EVIDENCE-BASED PLAN FOR PROMOTING PHYSICAL ACTIVITY AMONG DEAF ADULTS IN PRIMARY CARE

by

Derrick K. Pelton

A Practice Inquiry Project Submitted to the Faculty of the

COLLEGE OF NURSING

In Partial Fulfillment of the Requirements
For the Degree of

DOCTOR OF NURSING PRACTICE

In the Graduate College

THE UNIVERSITY OF ARIZONA

2013
As members of the Practice Inquiry Project Committee, we certify that we have read the practice inquiry project prepared by Derrick K. Pelton entitled ‘Evidence-Based Plan for Promoting Physical Activity Among Deaf Adults in Primary Care’ and recommend that it be accepted as fulfilling the practice inquiry project requirement for the Degree of Doctor of Nursing Practice.

Elaine G. Jones, PhD, RN  
Associate Professor  
Date: November 18, 2013

Kate G. Sheppard, PhD, RN, FNP, PMHNP-BC, FAANP  
Clinical Associate Professor  
Date: November 18, 2013

Janice D. Crist, PhD, RN, FNGNA  
Title  
Date: November 18, 2013

Final approval and acceptance of this practice inquiry project is contingent upon the candidate’s submission of the final copies of the practice inquiry project to the Graduate College.

I hereby certify that I have read this practice inquiry project prepared under my direction and recommend that it be accepted as fulfilling the practice inquiry project requirement.

Practice Inquiry Project Director: Elaine G. Jones, PhD, RN  
Associate Professor  
Date: November 18, 2013
STATEMENT BY AUTHOR

This practice inquiry project has been submitted in partial fulfillment of requirements for an advanced degree at The University of Arizona and is deposited in the University Library to be made available to borrowers under rules of the Library.

Brief quotations from this practice inquiry project are allowable without special permission, provided that accurate acknowledgment of source is made. Requests for permission for extended quotation from or reproduction of this manuscript in whole or in part may be granted by the head of the major department or the Dean of the Graduate College when in his or her judgment the proposed use of the material is in the interests of scholarship. In all other instances, however, permission must be obtained from the author.

SIGNED: __Derrick K. Pelton__________________
ACKNOWLEDGEMENTS

Thanks to my committee members: Elaine Jones, PhD, RN (Chair), Kate Sheppard, PhD, RN, FNP, PMHNP-BC, and Janice Crist, PhD, RN, for all of their time, commitment, input, and support.
# TABLE OF CONTENTS

LIST OF TABLES .................................................................................................................. 7
ABSTRACT .......................................................................................................................... 8

CHAPTER 1: INTRODUCTION .............................................................................................. 10
The Culturally Deaf Community ....................................................................................... 10
Significance of the Problem ............................................................................................. 12
Deaf Adults and Health Disparities ................................................................................ 14
Health Related Research about Deaf Adults .................................................................. 18
Summary and Conclusion ............................................................................................... 20

CHAPTER 2: REVIEW OF THE LITERATURE ..................................................................... 21
Recommendations for Physical Activity for Adults ......................................................... 21
Physical Inactivity and Poor Health ............................................................................... 22
Physical Activity and Improved Health ........................................................................ 24
Pedometer Use as a Motivational Tool for Increasing Walking Distance .................. 27
Summary and Conclusion ............................................................................................... 32

CHAPTER 3: METHODS ..................................................................................................... 34
The Umbrella Study: Overview and Conceptual Model .................................................... 34
Health Risk Assessment Using Pedometer Step Counts in Culturally Deaf Adults .......... 35
Sample ............................................................................................................................. 36
Instrument ....................................................................................................................... 36
Data Collection ............................................................................................................... 36
Data Analysis Plan .......................................................................................................... 37
Summary and Conclusion ............................................................................................... 38

CHAPTER 4: RESULTS ....................................................................................................... 40
Sample Characteristics ................................................................................................... 40
Research Questions ......................................................................................................... 41
  Primary Research Question ......................................................................................... 41
  Research Question Two ............................................................................................... 42
  Research Question Three ............................................................................................ 42
  Research Question Four ............................................................................................ 42
Summary and Conclusion ............................................................................................... 43
## TABLE OF CONTENTS – Continued

### CHAPTER 5: DISCUSSION AND PRESENTATION OF EVIDENCE-BASED PLAN TO INCREASE PHYSICAL ACTIVITY

- Comparison of Results to Prior Research .......................................................... 44
- Strengths and Limitations .................................................................................. 46
- Evidence-Based Plan to Increase Physical Activity in the Primary Care Setting ....... 47
  - Visit One ............................................................................................................. 49
  - Visit Two ........................................................................................................... 50
  - Visit Three ....................................................................................................... 51
- Summary and Conclusion ...................................................................................... 51

### APPENDIX A: PEDOMETER PROTOCOL ................................................................. 53

### APPENDIX B: UNIVERSITY OF ARIZONA IRB APPROVAL LETTER ..................... 55

### REFERENCES ....................................................................................................... 58
LIST OF TABLES

TABLE 1.  *Frequencies and Mean Values of Men and Women for Steps/Day* ..........................40
TABLE 2.  *Frequencies of Age and Mean Values of Steps/Day* ........................................41
TABLE 3.  *Frequencies and Percentages for Level of Education* .......................................41
TABLE 4.  *Step-Defined Physical Activity Lifestyle* ..........................................................43
ABSTRACT

Objectives. The purpose of this practice inquiry (PI) was to develop an evidence based plan for promoting physical activity among Deaf adults in a primary care setting. There is considerable evidence that Deaf adults experience health disparities and that unique strategies are necessary to address the disparities. The aims of this PI were to 1) review research about the relationship between physical activity and health 2) review research about use of pedometers to motivate increased walking and 3) describe baseline physical activity among Deaf adults using pedometer step counts based on a secondary analysis of an existing data set.

Design. The review of research was conducted using key words including physical activity, health promotion, cardiovascular disease, pedometers, and health risks in PubMed and CINAHL databases. The secondary analysis of an existing data set analyzed demographic data and pedometer data (steps/day) from the Omron HJ 150 hip pedometer. Participants received standardized instructions about using the pedometer in-person, in American Sign Language (ASL) and also received a DVD with the instructions in ASL for review at home. Additional data analysis was conducted to assess whether there were differences in average steps per day for men versus women, or differences with age or educational level of study participants. The review of literature and secondary analysis were used to propose an evidenced-based plan to increase physical activity in Deaf adults in the primary care setting.

Sample: A total of 13 published studies met inclusion criteria for the literature review. Eighty-seven participants met inclusion criteria for this secondary analysis: 1) at least 45 years of age, 2) self-identified as a member of the Deaf community, 3) fluent in ASL, 4) no existing diagnosis of coronary artery disease, and 5) at least one risk factor for cardiovascular disease: overweight/obese, sedentary, diabetes, hypertension, hyperlipidemia.
Results: Extant research results support the value of physical activity for health promotion and risk reduction, and supported use of pedometers to encourage increased walking. The secondary analysis of data from 87 Deaf adults showed that their average steps/day were 5,667, which fall short of the 2008 Physical Activity Guidelines for Americans. Men tended to walk more (mean=6,548 steps/day) than women (mean=5,044 steps/day), though the difference did not reach statistical significance. There was an inverse correlation between age and steps/day (r=.280, p=.007) consistent with a low active lifestyle (5,000–7,499 steps/day). There were no significant relationship between participants’ educational level and physical activity.

Conclusion. There is considerable support for providing pedometers to at-risk Deaf adults in primary care, with both group and individual instructions in ASL and follow-up to monitor increases in average steps/day as an effective strategy for increasing physical activity. This would not be a stand-alone intervention, but part of an overall risk assessment and evidenced based plan to increase physical activity in Deaf adults.
CHAPTER 1: INTRODUCTION

The purpose of this practice inquiry (PI) was to develop an evidence based plan for promoting physical activity among Deaf adults in a primary care setting. There is considerable evidence that Deaf adults experience health disparities and that unique strategies are necessary to address the disparities. The aims of this PI were to review research about health benefits of physical activity, review research about use of pedometers to motivate increased walking, and to describe baseline physical activity among Deaf adults using pedometer step counts in a secondary analysis of an existing dataset. These form the foundation for an evidence based strategy to encourage increased physical activity among Deaf adults in a primary care setting.

The following sections present background information about characteristics of the culturally Deaf community, factors contributing to disparities in health related knowledge, and review of relevant health-related research about Deaf adults. Research about the relationships between physical activity and health, and about strategies to promote physical activity are presented in chapter 2. Chapter 3 presents the secondary analysis of data about physical activity among a sample of 87 Deaf adults. Chapter 4 presents results of the secondary analysis. Chapter 5 presents the discussion of findings and a proposed evidence-based strategy for promoting increased physical activity among Deaf adults in a primary care setting.

The Culturally Deaf Community

Since the 18th century, American Deaf culture has evolved with milestones ranging from the establishment of the first all-deaf school to the recognition of American Sign Language as an independent language (Public Broadcasting Services, 2007). The richness of American Sign Language has the capability of complex grammar, deep expression, invention, and emotion (National Association of the Deaf, 2013). In turn, Deaf people have developed strong bonds with
American Sign Language and its ability to convey simple to complex conversations from poetry to politics (U.S. Department of Health & Human Services, 2013). Achievements made by the Deaf community have helped shape a unique culture with a strong sense of pride and independence.

