr BB, Reis JP, Dubose KD, Ainsworth BE: A preliminary study of one year of pedometer self-monitoring. *Ann Behav Med* 28:158–162, 2004

[29]Pronk NP: Designing and evaluating health promotion programs: simple rules for a complex issue. *Dis Manage Health Outcomes* 11:149–157, 2003

[30]U.S. Department of Commerce: A nation online: how Americans are expanding their use of the Internet [article online]. Available from http://www.ntia.doc.gov/ntiahome/dn/anationonline2.pdf

Jeffrey J. VanWormer, MS, is an evaluation consultant; Nicolaas P. Pronk, PhD, is executive director; and Jackie L. Boucher, MS, RD, BC-ADM, CDE, is director of Health Programs & Performance Measurement at the HealthPartners Health Behavior Group in Minneapolis, Minn. Ms. Boucher is also an associate editor of Diabetes Spectrum.

***Note of disclosure:** All authors are employed by HealthPartners, which owns and distributes the 10,000 Steps program.*