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The Impact of an Employer Sponsored Walking Program on Employees' Cardiovascular Risks

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THE IMPACT OF AN EMPLOYER SPONSORED WALKING PROGRAM ON EMPLOYEES' CARDIOVASCULAR RISKS

by

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ABSTRACT

THE IMPACT OF AN EMPLOYER SPONSORED WALKING PROGRAM ON EMPLOYEES' CARDIOVASCULAR HEALTH RISKS

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The problem of this study was to determine if participation in an employer sponsored walking program reduced employees' cardiovascular health risks. The independent variable was the "WalkAbout with Healthy Edge" program and the dependent variables included: body mass index (BMI), blood pressure, cholesterol, amount of exercise, and tobacco use. The study population was an employer group of 1300, and 284 employees registered for the program. Due to attrition, 79 submitted the first month of step logs and participation decreased over the months respectively to 58, 40, 38, 32, and 29. Twenty-three participants submitted six months of walking logs, and pre-test and post-test data. Significant improvement was found between clinical measurements for pre-BMI ($M = 30.80$, $SD = 6.14$) and post-BMI ($M = 29.996$, $SD = 5.95$), $t(22) = 2.65$, $p = .015$ (two-tailed) and pre-systolic blood pressure ($M = 128.17$, $SD = 18.1$) compared to post-systolic blood pressure ($M = 122.87$, $SD = 16.4$), $t(22) = 1.79$, $p < .05$ (one-tailed). This group had a significant improvement in their exercise habits; weekly exercise amounts respectively were 2.82 (1.99) and 4.23 (2.18), $t(21) = -3.14$, $p = .005$ (two-tailed). Mean daily steps for the first week were 7451.40 (SD = 3419.48) and 9069.73 (SD = 2678.10), $t(22) = 3.14$, $p = .005$ (two-tailed) for week 24. The mean daily steps taken remained below the 10,000 step goal throughout the six-month program. Exercise amount was significantly correlated with each month of steps taken, suggesting

that as daily steps increased overall exercise amount increased in a moderately obese, sedentary sample. This group had a very low incidence of tobacco use, which did not change over the course of the study. Clinical measurements on a control group from health screenings pre and post study were evaluated and there were no significant changes in BMI, blood pressure, cholesterol measurements, exercise amount or tobacco use over the six month study period. Based on the findings presented, "WalkAbout with Healthy Edge" program increases physical activity in a workplace setting and improves systolic blood pressure and BMI measurements.

Co-Directors of Advisory Committee: Dr. Walter F. Deal, III
Dr. Robert J. Spina

DEDICATION

This dissertation is dedicated to my loving husband, Scott

and to our sons, Matthew and Mark,

and in memory of my grandparents and great-grandparents, the Flynns, Breslins,

Moynihans and Hanrahans who bravely left Ireland to come to America.

Joan Breslin Sechrist

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CHAPTER I

INTRODUCTION

Unhealthy employees cost the organization in time, money, and morale (Partnership for Prevention, 2005). Sick employees tend to have high rates of absenteeism, and injuries on the job as the workload is forced onto other employees (Chapman, 2005; Pronk, 2004; Blair, 1986; Goetzel, 1998; Hirschman, 2006). Sedentary employees, especially obese sedentary employees, have higher health care costs than moderately active and highly active employees (Wang, McDonald, Champagne, & Edington, 2004). Employer sponsored wellness programs address these issues to improve the health of their employees and reduce expenditures for health-related issues.

The U.S. Department of Health and Human Services publication "Healthy People 2010" specifically addresses the need for "regular physical activity throughout life" for health and well-being. Additionally, "regular physical activity decreases the risk of death from heart disease," reduces "blood pressure in persons with elevated levels," and "aids in weight control" (U.S. Department of Health and Human Services, 2000, p. 27). Worksites are specifically mentioned in Healthy People 2010 (2000) as instrumental in promoting healthy eating and exercise for Americans; objectives relating to health education and a supportive work environment are described in *Healthy Workforce 2010* (Partnership for Prevention, 2001).

Chenoweth (2002) recommends studying health risk factors in the evaluation of worksite health promotion programs. Citing data from the Health Management Associates database, Chenoweth (2002) stated that people with multiple health risks had proportionally higher health care costs compared to those with fewer or no health risks.

Additionally, he cites some of the highest "median annual risk factor costs per employee per year" to include tobacco use, physical inactivity, obesity, hypertension, and elevated cholesterol based on data from Crawford and Company, Health Management Associates, Health Evaluation and Research Organization, Milliman and Robertson, Inc., National Council on Compensation Insurance, and the University of Michigan (Chenoweth, 2002). With research pointing to the importance of a healthy work environment, are work programs effective for employees?

STATEMENT OF THE PROBLEM

The problem of this study was to determine if participation in an employer sponsored walking program will reduce employees' cardiovascular health risks. The independent variable was participation in the "WalkAbout with Healthy Edge" program and the dependent variables included: body mass index (BMI), blood pressure, cholesterol, amount of exercise, and tobacco use. Although pedometer-based walking programs have been evaluated, they have been of shorter duration and limited to specific assessments of clinical values separate from overall exercise and smoking habits.

RESEARCH GOALS

This study was guided by the following hypotheses:

H_1: Employee participation in the "WalkAbout with Healthy Edge" program will improve employees' clinical measurements for body mass index (BMI), blood pressure, and cholesterol.

H_2: Employee participation in the "WalkAbout with Healthy Edge" program will improve employees' exercise habits leading to improved health.

H_3: Employee participation in the "WalkAbout with Healthy Edge" program will positively impact employees' tobacco use leading to improved health.

BACKGROUND AND SIGNIFICANCE

"Overweight and obesity are associated with increased morbidity and mortality," accounting for about 400,000 adult deaths annually, according to Thompson, the chief of Public Health Practice at the Centers for Disease Control and Prevention (Hearing Testimony, 2004, p. 1). For the year 2000, the total cost of obesity from direct medical costs and days lost from work due to illness, disability, or premature death, in the U.S., was approximately $117 billion, Thompson (2004) stated. There was a disturbing trend of overweight and obesity which impacted the worksite.

In May, 2006, the Centers for Disease Control reported that 35% of adults were overweight and 24% were obese in the *Summary Health Statistics for U.S. Adults: National Health Interview Survey, 2004 (2006).* Two of the main causes of being overweight were excessive calorie intake and physical inactivity (Surgeon General's Call to Action, 2001). It was imperative that Americans increase physical activity both at home and at the workplace to reduce obesity.

Also included in the *Summary Health Statistics for U.S. Adults: National Health Interview Survey, 2004* (2006) were the results of a randomized survey of over 30,000 adults in America, in which 62% responded they never participated in any type of vigorous leisure-time physical activity. Twelve percent reported being told by a healthcare provider that they had heart disease, and 22% had been diagnosed with hypertension. Twenty-one percent of all adults were current smokers, and 21% were former smokers (*Summary Health Statistics for U.S. Adults: National Health Interview*

Survey 2004, 2006). Smoking was a major risk factor for heart disease and was a leading cause of death in the United States according to Healthy People 2010 (U.S. Department of Health and Human Services, 2000). Cardiovascular health risks including obesity, heart disease, hypertension, smoking, and physical inactivity could lead to unhealthy employees at the worksite.

Because of concern about the increasing number of employees with cardiovascular health risk factors, Sentara Healthcare developed a walking program to promote exercise. The goal of the program was to encourage daily exercise by walking 10,000 steps a day. In July 2003, a pilot "WalkAbout with Healthy Edge" program was initiated for employees at one worksite. A total of 121 employees participated in the program; they each received a pedometer to count their total daily number of steps and a log book to track their steps. Participants received monthly post cards with information about the health benefits of exercise and ways to increase their exercise. Incentives were distributed at three months and for completing program requirements at six months. At the conclusion of the six-month program, 59 participants completed the post survey. The findings of the pilot study included: 36% reported decrease in blood pressure; 34% reported increase in number of times they exercise per week; 23% reported decrease in weight (total weight loss was 132 pounds collectively); and 21% reported a change in their health status from "fair" or "poor" to "good" or "excellent" according to T. M. Thomas (personal communication, June 6, 2006). The "WalkAbout with Healthy Edge" program was offered to all Sentara employees and to employer groups carrying Sentara health insurance in 2004. To-date over 15,000 employees have participated. The impact

of the "WalkAbout with Healthy Edge" program will be evaluated on the population of one employer group.

"Regular physical activity helps prevent obesity, heart disease, hypertension, diabetes, colon cancer, and premature mortality" (MMWR, 2003, p. 764). Worksite health promotion, including an employer sponsored walking program, provided employees with the opportunity to exercise and could positively impact their health. The significance of this study will be to determine if participation in the "WalkAbout with Healthy Edge" program impacts obesity, cholesterol level, blood pressure, tobacco use, and physical inactivity for employees at one employer group.

LIMITATIONS

The limitations of this study include that the research study population was limited to the employees of one employer group carrying Sentara health insurance at a facility in southeast Virginia. Participation in the program was voluntary and it was part of the overall employee improvement program offered at this facility. The study was limited in the types and amount of physical activities that participants were able to perform. Additionally, step equivalents for non-walking activities such as bicycling and swimming would increase the amount of physical activity measured. Only employees that registered for the six-month "WalkAbout with Healthy Edge" program and had completed a "WalkAbout with Healthy Edge" registration survey prior to and following participation in the program were considered for this study. Since it was a self-report instrument, responses on the survey may have been affected by participants' recall ability and "social desirability bias" (Croteau, 2004a, p. 280). Another limitation of the study was that non-participants in the "WalkAbout with Healthy Edge" program benefited

without actually formally registering for the program. Another limitation of this study was that the WalkAbout program is a six-month program; a longer duration may have been necessary to achieve significant clinical changes in BMI, blood pressure, and cholesterol measurements. Medications may have had an effect on clinical measurements.

ASSUMPTIONS

The main assumption of this study was that participants were interested in developing healthy exercise habits while completing the six-month "WalkAbout with Healthy Edge" program. Participants maintained daily record-keeping activities on a paper log book which was submitted monthly. Another assumption of this research was that participation in the "WalkAbout with Healthy Edge" program would improve employees' clinical measurements for body mass index (BMI), blood pressure, and cholesterol. Additionally, participation in the program would improve employees' exercise habits leading to improved health. Finally, it was assumed that participation in the "WalkAbout with Healthy Edge" program will positively impact employees' tobacco use leading to improved health.

PROCEDURES

With approval of the Old Dominion University Human Subjects Committee and Sentara Healthcare, data on employees who participated in the "WalkAbout with Healthy Edge" program as part of their employee health improvement program will be evaluated. A baseline health risk assessment, completed within one month prior to participation in the program, will be compared to the post data gathered within one month after employees completed the program. Data collected will include clinical measurements for

weight, blood pressure, cholesterol, tobacco use, and exercise amount. Confidentiality of responses will be assured for all subjects and data will be evaluated in aggregate.

Data on participants from the baseline and post program health risk assessments were compared. A quasi-experimental pre-test post-test design was used on participants in the "WalkAbout with Healthy Edge" program. A purposeful sample included only participants in the walking program that had both pre and post surveys completed, including: exercise amount, tobacco use, body weight, height, blood pressure, and cholesterol measurements. Data on daily steps taken were also evaluated when a step log was submitted.