The term “Deaf” is capitalized in contemporary society to represent a cultural identity in the Deaf community. Culturally Deaf individuals are a unique linguistic minority group who share specific characteristics including using sign language, usually American Sign Language (ASL), as their primary language, having hearing loss from an early age, associating with others in the Deaf community, and viewing deafness not as a disability but an identity. The capital “Deaf” distinguishes them from others with hearing loss who communicates through residual hearing, speaking, and speech reading. Those who are deaf with a small “d” don’t use ASL and typically consider their hearing loss to be a physical disability rather than qualifying them for membership in the Deaf community. In the Deaf (cultural) community, there is a strong social support system where behaviors and interpersonal skills are learned from members of the community and where most intimate relationships occur (Jones, Renger, Kang, 2007). Health-related information specific to Deaf adults is sparse because available health databases do not distinguish between those who are “Deaf” and those who are “deaf.” The barriers encountered in accessing health care and health-related information are quite different for Deaf vs. deaf, particularly since many in the “deaf” group experienced hearing loss at much older ages, after literacy and language competencies were acquired.

Deaf adults’ preferred primary communication is typically ASL, which has no written form, and different grammar and syntax than English. For most Deaf adults, English serves as a second language and their English literacy is often limited. As a linguistic minority group,
communication barriers are a key element affecting understanding of health information and health-related decisions of Deaf adults. According to Marschark et al. (2009), Deaf individuals who are 18 years old are often considered functionally illiterate with an average reading level of a fourth-grader at the time of their high school graduation. As a result, recommendations about health promotion from journals, reading food labels in the grocery store, or reading the newspaper’s current events may prove to be difficult to interpret and implement into everyday life. Preferences for ASL and limited English literacy have strong implications for adapting existing, English-based health services for Deaf adults. The vast majority of health-related research is conducted with people with no hearing loss. Due to communication barriers and literacy levels of the Deaf population, implementation of non-adapted interventions may not be appropriate for many Deaf adults and so unlikely to be effective. To be fully effective in promoting health, interventions must be tailored to the Deaf population to ensure optimal outcomes are achieved along with increasing health-related research.

Significance of the Problem

Estimates of the number of culturally Deaf persons in the United States are approximately 1.2 million people (Margellos-Anast, Estarziau, Kaufman, 2006). The usual basis for the estimates have been 2-3/1,000 births (U.S. Department of Health & Human Services, 2013) however, there is no reliable data about the actual number of people who are part of the Deaf community, largely due to the difficulty in gathering data to distinguish between those with hearing loss only and those with hearing loss who use ASL and identify as part of a Deaf community. In addition, the development of cochlear implants to correct hearing loss further complicates distinctions among those with hearing loss. This section explains in more detail the difficulties in estimating the number of adults who are “Deaf” with a capital D. However, one
thing is certain, primary care providers may encounter patients who are “Deaf” and it is essential that they understand the implications for effective health care for this group.

In the United States, the demography of deafness was first established by the federal government during the decennial census. Since the first estimate of deaf persons in 1830, the reliability of accurate records has been questioned resulting in decades where questions about deafness were dropped from surveys (Mitchell, 2005). In recent years, surveys such as the National Health Interview Survey (NHIS), the National Health and Nutrition Survey, and the Survey of Income and Program Participation (SIPP) have captured more reliable estimates, addressing discrepancies in defining deafness (Mitchell). The continuum of deafness is as impressive as it is complex ranging from degrees of hearing loss, types of hearing loss, and whether you capitalize the term “deaf.” The SIPP is thought to be more efficient at separating people who are deaf from those who are hard of hearing (Gallaudet Research Institute, 2007). The SIPP used questions that assessed the ability to hear during verbal conservations.

“Difficultly hearing” was a category for participants who had trouble with hearing during conversations even when wearing a hearing aid. “Severe difficulty” included participants who were deaf and could not hear normal conversations (Brault, 2012). From the 2010 SIPP report, 1.1 million people were classified as having “severe difficulty” (Brault). Although this estimate may be the closest match to the U.S. culturally Deaf population, these numbers could fall short. The “deaf” category is under the SIPP disabilities section which included ambulatory, cognitive, self-care, and independent living difficulties (U.S. Department of Commerce, 2013). Considering that Deaf people do not perceive their hearing status to be a disability (Lane, 2005), Deaf people may opt out of participating in the section on disability or give unreliable data.
Deaf Adults and Health Disparities

Health disparities exist when outcomes are seen in a greater or lesser extent between populations. In comparison to the hearing population, health disparities in Deaf adults occur from differences in health knowledge, lack of tailored interventions/tools for health promotion, communication barriers, and limited research involving the Deaf community. In the Deaf community, physical activity level is one area that lacks research and tools for assessment. Risks of physical inactivity are complicated by communication barriers, limited health literacy, and misinterpreted health information that is learned through social relationships. The use of pedometers to assess physical activity is a cost effective and simple method that may help bypass many existing communication barriers acting as a tool for self-regulation and motivation for increased physical activity. With the potential to impact the estimated 1.2 million members of the Deaf community, identifying physical inactivity as an area of health risk will help strengthen current research and support new tailored interventions to promote healthful living and decreased associated health disparities.

There is little published health-related research focusing on culturally Deaf adults. Because Deaf communities share many risk factors with other ethnic minority groups such as lower income, lower education, and limited literacy available health-related research about Deaf communities is compared with health-related research about ethnic minorities groups. Presented literature will address knowledge of cardiovascular disease in the Deaf population, health priorities in the Deaf population, and principles of tailoring interventions for minority groups. Quantitative and qualitative articles between the years 2000-2011 were chosen for review.

Margellos-Anast, Estarziau and Kaufman (2006) conducted a research study to assess knowledge of cardiovascular disease in Deaf adults. Participants were recruited from two of
Chicago’s largest Deaf-serving health care systems, Sinai Health System (SHS) and Advocate Health Care (AHC). A total of 203 Deaf participants were included that were over 18 years and could make their own health decisions. Surveys were administered to assess health related topics that included knowledge of cardiovascular disease including heart attack and strokes (Margellos-Anast, Estarziau and Kaufman, 2006). Demographics found that most participants had a high school education or less and had a mean annual income of less than 20,000 dollars. Results from the survey showed that 40.4% of participants could not list any symptoms of heart attack and 62.2% could not list any symptoms of stroke. Most surprisingly, 39% stated that they would not think of activating the 911 telephone emergency system or feel that it was deaf-accessible. Additional risk factors from surveys found that 67.1% reported high blood pressure, 71.9% reported high cholesterol, and 52.5% were current tobacco users (Margellos-Anast, Estarziau and Kaufman). Results suggest that this population is at an increased risk not only for knowledge on cardiovascular disease, but also having significant risk factors associated with cardiac disease. Implementing tailored interventions to increase education on health and reduce risk factors are imperative to promoting healthy lifestyles in the Deaf community.

Jones, Renger and Firestone (2005) conducted a community analysis to assess the priorities of the Deaf community for health education topics. From the 111 participants, 55% reported a family history of cardiac events with 20% occurring before the age of 55 years, 27% thought their blood pressure was above 140/90, and 54% reported exercising less than three times per week. The most concerning topic (Jones, Renger, and Firestone). The seven-step analysis used information from surveys, interviews, and discussions on health issues and concerns.

Based on results of the community analysis, they developed a community based intervention to address CVD risk: the Deaf Heart Health Intervention (DHHI) (Jones, Renger and
Firestone, 2005). The DHHI targeted modifiable health behaviors related to CVD risk through classroom activities and take-home assignments (Jones, Renger, Kang, 2007). Using the Self-Rated Abilities Scale for Health Practices questionnaire, results found a significant increase in self-efficacy for healthy behaviors in areas including physical activity, nutrition, stress management, and responsible health practices (Jones, Renger, Kang). Tailoring interventions to overcome communication barriers found within the Deaf community is essential to the promotion on health and favorable lifestyles. Although the DHHI showed promise, there were few significant changes in health behaviors, and it would not be feasible in a primary care setting.

McKee et al. (2011) conducted a study to explore the perception of CVD among Deaf adults. The sample consisted of 22 participants with a mean age of 55 years who were predominantly educated at a college level or higher. Group discussions were held to discuss knowledge, barriers, facilitators, and dissemination of CVD information (McKee et al., 2011). Results indicated that CVD knowledge varied widely among participants. Strengths of the participants included knowledge of the dangers of cigarette smoking, common heart disease symptoms, and basic benefits of physical activity. Areas of limitation included knowledge of stroke, heart and brain anatomy, and medications (McKee et al., 2011). Barriers of communication, environment, lack of free time due to busy schedules, and finances were all reported and found to increase the risk of CVD. Deaf participants reported misunderstanding health information due to lack of interpreters, inability to fully access health education material due to language, increasing fast food/processed food in personal diets due to lower cost, and decreased physical activity from being unable to afford memberships to fitness clubs (McKee et al., 2011). Facilitators of health promotion were found to be highly influenced by group and
community support. Participants reported that they were much more likely to maintain a walking/fitness program when conducted with friends. Health providers who were fluent in ASL were also found to be highly motivational in promoting healthful behaviors and providing access to health education (McKee et al., 2011). Results showed that the dissemination of health information was best accomplished through websites tailored to the Deaf community. Additional sources identified were captioned television and knowledge of deaths of famous celebrities due to disease (McKee et al., 2011). Overall, knowledge of CVD was limited among the Deaf participants. They reported communication barriers limiting access to health related education. Tailoring interventions and utilizing tools to accommodate the Deaf community can greatly influence the promotion of healthful behaviors and decrease the risk of CVD in the Deaf community.

