

Article

The Feasibility, Safety, and Efficacy of Using a Wireless Pedometer to Improve the Activity Level in a Cohort of Nurses

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Purpose: This study had two aims: (1) to test the feasibility, safety, and efficacy of using a wireless pedometer in a cohort of nurses; and (2) to understand if wireless pedometer use increased number of steps walked, number of flights of stairs climbed, daily activity level, and improved personal perception of health. **Design:** This study used a nonexperimental exploratory design to test the feasibility and efficacy of using a wireless pedometer in a cohort of nurses. Pre- and posttest measures captured the number of steps walked, flights of stairs climbed, activity level, and perception of health. **Results:** Sample characteristics: 27 females, 3 males; 90% non-Hispanic Caucasian, 3% Hispanic; 47% between the ages of 55 and 65 years. Eighty percent of the participants reported that they were caregivers of other people. There was a significant increase from baseline to the end of the study in the following measures: self-perception of steps walked ($p < .001$), flights of stairs climbed ($p < .005$), self-perception of daily activity ($p < .001$), and although there was an improvement in self-perception of health, the change was not significant. **Conclusions:** The wireless pedometer was a feasible, safe, and efficacious device to use. This study may have implications for interventions aimed at improving caregiver health.

Keywords: *self-care; nurses; caregivers; wireless pedometer*

Purpose

Nurses have a key role in educating patients and the public in general about healthy lifestyles, including increasing daily physical activity to improve health outcomes, yet evidence indicates that over 50% of nurses report a sedentary lifestyle (Malik, Blake, & Batt, 2011; Tucker, Harris, Pipe, & Stevens, 2010). Findings from these studies indicate that despite having knowledge of the importance of exercise for reducing stress and improving health outcomes, nurses are no better than the general

population in terms of exercising or increasing their daily activity level.

This suggests that there is a gap in understanding strategies that may improve nurses' activity patterns

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and therefore overall health. Given the aging demographics of nurses coupled with their role in health promotion, it is a critical public health concern that the sedentary activity level of nurses is understood and addressed. This study had two aims: (1) to test the feasibility and safety of using a wireless pedometer in a cohort of nurses and (2) to determine if use of a wireless pedometer increased nurses' perception of the number of steps walked, number of flights of stairs climbed, activity level, and personal perception of overall health.

Background and Significance

Activity Recommendations and Sedentary Lifestyle

Over the past several decades, there has been an increase in sedentary lifestyle that has resulted in poor health outcomes (Kushi et al., 2012; Notthoff & Carstensen, 2014). Computers, television, and video games all are factors that contribute to an increase in sedentary time (Stamatakis, Hamer, & Dunstan, 2011). Prolonged sitting time is a major health risk contributing obesity and chronic illnesses, such as diabetes and cardiovascular disease, which in turn contribute to disability and limited life expectancy (Laditka & Laditka, 2015). Nearly 50% of adults over age 18 years report having a sedentary lifestyle (Ward, Schiller, Freeman, & Peregoy, 2013). It is clear that inactivity is associated with chronic illness. In response, many organizations have developed physical activity guidelines.

The Physical Activity Guidelines for Americans (Buchner et al., 2008) recommend that adults get at least 150 minutes of moderate-intensity aerobic physical activity or 75 minutes of vigorous-intensity physical activity and muscle strengthening of all major muscle groups 2 or more days per week, or an equivalent combination each week. It is suggested that following these guidelines may contribute to overall health and decrease the risk of chronic diseases such as heart disease, cancer, or diabetes (Buchner et al., 2008). The American Cancer Society (Kushi et al., 2012), the American College of Sports Medicine (Thompson, Arena, Riebe, & Pescatello, 2013), *Healthy People 2020* (U.S. Department of Health & Human Services, 2014), and Let's Move (2013) guidelines each mirror *Physical Activity Guidelines for Americans*. Each of these guidelines

acknowledges the importance of a supportive community environment in helping individuals meet their activity goals.