DEFINITION OF TERMS

Operational definitions for this study include:

- Blood pressure (diastolic). Blood pressure when ventricles are relaxed; normal was below 80 millimeters of mercury (mmHg), prehypertension was 80-89 mmHg, hypertension was above 90 mmHg and above (NIH, 2002).
- Blood pressure (systolic). Blood pressure during contraction of ventricles; normal was below 120 mmHg, prehypertension was 120-139 mmHg, hypertension was 140 mmHg and above (NIH, 2002).
- Body Mass Index (BMI). Was a measure of weight in relation to height and was calculated as weight in kilograms divided by the square of height in meters (weight kg/height m^2) according to the Surgeon General's Call to Action (2001).
- Cholesterol. Total cholesterol: optimal less than 200 mg/dL, borderline high 200-239 mg/dL, and high 240 mg/dL and above (NIH, 2001).

- Coronary Heart Disease (CHD). Coronary heart disease can result in heart attacks, congestive heart failure, cardiac arrhythmia, or sudden death (Wasserman et al., 2000).
- Morbidity. Referred to the number of cases of a particular disease occurring in a population according to *Webster's Dictionary* (1990).
- Mortality. Referred to the number of deaths in a population according to *Webster's Dictionary* (1990).
- Obesity. Was defined as a BMI in the range of 30 or greater according to National Institutes of Health (2002).
- Overweight. Was defined as a BMI between 25 and 29.9 (National Institutes of Health, 2002).
- Pedometer. Was a device used to measure steps walked. It was worn on the waist band and it counts the number of hip swings as the pendulum moves with every step (Hatano, 1993). The pedometer was useful in measuring physical activity in the form of steps taken in an entire day (Sidman, 2002).
- Physical activity. Movement of the body that results in a higher amount of energy spent than during relaxation (deRuiter & Faulkner, 2006).
- Recommended physical activity. The CDC (Health and Human Services, 2005) definition was moderate-intensity activities, such as walking or bicycling or any activity that causes small increases in breathing or heart rate for 30 minutes per day, most days of the week.
- Sedentary. Referred to sitting or taking little exercise according to *Webster's Dictionary* (1990).

- Step log. Referred to the daily written record of steps taken.
- "WalkAbout with Healthy Edge" program. Referred to the employer sponsored "WalkAbout with Healthy Edge" program.

OVERVIEW OF CHAPTERS

Chapter I presented the problem of this study which was to determine if participation in an employer sponsored walking program will reduce employees' cardiovascular health risks. The study was guided by hypotheses that participation in the "WalkAbout with Healthy Edge" program will lead to improved health as determined by employees' clinical measurements, exercise habits, and tobacco use. The significance and background of studying health risk factors in the evaluation of the impact of a worksite health promotion program was presented. Chapter I established the foundation of this study to evaluate an employer sponsored health promotion walking program.

Chapter II included a review of the literature on health risks that lead to cardio-vascular disease and the impact of these health risks on employees at the worksite. Additionally, information on national health trends for employer sponsored health promotion programs was presented. Existing programs were evaluated specifically for their impact on employees' health risks and physical activity. Chapter II presented the value of employer sponsored health promotion programs and the impact on employees' health.

Chapter III presented the methodology and procedures used to determine if participation in a walking program improves measurements for BMI, blood pressure, and cholesterol. Additionally, the method to evaluate changes in employees' exercise and employees' tobacco use habits was presented. Chapter III communicated the

methodological and procedural strategies that will be used to determine if participation in an employer sponsored walking program leads to improved health for employees.

Chapter IV reports the data from this study, including a statistical analysis of employees' clinical measurements, exercise habits, and tobacco use. Chapter V summarizes all the information gathered on employee health risks and employer sponsored health promotion programs. Based on the findings of this study, the effectiveness of the "WalkAbout with Healthy Edge" program will be discussed according to each hypothesis on the clinical measurements, exercise habits, and tobacco use. Recommendations will be made for further research on the impact of employer sponsored health promotion programs in light of this study's findings.

CHAPTER II

REVIEW OF LITERATURE

Pedometers can be useful tools in measuring physical activity, and by wearing a pedometer, some may be motivated to increase their physical activity (Tudor-Locke, 2002). By increasing physical activity, participants can improve their health and lower their cardiovascular risks (Thompson, 2005). In this chapter a review of the literature will be presented on the impact of health promotion programs, particularly walking, on cardiovascular risks including clinical measurements for body mass index (BMI), blood pressure, and cholesterol, on the daily amount of overall exercise, and on employees' tobacco use.

Wasserman, Whitmer, Bazzarre, Kennedy, Merrick, Goetzel, et al. (2000) evaluated the Health Enhancement Research Organization (HERO) database of 39,999 employees from six large employer groups to determine the health risk of coronary heart disease (CHD) based on data collected from health risk assessments, biometric screenings of clinical measurements, and health plan insurance claims. CHD was found in 6.1% of the sample of 2452 subjects, and men accounted for 66.3% of CHD cases. Those with CHD were more likely to be obese, inactive, have high blood pressure and elevated cholesterol, and be former or current tobacco users.

CLINICAL MEASUREMENTS FOR BODY MASS INDEX (BMI), BLOOD PRESSURE, AND CHOLESTEROL

Obesity

Obesity was a significant problem in Virginia; 56% of the state's adult population was overweight according to the Centers for Disease Control *1991-2001 Prevalence of*

Obesity Among U.S. Adults by State report (2003), and more specifically, 25.1% were obese in 2006 (SMART BRFSS, 2006). One objective of Healthy People 2010 was to reduce the proportion of adults aged 20 years and older who are obese (U.S. Department of Health and Human Services, 2000). Wasserman et al. (2000) found that obesity was associated with a 39% increased risk for CHD, after controlling for high blood pressure, elevated blood glucose and cholesterol levels, and sedentary lifestyle. Controlling obesity will not only decrease health care expenditures but will improve the overall health of the workforce.

Aldana, Greenlaw, Diehl, Salberg, Merrill, and Ohmine (2005) conducted a randomized clinical trial on the impact of a worksite chronic disease prevention program on 145 employees. The *Coronary Health Improvement Project* curriculum was presented in four 2-hour sessions over four weeks, and participants were given a pedometer with instructions to walk or exercise at least 30 minutes daily. Total steps taken increased significantly in the walking group after six weeks and at six months, however, the mean of daily steps taken did not reach 10,000 in the intervention group. The walking group had a small but significant decrease in BMI, with the mean decreasing to 30.5, almost below the obese range that starts at a BMI of 30 (NIH, 2002). Total cholesterol dropped initially in the intervention group but returned to baseline after six months. It was important to note that total cholesterol measurements for both intervention and control groups at baseline and at six month were below 200 mg/dL, in the normal range according to NIH guidelines (2001). Additionally, mean diastolic blood pressure measurements were in the normal range for both intervention and control groups at baseline and at six months. Mean systolic blood pressure measurements for the

intervention group dropped to 120.6 mmHg and to 120.7 mmHg for the control group at six months, an insignificant change statistically, but both groups moved closer to the normal systolic blood pressure measurement (NIH, 2002). The authors noted that the control group was asked to wait six months to begin the program and may have made lifestyle changes in anticipation of starting the program. Participants had improved cardiovascular risk reductions as a result of this worksite disease prevention program.

Manson, Hu, Rich-Edwards, Colditz, Stampfer, Willett, et al. (1999) evaluated the incidence of coronary events among 72,488 female nurses in the Women's Health Initiative Observational Study, ages 40 to 65 years at baseline in 1986, including eight years of follow-up in a prospective study. Participants reported amount of time spent exercising, including walking, each week during the previous year. Some confounding variables studied included smoking status, BMI, history of high blood pressure and elevated cholesterol, and age. The authors found that women who were more physically active had lower BMIs, fewer smoked, and had lower risks for high blood pressure and elevated cholesterol than less active women. The authors concluded that women who walked briskly for three or more hours weekly, and sedentary women who became active, had a lower risk of coronary events than those who were sedentary (Manson et al., 1999). Although the post data were not provided, baseline data showed a fairly healthy population at the onset for all levels of physical activity; the most sedentary group mean BMI was 25.1, which borders on the normal weight range. Also notable was that 28% of the most sedentary group were smokers compared to 17.5% of the most active group. The authors stated that smoking status and BMI were some of the covariates that were

controlled in the multivariate analysis. Physical activity was a useful predictor for coronary events, and brisk walking reduced the risk of coronary events in women.

Again looking at the same population, Manson, Greenland, LaCroix, Stefanick, Mouton, Oberman, et al. (2002) prospectively examined 73,743 women from Women's Health Initiative Observational Study to determine if walking prevents cardiovascular disease compared to vigorous exercise. They concluded that both walking and vigorous exercise were associated with cardiovascular risk reduction, regardless of race or ethnic group, age, or BMI. They also noted that extended periods of sitting increased cardiovascular risk.

Robbins, Slenz, Houmard, Duscha, Johnsons, Aiken, et al. (2006) presented data on their randomized study on the impact of inactivity in the middle-aged, overweight population. After six months of inactivity, 33 participants had significant changes in waist size, visceral fat surrounding vital organs, and time to exhaustion on the treadmill. After six months of exercise, 13 of the 17 variables measured returned back to baseline or improved, including BMI, waist size, and serum lipids. The authors concluded that the harmful effects of inactivity can be reversed with exercise training, as indicated by improvements in BMI and serum lipids. The population from this study was taken from the control group of the STRRIDE randomized control study done by Slentz, Duscha, Johnson, Ketchum, Aiken, Samsa, et al. (2004) that evaluated the effects of amount of exercise on body weight, body composition, and obesity with an eight month exercise program. Slentz et al. (2004) found that in non-dieting overweight adults, controls gained weight, participants in the low amount exercise groups that either jogged or walked lost significant weight and fat compared to the control group, and participants in the high

amount, high intensity exercise group lost significantly more body mass and fat than any of the other three groups. Modest amounts of exercise, such as walking for 30 minutes daily can affect BMI.

Blood Pressure

Reductions in blood pressure significantly affected cardiovascular disease according to Braith and Stewart (2006); every 3 mmHg reduction of systolic blood pressure lowered cardiac morbidity between 5-9%, reduced stroke between 8-14%, and reduced mortality by 4%. Additionally, these authors cited research that modest weight loss of approximately 5% of initial weight could improve or prevent cardiovascular risks such as elevated cholesterol and high blood pressure. The authors concluded that current recommendations for moderate-intensity resistance training in combination with aerobic exercise contribute to cardiovascular disease reduction (Braith & Stewart, 2006). Additionally, an objective of Healthy People 2010 was to reduce the proportion of adults aged 20 years and older who have high blood pressure (U.S. Department of Health and Human Services, 2000).

Pinto, DiRaimondo, Tuttolomondo, Fernandez, Arna, and Licata (2006) evaluated 168 hypertensive, non-obese, sedentary subjects who participated in a supervised walking program three days a week for six weeks. Baseline measurements included blood pressure, BMI, and cholesterol in addition to other biochemical variables. The researchers found a significant decrease in both systolic and diastolic blood pressure, and all participants were already taking blood pressure medication. Mean blood pressure measurements at baseline were in the hypertension range, 143.1 mmHg systolic and 91.1 mmHg diastolic, and these were reduced to pre-hypertensive range of 135.5 mmHg

systolic and 84.8 mmHg diastolic (NIH, 2002). A supervised, six-week walking program lowered the cardiovascular risk of high blood pressure in hypertensive participants. Additionally, Moreau, Degarmo, Langely, McMahon, Howley, Bassett, et al. (2001) evaluated the effect of a 24 week walking program, using a pedometer on 24 postmenopausal women with high blood pressure. The control group of nine had no increase in activity and had no change in blood pressure measurements; however, the walking group had reductions of 6 mmHg in systolic blood pressure after 12 weeks and a total reduction of 11 mmHg after 24 weeks in the program. Walkers also had a small but significant reduction in BMI. Walking can be an effective method in lowering blood pressure in hypertensive patients.