Tamaskar et al. (2000) examined attitudes of physician-initiated preventive medicine in the Deaf and hard-of-hearing (D&HH) population. The sample population included 144 D&HH (mean age of 51 years old) and 76 hearing participants (mean age 42 years old). In the D&HH group, 60% reported a profound hearing loss. Self-administered surveys were used to compare D&HH and the hearing population in areas including the use of health care services and health problems, attitudes toward health maintenance behaviors, and health maintenance procedures performed by physicians (Tamaskar et al., 2000). Results found that the D&HH group was more likely to avoid utilizing health services due to communication problems including interpreter unavailability. Medical conditions such as heart disease, cancer, and high blood pressure did not differ between the D&HH and hearing groups (Tamaskar et al.). Significant differences were found in sources where preventative medicine information is obtained. In the D&HH group, individuals reported that they were less likely to obtain preventive medicine information from
physicians, books, and other forms of media. Instead, Deaf clubs served as a main source for acquiring health information (p=.007). In contrast, differences in the primary sources for health information in the hearing group included books (p=.02), physicians (p=.007), radio (p=.005), and television (p=.004) (Tamaskar et al.). Questions on the importance of common health maintenance procedures such as screening for blood pressure (p=.03), diet (p=.01), and smoking questions (p<0.001) were found to be more important in the hearing population. No differences were found in cholesterol screening (p=.48), exercise questions (p=.76), and weight/height questions (p=.07). Differences in attitudes of health maintenance between the groups are thought to be from poor patient-provider relationships due to communication barriers or time pressures during office visits (Tamaskar et al.). In the D&HH group, the importance of lifestyle behaviors on overall health reached statistical significance when physicians regularly addressed them during office visits (exercise p=.003, smoking cessation p=<.001, and watching weight p<.001). For example, if their blood pressure was checked at every office visit respondents in the D&HH group rated it as more important on overall health (Tamaskar et al.). The D&HH and hearing groups both showed major differences in attitudes and beliefs of preventive medicine. In the D&HH group, it was clear that communication barriers pose a significant problem in relaying health information. Tailored educational materials and reinforcement of healthful behaviors during office visits may help alleviate this burden. In turn, members of the D&HH community can strengthen patient-provider relationships helping to decrease their risk of health disparities.

**Health Related Research about Deaf Adults**

As research continues to show the benefits of physical activity, there are interventions tailored for a wide variety of groups but none tailored to the culturally Deaf. As a result, literature focused on the Deaf population is limited and often lacking. Obstacles including
communication barriers, literacy levels, credible methods to collect data, and challenges to recruit community members are all reasons for the lack of Deaf health-related research. Deaf and hard-of-hearing participants reported health conditions including heart disease, but have a less favorable health status compared to those without hearing loss (Woodcock & Pole, 2007). Deaf self-efficacy studies also indicate an increased risk for adherence to health promotion recommendations (Jones, Renger, Kang, 2006) (Woodcock & Pole, 2007). Communication barriers may greatly inhibit accurate patient histories, reported symptoms, and understanding of health promotion instructions (Woodcock & Pole). Using English as a second language, the Deaf population has a limited health literacy level which further impedes education of health promotion. According to Magellos-Anast, Estarziau and Kaufman (2006) knowledge of cardiovascular disease was lower in the Deaf community when compared to the hearing population. From a sample of 203 Deaf participants 40% could not list symptoms of a heart attack, 60% could not list symptoms of a stroke, and only 61% would initiate emergency medical services in the event of exacerbated cardiovascular disease (Magellos-Anast, Estarziau and Kaufman, 2006). As continuing evidence presents, the Deaf community are found to share many of the risk factors for poor health with ethnic minorities. Similarities in health risk such as use of non-English language, lower education and socioeconomics levels, and infrequent encounters with a health care provider from their own cultural group all increase the risk for health disparities (Bennett, 1999). The totality of barriers and risks pose an extreme threat for health disparities in the Deaf population from lack of access of health related information and health promotion interventions (McKee et al., 2011). Tailoring interventions and methods of research for Deaf persons may help overcome barriers and in turn promote healthful lifestyles. As literature on physical activity in the Deaf population is scarce, this practice inquiry focuses on a
modifiable lifestyle factor which has proven to decrease cardiovascular disease risk and associated co-morbidities.

**Summary and Conclusion**

Culturally Deaf communities are a unique linguistic minority group with a rich history of having a strong sense of pride and independence. With strong social influences on behaviors and limited resources this population is at risk for adverse health outcomes. The focus of most research with the Deaf community is on communication barriers causing them to be at risk for chronic diseases, but few have developed interventions that are culturally and linguistically tailored to address health care needs of Deaf adults. The goal of this PI was to develop an evidence based program to increase physical activity in Deaf adults. The aims included reviewing research about health benefits of physical activity, reviewing research about use of pedometers to motivate increased walking, and to describe baseline physical activity among Deaf adults using pedometer step counts in a secondary analysis of an existing dataset.
CHAPER 2: REVIEW OF THE LITERATURE

This review of literature examines studies about the relationships between physical activity and health, and about strategies for increasing physical activity. PubMed and CINAHL databases were searched based on the following criteria: included adults at least 18 years old, using health related key words: physical activity, health promotion, cardiovascular disease, pedometers, health risks, minority groups. Presented research studies will include studies about the effectiveness of interventions to promote increased physical activity. The criteria for inclusion were that the articles be 1) peer reviewed 2) published after the year 2000, and 3) quality of evidence strength at a level 2 or greater. Studies about use of pedometers as motivational tools are presented in a separate section. This section begins with presentation of recommendations for physical activity among adults.

Recommendations for Physical Activity for Adults

The 2008 Physical Activity Guidelines for Americans are the most current and comprehensive recommendations issued by the U.S. Federal government that provides science-driven guidance for improving health through increased physical activity (U.S. Department of Health and Human Services, 2008). The guidelines stem from an extensive review of scientific data conducted by the Physical Activity Guidelines Advisory Committee since the release of the 1996 Surgeon General’s Report on Physical Activity and Health (U.S. Department of Health and Human Services). The 2008 Physical Activity Guidelines are intended to be a primary source of information for health care providers, policy makers, and the public on the amount, type, and intensity level of physical activity needed to achieve health benefits across the life span (U.S. Department of Health and Human Services). Recommendations from the 2008 Physical Activity Guidelines for Americans suggest implementing both aerobic and anaerobic activities to gain the
most health related benefits. Both types of activities use muscle contractions to increase oxygen consumption and energy expenditure above the body’s basal level (Peterson, 2013). Aerobic activities are primarily used for weight loss and use larger amounts of oxygen for continuous muscle contractions. Anaerobic activities require short bursts of contractions and are mainly used to build muscle (Mayo Clinic, 2013). Categories of activity include leisurely, occupational, household, and transportation activities (Mayo Clinic). For men and women the recommendation includes at least 150 minutes of moderate-intensity, or 75 minutes of vigorous intensity aerobic activity (U.S. Department of Health and Human Services). Types of moderate-intensity activities include walking fast, yard work, riding a bike on level ground, or water aerobics. Types of vigorous-intensity activities include jogging/running, swimming laps, riding a bike on hills, or playing basketball (Centers for Disease Control and Prevention, 2013). Anaerobic activities are recommended on two or more days of the week and include lifting weights using all the major muscle groups (Centers for Disease Control and Prevention). For older adults, if it is not possible to follow the recommendations it is suggested that they be as physically active as they can be (U.S. Department of Health and Human Services).

**Physical Inactivity and Poor Health**

There has been a marked rise in the sedentary lifestyles in recent years. The factors contributing to increased sedentary living include, changing modes of transportation, and increasing urbanization (World Health Organization, 2013). In fact, sedentary jobs have increased 83% since the 1950’s along with a 47 hour work week on average (American Heart Association, 2013). According to the Centers for Disease Control and Prevention (2013), in 2012 only 48% of American adults met the 2008 physical activity guidelines. Increases in cardiovascular disease, diabetes, and cancers have all been directly linked to sedentary lifestyles.
Strategies to increase physical activity have focused on the family, work place, and in the community (Centers for Disease Control and Prevention, 2013). To help create sustainability of physical activity programs an essential element is to fully understand the benefits of activity and risks of inactivity. Although the risks associated with sedentary lifestyles are most readily seen at the individual level the consequences reach much further.