In addition, several guidelines also make a clear recommendation to reduce the amount of sedentary time per day (Kushi et al., 2012; Let's Move, 2013; U.S. Department of Health & Human Services, 2014). This is an important point because mounting evidence indicates that even people who do achieve regular exercise fitness goals are at risk for chronic conditions, such as obesity, heart disease, and diabetes, because even in this "healthy, active" population, upwards of 77% of the day is still spent being sedentary (Ford & Caspersen, 2012; Katzmarzyk, Church, Craig, & Bouchard, 2009; Thorp et al., 2012). This suggests that to reduce these chronic conditions more time per day must be spent doing activities that are not sedentary. Although much attention has been given to increasing physical exercise daily, only recently has attention been given to decreasing sedentary lifestyles. With the increased sedentary nature of many occupations, including nursing due to computers and documentation demands, the focus needs to be on changing work environments to alter this trend.

Nurses as Role Models for Improving Physical Activity

Many studies suggest nurses are no more active or less vulnerable to the ill effects of a sedentary lifestyle (Malik et al., 2011; McElligott, Siemers, Thomas, & Kohn, 2009; The Nurses' Health Study, n.d.; Tucker et al., 2010). Data from the long-standing Nurses' Health Study (1978-2013) suggest nurses are no less affected by the tendency to develop obesity, cardiovascular disease, diabetes, and other chronic illnesses than the general public (The Nurses' Health Study, n.d.).

The challenging work environment of nurses can increase the risk of stress, injury, and poor health (Collins-McNeil, Sharpe, & Benbow, 2012). Previously, nursing was considered a top 10 career in terms of activity level, but that is no longer the case (Bradford, 2012). Improving the environment of nurses to increase activity levels, decrease injury, improve job satisfaction, and reduce sick days may help improve nurses' health and in turn their ability to be role models to the public. Given nurses' role in health promotion, it is imperative that nurses are at

the forefront of a movement toward decreasing sedentary time and increasing overall activity level. Work to date addressing nurses' fitness has been promising in terms of meeting activity goals (Tucker et al., 2011; Yuan et al., 2009), but these exercise programs were in isolation of the work-day and not as an integrated approach within the work environment.

The American Nurses Association (ANA) has identified a healthy work environment as one that "is safe, empowering, and satisfying," and it is a place of "physical, mental, and social well-being" that supports safety and health (ANA, 2015). The ANA has demonstrated its commitment to safe and healthy work environments with a program called "HealthyNurse™." The ANA defines a healthy nurse as someone who focuses on creating and maintaining a balance of physical, intellectual, emotional, social, spiritual, personal, and professional well-being and serves as a role model for their families, their communities, and work environments. The ANA encourages nurses to focus on self-care so they can be at their healthiest—physically, mentally, emotionally, and spiritually—to provide the highest quality of care and serve as role models, advocates, and educators for their patients (ANA, 2015).

Furthermore, The American Holistic Nurses Association (AHNA) addresses self-care as a core value. Self-care is a lifelong process that encompasses the body, mind, and spirit. Care of the body involves exercise, massage, breathing, yoga, and conscious eating. Care of the mind and spirit include meditation and prayer, contemplation, focusing on the present, healing music, and laughter (AHNA, 2013). In the AHNA Standards of Holistic Nursing, self-care is integral to each standard, but Standard 16 specifically addresses environmental health, suggesting that the holistic nurse is a leader in addressing worker health and educating the public in ways to reduce the risks to worker health.

Addressing Workplace Health

Inexpensive, accessible tools and prompts delivered in the workplace may contribute to improved activity levels and decreased time spent sedentary for large numbers of working adults, yet to date, there is only limited evidence supporting such programs in the general adult working population.

Based primarily on successes in improving the physical activity levels of school-age children, studies

examining short bouts of exercise in workers have shown promise in increasing overall activity levels (Barr-Anderson, AuYoung, Whitt-Glover, Glenn, & Yancey, 2011). Others have found that sit-and-stand devices in the workplace (Pronk, Katz, Lowry, & Payfer, 2012) or prompts delivered to workers' computers every 30 minutes (Evans et al., 2012), respectively, had a modest impact on reduced sitting time and increased daily activity at work. Treadmill desks/workstations (Levine & Miller, 2007) are also evolving as ways to increase daily physical activity, but high cost (around \$4,000) make this unrealistic for most.