Iwane, Arita, Tomimoto, Santani, Matsumoto, Miyashita, et al. (2000) evaluated the effects of walking 10,000 steps daily on 730 manufacturing employees. They concluded that walking 10,000 or more steps daily during the 12-week program was effective in lowering elevated blood pressure, sympathetic nerve activity, and maximal oxygen intake. There were no significant changes in blood cholesterol or BMI, however, both of these clinical measures were already within normal range at baseline. This 12-week program was successful in lowering blood pressure in hypertensive participants from the hypertensive range to the prehypertension range.

Cholesterol

Elevated blood cholesterol has been identified as a risk for cardiovascular disease. One objective of Healthy People 2010 was to reduce the proportion of adults aged 20 years and older who have elevated blood cholesterol (U.S. Department of Health and Human Services, 2000).

Duncan, Gordon, and Scott (1991) evaluated the quality and quantity of walking required to decrease the risk of cardiovascular disease in a randomized controlled study of 102 sedentary females ages 20-40 years. There were three intervention groups who walked 4.8 km with varying intensity, five days per week for 24 weeks, and one control group. Walkers in the strolling category significantly decreased body fat percentage, and all levels of intensity improved their fitness levels as measured by maximum oxygen consumption. Although there were no significant changes in blood pressure, baseline measurements were already within normal ranges. Total cholesterol was within normal range at baseline and there was no significant difference at the conclusion of the study. High-density lipoprotein (HDL) cholesterol increased among all intervention groups, and the authors stated that even small increases in HDL cholesterol lowers coronary disease risks. This study showed that walking at various intensities can improve cardiovascular risks.

Kraus, Houmard, Duscha, Knetzger, Wharton, McCartney, et al. (2002) evaluated the effects of the amount and intensity of exercise on plasma lipoproteins of 111 sedentary, overweight adults randomly assigned to either a control group for six months or an intervention group for eight months of exercise. The intervention groups included: high amount, high intensity exercise jogging 20 miles weekly; low amount, high intensity exercise jogging 12 miles weekly; and low amount, moderate intensity walking 12 miles per week. Serum lipid improvements were evident with all exercise groups compared to the control group, and the walking group was able to limit or avert weight gain and the associated worsening lipid measurements that occurred in the control group. The authors concluded that the amount of activity, regardless of intensity, had a greater impact on

serum lipids. Brisk walking for at least 12 miles weekly can have a positive impact on blood lipid measurements.

Tully, Cupples, Chan, McGlade, and Young (2005) evaluated the effect of a 12-week brisk walking program on sedentary adults aged 50 to 65 years, where 21 participants were randomized into the intervention group walking for 30 minutes five days a week, versus a control group of 10 participants. There were no differences in baseline clinical measurements of both groups which included: mean BMI in the overweight range, mean systolic blood pressure in the prehypertensive range, and mean total cholesterol in the borderline high range. At the completion of the program, there were significant reductions in systolic blood pressure, with means in the normal range for the treatment group. Significant reductions in 10-year risk of Coronary Heart Disease were present in both groups at the end of the study; however, there were no significant changes in BMI or lipid measurements. The Framingham 10 year risk Coronary Heart Disease score measures gender, age, smoking status, total and HDL cholesterol, and diabetic status to predict the likelihood of a coronary event over a 10-year period according to Tully et al. (2005). The Coronary Heart Disease score equation may not be sensitive enough, or it may have been that small changes in a healthy study population decreased the score, since both treatment and control groups showed improvement in their scores. The authors concluded that brisk walking for 30 minutes on five days of the week significantly improves cardiovascular risks.

Sugiura, Suiura, Kajima, Mirbod, Iwata, and Matsuoka (2002) evaluated the effects of a walking program on serum lipids in a randomized study of 27 menopausal women over a 24-month period. All subjects wore a pedometer and recorded their daily

steps and the exercise group of 14 participated in a 90 minute physical education class weekly. The mean steps taken daily were approximately 7000 at baseline for both groups, however, at 1, 6, 15 and 24 month follow-ups the exercise group significantly increased their daily steps over the control group. At the conclusion of the study, the exercise group had maintained their daily steps over 8000 while the control group was under 6800 steps. The mean total cholesterol for both groups was above normal at baseline. The exercise group had a significant decrease at 24 months over the control group and the mean of 193 mg/dL falling into the normal range (NIH, 2001). BMI did not significantly change over the course of the study; however the mean BMI for both groups was 22, in normal range. The authors concluded that daily exercise and increasing the number of daily steps improves serum lipids.

Faghri (2006) examined the impact of a 10-week pedometer-based program at work on 121 sedentary employees with a pre-test post-test experimental study. The variables measured included daily steps, BMI, blood pressure, and attitude towards health. The author concluded that the significant drops in blood pressure, improvements in attitude towards overall health, and increases in physical activity were due to the walking program. Since it was a 10-week program, a greater effect may have been seen with a longer time period. Walking can reduce the risks of coronary heart disease by lowering BMI, blood pressure, and cholesterol.

EMPLOYEE EXERCISE HABITS

According to the Centers for Disease Control and Prevention (2003), more than half of all Americans do not engage in the recommended 30 minutes of moderate-intensity physical activity on most days of the week, and 26% do not engage in leisure-

time physical activity at all as reported in the MMWR Weekly. This same publication reports that only 47.6% of Virginians meet the national recommendations for exercise and 23.4% have no leisure-time physical activity.

Wasserman (2000) found that sedentary lifestyle was associated with an increased risk for CHD, and sedentary males had a 13% increased risk of CHD. Hakim, Curb, Petrovitch, Rodriguez, Yano, Webster, et al. (1999) studied the effect of walking on the risk of coronary heart disease in 2678 physically capable elderly men after two years and four years of follow-up. The authors' findings included a 2.3 times increased risk of CHD in men who walked less than a quarter mile daily compared to men who walked more than 1 ½ miles daily, after adjusting for age, cholesterol, hypertension, and other variables. Exercise can lower the risk of coronary heart disease.

Pedometer Usage

The U.S. Surgeon General advised that "adults get at least 30 minutes of moderate physical activity on most days of the week" (U.S. Department of Health and Human Services, 2001, p. 34). Walking was one method of achieving this goal (LeMasurier, Sidman, & Corbin, 2003). Approximately 3,100 to 4,000 pedometer-measured steps represents 30 minutes of moderate intensity walking (Tudor-Locke, 2002; Welk, et al., 2000). Additionally, Hatano (1993) stated that the target of walking 10,000 steps a day was effective in preventing cardiovascular disease.

Tudor-Locke (2002) contended that 10,000 steps per day was a reasonable goal for healthy adults, however, she stated that this goal may be too high for sedentary adults who typically take between 3,500-5,500 steps daily. Research on a workplace walking program based on 10,000 steps daily resulted in a significant decrease in blood pressure

for participants, however, over the course of the 12-week program participation dropped from 730 at the onset to 83 completing the program (Iwane et al., 2000). The 10,000 step goal may have been too rigorous causing the high drop-out rate.

Wilde, Sidman, and Corbin (2001) studied 32 sedentary women who used a pedometer for two walking days and two non-walking days to determine steps taken. They evaluated whether baseline steps taken by sedentary women, when added to the steps taken in 30 minutes of brisk walking, would total to 10,000 steps taken daily. The authors concluded that walking for 30 minutes yielded approximately 3,100 steps and when added to steps taken during the daily routine, the target of 10,000 steps could be achieved. However, the authors also noted that only 38-50% met the target of 10,000 steps on the monitored walking days, and even fewer met that goal on days without a 30-minute walk.

Thomas and Williams (2006) reported the results of pedometer usage in the workplace to increase physical activity. Over 1,100 employees in the Department of Human Services in South Australia were loaned a pedometer for four weeks and instructed to achieve the goal of 10,000 steps daily to meet their national guideline of 30 minutes of moderate physical activity most days of the week. There was a 72% response rate of returned steps diaries, and the authors reported a 10% increase in daily steps from an average of 8,501 to 9,374 in the fourth week. By the conclusion of the program, there was a 25% increase in the number of average days of achieving 10,000 or more steps from 2.2 days to 2.8 days. The authors concluded that a pedometer-based physical activity program at the worksite can be beneficial in assisting employees to increase physical activity to meet national health standards.

Tudor-Locke (2001) studied nine obese and sedentary individuals to examine concurrent measurements of an activity log and a specific pedometer to determine physical activity in a walking-based program. Participants used a validated 3-day physical activity log, recording activity every 15 minutes. She concluded that pedometers are user-friendly and are "capable of detecting increases in physical activity resulting from walking-based interventions" (Tudor-Locke, 2001, p. 291).

In research of 428 participants in a population-based study, a pedometer was worn for four or more days to evaluate the daily steps taken. The authors concluded that men averaged more daily steps than women, and overweight participants regardless of gender were less likely to achieve 10,000 steps daily. Men who performed vigorous activity at work, or were blue-collar workers, and women who participated in at least 150 minutes of leisure-time physical activity per week met the target of 10,000 steps daily. The authors concluded that males achieved 10,000 steps daily due to workplace physical activity and blue-collar employment (McCormack, Giles-Corti, & Milligan, 2006). In a study of 16 physicians wearing pedometers for five consecutive days for nine hours while at work, Atkinson, Goody and Walker (2005) found average daily steps ranged from 4647-7907. They concluded that physical activity in addition to the workday was necessary for their population to meet exercise recommendations.

Walking Programs

A large managed healthcare organization in Minnesota offered the 10,000 Steps® walking program to increase physical activity among its members. Lindberg (2000) concluded that physically active members had almost 5% lower health care charges per active day per week when compared to inactive members over the course of the 18-month

program. Of the 92 participants in the pilot program, twenty-two step logs were evaluated at baseline, four weeks and eight weeks into the program. There were significant increases in steps taken from approximately 4,700 initially to 7,156 and 7,649 at weeks four and eight. The program was implemented at 11 additional companies, on a total of 2,577 participants; steps increased from 8,854 at baseline to 9,600 at eight weeks into the program. Daily steps taken by all participants increased over the course of the program, and later participants approached the target of 10,000 steps (Lindberg, 2000).

Croteau (2004b) investigated the effects of an 8-week pedometer-based intervention. Thirty-seven volunteers were evaluated in a one-group, pre-test post-test design, and the dependent variable was the number of steps taken daily. There was a significant increase in steps taken from baseline to eight weeks, with obese participants increasing their average daily steps by 34%. Participants in both the normal and overweight categories were able to exceed 10,000 steps daily, however participants in the obese category averaged approximately 9300 steps, by the conclusion of the program. Croteau (2004b) concluded that a pedometer-based intervention can be effective in increasing physical activity.