Sedentary behavior refers to activities that do not increase energy expenditure above the basal resting level such as sitting, lying down, or watching TV (Proper, Singh, Mechelen, Chinapaw, 2011). Physical inactivity is the lack of regular exercise or at irregular intervals (World Health Organization, 2013). Both sedentary and physical inactivity have similar consequences associated with increased co-morbidities and mortality. Most notably, the lack of physical activity greatly increases the risk for cardiovascular disease including heart failure, hypertension, stroke, and coronary artery disease (Peterson, 2013). This accounts for 1 in 4 deaths and a rate of 600,000 deaths per year making it the leading cause of death for both men and women (Centers for Disease Control and Prevention, 2013). The consequences associated with lack of physical activity also ripple further than health risk to include economic burden. As the leader in deaths per year, heart disease associated costs account for a staggering $108.9 billion dollars each year alone (Centers for Disease Control and Prevention). Another common co-morbid condition associated with lack of physical activity is diabetes with a cost that has risen from $174 billion dollars in 2007 to $245 billion in 2012 (American Diabetes Association, 2013). Finally, obesity affects more than one-third of the United States population and is closely related to other conditions including heart disease, diabetes, and stroke. In 2008, obesity related costs were $1,429 dollars higher than normal weight individuals and total an estimated $147
billion U.S. dollars (Centers for Disease Control and Prevention). As evidence suggests, the burdens associated with lack of regular physical activity are extremely costly not only to one’s own well-being but to an already extremely stressed health care system. Recommended guidelines for physical activity have shown to be a cost effective and modifiable solution to a preventable problem among both genders, diverse ethnicities, and across the lifespan.

**Physical Activity and Improved Health**

The physical, social, and psychological areas of individual well-being are all directly affected by increasing physical activity. Physically active individuals were found to have a 30% mortality risk reduction than inactive individuals (Brown et al., 2013). Increasing physical activity supports improved circulation, reducing serum cholesterol and triglycerides, and reducing body weight. In turn, this helps to prevent cardiovascular disease by reducing known risk factors (American Heart Association, 2013). A meta-analysis conducted by Wendel-Vos et al. (2004) examined the relationship between physical activity and stroke. Results show that participating in moderately intense physical activity may reduce total strokes along with stroke subtypes. This section of the review will provide evidence of the importance of physical activity. Included studies will show the effects that physical activity has on mortality, systemic chronic inflammation, and risk of cardiovascular disease.

Brown et al. (2013) studied the association between the frequency of physical activity and mortality risk across adulthood. The sample consisted of 9,249 participants from the National Health and Nutrition Examination Survey III (NHANES III) from 1988 to 1994. Data was extracted from the records of participants who were greater than 40 years of age and had no missing data on health information (Brown et al., 2013). Participants were categorized by age: middle-aged (40-64 years), old (65-79 years), and very old (80+ years). Data was collected with
monthly self-report questionnaires about the frequency and intensity of activities. Only moderate intensity activities were included for analysis (Brown et al.). Examples of moderate intensity activities were walking one mile without stopping, jogging, biking, gardening, and aerobics. Data analysis revealed that greater frequency of moderate intensity physical activity was associated with a decreased risk of mortality from disease in all age categories. Engaging in moderate intensity activities five days a week had the highest correlation with risk reduction although any level of activity showed benefits when compared to inactive individuals (Brown et al.). Overall, when engaging in physical activity five days a week, the 80+ year old group had the greatest mortality risk reduction from disease (Brown et al.). This study provides evidence of the overall impact of physical activity on health. Results support the value of encouraging moderate intensity physical activity, even among older adults.

Hamer et al. (2012) conducted a longitudinal study to examine physical activity and inflammatory markers over a 10 year period. The basis of the study was the fact that chronic systemic inflammation greatly increases the risk of CVD, and inflammatory markers are lower among people with high levels of physical activity. Increased inflammatory markers are indicative of cardiovascular disease risk (Hamer et al.). The sample consisted of 4,289 men and women aged 35-55 years. The data included duration and frequency of physical activity and inflammatory markers serum C-reactive protein (CRP) and interleukin-6 (IL-6) levels. Participants completed questionnaires about the intensity and duration of activities such as walking, biking, sports, gardening, and house work. Serum CRP and IL-6, markers that increase during inflammation, were obtained through blood samples (Hamer et al., 2012). At baseline, inflammatory markers were lowest in participants who reported at least 2.5 hours of activity per week. Ten year follow-up analysis showed that with continued physical activity the
inflammatory markers decreased as did a marker production site, adipose tissue. Participants who reported increased physical activity since baseline also showed a decrease in inflammatory markers. Results of data analysis supported the importance of physical activity and its role in reducing systemic inflammation. Strong empirical evidence of the positive effects of physical activity indicates the need for more research on interventions to increase physical activity. More importantly, interventions that are tailored to the Deaf community are imperative due to the barriers they encounter in accessing usual health-related information.

Li, Loerbroks and Angerer (2013) conducted an epidemiological meta-analysis to determine the relationships between physical activity and CVD risk. The specific aim was to examine the associations between leisure time physical activity and cardiovascular disease risk. Using the PubMed database, 23 studies fit inclusion criteria including published and peer reviewed from 2011-2013, minimum sample of 1,000 participants, not diagnosed with cardiovascular disease, and follow-up duration of at least three years. Literature searches were performed using headings/terms including physical activity, cardiovascular disease, coronary heart disease, stroke, and cerebrovascular disease to narrow the results (Li, Loerbroks, Angerer, 2013). The total sample consisted of 790,000 adults who were initially free of cardiovascular disease. Data analysis showed that the relative risk for overall cardiovascular disease was reduced by 24% with a moderate level of physical activity when compared to those with low levels of physical activity. Interestingly, an analysis of occupational activity versus leisure time activity also showed a decreased risk of CVD by 5-30%, varying by the intensity of work activity (Li, Loerbroks, and Angerer). The researchers suggested that one explanation for their finding regarding work activity and CVD risk was that work activities often are of longer durations than leisure activity; they noted that work activity may include bending, twisting, and
lifting compared to leisure time activities which include shorter burst of activity (Li, Loerbroks, and Angerer). This study presented a convincing meta-analysis with solid evidence that physical activity can significantly reduce the risk of CVD. In addition, identifying the strength of leisurely vs. occupational activity provides insight for individuals who may be unaware of their increased risk for cardiovascular disease. This holds especially true for the Deaf population who typically have more physically demanding jobs due to education levels and communication barriers.

**Pedometer Use as a Motivational Tool for Increasing Walking Distance**

The studies reviewed in this section are limited to those which evaluated pedometers as motivational tools and as accurate measures of actual walking distance. This section will present evidence of the pedometer’s ability to capture physical activity levels, compare pedometers to other methods of physical activity data collection, and use in minority groups. In addition, topics will include translating pedometer step counts to physical intensity levels. Quantitative and qualitative articles published from the year 2000 or newer were chosen for review.

Bravata et al. (2007) conducted a meta-synthesis of studies conducted to evaluate pedometer use to increase physical activity and improve health outcomes in adults. The systematic review included 26 studies (8 randomized control trials [RCT] and 18 observational studies) that fit inclusion criteria of assessment of pedometer use in adults, reported steps per day, and included at least five participants. The mean age of the 2,767 participants was 49 years. The majority (85%) was women, and 93% were Caucasian. Mean duration of intervention was 18 weeks and 16 of the total studies used the Yamax model pedometers (Bravata et al.). Results from both RCT and observational studies found increased activity with pedometer use. Participants in RCT studies increased their mean steps/day by 2,491 more than control participants. Observational studies showed participants increased their step counts by 2,183 steps.
a day. This was a 26.9% increase from baseline. Additional findings suggest that setting steps/day goals or keeping pedometer diaries increased step counts. Three of the reviewed studies without a steps/day goal had no significant findings in comparison to increases of more than 2,000 steps in studies with set goals. Health outcomes with increased physical activity found an average decrease in body mass index (BMI) of .38, decrease in systolic blood pressure by 4mmHg, and decreases in low-density lipoproteins (LDL) (Bravata et al.). Evidence showed that pedometer use was an effective motivation strategy for increased physical activity. Strategies such as goal setting can produce optimal outcomes motivating participants to increase steps per day. Using similar techniques, pedometers could be a beneficial tool for increasing physical activity and health in the Deaf population implemented from the primary care setting.

Baker and Mutrie (2005) investigated the effectiveness of using pedometers and goal setting as motivational tools to increase physical activity. The sample population included 71 participants who were 18-61 years of age. The Omron HJ-104 pedometers used in the study had the capability to record/store seven days of step counts. The participants were randomly assigned into 1) pedometer intervention (n=23), 2) minutes goal-setting intervention (n=24), and control group (n=24) (Baker & Mutrie, 2005). In the pedometer intervention group, participants wore open faced pedometers to allow for immediate feedback for 28 days and followed a goal step/day program. Pedometer step counts were obtained for the last seven days for analysis. The minute’s goal setting group followed a 28 day goal-setting program to increase minutes per day of physical activity. During the last seven days of the intervention the participants wore a closed faced pedometer to collect step count data. The control group followed normal physical activity routines for 28 days with no instructions on goal setting. During the last seven days participants wore a sealed pedometer to collect step counts for analysis. At the end of the 28 days all
participants completed a 7-day physical activity recall and questionnaires based on the transtheoretical model of behavior change (Baker & Mutrie). In the pedometer intervention group, analysis of pedometer data showed a significant increase in step counts. Qualitative data also showed that immediate pedometer feedback provided motivation to increase walking over goal setting alone. The minute’s intervention group and control group showed no significant differences in step counts compared to the pedometer intervention group (Baker & Mutrie). Pedometer use as a motivational tool can help to increase daily physical activity by providing immediate feedback on activity levels, act as an environmental cue and reminder to be active, and as a tracking tool for current activity (Tudor-Locke, 2002). This supports use of pedometers in a primary care setting for Deaf adults.

