The Effects of an Incremental Approach to 10,000 Steps/Day on Metabolic Syndrome Components in Sedentary Overweight Women

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Background: Pedometer programs can increase physical activity in sedentary individuals, a population that is at risk for developing metabolic syndrome and each of its individual components. Although the popular 10,000 steps/day recommendation has shown to induce many favorable health benefits, it may be out of reach for sedentary individuals. This study observed the effects of incremental increases in steps/day on metabolic syndrome components in sedentary overweight women.

Methods: This study was a longitudinal, quasi-experimental design. Participants were recruited from a 12-week work-site pedometer program and grouped as either 'active' or 'control' after the intervention based on their steps/day improvement. Self-reported physical activity, pedometer assessed physical activity, BMI, resting heart rate, waist circumference, blood pressure, triglycerides, HDL-C, and fasting glucose were measured before and after the program.

Results: The active group showed significant within-group improvements in waist circumference and fasting glucose. Significant group differences were observed in resting heart rate, BMI, and systolic blood pressure; however, the changes observed in systolic blood pressure were not independent of weight loss.

Conclusions: Incremental increases in steps/day induced favorable changes in some MetS components suggesting that this approach is a viable starting point for sedentary individuals that may find it difficult to initially accumulate 10,000 steps/day.

Keywords: pedometer, physical activity, waist circumference, blood pressure, fasting glucose

The clustering of cardiovascular disease (CVD) risk factors, often codified as the metabolic syndrome (MetS), looms as a potential health care crisis. In the United States, MetS affects 27% of adults, a proportion expected to rise in parallel with the increase in the national prevalence of obesity.1 The National Cholesterol Education Program (NCEP) defines MetS as the presence of any 3 of the following cardiovascular and metabolic risk factors: abdominal obesity, elevated triglycerides, elevated blood pressure, elevated fasting glucose, and reduced high-density lipoprotein cholesterol (HDL-C).2 Each of these components carries an independent health risk, which when together increases the susceptibility of type 2 diabetes3,4 and CVD.5,7

Treatment guidelines encourage physical activity (PA) as an effective therapy for both primary and secondary prevention of MetS.5 In fact, a physically active lifestyle has the strongest association with a decreased risk of developing the MetS.8 This presents another challenge to health professionals because only 45% of the adult population meet the minimal recommended level of PA necessary for good health.9 Given the high prevalence of physical inactivity in the United States and the favorable response of individual MetS components to PA,10,11 interventions aimed at increasing PA levels should be a priority for those at risk for developing MetS.

Pedometer-based programs prove effective in increasing daily PA participation in sedentary individuals.12–14 Pedometers allow self-monitoring of daily ambulatory activity (reported as steps/day) and provide direct feedback of progress; which are strategies known to improve PA behaviors.15 Based on health outcomes observed in Japanese studies,16,17 many pedometer-based programs have adopted “10,000 steps/day” as the target PA goal. Further research confirms that programs that use this step/goal result in favorable improvements in some of the MetS components.13,14 However, 10,000 steps/day may be too challenging for previously sedentary individuals.18 Given that a sedentary person may accumulate fewer than 5000 steps/day,19 an immediate increase to 10,000 steps/day may be too far-reaching and result in poor compliance. A progressive incremental approach to increasing daily step toward 10,000 steps/day may be more feasible for the sedentary population. Currently,
little is known about the health outcomes that occur “en route” to the popular 10,000 steps/day recommendation. Therefore, the purpose of this study was to examine the effects of a progressive increase in steps/day on MetS components. To accomplish this, we observed overweight sedentary women enrolled in a worksite pedometer program that used a gradual weekly progression toward 10,000 steps/day.