Olin (2002) conducted a pre-test post-test design of an eight-week walking program on 21 participants, with a control group of eight receiving no training on progressive walking. Her results included significant measures of resting blood pressure, with the average systolic blood pressure moving from the prehypertensive range to normal in the treatment group; there were significant decreases in the diastolic measurements for both groups. The values were in the normal range at pre-test. The treatment group had significant results for 50 meter walking velocity and distance

traveled in six minutes. Based on significant findings, Olin (2002) concluded that an eight-week moderate-intensity, progressive, pedometer-monitored walking program improved blood pressure and walking speed of women and men aged 50 years and up.

Jacob (2003) evaluated 23 sedentary women on a pre-test post-test design of a ten-week walking program. The treatment group wore a weighted belt to increase the intensity of the work-out and both groups walked for 20-60 minutes daily, five days a week. There were no significant group differences on the clinical measurements for total, LDL, and HDL cholesterol, glucose, triglycerides, blood pressure, and body composition from baseline to the conclusion of the study. There were significant decreases in percent of body fat; waist, thigh, and hip girth; and increased lean body weight in the treatment group. The control group had significant decreases in waist girth, waist/hip ratio, and thigh and flexed arm girth. Some possible explanations for the lack of significant changes in clinical measurements included: the length of the walking program was too short, actual time spent walking daily may have been inadequate, and selection bias towards a fairly healthy population. BMI ranges for both groups ranged from 26.5 to 27.0, slightly higher than the BMI for normal, which was less than 25 (NIH, 2002). Total cholesterol for both groups ranged from 200-219 mg/dL, slightly higher than the range for normal which was less than 200 mg/dL (NIH, 2002), and blood pressure was in the normal range for both groups at the onset of the study. The ten week walking program had a preliminary impact on fairly healthy subjects.

Chan, Ryan, and Tudor-Locke (2004) evaluated the health benefits of a walking program on 106 sedentary employees from five worksites with a pre-test post-test experimental design. Participants served as their own controls with baseline

measurements of BMI, waist girth, resting heart rate, and blood pressure taken before the 12 week program. These measurements were repeated after completing the program. Baseline data indicated an overweight population, with a mean BMI of 29.5, and while mean systolic blood pressure was in the prehypertensive range at 128.2 mmHg, the mean diastolic blood pressure was in the normal range. Participants averaged 7029 steps per day at baseline. The authors found significant changes in BMI and waist girth, however, no significant correlation was found between steps per day and baseline BMI, meaning that baseline BMI did not deter participants from increasing their exercise. Participants increased daily steps by an average of 3,451 steps which equated to 30 minutes of moderate intensity physical activity. The mean of 10,500 steps daily was achieved in weeks four through twelve. The authors concluded that a 12 week walking program can increase physical activity in sedentary employees which can positively affect BMI, waist girth, and resting heart rate.

The efficacy of a walking program on glycemic control, insulin sensitivity, and cardiovascular risks in 30 patients with diabetes was researched in a randomized, controlled study (Araiza, Hewes, Gashetewa, Vella, & Burge, 2006). The treatment group was instructed to walk at least 10,000 steps per day on five or more days, for six weeks, and the control group continued with their baseline activity. There were no significant differences in clinical measurements at baseline, and both groups had BMIs in the obese range, and blood pressure measurements in the prehypertensive range. There were significant changes in HDL cholesterol and physical activity in the active group at the conclusion of the study. The authors concluded that a recommendation to walk

10,000 steps daily increased physical activity, and that a longer intervention duration may have resulted in significant changes in biometric measurements and cardiovascular risks.

Measuring physical activity on a health risk assessment allows researchers to determine activity level among participants. Schechtman, Barzilai, Rost, and Fisher (1991) evaluated 1,004 subjects enrolled in a worksite health promotion program with one question to determine participation in regular exercise. Their question from the St. Louis Working Hearts program was validated by correlating exercise response with individual measurements for BMI, high-density lipoprotein (HDL) cholesterol, and oxygen capacity at baseline and at the conclusion of the two-year cardiovascular risk reduction. Their question, "Do you currently participate in any regular activity or program (either on your own or in a formal class) designed to improve or maintain your physical fitness?", was investigated (Schechtman et al., 1991, p. 771). Subjects were divided into four groups: those that answered "no" exercise both times, those answering "yes" both times, those answering "no" then "yes", and finally those answering "yes" initially and "no" on the final question. BMI and oxygen capacity for both genders, and HDL cholesterol in women, were correlated with exercise responses. They concluded that brief, self-administered questionnaires, with one or two questions about exercise can provide valid measurement (Schechtman et al., 1991).

Physical activity level can be determined by evaluating responses from a health survey in addition to daily record keeping from steps measured on a pedometer. Participants who exercise, including walking daily, can improve their clinical measurements for weight, blood pressure, and cholesterol. Increasing physical activity by participating in a walking program can decrease cardiovascular risks.

EMPLOYEE TOBACCO USE

One objective of Healthy People 2010 was to reduce the proportion of adults aged 20 years and older who use tobacco (U.S. Department of Health and Human Services, 2000). The National Center for Chronic Disease Prevention and Health Promotion (2006) data from 2004 indicated that 24.6% of Virginians smoke, which was higher than the national average of 23.1%. Additionally, smoking accounted for 9,177 deaths in Virginia during 2004. Nationally, tobacco smoke caused more than 400,000 deaths a year (Morbabia & Costanza, 2006).

Smoking cost the nation about $92 billion in the form of lost productivity in 1997-2001, according to the Centers for Disease Control and Prevention (2005). When combining smoking-related health-care costs with the lost productivity estimates, the total exceeded $167 billion per year in the United States (CDC, 2005).

Wasserman, Whitmer, Bazzarre, Kennedy, Merrick, Goetzel, et al. (2000) evaluated the Health Enhancement Research Organization (HERO) database of 39,999 employees from six large employer groups to determine the health risk of coronary heart disease (CHD) based on data collected from health risk assessments, biometric screenings, and health plan insurance claims. They found a 37% increase in the risk for CHD in all tobacco users, and total health care expenditures were significantly higher for current tobacco users.

Emmons, Linnan, Shadel, Marcus, and Abrams (1999), in a randomized, matched-pair design of 2055 participants at 26 manufacturing worksite, studied behavior change as the result of worksite health promotion. The Working Healthy Project intervention targeted smoking, nutrition, and physical activity. At baseline 28% of the

participants were smokers. By the conclusion of the program, the authors reported a significant increase in exercise behavior but no difference in smoking cessation. The authors called for further evaluations of multiple factor worksite health promotion, focusing on increased overall participation in employee health promotion programs and spreading the health improvement program impact throughout the worksite (Emmons et al.,1999).

Duncan, Gordon, and Scott (1991) evaluated the intensity and the amount of time spent walking required to decrease the risk of cardiovascular disease in a randomized controlled study of 102 sedentary females ages 20-40 years. There were three intervention groups who walked with varying intensity during the 24 week program and one control group. Smoking habits did not change significantly among the four groups after 24 weeks; however, all walkers improved their fitness levels as measured by maximum oxygen consumption.

Physical activity increases active life expectancy among smokers later in life, and physically active smokers live longer than sedentary smokers (deRuiter & Faulkner, 2006). They also reported that smokers tend to be less active than nonsmokers. There are many health risks associated with smoking, however, physical activity may delay both the morbidity and mortality associated with tobacco use. Additionally, Manson et al. (1999) found that female smokers had a 32% risk reduction of CHD with regular exercise, including walking. Although smoking cessation was a goal in employee health promotion, encouraging smokers to get regular physical activity can help to reduce their cardiovascular risks.

SUMMARY

Chapter II included a review of the literature on health risks that lead to cardiovascular disease and the impact of these health risks on employees on the worksite. Employer sponsored health promotion programs and study investigations of walking programs were evaluated specifically for their impact on participants' cardiovascular health risks such as weight, cholesterol, blood pressure, smoking habits, and physical activity. Chapter II presented the importance of exercise, specifically walking, and its impact on employees' health. Chapter III will present the methodology and procedures used to determine if participation in a walking program improves measurements for BMI, blood pressure, and cholesterol, and the method to evaluate changes in employees' exercise and employees' tobacco use habits.

CHAPTER III

METHODS AND PROCEDURES

This study examines the effect of an employer sponsored walking program on cardiovascular risks. The literature review included information on health risks that lead to cardiovascular disease, the impact of these health risks on employees at the worksite, and how walking programs and pedometers can be useful tools in measuring physical activity. This chapter describes the study population, experimental design, and the data collection procedures used to determine if participation in a walking program improves measurements for BMI, blood pressure, and cholesterol. Additionally, the method to evaluate changes in employees' exercise and employees' tobacco use will be presented. Chapter III describes the methodological and procedural strategies that will be used to determine if participation in an employer sponsored walking program leads to reduced cardiovascular risks for employees.

POPULATION

The study population consisted of the 1300 employees of an employer group carrying Sentara health insurance at one facility in southeastern Virginia that participated in the six-month "WalkAbout with Healthy Edge" program. Participation in the walking program was voluntary and the program was part of the overall employee health improvement program at the site. Employees that participated in the walking program and completed the "WalkAbout with Healthy Edge" registration survey prior to and following participation in the "WalkAbout with Healthy Edge" program were considered for this study. The business type was an insurance call center, with employees working at computer stations and on the phone. Smoking was not permitted in the building and was

only allowed in a hut on the grounds of the facility. There was a gym onsite with several exercise bicycles, treadmills, and showers that all employees were permitted to use. The demographics of insured members for this employer group included a median age in the 26 to 35 year old range, less than 10% are above the age of forty-six, and approximately 60% of the members are female. Of the 1300, initially 284 participated in the study.

RESEARCH VARIABLES

The purpose of this study was to determine if participation in the "WalkAbout with Healthy Edge" program reduced employees' cardiovascular health risks. The independent variable was participation in the employee health improvement program, "WalkAbout with Healthy Edge," a pedometer-based walking program. Dependent variables included: clinical measurements for body mass index (BMI), blood pressure, cholesterol, employees' exercise habits, and employees' tobacco use. Evaluating these research variables will determine if participation in a walking program improves employees' cardiovascular risks leading to improved health.

Participants were given a Yamax Digi-Walk SW 701 pedometer and instructions to count their daily steps, and a log book to track their steps. The pages of the log book were perforated, pre-stamped and addressed; participants were instructed to mail these in monthly. Program participants received monthly post cards with health benefits of exercise information and ways to increase exercise. Incentives, including a portable radio and tee-shirt, were sent at three months and at six months for completing program requirements.

INSTRUMENT DESIGN

The research design for this study was a quasi-experimental, pre-test, post-test design. Participation in the walking program was voluntary, and all registrants who completed baseline evaluations were accepted into the program. There was a purposeful sample of walking program participants. There was a control group that did not participate in the walking program. The control group was formed by evaluating existing data on clinical measurements, exercise amount, and tobacco use from health screenings conducted at the onset and at the conclusion of the study.

The sources of data for this study included "WalkAbout with Healthy Edge" registration and an end of program survey forms. These included clinical measurements and a step log of daily steps recorded by participants during the six-month program. A health screening, which was a standard service of the wellness program, was held onsite by qualified health professionals prior to the initiation of the walking program and again in six months, coinciding with the completion of the program. Health screenings were routinely provided every six months for this group, and employees signed Sentara's standard health screening consent prior to having their clinical measurements taken. All data were entered into the secure Walkabout Access 2000 database, and BMI was calculated based on weight and height measurements using the calculation of weight in kilograms divided by height in meters squared.