Bassett, Cureton and Ainsworth (2000) compared methods of physical activity data collection using validated questionnaire and pedometers in college adults. The sample population included 96 participants (48 male and 48 female) that were 25-70 years old, and 92% Caucasian. The College Alumnus Questionnaire (CAQ) was initially administered via self-questionnaire. The CAQ estimates energy expenditure by inquiring about types of physical activities performed that day. From the CAQ, a physical activity index was computed for the sums of activities such as walking, stair climbing, and recreational activities (Bassett, Cureton, and Ainsworth). Using the Yamax pedometer, participants then recorded their step counts for seven days. The overall main results from the study found that both men and women underestimated their daily walking distance on the CAQ when compared to pedometer step counts. This further suggests that pedometers are a practical quantitative method for collecting data on physical activity helping to ensure accurate results (Bassett, Cureton and Ainsworth). Results of this study support use of pedometers instead of self-report tools with Deaf patients for two reasons: 1) people tend to
underestimate their physical activity in self-report and 2) pedometers don’t require reading making them appropriate for use with Deaf adults. Determining physical activity in the Deaf population has many communication barriers. Pedometers provide an optimal method to overcome barriers and ensure accurate data.

Bennett, Wolin, Puleo, and Emmons (2006) examined physical activity using pedometers in a multi-ethnic and racial low income housing population. The study included 433 participants who were African American (50%), Hispanic (42%), and Caucasian (8%) with a mean BMI of 29.9kgm2. In addition, most participants were female (65%) and reported an annual income of less than 20,000 dollars. Forty percent of participants were over the age of 60 and 75% had a high school education or less. Daily pedometer step counts were self-recorded in daily logs for five days (Bennett, Wolin, Puleo, and Emmons). Data analysis revealed that the mean step count was 5,326/day consistent with a sedentary lifestyle (Bennett, Wolin, Puleo, and Emmons). Differences across groups included lower step counts in women than men and with increased age, lower counts in unemployed vs. employed participants, and over 1,000 fewer step in obese individuals (BMI >30.0kgm2). Pedometers were found to be an effective method to collect physical activity data in minority groups. Researchers concluded that minority groups are at an increased risk for physical inactivity (Bennett, Wolin, Puleo, and Emmons). These results suggest that pedometers may be effective in low-income, ethnic minority groups who share economic and minority status similar to Deaf community members. In addition, Deaf adults may be members of ethnic minorities as well as members of the Deaf community. Being a linguistic minority, the Deaf population has lower mean education and socioeconomic levels than the hearing population (Jones, Renger, Firestone, 2005). In turn, their risk may be much greater due
to communication barriers compared to other minority groups. Providing tailored interventions to address physical inactivity could significantly improve health and decrease risk for disease.

Anderson, Wojcik, Winett, and Williams (2006) conducted a study to evaluate the social cognitive theory (SCT) determinants of social support, self-efficacy, outcome expectations, and self-regulation of physical activity. The sample included 999 participants that were recruited from 14 churches in the state of Virginia. Demographic included 21% African-American, 66% female, and 38% reported being physically inactive. Using a 41-item Likert-scale, social support, self-efficacy, outcome expectations, and self-regulation data were obtained at baseline. Participants were also provided pedometers and daily tracking logs to record step counts for seven days. Physical activity results show that participants had a mean pedometer step count of 6,900 steps/day with men having higher daily step counts than women. Additional physical activity findings suggest that Caucasian participants took 27% more daily steps than African-American and those younger than 53 years took 29% more steps per day. Results from the examination of the SCT determinants show that self-regulation, self-efficacy and social support all had an effect on physical activity. Each determinant was also found to directly or indirectly impact one another aiding in strengthening the effect on physical activity. Self-regulation had the overall greatest effect on physical activity and outcome expectations did not influence physical activity. Social influences also had a greater impact on physical activity old participants in the sample. Based on the self-regulation determinant, the authors suggest that goal setting, tracking daily activity, and planning are most beneficial at increasing physical activity.

Tudor-Locke and Bassett (2004) reviewed activity intensity levels based on pedometer step count. Healthy adults take between 7,000-13,000 steps/day. A popular current value of 10,000 steps per day is a general recommendation for physical activity (Tudor-Locke and
Bassett, 2004). Research indicates that 30-minutes of moderate-intensity walking are equivalent to approximately 3,000-4,000 steps and that usual daily activity is indicative of 6,000-7,000 steps/day (Tudor-Locke and Bassett). Combining these approximations, following the recommended physical activity guidelines of 30-minutes of moderately intense physical activity would equate to 9,000 to 11,000 steps per day. Several advantages of using 10,000 steps/day as a goal is that it’s easy to remember and is a concrete goal for increasing physical activity (Tudor-Locke and Bassett). Based off the National Health and Nutrition Examination Survey (NHANES), equivalents for physical activity intensity levels are compared to pedometer counts (Tudor-Locke and Bassett). Recommendations are as follows: sedentary lifestyle (<5,000 steps/day), low active lifestyle (5,000-7,499 steps/day), physically active (>7,500 steps/day) (Tudor-Locke and Bassett). To meet the physical activity recommendations of moderate-vigorous physical activity individuals would have to achieve at least 7,500 steps per day. Pedometers use in research is continuing to grow (Crouter, Schneider, Karabulut, Bassett, 2003). Meeting physical activity guidelines of 30 minutes of moderate-vigorous activity most days a week has proven to have health benefits. The ability to translate pedometer step counts to activity intensity level will benefit any research population to better promote and assess health.

**Summary and Conclusion**

This review of literature presented evidence of the significance of health related benefits to physical activity. Included research articles were peer reviewed and had greater than a level 2 quality of evidence. Understanding the negative impacts of physical inactivity and how the consequences affect health provides a foundation on the importance of health promotion. To effectively assess physical activity, pedometers are proven to be an accurate, cost effective, and simple method for data collection. Due to unique communication barriers in the Deaf population,
Pedometers can provide quantitative data that can be categorized to physical activity guidelines and provide immediate feedback that requires no narrative to be read or understood. In Deaf adults whose native language is not English, understanding pedometer results may be much clearer to determine health risks of physical inactivity. In the primary care setting, pedometer use could be an effective method to increase physical activity levels and promote better health in Deaf adults.
CHAPTER 3: METHODS

This chapter will begin with an overview of the umbrella study for the proposed secondary analysis. For the proposed study, subsequent sections include the study design, confirmation of approval by the University of Arizona IRB, inclusion criteria for the secondary analysis, data collection methods, and data analysis plans to answer the research questions for the practice inquiry.

The Umbrella Study: Overview and Conceptual Model

The purpose of the Signs of Health Intervention (SoHI) study was to test the feasibility and effectiveness of SoHi in reducing CVD risk among Deaf adults. The study was a quasi-experimental waitlist repeated-measures design that used 10 community sites that were paired and randomly designated as intervention “SoHi now” group or waitlist attention “SoHi later” groups. The study was approved by the University of Arizona Institutional Review Board before recruitment or consenting participants. Consent was obtained from each participant by a research associate fluent in ASL. In addition, the consent forms had been translated into ASL and recorded on DVDs for the participants to take home for review, as desired.

SoHi consisted of classroom education and walking groups over a 12-week period. Discussion-based classes were held weekly and were conducted in ASL by a Deaf teacher. To ensure consistency in classes, a standard format was used that included discussions on the successes/challenges to healthy eating and physical activity, specifically walking. At the group’s convenience, walking groups met with the Deaf teacher twice a week for 30 minutes. Social group activities were provided for 12 weeks to the “later” group which preceded their participation in the SoHI intervention. Conducted by a Deaf team member, social groups
included food and activities such as pizza and game nights. No health or physical activity education was provided during social groups.

In both groups, data were collected at baseline, 12-weeks, and 24-weeks. The “SoHi later” group had an additional data collection three months following the completion of the intervention. At all data collection points, demographics, modifiable risk factors, a 24-hour food recall, and completed 28-item self-efficacy questionnaire were collected from participants. Participants were also issued a hip pedometer and instructed to wear and collect daily step counts for 7 days.

Using a convenience sample, the SoHI study included 105 participants from the Tucson and Phoenix areas in Arizona who met the inclusion criteria and completed data collection points. Networking was the primary method for participant recruitment. Effectiveness of the SoHI was evaluated through analyzing data from data collection points as well as comparison of intervention and control groups.

**Health Risk Assessment Using Pedometer Step Counts in Culturally Deaf Adults**

One aim of this practice inquiry was to describe physical activity using pedometer step count in culturally Deaf adults. This part was a secondary analysis of an existing data set (Jones, n.d.). Physical activity was defined as the pedometer step count taken over a 7 day period at the baseline data collection of the umbrella study.

The primary research question was: Does the average 7-day physical activity (steps/day) for Deaf adults meet the 2008 Physical Activity Guidelines for Americans? Additional exploratory research questions described/explored the relationships between participants’ demographic characteristics (gender, age, and education) and physical activity (average steps/day).
1. Is there a difference in average 7-day steps/day between Deaf men vs. Deaf women?
2. Is there a relationship between age and 7-day average steps/day among Deaf adults?
3. Is there a relationship between years of education and 7-day average steps/day among Deaf adults?