**Methods**

**Study Participants**

Participants for this study were female university employees recruited from a worksite pedometer-based PA program. Inclusion to the study was limited to those participants considered sedentary, as indicated by an accumulation of fewer than 5000 steps/day during the baseline week of the program. All participants completed a health-history questionnaire before participation in the study. Those having cardiovascular complications, pulmonary disorders, metabolic disease or previous cardiac surgery as well as those taking medication for elevated cholesterol, hypertension or impaired fasting glucose were excluded from participation in the study. All participants provided written informed consent according to the guidelines outlined by the University of Miami Human Subjects Research Office.

**Study Design**

The study was a longitudinal quasi-experimental (non-equivalent comparison) group design conducted in 3 phases: (1) baseline testing phase, (2) 12-week worksite pedometer program, and (3) the posttesting phase. After the posttesting phase, the women were categorized into one of 2 study groups (active or control) based upon the magnitude of improvement in steps/day observed in the pedometer program (Figure 1). Details regarding the grouping criteria are described in posttest measures.

**Baseline Measures**

All participants reported to the laboratory for baseline measurements of resting heart rate, resting blood pressure, height, weight, body mass index (BMI), waist circumference, blood lipid analysis, fasting glucose, 3-day dietary analysis, and PA levels. Participants fasted for 12-hours before their appointment. All measures were completed within 7 days of recruitment into the study.

Upon arrival to the laboratory, the participants rested for 10-minutes in a seated position. Resting heart rate was measured by palpating the radial pulse rate for 60 seconds. Seated blood pressure measurements were taken on the nondominant arm by a trained technician with an appropriate sized cuff and mercury sphygmomanometer (American Diagnostic Corp., Hauppauge, NY). Two blood pressure measures were recorded with a 2-minute rest between each reading and the average of the 2 readings was used for data analysis. Height was measured utilizing a wall mounted measuring scale (Seca, Hamburg, Germany) and recorded to the nearest centimeter. Weight was measured to the nearest 0.25 kg using a digital platform scale (Tanita Corp., Tokyo, Japan). These measures were used to calculate BMI (kg/m²). Waist circumference was recorded to the nearest 0.1 cm using a Gulick tension regulated tape measure (Creative Health Products, Ann Arbor, MI). Test-retest reliability measurement for waist circumference was r > .99. Blood samples for assays of triglycerides, HDL-C and fasting glucose were collected through finger stick procedures and analyzed with the Cholestech LDX blood analyzer (Cholestech Corporation, Hayward, CA). Quality control agents of known concentrations as well as optical sensor checks were run daily to verify system performance, accuracy, and precision.

To assess any changes in energy intake during the study, participants were provided with a 3-day food log and asked to record everything they consumed for 2 week days and 1 weekend day. Food logs were analyzed for average total daily Calories (kcal) using Nutritionist Pro IV (Axxya, Houston TX). Each participant was provided with a self-addressed interoffice envelope to promptly and discretely return the food logs.

Baseline PA levels included the mean steps/day recorded during baseline week of the pedometer program. To further validate the pedometer assessed steps/day, self-report lifestyle PA was assessed by the Stanford
Description of the 12-Week Pedometer Program

The 12-week pedometer program used in this study is an annual university worksite intervention designed to encourage participants to increase their daily step count by increasing lifestyle activity. All participants received a pedometer, a guide providing program details, a daily step log, and an education booklet. The education booklet included information regarding the health benefits of PA, tips for increasing daily steps through lifestyle activity, and basic nutrition information. The pedometer used for this program (Sportline 330) was chosen by program administrators due to its simple function and cost and has been deemed suitable for research of free-living activity.

During the baseline week (7 days) of the program, participants wore their pedometer during waking hours and continued their daily PA behavior as usual. Each night, participants recorded their daily step count on the step log and reset their pedometer to ‘0.’ After the baseline week, participants reported their weekly step total via a web-based database application. The database application automatically calculated weekly step goals for the entire program by converting the self-reported week total from the baseline week to mean steps/day (total steps per week / 7) then increasing this step/day value by 10% for each remaining week. Once a participant’s step goal reached 10,000 steps/day, then the progression was reduced to a 3% increase for the remaining weeks of the program.