Data on employees' exercise habits were evaluated according to their response to the "Walk About with Healthy Edge" pre-test and post-test survey question: "I currently exercise _____ times per week." Additionally, daily steps obtained from the exercise logs, submitted by employees in hand-written logs, were evaluated to measure changes in

exercise amount, and correlated using Pearson's Correlation with clinical measurements. Data on employees' tobacco use, determined by "Walk About with Healthy Edge" pre-test and post-test survey question: "I currently use or do not use tobacco products" were evaluated. A sample registration form and exercise log are included in the Appendix A and B.

The instrument reliability was tested with Cronbach's alpha scale to determine if all dependent variables were consistently measured. In this study the scale had Cronbach's alpha ranging from .70 to .99. Participants in the "WalkAbout with Healthy Edge" program used a Yamax Digi-Walker pedometer, a brand with documented reliability and validity (Welk, et al., 2000). Additionally, Schneider, Crouter, Lukajic, and Bassett (2003) evaluated the accuracy and reliability of ten brands of pedometers and concluded that the Yamax Digi-Walk SW-701 was accurate in BMIs from 18.6 to 33.6, it had a 95% prediction interval within +/- 17 steps, and it had an intramodel reliability Cronback's alpha of .992. Instructions were provided to the participants for proper usage of the pedometer, including correct placement and periodic quality control checks.

Threats to internal validity due to instrumentation were controlled with the use of valid and reliable measurement tools. The extraneous variables selection and history were controlled with the use of a control group. Assessments were made between the sample and control group to check for pre-existing differences among the groups and controlled for outside occurrences that could possibly impact the study. External validity for the study design was assured by defining the population to whom the results of this study can be generalized, employer groups with a moderately obese, sedentary population with mild prehypertension.

PROCEDURES

In the fall of 2006, the six month "WalkAbout with Healthy Edge" program was initiated for employees at one employer group worksite. At baseline, employees completed a "WalkAbout with Healthy Edge" registration form that included questions on tobacco and exercise amount and had clinical measurements taken onsite for blood pressure and weight. Cholesterol measurements were taken at a health screening two weeks prior to program registration and later matched to program participants.

At registration, participants were given a "WalkAbout with Healthy Edge" packet that included a pedometer, explanation of the program and use of the pedometer, a log book, and exercise information. Packet instructions encouraged participants to work towards the goal of achieving 10,000 steps daily. Approximately sixty to one hundred participants were anticipated to register for the program and ultimately 284 registered onsite. Monthly post cards were sent to participants with motivational messages to continue walking and recording steps. Incentives were mailed to participants for completing three months of steps and for completing the program.

Six months after the initiation of the program another health screening was held for all employees onsite. "WalkAbout with Healthy Edge" participants completed a final survey that included questions on tobacco and exercise amount, and had clinical measurements taken for blood pressure, cholesterol, and weight.

All employees participating in the program were registered and their data were entered into the secure WalkAbout Access 2000 database. Queries were run to select data on employees who submitted "WalkAbout with Healthy Edge" registration data, including clinical measurements, within one month prior to and following program

participation. The database also includes daily steps taken from logs that were entered by hand from written logs submitted monthly. Data on clinical measurements for employees not participating in the study, but attending the health screening immediately prior to program initiation and coinciding with the end of the program, were evaluated as a control group.

METHOD OF DATA COLLECTION

Upon approval by the Old Dominion University Human Subjects Review Board, data were collected and evaluated. A purposeful sample was selected to include only participants in the walking program that had completed registration data, including clinical measurements. Clinical measurements included body mass index, blood pressure, and cholesterol, employees' exercise habits, and tobacco use. Cholesterol measurements were taken from existing data from a health screening held two weeks prior to the onset of the program. Data on daily steps taken for these participants were also evaluated.

STATISTICAL ANALYSIS

Frequency distributions and percentages were calculated to describe the sample. Means and standard deviations were calculated for each dependent variable, including BMI, blood pressure, cholesterol, tobacco use, and weekly exercise amount as measures of central tendency and variance. Within groups paired *t* tests were conducted on the means for all dependent variables to test for significant improvement over the six month program. These groups included the sample, a group adhering to the six month program, and a control group. Dependent variables of the clinical measurements were tested for Pearson's Correlations with steps taken for the group submitting six months of step logs. Additionally, paired *t* tests were performed on daily steps taken to assess changes in the

number of steps taken from baseline to the conclusion of the study. Cohen's Effect size was used to compute effect size of the program on participants and control groups to determine the difference in post-test scores. The SPSS version 15.0 was used to perform all statistical calculations.

SUMMARY

Chapter III presented the methodology and procedures used to determine if participation in a walking program improves measurements for BMI, blood pressure, and cholesterol. The method to evaluate changes in employees' exercise and employees' tobacco use habits was also presented. Chapter III communicates the methodological and procedural strategies that will be used to determine if participation in an employer sponsored walking program leads to improved health for employees. Chapter IV reports the data from this study, including a statistical analysis of employees' clinical measurements, exercise habits, and tobacco use.

CHAPTER IV

FINDINGS

The problem of this study was to determine if participation in an employer sponsored walking program reduced employees' cardiovascular health risks. Statistical analysis included testing the hypotheses that participation in the "WalkAbout with Healthy Edge" program will improve employees' clinical measurements for body mass index, blood pressure, and cholesterol, improve employees' exercise habits, and positively impact employees' tobacco use. Chapter IV reports the findings from this study, including population participation, and a statistical analysis of employees' clinical measurements, exercise habits, and tobacco use.

POPULATION PARTICIPATION

When the WalkAbout with Healthy Edge program was offered onsite, 284 employees registered for the program. All 284 employees registering for the walking program submitted baseline data, including blood pressure, height, weight, exercise amount, and tobacco use. A sub-group of these participants had existing data on file for cholesterol from a screening held two weeks earlier. Attrition occurred monthly. Of the 284 that registered for the program, only 79 submitted the first month of step logs. A gradual reduction in participation ensued over the six months respectively to 58, 40, 38, 32, and 29. Twenty-three participants adhered to the program by submitting 6 months of walking logs, and completing pre-test and post-test data collection. Dependent variables were evaluated on the initial group of 284 and for the subgroup of adherers.

Additionally, an assessment was made of steps recorded over the course of the six month program. A group of employees with data from the initial and post program health

screenings who did not participate in the walking program formed the control group. Matched data on their clinical measurements for BMI, blood pressure and cholesterol, exercise, and smoking status were evaluated. Findings on the initial group of 284, on the subgroup adhering to the program, and on a control group were statistically evaluated and are presented. The findings of each research goal will be reported separately.

CLINICAL MEASUREMENTS

The research goal on the impact of participation in the "WalkAbout with Healthy Edge" program on the improvement of employees' clinical measurements included an evaluation of body mass index, blood pressure, and cholesterol. Baseline clinical measurements taken for all 284 participants included blood pressure and BMI. The mean systolic blood pressure was 127.06 mmHg (SD = 17.10), and the mean diastolic blood pressure was 81.06 mmHg (SD = 10.77). BMI was calculated based on height and weight measurements, and the mean BMI was 31.281 (SD = 8.14). Blood cholesterol measurements taken at a health screening two weeks prior to the program registration were matched to program registrants. A subgroup of 23 program registrants had a cholesterol measurement from the health screening, and their mean total cholesterol was 193.22 mg/dL (SD = 42.75, n = 23). Table 1 includes descriptions of the baseline clinical measurements and exercise amount.

Post-test measurements for all registrants were evaluated, and due to attrition only 45 participants completed the pre-test and post-test surveys. Results were significant for a drop in systolic blood pressure, from 128.70 mmHg (SD = 16.70) before the study to a post mean systolic blood pressure of 122.22 mmHg (SD = 16.05), t (45) = 3.14, p = .003. There was an insignificant change in diastolic blood pressure from a mean of 80.39

mmHg (*SD* = 11.71) to 80.74 mmHg (*SD* = 12.16), *t* (45) = -.23, p = .818 at the conclusion of the study. The pre-test and post-test means and standard deviations for cholesterol were 191.60 (33.58) and 194.60 (39.46), *t* (4) = -.53, *p* = .624. There was not enough data from the paired t-test cholesterol evaluation to make this a meaningful result. However, post cholesterol means were 188.00 (*SD* = 32.56) on thirty-five members of the sample. Table 2 provides the means for clinical measurements for matched data sets in the sample.

Table 1

Means of Sample for Baseline Clinical Measurements and Exercise Amount

Measurement	Mean	Standard Deviation	N
Blood Pressure			
Systolic	127.06	17.10	284
Diastolic	81.06	10.77	284
BMI	31.28	8.14	284
Cholesterol	193.22	42.75	23
Exercise, weekly	2.04	1.80	284

Due to attrition in the sample, only twenty-three participants in the program submitted six months of walking logs. These participants adhered to the program by submitting their walking logs, and completing pre-test and post-test data collection. To distinguish this subgroup from the sample, this group was named the adherers' group.

Significant improvement was found in the adherers' group for clinical measurements for pre-BMI (*M* = 30.80, *SD* = 6.14) and post BMI (*M* = 29.996,

SD = 5.95), t (22) = 2.65, p = .015. Additionally, the mean weight loss was 4.6 pounds, means respectively were (*M* = 193.65, *SD* = 39.09) and (*M* = 189.07, *SD* = 39.34), t (22) = 2.52, p = .020. Systolic blood pressure was significantly improved (*M* = 128.17, *SD* = 18.1) when compared to post systolic blood pressure (*M* = 122.87, *SD* = 16.4), t(22) = 1.79, $p < .05$ (one-tailed) in the group reporting six months of steps. Since it was a directional test, a one-tailed level of the appropriated degree of freedom was accepted for this measure.

Table 2

Means of Matched Sample for Pre-test and Post-test Clinical Measurements

Measurement	Mean Pre-test	Mean Post-test	*df*	*t*
Blood Pressure				
Systolic	128.70 (16.70)	122.22 (16.05)	45	3.14*
Diastolic	80.39 (11.71)	80.74 (12.16)	45	-.23
BMI	30.82 (7.23)	30.17 (6.85)	43	3.01*
Cholesterol	191.60 (33.58)	194.60 (39.46)	4	-.53
Exercise, weekly	2.29 (1.87)	2.90 (2.21)	47	-2.18*

Note: SD are in ( )
*$p < .05$, two-tailed

Means and standard deviations for pre-test and post-test diastolic blood pressure measurements on the adherers' group were 80.26 (10.4) and 79.48 (12.6), t (22) = .41, p = .68; this was not a significant finding. The pre-test and post-test means and standard deviations for cholesterol were 183.5 (30.4) and 175 (21.2), t (1) = 1.3, p = .42. Post cholesterol means were 185.67 (*SD* = 28.53) on twelve members of this group. Table 3 provides the means for clinical measurements in the adherers' group.

Table 3

Means of Adherers' Group for Clinical Measurements

Measurement	Mean Pre-test	Mean Post-test	*df*	*t*
Blood Pressure				
Systolic	128.17 (18.10)	122.87 (16.40)	22	1.79†
Diastolic	80.26 (10.40)	79.48 (12.60)	22	.41
Body Weight				
BMI	30.80 (6.14)	29.996 (5.95)	22	2.65*
Weight, lbs.	193.65 (39.09)	189.07 (39.34)	22	2.52*
Cholesterol	183.50 (30.40)	175.00 (21.20)	1	.42
Cholesterol, post-test[a]		185.67 (28.53)		

Note: SD are in ( )
*$p < .05$, two-tailed. †$p < .05$, one-tailed
[a]N = 12

Additional existing data from the health screening included 14 employees who had clinical measurements taken prior to the initiation and at the conclusion of the program but did not participate in the "WalkAbout with Healthy Edge" program. They were considered the control group because they did not participate in the program.