**Sample**

Inclusion criteria from the umbrella study consisted of 1) at least 45 years of age, 2) identifies self with Deaf community, 3) fluent in American Sign Language (ASL), 4) have no existing diagnosis of coronary artery disease, and 5) have at least one risk factor for cardiovascular disease such as hypertension, dyslipidemia, obesity, or sedentary lifestyle. From the 105 participants in the umbrella study, 87 completed pedometer data at baseline and were eligible for this secondary analysis.

**Instrument**

The Omron HJ-150 hip pedometer was used to collect daily step counts of research participants. Omron pedometers are commonly used in research studies due to their reputation as reliable and valid tools for accurate data collection (Holbrook, Barreira, Kang, 2008). The Omron HJ-150 is an accelerometer type pedometer that does not require a pendulum found in more traditional styles. Using sensors, the pedometer is quieter as well as accurate. The HJ-150 pedometer has the ability to store seven days of step counts and resets the count to zero at midnight each night. This feature greatly supports accuracy of pedometer data.

**Data Collection**

A trained research associate (RA) was responsible for obtaining consent and data collection. The RA was a certified ASL interpreter that was well versed in medical terminology and Deaf culture. In-person interviews were used to collect demographic data and provide
instructions on pedometer use and self-data collection. Participants also received a take-home DVD with the instructions for pedometers use in ASL.

**Data Analysis Plan**

The data analysis plan is presented below for each research question. For each question, statistical analyses were conducted using PASW 18 statistical software.

*Primary Research Question*: Does the average 7-day physical activity (steps/day) for Deaf adults meet the 2008 Physical Activity Guidelines for Americans?

*Data Analysis Plan*: Pedometer data were used to find mean steps for the 7 days of pedometer step counts. Average step counts were calculated using the PASW syntax by adding the daily step counts for 7 days and dividing by 7. Mean 7-day step counts were then translated into intensity of activity per day. Tudor-Locke and colleagues have conducted extensive research using pedometers for collecting data on physical activity, including translating pedometer step counts to intensity level of physical activity. To determine physical activity intensity level, mean step counts were categorized using the guidelines: sedentary lifestyle (<5,000 steps/day), low active lifestyle (5,000-7,499 steps/day), physically active (>7,500 steps/day) (Tudor-Locke, Craig, Thyfault, Spence, 2012). Compared with the 2008 Physical Activity Guidelines for Americans, a physically active individual (>7,500 steps/day) meets the recommended 30-minutes of physical activity per day (Tudor-Locke, Craig, Thyfault, Spence, 2012).

*Research Question 2*: Are there differences in physical activity for adult Deaf men vs. Deaf women?

*Data analysis plan*: To answer the question of differences in physical activity between Deaf men and women frequencies and t-tests were used. Frequencies were used to
determine average pedometer step counts for both men and women. T-tests were then used to evaluate equal variances of the mean step counts and determine significance. The level of significance was set at p<=0.05.

Research Question 3: Is there a relationship between age and average steps/day among Deaf adults?

Data analysis plan: Pearson’s product movement correlation was used to determine significance and correlation in the total sample population. Further analysis was repeated for both men and women independently.

Research Question 4: Is there a relationship between years of education and average steps/day among Deaf adults?

Data analysis plan: Pearson’s product movement correlation was used to determine significance and correlation in the total sample population. Further analysis was repeated for both men and women independently.

Summary and Conclusion

The chapter began with an overview of the umbrella study along with a proposed design for the secondary analysis. Elements of the proposal included the main question of “What is the average physical activity (steps/day) for Deaf adults?” along with additional questions to examine the relationships of physical activity and gender, age, education level, and marital status. An analysis plan was also addressed for each question. Additional elements included in this chapter included, IRB approval, inclusion criteria, and data collection methods, and design model. This research study will help identify physical activity levels in Deaf adults along with influencing factors of participation. Gaining a better understanding of physical activity in the
Deaf population will help support the adaptation of current tools, as well as the advent of new interventions to improve health through prevention of health disparities.
CHAPTER 4: RESULTS

This chapter reveals the statistical analysis of the proposed research questions of the practice inquiry. PASW 18 statistical software was used for data analysis. Demographical analyses were used to show frequency, percentages, and mean values of pedometer step counts in the sample population. T-test and Pearson’s product moment were used to examine correlations and significance in the identified variables from the proposed questions.

Sample Characteristics

Participants of the sample population were from the Tucson and Phoenix areas in Arizona. The sample consisted of a total of 87 participants that completed base line pedometer data and were predominately Caucasian (99%). From the data, 36 were male (41.4%) and 51 were female (58.6) with a mean age of 61.82 years (Tables 1 and 2). The mean age of males was 62.06 years and women 61.33 years. From the sample, inquiries on education found participants mostly had a high school diploma or GED (n=40, 46%). Further analysis found that one participant had less than an 8th grade level (1.1%), four completed up to an 8th grade level (4.6%), eight had at least some high school education (9.2%), 11 had vocational/technical training (12.6%), and 22 had a college degree (25.3%) (Table 3). Data from the 87 participants was used to address the proposed research questions.

TABLE 1. *Frequencies and Mean Values of Men and Women for Steps/Day*

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Gender</th>
<th>N</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Male</td>
<td>36</td>
<td>62.17</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>51</td>
<td>61.47</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>87</td>
<td>61.76</td>
</tr>
<tr>
<td>Step/day</td>
<td>Male</td>
<td>36</td>
<td>6548</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>51</td>
<td>5044</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>87</td>
<td>5667</td>
</tr>
</tbody>
</table>

*Note. N = number of participants in secondary analysis.*
TABLE 2. Frequencies of Age and Mean Values of Steps/Day

<table>
<thead>
<tr>
<th>Age (Years) Range</th>
<th>N</th>
<th>Mean Steps/day</th>
</tr>
</thead>
<tbody>
<tr>
<td>45-54</td>
<td>30</td>
<td>7067</td>
</tr>
<tr>
<td>55-64</td>
<td>20</td>
<td>4802</td>
</tr>
<tr>
<td>65-74</td>
<td>25</td>
<td>5897</td>
</tr>
<tr>
<td>75+</td>
<td>12</td>
<td>3129</td>
</tr>
</tbody>
</table>

*Note.* N = number of participants in secondary analysis.

TABLE 3. Frequencies and Percentages for Level of Education

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>N</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 8&lt;sup&gt;th&lt;/sup&gt; grade level</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>Up to 8&lt;sup&gt;th&lt;/sup&gt; grade level</td>
<td>4</td>
<td>4.6</td>
</tr>
<tr>
<td>Some high school education</td>
<td>8</td>
<td>9.2</td>
</tr>
<tr>
<td>High school diploma or GED</td>
<td>40</td>
<td>46</td>
</tr>
<tr>
<td>Vocational/technical training</td>
<td>11</td>
<td>12.6</td>
</tr>
<tr>
<td>College degree</td>
<td>22</td>
<td>25.3</td>
</tr>
</tbody>
</table>

*Note.* N = number of participants in secondary analysis.

**Research Questions**

**Primary Research Question**

The primary research question was “Does the average 7-day physical activity (steps/day) for Deaf adults meet the 2008 Physical Activity Guidelines for Americans?” During the 7-day pedometer step count data collection, steps per day ranged from 469 steps to 21,725 steps with an average of 5,667 steps. For men, the average steps per day were 6,548 and ranged from 559 to 15,455. Women had an average of 5,044 steps per day and ranged from 469 to 21,725 steps. Transposed to intensity level, the entire sample along with men and women individually were classified as having a low active lifestyle (<7,500 steps/day). Compared to the 2008 Physical Activity Guidelines for Americans, a low active lifestyle equates to activity above baseline (inactive lifestyle), but does not meet the recommended 150 minutes per week of physical activity (U.S. Department of Health and Human Services, 2008).
Research Question Two

The second research question was “Are there differences in physical activity for adult Deaf men versus Deaf women?” Results found that men had a mean pedometer step count of 6,548 steps/day and women had a mean step count of 5,044 steps/day. The t-test showed a trend in the difference in steps/day between culturally Deaf men and women (p=.063).

Research Question Three

The third research question was “Is there a relationship between age and average steps/day among Deaf adults?” Variables of age and mean 7-day pedometer step count were used to determine correlation and significance. Pearson’s test concluded that age and step count were inversely correlated (r = -.289) and statistically significant (p = .007). Analysis of genders showed that men had a correlation between age and step count of r = -.333 (p = .047) and women r = -.279 (p = .047).