Participants continued to self-report their weekly step count each week of the program as they did during the baseline week. All participants received weekly e-mail reminders to log-in their steps along with mean step improvements for the entire program population. Once they logged their step count, they received their new step goal for the upcoming week.

Post Test Measures

Following the pedometer program, participants were retested in the same manner as baseline. To determine study groups, the mean baseline steps/day was subtracted from the mean steps/day achieved during each week of the program. This difference was used to calculate a volume improvement for the entire 12-week program (sum of all weekly improvement values / 12). Women who improved their daily step count by a mean volume of 3000 steps/day or greater were categorized as ‘active,’ while those who either stopped participating in the program or did not achieve this step improvement level were considered the ‘control.’

Statistical Analysis

Independent sample t tests were performed to examine baseline differences between groups. Within-group differences between baseline and posttest measures for all variables were examined using a paired t test. Time-dependent change-scores for all variables were calculated by subtracting the postprogram measurements from the baseline measurements. Differences between groups for these change-scores were examined using one-way analysis of variance (ANOVA). MetS components, in which there were significant group differences for change-scores, were further tested using analysis of covariance (ANCOVA) while controlling for change-scores in weight and caloric intake. Pearson product moment correlation examined the relationship between pedometer-assessed PA (steps/day) and SUAQ scores obtained both at baseline and derived from program change-scores. All data were analyzed using SPSS 14.0 (SPSS Inc. Chicago, IL), with a criterion of significance set at $P = .05$.

Results

Subject Characteristics

Seventy-seven (34 control, 43 active) of the 84 women enrolled completed the study. Seven women were lost to study or did not complete the posttest phase for personal reasons. Of the 34 women in the control, only 14 logged their weekly step count for the entire 12-weeks; thus, a carry forward strategy from their last recorded step/count was used as posttest data. There was no significant difference in age between the control group and active group, (45.7 ± 9.5 yrs. vs. 46.3 ± 10.4 yrs., respectively).

Baseline and Change-Score Comparisons of PA Participation, Physical Characteristics, and Energy Intake

Physical activity participation, physical characteristics, and energy intake before and after the pedometer program for both groups is presented in Table 1. There were no significant baseline group differences for steps/day or SUAQ scores. Both groups had significant increases in steps/day ($P < .001$). A significant group effect, was observed in change-scores for steps/day ($F = 406, P < .001$) and SUAQ scores ($F = 34, P < .001$). There were no significant baseline group differences for body weight, BMI, or resting heart rate. The active group only, experienced significant within group decreases for these variables. A significant group effect was observed in change-scores for body weight ($F = 11.23, P < .001$), BMI ($F = 11.80,$
Table 1  Physical Activity, Physical Characteristics, and Energy Intake Before and After the 12-Week Pedometer Program