Clinical measurements from the health screenings on the control group were evaluated using the two-tailed paired *t* test and there were no significant changes in any of these measurements over the six month study period. The pre-test mean systolic blood pressure 123.29 mmHg (*SD* = 11.65) and post mean systolic blood pressure 124.29 mmHg (*SD* = 11.20), *t* (13) = -.313, p = .76 had no significant changes. The pre-test mean diastolic blood pressure of 80.00 mmHg (*SD* = 8.80) was not significantly different than the post-test diastolic blood pressure of 79.29 mmHg (*SD* = 10.40), *t* (13) = .316, *p* = .76.

The control group had no significant changes in cholesterol; the means respectively were pre-test mean cholesterol 190.64 mg/dL (*SD* = 43.05) and post mean cholesterol 197.00 mg/dL (SD = 37.26), t (13) = -1.20, p = .251. Weight measurements showed no significant changes over the six month period; means for pre-test and post-test BMI respectively were 32.25 (*SD* = 6.94) and 32.42 (*SD* = 8.16), t (11) = -.23, p = .82. Table 4 depicts clinical measurements for the control group.

Table 4

Means of Control Group for Clinical Measurements

Measurement	Mean Pre-test	Mean Post-test	*df*	*t*
Blood Pressure				
Systolic	123.29 (11.65)	124.29 (11.20)	13	-.31
Diastolic	80.00 (8.80)	79.29 (10.40)	13	-1.20
BMI	32.25 (6.94)	32.42 (8.16)	11	-.23
Cholesterol	190.64 (43.05)	197.00 (37.26)	13	-1.20

Note: SD are in ( )
Non-significant results, $p > .05$

Cohen's Effect size computations were conducted on the adherers' group post-test means for blood pressure and BMI. Both systolic and diastolic blood pressure had a small effect size between the groups. However, the Cohen's Effect size was medium, .34 for post-test BMI measurements.

Data on the clinical measurements for blood pressure, BMI, and cholesterol were presented for three groups, which included the sample, adherers, and the control groups. The impact of the walking program on exercise habits was evaluated for these groups.

EXERCISE HABITS

The research goal on the impact of employee participation in the "WalkAbout with Healthy Edge" program on the improvement of employees' exercise habits was evaluated by weekly exercise amount and steps taken over the period of the study. The registration survey included data on employees' exercise habits which were evaluated according to their response to the "WalkAbout with Healthy Edge" survey question: "I currently exercise _____ times per week." Responses to the question on exercise amount were 83 (29.20%) for no exercise, 40 (14.10%) for once weekly, 48 (16.90%) for twice weekly, 55 (19.40%) for thrice weekly, 22 (7.70%) for four times per week, 29 (10.20%) for five times weekly, 4 (1.40%) for six times weekly, and 3 (1.10%) exercised for seven days a week. The mean exercise amount was 2.04 (SD = 1.80). In this group 60.2% exercised less than three times weekly. Table 5 includes a description of the days spent exercising in this population. Additionally, weekly exercise amount was evaluated on matched participants in the sample and the pre-test mean was 2.29 (1.87) and post-test mean was 2.90 (2.21). This was a significant increase in the amount of exercise in the sample, t (47) = -2.18, p = .034.

Table 5 also includes data on the control group for weekly exercise amount. Responses to the question: "Do you exercise at least three times weekly" on existing data were evaluated. The pre-test responses included 5 (35.70%) exercised for at least three times weekly, and 9 (64.30%) exercised less than that amount. Post-test responses included 4 (28.60%) exercised at least three times weekly and 10 (71.40%) exercised less than three times weekly. There was no significant change in weekly exercise amount in the control group, t (13) = -5.63, p = .583 over the six month period.

Table 5

Frequency of Weekly Exercise in Sample and Control Group

Measurement	*n*	Percent of Total in Group
Sample[a]		
Days Spent Exercising		
0	83	29.20
1	40	14.10
2	48	16.90
3	55	19.40
4	22	7.70
5	29	10.20
6	4	1.40
7	3	1.10
Control[b]		
Pre-test		
At least 3 times	5	35.70
Less than 3 times	9	64.30
Post-test		
At least 3 times	4	28.60
Less than 3 times	10	71.40

Note: [a]N = 284. [b]N = 14.

The adherers' group had a significant improvement in their exercise habits. The means and standard deviations for pre-test and post-test amounts respectively were 2.82 (1.99) and 4.23 (2.18), t (21) = -3.14, p = .005. In order, means of steps taken for months one through six were 218196.30, 230385.09, 231924.74, 243599.43, 242141.35, and 248748.43 (*SD*s = 76206.09, 79202.04, 75742.57, 72819.20, 80406.66, and 72877.34, respectively); the number of participants for each month was 23. There was a significant increase of 30552 steps from the first month compared to the sixth month, t (22) = 2.54, p = .019. Additionally, an evaluation of the first week of recorded steps with the steps of

week 24 yielded significant results. Mean daily steps for the first week were 7451.40 (SD = 3419.48) and the mean daily steps for the sixth month were 9069.73 (SD = 2678.10), t (22) = 3.14, p = .005. There was a 22% increase in daily steps taken from the first week compared to the end of the program. Table 6 summarized the adherers' group means for exercise measurements.

Table 6

Means of Adherers' Group Exercise Measurements

Measurement	Mean	SD	*df*	*t*
Exercise, weekly				
Pre-test	2.82	1.99		
Post-test	4.23	2.18	21	-3.14**
Steps, monthly				
Month 1	218,196.30	76,206.09		
Month 2	230,385.09	79,202.04		
Month 3	231,924.74	75,742.57		
Month 4	243,599.43	72,819.20		
Month 5	242,141.35	80,406.66		
Month 6	248,748.43	72,877.34	22	-2.54*
Steps, daily				
Week 1	7451.40	3419.48		
Week 24	9069.73	2678.10	22	3.14**

Note: Steps monthly compared month 1 with month 6
*p < .05, two-tailed. **p < .01, two-tailed

There was a significant correlation between monthly steps with post-test exercise amount. The correlations respectively for months one through six were, r (20) = .54, r (20) = .69, r (20) = .68, r (20) = .75, r (20) = .77, and r (20) = .73, p < .01. There was also a significant correlation between monthly steps and post-test cholesterol measurements for months two through five respectively, r (10) = -.64, r (10) = -.60, r (10) = -.66, and,

r (10) = -66, $p < .05$. There were no significant correlations between steps taken with BMI and systolic blood pressure post-test measurements. Table 7 presented the correlation of monthly steps with post measurements for exercise amount and clinical measurements in the adherers' group.

Table 7

Correlation of Adherers Monthly Steps with Post-test Exercise and Clinical Measurements

Measurement, Post-test	Exercise, Amount[a]	Cholesterol[b]	BMI[c]	Systolic Blood Pressure[c]
Steps				
Month 1	.54*	-.36	-.31	-.15
Month 2	.69**	-.64*	-.24	-.19
Month 3	.68**	-.60*	-.40	-.26
Month 4	.75**	-.66*	-.30	-.32
Month 5	.77**	-.66*	-.33	-.35
Month 6	.73**	-.56	-.16	-.21

Note: [a]$df = 20$. [b]$df = 10$. [c]$df = 21$.
*$p < .05$. **$p < .01$.

Data were presented on exercise amount for the sample and the subgroup of adherers who completed six months of walking logs. Results of statistical analysis of six months of step logs were also presented.

TOBACCO USE

The research goal on the impact of employee participation in the "WalkAbout with Healthy Edge" program on employees' tobacco was evaluated. Results on the survey question regarding tobacco use, completed at the time of registration and at the conclusion of the study, were presented. At baseline, there were thirty-one smokers and

two-hundred fifty-three non-smokers, representing 10.9% and 89.1% of the sample. At the end of the six month study, there were four smokers out of the group of forty-eight in the sample completing the post survey question. Smokers represented 8.3% of the sample at the conclusion of the study. Table 8 summarized tobacco use in the sample and control group.

Table 8

Tobacco Use in Sample and Control Group

Measurement	*n*	Percent of Overall Population
Sample		
Tobacco Use Pre-test		
Smoker	31	10.9
Non-Smoker	253	89.1
Tobacco Use Post-test		
Smoker	4	8.3
Non-Smoker	44	91.7
Control Group		
Tobacco Use Pre-test		
Smoker	2	14.3
Non-Smoker	12	85.7
Tobacco Use Post-test		
Smoker	3	21.4
Non-Smoker	11	78.6

In the adherers' group there were two smokers at the onset of the study, which remained unchanged at the conclusion of the study. Smokers represented 8.7% of the group adhering to the program. Additionally, the control group had an increase in the number of smokers. There were two smokers prior to the study and three smokers at the

conclusion of this study, representing 14.3% and 21% of the control group. This was an insignificant change t (13) = 1.00, p = .336 for the control group and for the sample t (47) = .573, p = .569.

SUMMARY

The problem of this study was to determine if participation in an employer sponsored walking program reduced employees' cardiovascular health risks. Results of the statistical analysis testing the hypotheses that participation in the "WalkAbout with Healthy Edge" program will improve employees' clinical measurements for body mass index, blood pressure, and cholesterol, improve employees' exercise habits, and positively impact employees' tobacco use were presented. Chapter IV reported the findings from this study, including population participation and a statistical analysis of employees' clinical measurements, exercise habits, and tobacco use. Chapter V summarizes all the information gathered on employee health risks and the employer sponsored health promotion program.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The information gathered on employee health risks and employer sponsored health promotion programs are presented. Based on the findings of this study, the effectiveness of the "WalkAbout with Healthy Edge" program will be discussed according to each hypothesis on the clinical measurements, exercise habits, and tobacco use. Recommendations will be made for further research on the impact of employer sponsored health promotion programs in light of this study's findings.

SUMMARY

The problem of this study was to determine if participation in an employer sponsored walking program will reduce employees' cardiovascular health risks. The independent variable was the "WalkAbout with Healthy Edge" program and the dependent variables included: body mass index, blood pressure, cholesterol, amount of exercise, and tobacco use. The research goals were, one, employee participation in the "WalkAbout with Healthy Edge" program will improve employees' clinical measurements for body mass index, blood pressure, and cholesterol. Two, employee participation in the "WalkAbout with Healthy Edge" program will improve employees' exercise habits leading to improved health. And three, employee participation in the "WalkAbout with Healthy Edge" program will positively impact employees' tobacco use leading to improved health.

"Regular physical activity helps prevent obesity, heart disease, hypertension, diabetes, colon cancer, and premature mortality" (MMWR, 2003, p. 764). Worksite health promotion, including an employer sponsored walking program, provided

employees with the opportunity to exercise and positively impact their health. Due to concern about the increasing number of employees with cardiovascular health risk factors, Sentara Healthcare developed a walking program to promote exercise. The goal of the program was to encourage daily exercise by walking 10,000 steps a day. The significance of this study was to determine if participation in the "WalkAbout with Healthy Edge" program impacts obesity, cholesterol level, blood pressure, smoking, and physical inactivity for employees at one employer group.