Research Question Four

The fourth research question was “Is there a relationship between years of education and average steps/day among Deaf adults?” Variables of education level and mean 7-day pedometer step counts were used to determine correlation and significance. Pearson’s test concluded that there was a weak correlation (r = .139, NS) between variables for the total sample. Comparing gender, women had a stronger correlation (r = .164, NS) than men (.016, NS) between education level and pedometer step count (Table 4).
## TABLE 4. Step-Defined Physical Activity Lifestyle

<table>
<thead>
<tr>
<th>Daily Steps/Day</th>
<th>Activity Lifestyle</th>
<th>Meeting MVPA Recommendations</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt;7,500</td>
<td>Physically active</td>
<td>Meets recommendations</td>
</tr>
<tr>
<td>5,000-7,499</td>
<td>Low active</td>
<td>Not meeting recommendations</td>
</tr>
<tr>
<td>&lt;5,000</td>
<td>Sedentary</td>
<td>Physical activity deficiency;</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Not meeting recommendations</td>
</tr>
</tbody>
</table>

*Note. MVPA = moderate to vigorous physical activity*


### Summary and Conclusion

This chapter presented the results of the practice inquiry. The demographics of the sample characteristics indicate that the population had diversity in gender, age, and education level. Results showed that culturally Deaf men and women did not meet the recommendations for physical activity. Differences in physical activity between men and women showed that women were less active and bordered on being classified as having an inactive lifestyle (<5,000 steps/day). There were no significant difference between gender and physical activity. Results from the correlations to specific variables found that age was significantly and inversely related to physical activity in the total sample and in men and women individually. Results indicate that as age increases physical activity decreases. Correlations between the variables of education level and physical activity found weak correlations that were not significant in the total sample and in men and women individually. Although, not significant, results indicate that men had a stronger correlation than women with education level and physical activity.
CHAPTER 5: DISCUSSION AND PRESENTATION OF EVIDENCE-BASED PLAN TO INCREASE PHYSICAL ACTIVITY

The purpose of this practice inquiry (PI) was to develop an evidence based plan for promoting physical activity among Deaf adults in a primary care setting. The aims of this PI were to 1) review research about the relationship between physical activity and health 2) review research about use of pedometers to motivate increased walking and 3) describe baseline physical activity among Deaf adults using pedometer step counts based on a secondary analysis of an existing data set. Pedometer step counts were compared to the 2008 Physical Activity Guidelines for Americans to determine if recommended levels of activity were met. The following sections include comparisons of the results to prior research, an evidence-based plan to increase physical activity, strengths and limitations of the study, and a comprehensive summary and conclusion.

Comparisons of Results to Prior Research

Results from this practice inquiry found similarities with prior research on physical activity using pedometer step counts along with comparisons of age and physical activity. Research conducted by Ecclestone, Jones, Myers, Paterson, and Tudor-Locke (2002) found that average 9-day pedometer step counts totaled 6,559 steps/day with an mean age of 69 years. This could be classified as having a low active lifestyle which was indicated in the current practice inquiry (Tudor-Locke, Craig, Thyfault, Spence, 2012). Compared to the current results, similarities were found in men with a mean daily step count of 6,548 per day and the total sample step count having a difference of 892 steps per day. Research conducted by Bennett, Wolin, Puleo, and Emmons (2006) also found similarities in average step counts, age, and education level in multiethnic low-income populations. Results from the sample included a mean
age of 60 years, an average of a high school education, and an average daily step count of 5,326 steps/day. These findings were similar to the current practice inquiry having a difference of 341 steps/day when compared to the total sample. Additional similarities included women having lower step counts than men and lower steps counts with increasing age (Bennett, Wolin, Puleo, and Emmons, 2006). Using pedometer step counts, Jones (n.d.) conducted research to validate an adapted 7-day physical activity calendar with Deaf adults. Strong similarities in pedometer step counts in culturally Deaf men and women were found with comparison to this PI. Findings indicated a mean step count of 5,638 steps/day in both men and women with men averaging 5,813 steps/day and women 5,463 steps/day (Jones, n.d.). Compared to results from the current practice inquiry, average daily pedometer step counts differed by only 29 steps on average per day. In addition, no significant differences in physical activity were found between men and women (Jones, n.d.). In a study conducted by Harris et al. (2009), results included men having higher step counts than women and as age increased daily pedometer step count decreased supporting the conclusions found in this practice inquiry.

Differences in results were found in research conducted by Giles-Corti and Donovan (2002) who found a positive correlation between physical activity and education level. One possible explanation for the differences could be from the use of surveys as the method for data collection. In comparison to the aforementioned research studies, it is clear that results have many similarities in average pedometer step counts and correlations between age and education level. This suggests a crucial need for continued research on physical activity to create programs for increasing activity levels in the Deaf population. In the Deaf population, pedometer use can be strong adjuncts in creating tailored interventions that are culturally appropriate to not only evaluate, but also to increase physical activity supporting better health and well-being.
**Strengths and Limitations**

Several strengths of the study include 1) diversity in the sample population including men and women, educational status, and age, 2) a fairly large sample size (n=87), recruiting from both Tucson and Phoenix areas, and 3) accuracy of data from detailed instructions on the use of pedometers that was given in ASL. These strengths helped to obtain a well-rounded perspective on physical activity in the culturally Deaf community. Expanding recruitment to both Tucson and Phoenix increased recruitment numbers yielding better generalized results of the Deaf community. Another major strength of the practice inquiry was the fact that it was one of few research projects that focus on physical activity in the Deaf community. As evidenced by the review of literature, the Deaf community is a minority population that is at risk for health disparities due to the plethora of barriers including communication barriers, health literacy levels, and lack of health related knowledge. Producing results to identify these risks will help increase awareness and attract future research interventions to intervene. In terms of physical activity, new interventions can be developed and implemented in the Deaf community to help break through barriers and promote better health.

Limitations of the study include 1) using a short data collection period, 2) errors in self-reported pedometer records, and 3) having a demographic of primarily Caucasian participants. Expanding the duration of pedometer data collection could help ensure the accuracy of average pedometer step counts. Although, the umbrella study used several data collection times, only baseline data were used in the practice inquiry because additional data collection points were influenced by the original Signs of Health Intervention. Using all data points of the umbrella study could skew results from influencing increased physical activity from the Signs of Health Intervention. The use of self-recorded pedometer data records introduces the possibility of errors
in recording. To reduce errors in self-reporting, pedometer instructions were given in ASL, in-person demonstrations were provided, and the pedometers used had the capability to store seven days of step counts using a self-resetting feature on the Omron HJ-150 hip pedometer. Finally, the sample consisted mostly of Caucasian participants who neglect to examine physical activity to other groups including Mexican-Americans, African-Americans, and Asians.

**Evidence-Based Plan to Increase Physical Activity in the Primary Care Setting**

The proposed evidence-based plan (EBP) for promoting physical activity among Deaf adults in a primary care setting stems from the review of literature on health benefits of physical activity, use of pedometers to motivate increased walking, and the results of the secondary analysis. The social cognitive theory (SCT) provides a theoretical framework that has been recommended by the Surgeon General as useful for promoting physical activity (Anderson, Wojcik, Winett, Williams, 2006). The SCT posits that personal (self-efficacy & self-regulation), environmental (social influence), and behavioral (health education & reinforcement) factors are influential in determining behavior and behavior change (Anderson, Wojcik, Winett, Williams). Numerous studies have shown that SCT based interventions have been effective at increasing physical activity in the community setting (Anderson, Wojcik, Winett, Williams, 2006) (Merom et al., 2007). Employing a theory driven EBP in the primary care setting will help standardize care and allow for proper assessment, reinforcement, and maintenance toward increased physical activity in Deaf adults.

Overwhelming evidence clearly defines the benefits of increased physical activity including reduced risks of cardiovascular disease, obesity, metabolic disease, and stress reduction (American Heart Association, 2013). To be most effective, promotion of the recommended physical activity guidelines must use accurate educational materials and taught in
a manner conducive to individual learning styles. In the culturally Deaf population, research suggests that primary care providers have a major influence on behaviors as long as they are regularly reinforced (Tamaskar et al., 2000). Results from the practice inquiry suggest that culturally Deaf men and women are not meeting the guidelines for recommended physical activity. From the total sample, the average pedometer step count was 5,667 steps/day. Compared to the active lifestyle classification (>7,500 steps/day) that equates to meeting the 2008 Physical Activity Guidelines for Americans (Tudor-Locke, Craig, Thyfault, Spence, 2012) this is more than 1,800 steps short. The use of pedometers in the primary care setting could produce outcomes to help reduce the risk of CVD, obesity, and diabetes by increasing physical activity.

Pedometers are a cost-effective and simple tool that has shown to be effective at increasing physical activity. Research suggests that pedometers aid in increasing physical activity by acting as an environmental cue to exercise, through setting daily goals of steps/day, and acting as a tool to track daily activity (Bravata et al., 2007)(Baker & Mutrie, 2005) (Tudor-Locke, 2002). In Deaf adults, pedometer use provides an option to increase physical activity that would bypass barriers associated with communication and limited literacy to increase motivation and participation in the program (McKee et al., 2011). In the primary care setting, incorporating a theory based protocol using pedometers could standardize the promotion of physical activity. Under the American with Disabilities Act, Title 3, Public Accommodation, it is required that professional interpreters are provided at each primary care visit to ensure accuracy of health education and explanation of health promotion (National Association of the Deaf, 2013). Providing interpreters at every primary care visit will ensure health education is properly understood and has shown to increase compliance in utilization of health care resources in Deaf
adults (Tamaskar et al., 2000) (McKee et al., 2011). The following sections outline a three-step visit plan to assess, implement, reinforce, and maintain a program to increase physical activity in Deaf adults in the primary care setting.