<table>
<thead>
<tr>
<th></th>
<th>Pre</th>
<th>Post</th>
<th>Change</th>
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<tbody>
<tr>
<td>Steps/day</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Control</td>
<td>4286 ± 850</td>
<td>5029 ± 772*</td>
<td>743 ± 546</td>
</tr>
<tr>
<td>Active</td>
<td>4244 ± 899</td>
<td>9889 ± 1609**</td>
<td>5646 ± 1328†</td>
</tr>
<tr>
<td>Self reported PA (SUAQ)</td>
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<td></td>
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<tr>
<td>Control</td>
<td>1.2 ± 0.8</td>
<td>1.9 ± 1.0</td>
<td>0.7 ± 0.9</td>
</tr>
<tr>
<td>Active</td>
<td>1.5 ± 1.1</td>
<td>3.4 ± 0.9**</td>
<td>1.9 ± 1.0†</td>
</tr>
<tr>
<td>Body weight (kg)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Control</td>
<td>79.5 ± 12.8</td>
<td>79.6 ± 13.3</td>
<td>0.2 ± 1.4</td>
</tr>
<tr>
<td>Active</td>
<td>81.0 ± 16.7</td>
<td>80.3 ± 16.3**</td>
<td>−0.8 ± 1.0†</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td></td>
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<td></td>
</tr>
<tr>
<td>Control</td>
<td>29.8 ± 5.0</td>
<td>29.9 ± 5.2</td>
<td>0.1 ± 0.5</td>
</tr>
<tr>
<td>Active</td>
<td>30.4 ± 5.5</td>
<td>30.2 ± 5.3**</td>
<td>−0.3 ± 0.4†</td>
</tr>
<tr>
<td>Resting heart rate (bpm)</td>
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<td></td>
</tr>
<tr>
<td>Control</td>
<td>72.6 ± 7.0</td>
<td>72.2 ± 7.5</td>
<td>−0.4 ± 3.7</td>
</tr>
<tr>
<td>Active</td>
<td>71.8 ± 7.5</td>
<td>69.0 ± 7.3**</td>
<td>−2.8 ± 3.5††</td>
</tr>
<tr>
<td>Daily energy intake (kcal)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>2186 ± 332</td>
<td>2111 ± 382</td>
<td>−74 ± 279</td>
</tr>
<tr>
<td>Active</td>
<td>2017 ± 375*</td>
<td>1976 ± 349</td>
<td>−40 ± 145</td>
</tr>
</tbody>
</table>

Note. All values are means ± SD.

* P ≤ .05 compared with nonadherers at baseline.
** P ≤ .01 compared with baseline.
† P ≤ .001 compared with changes over-time in control group.
†† P ≤ .01 compared with changes over-time in control group.

Discussion

There is overwhelming evidence that a physically active lifestyle reduces risk for developing MetS.8,23,24 Pedometer programs are effective at increasing PA levels among sedentary populations.12,13 Whereas previous pedometer studies25–29 used a predetermined controlled outcome goal of 10,000 steps/day, the current study observed the effects of a gradual weekly increase in steps/day (Figure 3). Our findings show that this approach of increasing steps/day was sufficient to initiate mild, but favorable health outcomes related to MetS. Although clinically mild, these

Baseline and Change-Score Comparisons of MetS Components

The MetS components before and after the pedometer program are shown in Table 2. There were no significant baseline differences between groups in MetS components. The active group experienced significant reductions in waist circumference (P < .01), systolic blood pressure (P < .001), and fasting glucose (P < .01). A significant group effect was observed in change-score for systolic blood pressure (F = 13.19, P < .001). When controlling for changes in body weight, this difference approached, but did not satisfy criteria for significance (F = 3.70, P = .058).

P < .001), and resting heart rate (F = 8.92, P < .01). A significant baseline group difference was observed for caloric intake (P = .043), with the active reporting an intake of 7% fewer kcal per day than the control. However, neither group experienced significant changes in caloric intake following the 12-week program.

Baseline steps/day was correlated with baseline SUAQ scores (r = .351, P < .01) for the entire sample. As shown in Figure 2, change-scores for steps/day was correlated with SUAQ scores for the active group (r = .463, P < .01). Shown in Figure 3 is the weekly calculated average steps/day over baseline for the active group only, which averaged to 3256 ± 1828 steps/day for the entire 12-week program.
Figure 2 — Scatterplot showing the relationship between improvements in steps/day and change-scores of self-report PA as measured by the Stanford Usual Activity Questionnaire (SUAQ) in the active group ($r = .463, P < .01$).

Figure 3 — Weekly increases in steps/day over baseline for the active group during the 12-week program.
improvements were not observed in the control group. To our knowledge, this is the first pedometer-based study to use a nonequivalent (intact) group design. That is, study participants were not randomly assigned to a study group before the pedometer program. Rather, the participants included for analysis were enrolled in a work-site pedometer program and grouped after the intervention based on self-directed physical activity behaviors; thus, contributing to the ecological validity of our findings.