Walking is among the most cost-effective and accessible means of exercise. The benefits of walking are widely documented and include reducing the risk of cardiovascular disease, diabetes, metabolic syndrome, some cancers, and prevention of weight gain (Kushi et al., 2012; Thompson et al., 2013). Research suggests that regular exercise for 150 minutes per week or 30 minutes 5 days per week will reduce the risk of such illness, as well as improve fatigue and mood (Robare et al., 2011). Given the difficulty many people, including nurses, have adhering to an exercise program, it is suggested that small, "baby steps" may be a way to motivate people to begin and adhere to an exercise program with the eventual goal being to gradually decrease overall sedentary time.

Wireless tracking pedometers are able to track steps, distances walked, calories burned, stairs climbed, and the amount of the day spent active. Individual users link the wireless pedometer to a secure online account that delivers real-time feedback. The data of such devices are generally secured through a combination of firewall barriers, encryption techniques, and authentication procedures to protect; however, users have the option to create or join teams to participate in competitions, which may further spur motivation. To date, there are no published studies describing the benefit of wireless tracking pedometers on workplace health, specifically nurses' health. This study bridges this gap by testing the feasibility, safety, and efficacy of using a wireless pedometer in a cohort of nurses.

Conceptual Framework

Barrett's (2010) theory of knowing participation in change served as a guiding framework for this

study. According to this theory, change is not cause and effect, but multifactorial and complex. An underlying assumption of Barrett's theory posits that power is the potential of the person to participate knowingly in change. The dimensions of power are awareness, choice, freedom to act, and involvement in creating change. The assumptions of this study are that for a person to knowingly participate in change, he or she must have an awareness of the issue, the ability to understand and make choices, and the freedom to act/participate and be actively involved in creating change. This theory is operationalized by participants' awareness of physical fitness, choice to use a pedometer, the freedom to act intentionally, and involvement in creating change as measured by Likert-type scale self-report measures of number of steps walked, flights of stairs climbed, self-perception of activity, and self-perception health.

Protection of Human Subjects

Prior to the commencement of this study, institutional review board approval for this study was obtained at the institution where this study took place. All members of the study team had training in the Responsible Conduct of Research as required by the National Institutes of Health.

Method

Design

This study used a nonexperimental exploratory pre-post design and a convenience sample of nurses working at a large hospital in the northeastern United States to test the feasibility, safety, and efficacy of using a wireless pedometer aimed at improving the number of steps walked, flights of stairs climbed, activity level, and perception of health in a cohort of nurses over a 12-week period. The specific questions addressed in this cohort of nurses were as follows:

1. Is the wireless pedometer feasible and safe to use?
2. Does use of a wireless pedometer increase nurses' perception of the number of steps walked, number of flights of stairs climbed, activity level, and personal perception of overall health?

Participants

An all user e-mail was sent to all nurses working in the main hospital inviting them to participate in the study. A member of the study team reviewed e-mail responses, contacted potential participants, and reviewed inclusion and exclusion criteria. Inclusion criteria were as follows: employed and actively working as a nurse on a patient care unit in the hospital where this study took place, verbal agreement that potential participant has primary care provider, and if pregnant, obstetric gynecologist approval to participate in an exercise program. Exclusion criteria were as follows: not employed or currently active as a nurse at the main hospital where the study took place, unable or unwilling to provide verbal agreement that they had a primary care provider, and if pregnant, obstetric gynecologist has approved participation in an exercise program.

Data Collection Procedures

Once a participant was determined to be eligible, the principal investigator met with the potential participant to review the study procedures and obtain written consent. A member of the study team collected demographic and premeasures, set the pedometer up, and reviewed how to safely increase activity per the Physical Activity Guidelines (Thompson et al., 2013). Participants were provided with contact information in case they had questions. The same member of the study team collected postmeasures at 12 weeks.

