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Using Calcaneal Heel Ultrasounds to Screen for Osteoporosis at Alaska Health Fairs

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This is to certify that the doctoral study by

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has been found to be complete and satisfactory in all respects,
and that any and all revisions required by
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Walden University
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Abstract

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by

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Project Submitted in Partial Fulfillment

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Doctor of Nursing Practice

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Abstract

Osteoporosis is a major health problem. The Alaska Department of Health and Social Services reports national rates of osteoporosis at 13-18% of women and 3-6% of men over age 50, but current evidence suggests that osteoporosis rates in Alaska are more equal between sexes. Known risk factors for osteoporosis that are very common among Alaskans include arthritis and low vitamin D and calcium levels. The U.S. Preventive Services Task Force (USPSTF) recommends dual-energy x-ray absorptiometry (DXA) scans of the hip and lumbar spine as the gold standard of screening for osteoporosis; however, DXA scans are expensive, not portable, and not practical for screening small populations. Calcaneal heel ultrasound (CHU) scans are a USPSTF-recognized alternative to the DXA scan and can reach these small populations. Guided by the PRECEDE-PROCEED model, this project sought to evaluate the effectiveness of offering CHU scans at health fairs in Alaska. The de-identified data from the CHU dataset (N = 494) were analyzed to determine any differences in bone health based on sex and age. Alaskans over 50 years of age were significantly more likely to have osteopenia or osteoporosis (X^2 = 28.2, df =4) than those $\leq$ 50 years old. No significant difference in bone health as determined by T-scores was noted between men and women, suggesting that Alaskan men should also be screened. Educational materials on bone health were readily available at the health fairs for anyone interested. Health fair attendees are routinely asked for feedback and their responses related to the CHU scan were summarized and were unanimously positive. This project contributes to positive social change by increasing awareness of osteoporosis in Alaskans.

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Dedication

I would like to dedicate this project to my parents. They both always supported me and made me feel that I could accomplish anything I set my mind to. While I know I never told them enough how much they meant to me, I also know they would both be very proud. Thank you, Mom and Dad!

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Section 1: Nature of the Project

Introduction

The Centers for Disease Control and Prevention (CDC) reports that 24.5% of women and 5.1% of men age 65 years old and older have osteoporosis nationwide (CDC, 2016). Looking for younger trends, the Alaska Department of Health and Social Services (2002) reported national rates of osteoporosis at 13-18% for women and 3-6% for men over age 50. The risk factors for osteoporosis are several: female gender, being post-menopausal, weighing less than 127 pounds, increasing age over age 50, family history of osteoporosis, White, Mexican-American or Asian ancestry, diseases such as rheumatoid arthritis or type I diabetes, lack of exercise, long-term use of certain medications (e.g., glucocorticoids, antacids with aluminum and gonadotropin-releasing hormone), smoking, excessive alcohol intake, and a diet low in dairy and other sources of calcium and vitamin D (Women's Health.gov, 2017). Individuals with arthritis, defined as any disease that can cause joint pain, swelling and decreased motion, are also at risk for osteoporosis since the pain from arthritis can cause a decrease in activity which may lead to osteoporosis (Lucas, 2002).

There are differences in the presentation of arthritis and osteoporosis in Alaska. The incidence of arthritis in Alaska i**s** essentially equal between men and women, at 50.6% for women and 49.4% for men, while the national incidence rates are 61.5% for women and 38.5% for men (Lucas, 2002). The proportion of Alaskans age 65 years and older is also rapidly increasing. From 1980 to 2000 there was a 209% increase of Alaskans 65 years of age or older (Lucas, 2002). The U.S. Preventive Services Task

Force (USPSTF, 2015) recommends women age 65 years and older, and younger women at the same risk for fracture as a healthy 65-year-old White female, be screened for osteoporosis. The Alaskan data cited earlier in this paragraph would suggest that men who are age 65 years and older or who have the same fracture risk as a healthy 65-year-old female should also be screened.

Dual-energy x-ray absorptiometry (DXA) scans of the hip and lumbar spine are the gold standard of screening for osteoporosis; however, DXA scans are expensive and not portable, and thus are not practical for screening small, remote populations (USPSTF, 2015). As an alternative, calcaneal heel ultrasound (CHU) scans have been shown to be a less-expensive, portable, and non-radiation exposure technology that could be used to reach these populations (USPSTF, 2015). The USPSTF (2015) recognizes the CHU as an alternative to the DXA scan.