Abdominal obesity is a strong predictor of obesity related health risks and MetS. In the current study, small but significant reductions were found in waist circumference as a result of the pedometer program. Chan and colleagues found larger reductions in waist circumference (–1.2 cm ± 0.8 cm) after 12-weeks of ≥10,000 steps/day. Participants in that study accumulated more steps/day at baseline (7029 ± 3100 steps/day) and maintained more steps/day throughout the duration of the pedometer program than the active group in this study. Therefore, the program of Chan and colleagues resulted in greater energy expenditure as evidenced by greater overall weight loss (1.5 kg ± 0.5 kg) than that observed in the current study (0.78 kg ± 1.03 kg). Although PA-induced reductions in waist circumference can occur independent of weight loss, concomitant weight loss generally results in more significant outcomes as evidenced by the significant correlation we observed between change-scores in body weight and waist circumference ($r = .67$, $P = .01$).

A recent meta-analysis of pedometer programs showed that longer duration pedometer programs result in a greater magnitude of weight loss. Perhaps long-term maintenance of the step count achieved at the end of the program (9889 ± 1609 steps/day) would have resulted in further weight loss, and subsequently, further improvements in waist circumference. Schneider et al. showed that obese/overweight adults who maintained >9500 steps/day for 36 weeks experienced significant decreases in body weight (–2.4 kg) and waist circumference (–1.8 cm). Interestingly, the magnitude of improvement in body weight and waist circumference was three-fold that observed in the current 12-week program, which was one-third the duration.

Elevated fasting glucose is another critical component of the MetS and an independent stand alone risk factor for type 2 diabetes. Results of the current study showed modest but significant reductions in fasting glucose levels (–2.9%) in the active group. Previous pedometer-based studies yielded smaller nonsignificant

### Table 2  Components of the Metabolic Syndrome Before and After the 12-Week Pedometer Program

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pre</th>
<th>Post</th>
<th>Change</th>
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<tbody>
<tr>
<td>Waist (cm)</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Control</td>
<td>86.4 ± 9.4</td>
<td>86.4 ± 10.3</td>
<td>–0.0 ± 3.2</td>
</tr>
<tr>
<td>Active</td>
<td>86.7 ± 11.3</td>
<td>86.1 ± 10.9***</td>
<td>–0.6 ± 1.4</td>
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<tr>
<td>Resting SBP (mmHg)</td>
<td></td>
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<tr>
<td>Control</td>
<td>126.0 ± 10.0</td>
<td>123.8 ± 10.6</td>
<td>–1.2 ± 3.9</td>
</tr>
<tr>
<td>Active</td>
<td>123.9 ± 14.9</td>
<td>118.4 ± 14.3***</td>
<td>–5.5 ± 5.7†</td>
</tr>
<tr>
<td>Resting DBP (mmHg)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>80.6 ± 7.7</td>
<td>80.2 ± 8.2</td>
<td>–0.4 ± 2.5</td>
</tr>
<tr>
<td>Active</td>
<td>79.3 ± 9.0</td>
<td>79.1 ± 8.4</td>
<td>–0.2 ± 2.5</td>
</tr>
<tr>
<td>Triglycerides (mmol/L)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Control</td>
<td>1.3 ± 0.4</td>
<td>1.3 ± 0.4</td>
<td>–0.0 ± 0.1</td>
</tr>
<tr>
<td>Active</td>
<td>1.4 ± 0.6</td>
<td>1.3 ± 0.6</td>
<td>–0.1 ± 0.1</td>
</tr>
<tr>
<td>Fasting glucose (mmol/L)</td>
<td></td>
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<td></td>
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<tr>
<td>Control</td>
<td>5.3 ± 0.7</td>
<td>5.3 ± 0.6</td>
<td>–0.0 ± 0.3</td>
</tr>
<tr>
<td>Active</td>
<td>5.3 ± 0.7</td>
<td>5.1 ± 0.6**</td>
<td>–0.2 ± 0.3</td>
</tr>
<tr>
<td>HDL-C (mmol/L)</td>
<td></td>
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<td></td>
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<tr>
<td>Control</td>
<td>1.3 ± 0.3</td>
<td>1.3 ± 0.3</td>
<td>–0.0 ± 0.1</td>
</tr>
<tr>
<td>Active</td>
<td>1.2 ± 0.2</td>
<td>1.2 ± 0.2</td>
<td>–0.0 ± 0.1</td>
</tr>
</tbody>
</table>