The pedometer data were captured via the Internet and was visible to the research team. Improvements in activity could be followed via the online platform, but findings from the company's research suggest that while this device accurately captures steps, flights of stairs, and overall distance, the device is not approved for research. Therefore, self-completed measures captured changes in activity level. Likert-type scale measures of activity included self-perception of the number of steps walked, flights of stairs climbed, activity level, and perception of health, as shown in Table 1. As this was an exploratory descriptive study, the study was not powered. To assure confidentiality, all data were coded and deidentified, and all confidential information

Table 1. Measures of Activity.

Steps walked: Please think about the approximate number of miles per day that you walk each day and circle the number that best matches that.

1	2	3	4	5	6	7	8
¼ mile	½ mile	1 mile	2 miles	3 miles	4 miles	5 miles	More than 5 miles

Stairs climbed: Please think about the number of flights of stairs you climb per day that you walk each day and circle the number that best matches that.

1	2	3	4	5	6	7	8
1	2	3-4	5-7	8-10	11-12	13-14	>15

Self-perception of daily activity: Please look at the choices below and pick that number that matches your current level of activity

1	2	3	4	5	7	8	9
I sit most of day and do no regular exercise	I do some activity at least 30 minutes 5 or more days per week	I do exercise at least 30-45 minutes 3-5 days per week	I do exercise at least 30-45 minutes more than 5 days per week	I do exercise 45-60 minutes 3-5 or more days per week	I do exercise 45-60 minutes more than 5 days per week	I do exercise at least 60-90 minutes 5 days per week	I do exercise 90 minutes or more 5 or more days per week

Self-perception of health: Please rate your perception of your health on a scale of 1 to 10 with 1 being “very poor health” and 10 being “extremely healthy”; no health-related issues

1	2	3	4	5	6	7	8	9	10
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linking participants to data was kept in a locked cabinet in a locked office.

Data Analysis

All data were entered into SPSS version 23 for analysis. Descriptive statistics were used on the demographic variables. Paired *t* tests were used to analyze the pre–post measures.

Results

Thirty-five nurses expressed interest in participating, but 30 met inclusion criteria and signed the written consent. Descriptive characteristics of the sample are the following: 27 females, 3 males, 90% Caucasian, 7% African American, and 3% Hispanic. The average age was 58.7 years. In addition, 80% of the participants reported that they were caregivers of other people. The initial study design did not include a question about caregiv-

ing, but because many of the nurses self-reported that this walking program incidentally described caregiving activities at home and that this program allowed them time to care for themselves, the institutional review board was amended to include the question, “Are you are caregiver of another person?” This question was asked of participants during the 12-week program. All 30 participants who enrolled in this study completed all 12 weeks of the program. Two participants had to modify the number of steps climbed due to aggravating preexisting knee injuries, but no participants described concerns with increasing daily steps through walking. There was a significant increase from baseline to the end of the study in the following measures: self-perception of steps walked ($p < .001$), flights of stairs climbed ($p < .005$), and self-perception of daily activity ($p < .001$), and although there was an improvement in self-perception of health, the change was not significant (95% confidence interval). See Table 2.

Table 2. Paired *t* Tests.

Pre and post self reported measures	<i>M</i>	<i>SD</i>	<i>t</i> Test	Significance
Pre perceived steps—Post perceived steps	−2.700	1.664	0.304	.000
Pre perceived flights of stairs—Post perceived flights of stairs	−1.233	2.012	0.367	.002
Pre perceived self-perception daily activity—Post perceived self-perception daily activity	−2.000	1.576	0.288	.000
Pre perceived self-perception of health—Post perceived self-perception of health	−7.000	17.251	3.150	.034

Discussion

The findings from this study indicate that the wireless pedometer was feasible and safe to use. Results suggest that pedometer use was an easy-to-use device, and its use resulted in increased physical activity (steps/flights of stairs), perception of activity level, and health in this cohort of nurses. Pedometer use enhanced participants' awareness of current activity level, choice to participate in a walking program, freedom to act intentionally, and knowingly participate in change. This was manifested by participants increasing the number of steps walked, number of flights of stairs climbed, and by an improved personal perception of health.