**Visit One**

During the initial visit, the provider performs a detailed risk assessment and review of findings, discussion with the patient on the benefits of walking (physical activity), and education on the proper use of pedometers including instructions on use with demonstration. To reinforce pedometer instructions, take-home DVD with instructions in ASL should be provided to the patient. The risk assessment primarily includes inquiring about past medical history (PMH) and social history (SH). A thorough PMH will help identify barriers such as past injuries or comorbidities that might influence the ability to participate in walking and how to best accommodate for them. The social history provides insight on current physical activity levels. This includes the number of sessions the patient engages in physical activity for at least 30 minutes during the week. After obtaining and reviewing the risk assessment discussion can then be initiated to discuss individual risk for poor health and the health benefits of walking. Education on the risks of inactivity and benefits of walking are crucial for the behavioral factor of the SCT. Health education provides the individual with the correct knowledge and motivation for making behavior changes. In turn, this knowledge can also improve self-efficacy giving the individual more confidence in changing personal behavior. Finally, the patient is educated on pedometers use and provided demonstration on using them. Discharge instructions for the patient includes recording seven days of physical activity using the pedometer and returning for a follow-up visit to set walking goals and discuss support group participation.
Visit Two

During the second visit the 7-pedometer log would be reviewed and used to interpret the patient’s activity lifestyle along with implementing a walking journal and encouraging participation in walking support groups. Interpreting lifestyle includes taking the average 7-day step count and classifying it into 1) sedentary lifestyle (<5,000 steps/day), 2) low active lifestyle (5,000-7,499 steps/day), 3) physically active lifestyle (>7,500 steps/day) (Tudor-Locke, Craig, Thyfault, Spence, 2012). Compared to the 2008 Physical Activity Guidelines for Americans, a step count less than 7,500 steps per day (physically active lifestyle) does not meet the recommended daily 30 minutes of physical activity. To increase daily step counts, implementing a pedometer step count journal addresses self-regulation which has proven to be effective in increasing physical activity (Bravata et al., 2007) (Anderson, Wojcik, Winett, Williams, 2006). Journals could also be used to self-regulate goal achievement such as increasing weekly step counts in increments of 1,000 steps per week, increasing number of days engaging in walking, or increasing the time engaging in physical activity. Environmental factors are essential to adherence of physical activity (Anderson, Wojcik, Winett, Williams). Encouraging the patient to participate in a weekly walking support group provides social support through modeling by friends and family, support from walking partners, and feedback from group leaders. In addition to addressing the environment factor, support groups strengthen self-efficacy by sharpening skills needed for continuing to be physically active. To be most effective, the groups would all be Deaf adults and taught in ASL. Discussion topics could include reinforcement of benefits of walking, promotion of healthful living, simple anatomy/physiology, and correction of any misperceptions about physical activity. The groups would also engage in 30 minutes of walking before or after the group session. Discharge instructions include reviewing and working toward
achieving personal goals, tracking daily steps counts in a pedometer journal, participating in weekly support groups, and returning for a follow-up visit in three months.

**Visit Three**

During the third visit, the provider performs another risk assessment using the PMH, SH, and FH. Emphasis should be on physical activity including number of times engaged in walking for at least 30 minutes a session. In addition, pedometer journals, participation in walking support groups, and determining if personal goals were met should be reviewed. Individual goals can then be re-evaluated to increase physical activity, maintain physical activity, or increase walking support group participation. Reinforcement of health education, benefits of walking, and using pedometers and journal to motivate continued walking should also be performed. If the desired levels of physical activity are being met (>7,500 steps/day) the patient should be instructed to continue to track daily steps and participate in support groups. Re-evaluation of physical activity would then be performed during annual physical examinations. If walking steps are <7,500 steps/day the provider can schedule a follow-up appointment after six months for goal re-evaluation of goals and health information reinforcement. Once the patient achieves a physically active lifestyle, follow-up visits for re-evaluation should be performed annually.

**Summary and Conclusion**

The culturally Deaf population is a unique linguistic minority group with a rich history and strong sense of pride. Research suggests that the Deaf population is at risk for health disparities stemming not only from an array of barriers, but physical inactivity. Physical activity has shown to significantly decrease adverse health risks including cardiovascular disease, obesity, and diabetes. Despite this knowledge, few research studies have focused on physical activity in the Deaf population along with tailored interventions to increase it. Using pedometer
step count data, this practice inquiry suggests that levels of physical activity do not meet the recommended guidelines in the Deaf community. In addition, results indicate that daily step counts decline with increasing age. As more research is needed to promote better health in the Deaf community, these results may add important insight to the curable problem of physical inactivity. The primary care setting is one area where pedometers could encourage increased physical activity along with continual reinforcement. The primary care setting offers the opportunity for follow-up visits for continuous education and promotion of physical activity. In the primary care setting, a tailored evidence based program to increase physical activity in Deaf adults may be an effective method to not only increase physical activity but promote healthful lifestyles and achieve better health.
APPENDIX A: PEDOMETER PROTOCOL
PILOT TESTING THE SIGNS OF HEALTH INTERVENTION (SoHI): INSTRUCTIONS FOR USING Pedometer
(Repeated/demonstrated on Take-Home DVD in ASL)

Pedometer Protocol:

Initial Pedometer Set-up
1. Open pedometer package and remove sticker on front display.
2. Using a thin stick (i.e. tip of mechanical pencil WITHOUT lead exposed) press reset button on the back of pedometer (reset button is in lower left of pedometer and has an arrow pointing to it).
   a. Hours on front display will begin flashing.
      i. Set hours by pressing “memo” button on top of pedometer and press set button on back of pedometer using thin stick.
   b. Minutes on font display will begin flashing.
      i. Set minutes by pressing “memo” button on top of pedometer and press set button on back of pedometer with thin stick.

Day
1. Press “memo” button to make sure battery is working.
   a. Steps should read zero.
2. Clip pedometer horizontally in same area of waist daily.
   a. Best choice: clip pedometer halfway between belly button and hip.
   b. Alternative choice: clip pedometer halfway between hip and backbone.
3. Begin daily activities.

Night
1. Remove from waist.
2. Record steps taken on data sheet.
   a. Once activated (initial pedometer set-up), pedometer will automatically reset at 12:00 am (midnight).
   b. If daily activities proceed past 12:00 am (midnight) press “memo” button and record steps from “1 day before.”
   c. Store in place where you will not forget to put it on the next day (i.e., next to wallet, car keys).
3. Record number of steps each night for seven consecutive days on pedometer log.
4. Mail pedometer log in provided pre-stamped/addressed envelope.

Correcting Mistakes
1. Put pedometer on as soon as possible each morning.
2. Make sure pedometer is attached horizontally on waist.
3. Keep the pedometer on throughout the day, removing it only when showering, swimming, or doing other activities that could submerge it under water.
4. Do not fidget with pedometer throughout the day.
APPENDIX B: UNIVERSITY OF ARIZONA IRB APPROVAL LETTER
Investigator: Elaine Jones, PhD  
Project No./Title: 10-0755-02 Pilot Testing the Signs of Health Intervention (SoHi)  
Expiration Date: October 25th, 2013  
Submit the “FORM: Continuing Review Progress Report” no later than 45 days prior to the expiration date.

IRB Committee Information  
IRB2 – IR500001751  
FWA Number: FWA00004218  
Expedited Review – Continuing Review

Documents Reviewed Concurrently  
F212 (signed 2012-08-28)

Determination  
Approved as submitted effective as of the signature date below

Comments  
- Continuing Review Category Status: The research remains active only for long-term follow-up of subjects

Regulatory Determination(s)  
- Criteria for Approval has been met (45 CFR 46.111): The criteria for approval listed in 45 CFR §46.111 have been met (or if previously met, have not changed)
- Eligible for Expedite Approval (45 CFR §46.110): Identification of the subjects or their responses (or the remaining procedures involving identification of subjects or their responses) will NOT reasonably place them at risk of criminal or civil liability or be damaging to the their financial standing, employability, insurability, reputation, or be stigmatizing, unless reasonable and appropriate protections will be implemented so that risks related to invasion of privacy and breach of confidentiality are no greater than minimal.
- Expedite Approval (45 CFR 46.110 Category 2): Collection of blood samples by finger stick, heel stick, ear stick, or venipuncture as follows: (a) from healthy, nonpregnant adults who weigh at least 110 pounds. For these subjects, the amounts drawn may not exceed 550 ml in an 8 week period and collection may not occur more frequently than 2 times per week; or (b) from other adults and children, considering the age, weight, and health of the subjects, the collection procedure, the amount of blood to be collected, and the frequency with which it will be collected. For these subjects, the amount drawn may not exceed the lesser of 50 ml or 3 ml per kg in an 8 week period and collection may not occur more frequently than 2 times per week.
- Expedite Approval (45 CFR 46.110 Category 4): Collection of data through noninvasive procedures (not involving general anesthesia or sedation) routinely employed in clinical practice, excluding procedures involving x-rays or microwaves. Where medical devices are employed, they must be cleared/approved for marketing.
- Expedite Approval (45 CFR 46.110 Category 7): Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

Reminder: No changes to a project may be made prior to IRB approval except to eliminate apparent immediate hazard to subjects.

Arizona’s First University – Since 1885
No changes to a project may be made prior to IRB approval except to eliminate apparent immediate hazard to subjects.
REFERENCES


Giles-Corti, B., & Donovan, R. (2002). The relative influence of individual, social and physical environment determinants of physical activity. Social Science and Medicine, 54, 1793-1812.