*Note. All values are means ± SD.
**$P \leq .01$ compared with baseline.
***$P \leq .001$ compared with baseline.
†$P \leq .001$ compared with changes over-time in control group.*
reductions after 8 weeks and 24 weeks of 1.7% and 1.9%, respectively. Tudor-Locke et al. examined the effects of a 16-week pedometer program on type 2 patients with diabetes and observed a nonsignificant 2.3% reduction in fasting glucose. The absolute change score observed in that study, however, was only slightly greater than that of the active group in the current study (–0.2 ± 2.3 mmol vs. –0.15 ± 0.32 mmol, respectively). Given that baseline fasting glucose levels in this study were well below the diagnostic criteria for impaired fasting glucose (>6.1 mmol), our results showed that even normoglycemic individuals can experience favorable changes in fasting glucose following a practical pedometer program that provided fairly subtle increases in steps/day. Upon further analyses, our findings did show a significant relationship between baseline fasting glucose levels and change-scores \( r = 0.518, P < .001 \) suggesting that those with higher baseline fasting glucose values benefited more. Furthermore, Tudor-Locke et al. observed a significant relationship between increases in steps/day and improvements in fasting glucose \( r = -0.43, P = .04 \). Although this relationship was not observed in the current study, application of their findings suggests that further increases in steps/day may have resulted in additional improvements in fasting glucose levels.

Physical activity is a well-established therapy for both the primary and secondary prevention of hypertension. Our study showed that even acute subtle increases in steps/day can result in significant improvements in systolic blood pressure when compared with those who remained sedentary. The reductions in systolic blood pressure observed in the active group can reduce risk of CHD mortality by as much as 9%. Both Iwane et al. and Moreau et al. recorded significant reductions of ~10 mmHg and ~6 mmHg, respectively, in hypertensive participants after 12 weeks of ~10,000 steps/day. Although we recorded significant reductions with less steps/day in a nonhypertensive population the latter research suggests that maintenance of 10,000 steps/day may indeed result in further reductions in systolic blood pressure.

The changes observed in systolic blood pressure were not independent of weight loss. A previous meta-analysis investigating effects of weight loss on blood pressure showed that a modest weight loss of ~5.0 kg results in a 4.4 mmHg reduction in systolic blood pressure. We observed a similar reduction in systolic blood pressure in the active group with far less weight loss. Since daily caloric intake did not change during the course of the program, the observed weight loss must have resulted from an increase in PA related energy expenditure. A recent meta-analysis by Richardson et al. showed that participants in a pedometer-based program can expect weight loss of 0.05 kg/week without dietary changes, which is slightly less than that observed in our study (~0.8 ± 1.0 kg).

Although the improvements observed in this study were mild, they occurred in overweight/obese, yet otherwise “apparently healthy” group of women. Since the baseline values for MetS components did not meet ATP III diagnostic criteria, the improvements observed in the active group cannot be generalized to those with established MetS. Physical activity related improvements that occur in many of these components may differ based upon the severity of the risk factors, clustering of the risk factors, and overall health status of the participant. However, given the evidence that increases in blood pressure and waist circumference account for much of the increase in the prevalence of the MetS, our findings demonstrate that even a conservative approach to adopting a physically active lifestyle is beneficial for primary prevention of MetS.