Although two participants had to modify the number of stairs they climbed, they did not have to stop this activity altogether. There were no new reported injuries as a result of using this wireless pedometer. Although limited by the small sample size and lack of standardized, valid, and reliable measures, the findings from this study do suggest a wireless pedometer was an efficacious way to increase daily steps, stairs climbed, and activity level. Although there was an improvement in self-perception of health, the change was not significant, which may suggest that it may take more time than 12 weeks for people to feel and/or report a change in overall health.

Previous work on nurses' fitness has not addressed the issue of decreasing sedentary lifestyle as a part of workplace fitness. As such, this is the first study to address these two important concerns. The findings from this study indicate that use of a wireless pedometer showed promise in addressing sedentary lifestyle as demonstrated by an increase in steps taken, stairs climbed, perception of daily activity level, and overall health.

Although caregiver status was not initially included in the demographic questionnaire, a number of participants incidentally described being a caregiver and that participating in this study made them aware of the need to take time to care for themselves. This is an

important finding in relation to the AHNA (2013) core value regarding self-care. Nurses are representative of the public in terms of health and illness, and although there are not specific statistics, it could be presumed that this is so in terms of being caregivers. According to the report on caregiving by National Alliance on Caregiving (NAC) and the American Association of Retired Persons (AARP), 6 in 10 caregivers are female, and their average age is 49.2 years. Estimates are that 43.5 million adults have served as caregivers in the past 12 months (NAC & AARP, 2015). Organizations like the AHNA call for all caregivers to take time to foster self-care. Exercise is uniformly recognized as an important component of such care (AHNA, 2013; NAC & AARP, 2015).

Limitations

There are several limitations to this study. We used self-reported measures that did not have established reliability and validity. Although representative in age, sex, race, and ethnicity of the hospital where the study took place, the sample size was small, and therefore findings cannot be generalized. This study did not obtain information about baseline health of measures of health that may have changed as a result of participation. Obtaining pre–post health measures, such as heart rate, blood pressure, hip/waist ratio, body fat, body mass index, and VO_{2max} , and conducting this study on a larger sample would provide further support to these findings.

This study did not obtain information about participants' perception of what it was like to participate in this study, which would have provided more depth to the findings. Anecdotal observations by the research team indicate that nurses enjoyed being part of a community of nurses focused on fitness, shared information about pedometers with patients, and nonpedometer using peers alike. In addition, they wanted to share more information about the experience with the research team. Therefore, we believe a qualitative component added to the study

design would have provided a rich description about the overall experience.

Implications

This is the first reported study to address wireless pedometer use as a way to increase activity and decrease sedentary lifestyle within nurses' work environment. The findings from this study suggest that a wireless pedometer was feasible, safe, and efficacious in terms of improving the number of steps taken, stairs climbed, perception of activity level, and perception of health in a cohort of nurses. These findings provide support to address workplace fitness and decrease sedentary lifestyle. Although baseline health information and/or health-related outcomes such as a change in body mass index or blood pressure were not captured in this study, future studies should capture these data.

Future work should also capture how incorporating a wireless pedometer that improves activity level improves nurses' and other caregivers' ability to perform self-care. Last, future work should address how reducing a sedentary lifestyle affects nurses' confidence and ability to be role models and better promote healthy lifestyles to the public.

Conclusions

Findings suggest that a wireless pedometer use was a feasible, safe, and efficacious device to use to increase daily walking. Modifications may be needed in some people with self-reported prior knee injuries in terms of increasing number of stairs climbed. Despite this, all participants increased the number of steps walked and flights of stairs climbed, and they reported an improved daily activity level and personal perception of health. Given that 80% were caregivers of other people, this study may have implications for interventions aimed at improving caregiver health. This study also has implications for what it means for nurses to be role models for patients and the public it serves in terms of increasing physical activity and promoting self-care to improve personal health.

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