The limitations of this study included a research study population limited to the employees of one employer group carrying Sentara health insurance at a facility in southeast Virginia. Participation in the program was voluntary and it was part of the overall employee improvement program offered at this facility. The study was limited in the types and amount of physical activities that participants were able to perform. Additionally, step equivalents for non-walking activities such as bicycling and swimming would increase the amount of physical activity measured. Only employees that had registered for the six-month "WalkAbout with Healthy Edge" program and had completed a "WalkAbout with Healthy Edge" registration survey prior to and following participation in the program were considered for this study. Since it was a self-report instrument, responses on the survey may have been affected by participants' recall ability and "social desirability bias" (Croteau, 2004a, p. 280). Another limitation of the study was that non-participants in the "WalkAbout with Healthy Edge" program benefited without actually formally registering for the program. A further limitation of this study was that the WalkAbout program is a six-month program, a longer duration may have

been necessary to achieve significant clinical changes in BMI, blood pressure, and cholesterol measurements. Medications may have had an effect on clinical measurements.

When the "WalkAbout with Healthy Edge" program was offered onsite, 284 employees out of a total of 1300 employees, registered for the program. A purposeful sample was selected to include only participants in the walking program that had completed registration data, including clinical measurements. All 284 employees registering for the walking program submitted baseline data, including blood pressure, height, weight, exercise amount, and smoking status. A sub-group of these participants had existing data on file for cholesterol from a screening held two weeks earlier. Attrition occurred monthly; of the 284 that registered for the program, only 79 submitted the first month of step logs. A gradual reduction in participation ensued over the six months respectively to 58, 40, 38, 32, and 29. Twenty-three participants adhered to the program by submitting 6 months of walking logs, and completing pre-test and post-test data collection. A group of employees with data from the initial and post program health screenings who did not participate in the walking program formed the control group. Matched data on their clinical measurements for BMI, blood pressure and cholesterol, exercise, and smoking status were evaluated. Participation in the walking program was voluntary and the program was part of the overall employee health improvement program at the site. The business type was an insurance call center, with employees working at computer stations and on the phone. Smoking was not permitted in the building and was only allowed in a hut on the grounds of the facility. There was a gym onsite with several exercise bicycles, treadmills, and showers that all employees were permitted to use. The demographics of insured members for this employer group included a median age in the

26 to 35 year old range, less than 10% were above the age of forty-six, and approximately 60% of the members were female. Participation in the walking program was voluntary and the program was part of the overall employee health improvement program at the site. Findings on the initial group of 284, on the group fully adhering to the program, and on a control group, were statistically evaluated.

The sources of data for this study included "WalkAbout with Healthy Edge" registration and an end of program survey forms which included clinical measurements, and a step log of daily steps recorded by participants during the six-month program. A health screening, which was a standard service of the wellness program, was held onsite by qualified health professionals prior to the initiation of the walking program and again in six months, coinciding with the completion of the program. Health screenings were routinely provided every six months for this group, and employees signed Sentara's standard health screening consent prior to having their clinical measurements taken. All data were entered into the secure Walkabout Access 2000 database, and BMI was calculated based on weight and height measurements using the calculation of weight in kilograms divided by height in meters squared.

Data on employees' exercise habits were evaluated according to their response to the "Walk About with Healthy Edge" pre-test and post-test survey question: "I currently exercise _____ times per week." Additionally, daily steps obtained from the exercise logs, submitted by employees in hand-written logs, were evaluated to measure changes in exercise amount, and correlated using Pearson's Correlation with clinical measurements. Data on employees' tobacco use, determined by "Walk About with Healthy Edge" pre-

test and post-test survey question "I currently use or do not use tobacco products;" were evaluated.

Each dependent variable, including BMI, blood pressure, cholesterol, tobacco use, and exercise amount was analyzed using a paired *t* test for dependent means to test for significant improvement over the six month program. These groups evaluated included the sample, the group fully adhering to the six month program, and a control group. Dependent variables of the clinical measurements were tested for Pearson's Correlations with steps taken for the group submitting 6 months of step logs. Additionally, *t* tests were performed on daily steps taken to assess changes in steps taken from baseline to the conclusion of the study. Cohen's Effect size was computed for the difference in post-test clinical measurements for systolic and diastolic blood pressure and BMI. The SPSS version 15.0 was used to perform all statistical calculations.

CONCLUSIONS

The effectiveness of the "WalkAbout with Healthy Edge" program will be discussed according to each hypothesis on the clinical measurements, exercise habits, and tobacco use based the study findings.

H_1: Employee participation in the "WalkAbout with Healthy Edge" program will improve employees' clinical measurements for body mass index, blood pressure, and cholesterol.

When the "WalkAbout with Healthy Edge" program was offered onsite, 284 employees registered for the program, representing approximately 20% of the workforce. Clinical measurements on this group included mean systolic blood pressure of 127.06 mmHg and mean diastolic blood pressure of 81.06 mmHg, which are in the

prehypertensive range as defined by NIH (2002). The mean BMI was 31.281, which was in the obese range according to NIH (2002). Existing data from blood cholesterol measurements taken at a health screening prior to the program included a mean total cholesterol of 193.22 mg/dL, which is in the normal range (NIH, 2002). Of the 284 employees registered for the walking program, existing data from the health screening matched on 23 participants for cholesterol. Cholesterol measurements on the subgroup were within normal limits, however, clinical measurements for blood pressure and weight in the group of 284 registrants were in the risk category for cardiovascular disease.

Although this entire group of 284 registrants received a pedometer, educational materials, and a log book at registration, only 79 submitted the first month of steps recorded, and the numbers continued to drop throughout the six month program. During the second month, 58 submitted records, and for months three and four, the numbers dropped to 40 and 38 respectively. There were 32 step logs submitted for five months of steps and 29 for the entire six-month program. Efforts to increase participation included: monthly educational post cards with reminders to submit step logs mailed to all registrants, an incentive was sent at 3 months to participants submitting three months of step logs, onsite incentive distribution at month four, and an indoor mile walking track was marked in the building to encourage employees to walk inside.

Others have reported attrition with walking programs (Iwane, 2000; Chan, 2004; Schneider, 2006), including two 12-week programs and a 36-week program respectively. Participants that completed six months of step logs for the "WalkAbout with Healthy Edge" program, and both pre-test and post-test survey information, were studied. There

were 23 participants meeting these requirements and they were considered the adherers' group.

Clinical measurements on this group included a significant improvement in mean systolic blood pressure from 128.17 mmHg to 122.87 mmHg. Although it remained in the prehypertensive range, systolic blood pressure approached the normal range of less than 120 mmHg. Diastolic blood pressure had an insignificant drop from 80.26 mmHg before the study, to 79.48 mmHg at the conclusion of the study. Murphy, Murtagh, Boreham, Hare and Nevill (2006) concluded in their experimental study of 37 subjects that 45 minutes of brisk walking twice a week resulted in a significant drop in systolic blood pressure and no significant changes in BMI, diastolic blood pressure, or lipoproteins. Additionally, they reported subjects took an average of 9303 steps on walking days compared to only 5803 steps on the other days of the week. Participants in the adherers' group had a significant decrease in systolic blood pressure and an insignificant change in diastolic blood pressure, with a mean daily steps of 9069.73 by the conclusion of the study. The mean of steps at week one was 7451.40, which may account for the small but significant change in systolic blood pressure.

There was a significant improvement in BMI measurements, dropping from 30.80 to 29.996 at the end of the study. This represents a change in the weight category from obese to overweight (NIH, 2002). This reduced the risk of cardiovascular disease due to obesity. The six month program time span included the six weeks between Thanksgiving and New Year's holidays which may explain the modest weight loss. Yanovski, Yanovski, Sovik, Nguyen, O'Neil and Sebring (2000) studied the net weight gain of 194 individuals after the six week holiday season and reported up to a five pound weight gain

in overweight and obese individuals. The adherers to the "WalkAbout with Healthy Edge" program had a four pound weight loss over the course of the program and it might have been greater had the study time frame excluded the holiday season. Additionally, Cohen's Effect size was medium for the post-test BMI measurements between the control and adherers' group. There was a difference in the post BMI measurements between these groups at the conclusion of the study.

The subgroup with matched cholesterol measurements for the *t* test was not a significant result. The mean cholesterol post measurement on 12 members of the adherers' group was 185.67 mg/dL, which is within the normal range defined by NIH (2002). Since the pre-program cholesterol measurements were not available, it is not possible to determine the impact of the walking program on cholesterol levels. It is important to note that the mean cholesterol measurement was 193.22 mg/dL at the onset of the study for 23 registrants, and the control group had mean cholesterol measurements in the normal range in pre-test and post-test evaluations, possibly indicating that elevated cholesterol was not a risk factor in this population. The control group had no significant changes in blood pressure, BMI, or cholesterol measurements over the six month time period.

Reductions in blood pressure significantly impacted cardiovascular disease according to Braith and Stewart (2006); every 3 mmHg reduction of systolic blood pressure lowered cardiac morbidity between 5-9%, reduced stroke between 8-14%, and reduced mortality by 4%. Additionally, these authors cite research that modest weight loss of approximately 5% of initial weight could improve or prevent cardiovascular risks

such as elevated cholesterol and high blood pressure. Participants in the current study had a 5 mmHg reduction in systolic blood pressure and a 2.6% reduction in body weight.

The hypothesis that employee participation in the "WalkAbout with Healthy Edge" program will improve employees' clinical measurements for body mass index and systolic blood pressure is accepted based on this study. There was a significant improvement in BMI measurements, dropping from 30.80 to 29.996 at the end of the study. There was significant improvement in systolic blood pressure; the current study had a 5 mmHg reduction in systolic blood pressure. Diastolic blood pressure had an insignificant drop from 80.26 mmHg before the study, to 79.48 mmHg at the conclusion of the study. Although this was an insignificant decrease in diastolic blood pressure, the final measurement was in the normal range for diastolic blood pressure and would be considered a low risk for cardiovascular disease.

The hypothesis that employee participation in the "WalkAbout with Healthy Edge" program will improve employees' clinical measurements for cholesterol is not accepted based on this study. Baseline mean total cholesterol levels for both the sample and control group were within in the normal range (NIH, 2002). This indicated that elevated cholesterol was not a risk factor in this population. "WalkAbout with Healthy Edge" program improved employees' clinical measurements for body mass index and systolic blood pressure is accepted based on this study.

Both blood pressure and BMI measurements improved due to participation in the walking program. Small but significant changes were seen in clinical measurements for systolic blood pressure and weight. The study time frame included the holiday season from Thanksgiving to New Year's which may have impacted participants' clinical

measurements, often weight gain occurs during this time. Elevated cholesterol may not have been a risk factor in the sample since the pre-test mean was within normal limits, and participation in the walking program did not further impact cholesterol levels. Non-participants in the walking program, who formed the control group, had no significant changes in their clinical measurements over the course of the six month study.

H_2: Employee participation in the "WalkAbout with Healthy Edge" program will improve employees' exercise habits leading to improved health.

Based on their initial registration survey responses, 168 or 60.2% reported exercising less than three times weekly, and only 20% of this group exercised four or more times weekly. The CDC (Health and Human Services, 2005) recommendation for physical activity included any moderate-intensity activities, such as walking or bicycling or any activity that causes small increases in breathing or heart rate for 30 minutes per day, most days of the week. Additionally, 29.2% reported to getting no exercise during the week. Additionally, weekly exercise amount was evaluated on matched participants of the sample. The pre-test mean was 2.29 (1.87) and post-test mean was 2.90 (2.21). This was a significant increase in the amount of exercise in the sample, t (47) = -2.18, p = .034, and approached the recommendation of exercising most days of the week.