Unfortunately, no improvements were observed for triglycerides or HDL-C. Longer duration PA programs of moderate to vigorous intensity exercise may be necessary to evidence improvements in these MetS components. Further research indicates that significant improvements in triglycerides and HDL-C may require exercise programs eliciting an energy expenditure of 1200 to 2200 kcal/wk. Since walking 2000 steps requires ~100 kcal of energy, it is possible that the active group did not meet this energy expenditure until the latter portion of the program (Figure 3). Again, perhaps long-term maintenance of post program steps/day or increases in intensity may be necessary to elicit significant changes in triglycerides and HDL-C.

Current U.S. Physical Activity Guidelines report that sedentary individuals can improve their health by performing at least 150 minutes of moderate-intensity PA per week to include lifestyle activity. Participants in the pedometer program were encouraged to focus on lifestyle activity as a means to increase their steps/day. Since we observed both a significant increase in SUAQ scores (Table 1) and a significant positive correlation between SUAQ change-scores and increases steps/day (Figure 2), it is likely that the active group made a conscious effort to incorporate such activity into their daily routine. Furthermore, previous evidence shows that 30 minutes of walking is equivalent to ~3000 steps (the active criterion for this study), which when combined with the step counts observed at baseline (<5000 steps/day) is well below the popular goal of 10,000 steps/day. Interestingly, the active group did not accumulate 3000 step/day above baseline until the 7th week of the program (Figure 3) but still experienced improvements in MetS components. This has implications for health professionals who may find it difficult to initially increase PA in sedentary individuals.

As previously mentioned, the participants for this study were recruited from an annual worksite pedometer program designed to increase lifestyle PA levels in employees. The rationale for implementing a gradual progressive increase in steps/day was to slowly ease participants into higher levels of PA and improve self-efficacy in an effort to promote long-term adherence. Within the sample recruited for this study, 40% of the participants either dropped out of the study or did not successfully complete the pedometer program. This was similar to the 41% dropout rate observed in another worksite-based pedometer study that used the 10,000
steps/day target. Therefore, based on the comparison of these 2 studies, the incremental approach did not improve program adherence but rather just provided a more subtle approach to obtaining 10,000 steps/day.

We note several study limitations. First, it is possible that participants who adhered to the pedometer program may also have been motivated to perform other forms of PA (ie, cycling, swimming) that were not quantified by the pedometer or the SUAQ; thus, contributing to the physiological changes observed. Second, it is quite possible that some inaccuracies occurred in the weekly reported steps/day. Since program participants self-reported their weekly step-count, a possibility of “false-reporting” exists. However, it is unlikely that only the participants who over-reported their steps/day experienced the known PA related health outcomes we observed. In addition, although the pedometer model used in this study is suitable to quantify free-living activity, its’ reliability is questionable. However, since we observed significant correlations between SUAQ scores and steps/day at baseline an after the program it is probable that the pedometers accurately quantified changes in PA. Finally, there are potential limitations within the study design that pose a threat to the validity of our results. Given that the groups were established post hoc and not randomized increases the threat of nonequivalence at baseline. For example, perhaps differences in baseline fitness levels or motivation contributed to program adherence and ultimately the health benefits we observed. Furthermore, this study lacked a true control group. The control group used for this study consisted of program participants that either did not meet the “active” steps/day criteria or stopped participating in the pedometer program. Unfortunately, we did not inquire about what influenced their nonadherence. It is possible that the behaviors that influenced program adherence also influenced other study variables.

The current study builds upon a research theme that supports the utility of pedometers for improving PA related health outcomes. In summary, our findings show that an incremental approach to achieving 10,000 steps/day can yield mild improvements in several MetS components in sedentary, overweight women. Gradually increasing steps/day serves as a good starting point for primary prevention of MetS and maybe an option to ease sedentary individuals into a physically active lifestyle. However, it is important to emphasize that although the progressive increase in steps/day was sufficient to initiate health improvements, long term adherence and continued maintenance of 10,000 steps/day may be necessary for larger, more significant health benefits. Future research is necessary to determine (1) if long-term maintenance of the steps/day observed at the end of the 12 week program can result in continued improvements in MetS components or (2) if additional increases in steps/day are necessary for further improvements in MetS components.

References