Prior to participation in the walking program, 43.5% of the adherers' group reported exercising less than three times weekly, and this measurement improved significantly to 19% by the end of the study. The attrition rate from the study may have been a factor for this group. Step logs submitted dropped monthly from a high of 79 the first month, to 58, 40, 38, 32, and 29 respectively. This subgroup out of the total sample that registered for the walking program may have been biased towards getting more

exercise and that motivation may have been a factor in their completing the six months of step logs. The mean amount of weekly exercise significantly increased in this group from 2.82 times per week at the onset of the study to 4.23 times weekly at its conclusion. The adherers' group recording six months of steps had a significant improvement in their exercise habits. In the control group of non-participants, 63.3% reported exercising less than three times weekly prior to the onset of the study and there was no significant change at the conclusion of the study.

Mean steps taken for the adherers' group increased significantly from a mean of 218,196.30 in the first month to a mean of 248,748.43 in the sixth month. Additionally, there was a significant increase from the first week of 7451.40 mean daily steps to 9069.73 mean daily steps in week 24, a 22% increase. Participants in the "WalkAbout with Healthy Edge" program fell short of the 10,000 daily step goal.

Clarke, Freeland-Graves, Klohe-Lehman, Milani, Nuss, and Laffrey (2007) conducted an experimental evaluation of an 8-week physical activity and dietary program on 93 low-income women. The treatment group significantly decreased their body weight by 6.6 lb. and increased daily steps from 5969 at baseline to 9757 steps at eight weeks. The weight loss may be due to a combination of calorie restriction and walking, however, physical activity increased daily with walking. Schneider, Bassett, Thompson, Pronk, and Bielak (2006) evaluated the effects of the 10,000 steps per day goal on 38 overweight and obese adults during a thirty-six week walking intervention. Nineteen participants adhered to the walking prescription by taking 9500 or more steps from week four through thirty-six. Adherers had significant improvement in BMI and body composition; there were no significant differences in caloric intake from baseline. Those

averaging 7600-7900 steps daily had no significant changes, even though they increased their daily steps by 2500 over baseline. The authors concluded that the 10,000 step goal might not be feasible for all adults, but those adhering to that prescription are likely to see significant changes in body weight.

The mean daily steps taken by the adherers in the "WalkAbout with Healthy Edge" program remained below the 10,000 step goal throughout the six-month program which may account for the modest reductions in both systolic blood pressure and BMI measurements. Exercise amount was significantly correlated with each month of steps taken, suggesting that as daily steps increased overall exercise amount increased in a moderately obese, sedentary sample. Based on this evidence, the hypothesis that participation in the "WalkAbout with Healthy Edge" program will improve employees' exercise habits is accepted.

Participating in an employer sponsored walking program resulted in an increase in exercise amount for both the sample and the subgroup of adherers, with adherers exercising 4 times a week to meet the CDC recommendations. The control group had no significant change in their exercise amount over the course of the study. The group adhering to the program had a 22% increase in their daily steps from the onset of the program to its conclusion. This resulted in a modest, but significant, weight loss and decrease of systolic blood pressure. This subgroup out of the sample may have been more motivated to exercise since they completed the program. However, their pre-test measurements for BMI and blood pressure were in the obese and prehypertensive ranges and they had significant decreases in these measurements, indicating that participation in the walking program improved these clinical measurements.

H_3: Employee participation in the "WalkAbout with Healthy Edge" program will positively impact employees' tobacco use leading to improved health.

Pre-test measurements for tobacco use in the sample at 10.9% was below both the national average of 23.1% and the Virginia state average of 24.6% smokers (National Center for Chronic Disease Prevention and Health Promotion, 2006). By the end of the six month study, there were four smokers out of the group of forty-eight in the sample completing the post survey question. Smokers represented 8.3% of the sample at the conclusion of the study. The adherers' group had a very low incidence of tobacco use, which did not change over the course of the study. There were two smokers, representing 8.7% of the group, at the onset of the study, which remained unchanged at the conclusion of the study. This group may have been avoiding tobacco due to previous knowledge on the health risks of smoking. Additionally, the control group had an increase in the number of smokers. There were two smokers prior to the study and three smokers at the conclusion of this study, representing 14.3% and 21% of the control group. There was no significant change in the number of smokers in the sample, adherers' group or the control group.

Additionally, since the survey was a self-report instrument about tobacco use, responses on the survey may have been affected by participants' "social desirability bias" (Croteau, 2004a, p. 280) and kept reported numbers low. Smoking in the workplace can be a sensitive issue and some participants may have been reluctant to admit to tobacco use. The numbers of smokers may have been lower than the state and national averages due to a wellness program already in place at the worksite and a physical limitation on where smoking is allowed on the grounds. Since there was no significant change in the

number of smokers and because the numbers of smokers was below both the state and national averages, the hypothesis that participation in the "WalkAbout with Healthy Edge" program will positively impact employees' tobacco use is rejected.

Smoking is a risk factor for cardiovascular disease. In this study the overall number of smokers decreased in the sample, however this was not a significant decrease. There were controls already in place at the employer site to limit smoking such as no smoking in the building and allowing smoking at one location outside on the grounds.

RECOMMENDATIONS

Based on the findings in this study, the employer sponsored "Walk About with Healthy Edge" program positively affected employees cardiovascular risks and increased exercise in a moderately obese, sedentary population. Both weight and systolic blood pressure pre-test measurements were in the obese and prehypertensive ranges respectively and there was a statistically significant reduction at the end of the study. The BMI range went from the obese range at the onset of the study to the overweight category at post-test, an important reduction in cardiovascular risk. Diastolic blood pressure and cholesterol were not significantly changed. However, both pre-test and post-test measurements were in the normal range for cholesterol and were borderline normal for diastolic blood pressure. Employees fully participating in the walking program increased both their weekly amount of exercise and their average daily steps taken. Due to the small number of smokers in the sample and control groups, and the small group size, tobacco use was essentially unchanged. "WalkAbout with Healthy Edge," an employee sponsored walking program, positively impacted employees' BMI and systolic blood pressure measurements and increased exercise in an obese, sedentary sample.

Some of the limitations of this study were an absence of daily caloric intake and expenditure assessments and an evaluation of body composition. These measurements would have provided additional information on the impact of physical activity. In addition to pre-test and post-test clinical measurements for blood pressure and BMI, intermittent measurements would have provided more data on the effect of the walking program throughout the six months. Additionally, an evaluation of the educational component of the program would have provided data on the impact of health education related to food choices and physical activity.

Recommendations included conducting the study with a health risk assessment survey taken at the time of program initiation, and immediately following program completion, to provide more in-depth information on the health status of participants. Other recommendations were to repeat the investigation including age, gender, and medical diagnoses as dependent variables, and to correlate changes in clinical measurements with medical claims data to determine the impact of the walking program on overall healthcare utilization.

It is also recommended to examine barriers to participation and other factors that impact walking and recording steps. Non-respondents may have used the pedometer and kept step logs but did not submit their steps. Differences between genders, age groups, and types of workers, such as management or hourly employees, should be evaluated. Lastly, the study should be expanded to include different populations of workers, such as, municipality and hospital, to examine differences and to assess if this study is predictive, in a variety of different employees.

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APPENDIX A

SAMPLE REGISTRATION FORM

REGISTRATION FORM

Name: _____

Address: _____

_____

Phone: _____ Email Address: _____

Work Location: _____

Date of Birth: _____ Best way to contact: ○ email ○ mail ○ phone

T-Shirt Size (check one) ○small ○ medium ○ large ○ xlarge ○ xxlarge

Are you an Optima or Sentara health plan member? ○ yes Member ID# _____
○ no

My blood pressure is: _____ My weight is: _____ My height is: _____

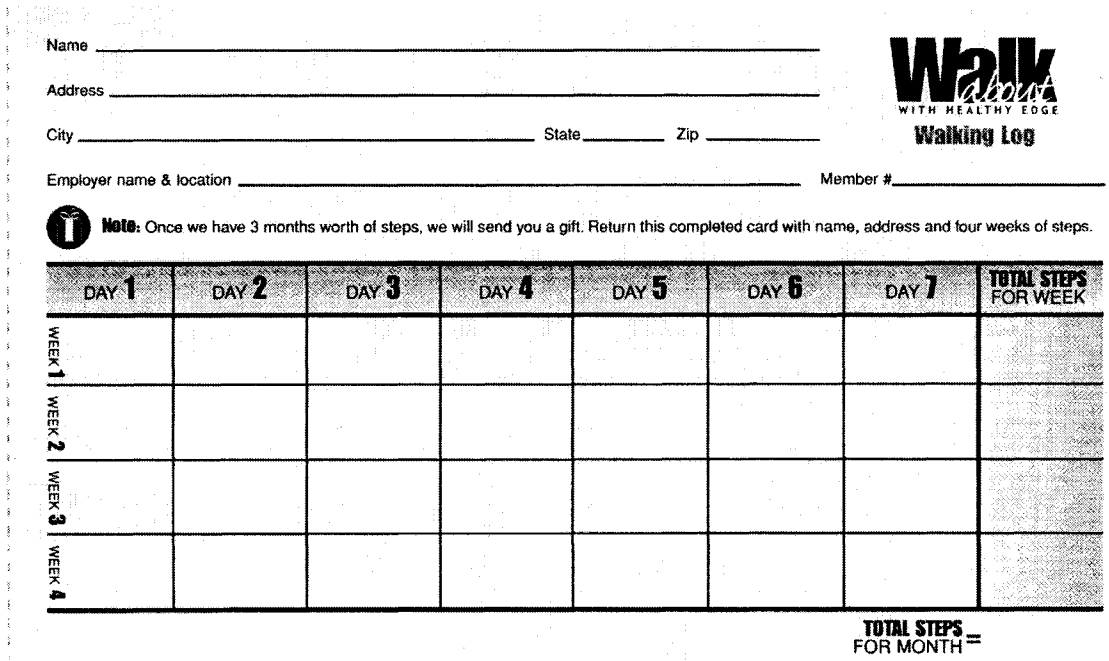
I currently exercise _____ times per week.

I currently ○ do ○ do not use tobacco products.

I feel my current health status is: ○ excellent ○ good ○ fair ○ poor

APPENDIX B

SAMPLE WALKING LOG



Name _____

Address _____

City _____ State _____ Zip _____

Walk about WITH HEALTHY EDGE

Walking Log

Employer name & location _____ Member # _____

Note: Once we have 3 months worth of steps, we will send you a gift. Return this completed card with name, address and four weeks of steps.

	DAY 1	DAY 2	DAY 3	DAY 4	DAY 5	DAY 6	DAY 7	TOTAL STEPS FOR WEEK
WEEK 1								
WEEK 2								
WEEK 3								
WEEK 4								

TOTAL STEPS FOR MONTH =

VITA

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Professional Experience:

Sentara Healthcare, Virginia Beach, Virginia
- Health Educator, 1995 – present
  - *Tidewater Teacher Magazine*, Teacher's Health feature contributor, bimonthly publication, November 2006 - present
  - *Presenter*, Hampton Roads Childhood Obesity Summit, Norfolk, VA, July 2006
  - *Presenter*, National Steps to a Healthier US Summit, Baltimore, MD, April 2004

Virginia Beach City and Public Schools, Virginia Beach, Virginia
- Nutrition and Training Coordinator, 1988 - 1994