Alaska Health Fair (AHF) is a nonprofit agency started in 1980 whose mission is to "promote statewide health education and preventative screenings, [a vision of] optimal health for all Alaskans, and [a core purpose to] promote health and wellness and save lives" (AHF, 2016, para. 3). It offers free patient education, health screenings and reduced-cost blood testing throughout the state (AHF, 2016). It was logical for AHF to implement the CHU for osteoporosis screening specifically to reach remote and/or underserved populations that otherwise would not have easy access to a screen.

Problem Statement

In 2016 AHF received a grant that fully covered the purchase of a CHU. After (a) initial testing to become familiar with its proper use, (b) the development of the CHU-use

protocol, and (c) the training of registered nurses to operate the CHU at the AHFs, the CHU was first? used at the Spring AHFs held in the state's interior. De-identified data obtained from the CHU recording system were analyzed to determine if offering both CHU scans and patient education on osteoporosis impacted the identification of osteoporosis and patient knowledge of the disease when compared to the prior absence of CHU scans. The target population consisted entirely of adults, 65 years of age or older, and those who screen by health history and risk factors to be at increased risk for osteoporosis, and who attended a health fair sponsored by AHF.

According to Terry (2015), the Doctor of Nursing Practice (DNP)–prepared nurse translates research into practice, evaluates practice, improves the reliability of healthcare practice and participates in collaborative research (p. 17). This study addressed all four of these goals. First, research generated the USPSTF (2015) recommendation for osteoporosis screening by DXA scans. Second, the AHF program recognized there was a gap in who was able to receive the DXA scan and third, tried to fill this gap by implementing the CHU. The CHU was one tool that could be used to reach these small, remote and/or underserved populations. Finally, the very nature of using volunteers from multiple health care disciplines made this initiative collaborative.

Purpose

The purpose of this project was to determine whether adding CHU scans to health screens offered by AHF increases the recognition of osteoporosis in women and men, age 65 years old and older, as well as those who screen to be at equal risk of osteoporosis. Health education materials on osteoporosis were given to all who screened positive for

osteoporosis and were available to all who attended the AHF. It was hoped the results of the CHU and the distribution of the educational materials would generate discussion on osteoporosis and provide information for developing programs aimed at decreasing the risk of osteoporosis before it develops.

Nature of the Doctoral Project

This quality improvement evaluation project used the Model for Improvement, from the Institute for Healthcare Improvement (2016), to evaluate the outcome of CHU screening procedures as recommended by the USPSTF (2015).

Demographic and feedback data have always been collected at AHFs. Attendees are given anonymous surveys to determine why they attend the health fair, what they liked, and what they would like to see changed and/or added. Basic demographic data, such as sex, age, and ethnicity, are also collected. The health fairs vary in location and size throughout the state. Some are held in remote villages and may only have 20 attendees. Others are held in the Alaskan cities and attract over 500 attendees. Access to health care also varies—from those who might have access to a range of health care, to those with access to a small clinic in a remote Native Alaskan village, to the homeless with minimal access. Since the Veterans Administration's largest facility is in Anchorage, veterans in many other parts of the state choose to use local health fairs for +basic health screenings. Many other Alaskans who have healthcare coverage choose to use the health fairs for screening labs because of the reduced cost.

The methods used in this study included the following: (a) a literature review, (b) a national clinical guidelines review, (c) rating of existing evidence, (d) developing a

policy for the use of the CHU to screen for osteoporosis, (e) education of the multidisciplinary staff and volunteers on the policy and techniques for using the CHU, (f) stakeholder meetings to obtain input and feedback, and (g) stakeholder satisfaction with the DNP student's management of the practice-change initiative.

The doctoral project used the de-identified data provided by the CHU to evaluate the incidence of osteoporosis in the population, to examine differences in osteoporosis in the target population, to examine differences in osteoporosis (risk-factors and actual disease) based on gender and age, and to ensure that educational materials were distributed.

The de-identified data related to the osteoporosis screen was pulled from the CHU itself. It included the result of the scan and basic demographic data. This allowed the comparison of results between males and females and between different age groups and ethnicities in order to confirm whether the rates of osteoporosis were, indeed, different from the national rates.

Significance

Several stakeholders were impacted by this initiative. First and foremost were the attendees who choose to have the CHU scan. They got printout from the scan that explained their results. Did they have a normal bone density screen or were they at risk for osteoporosis? Those with borderline scores and those with low scores were all encouraged to share their results with their health care provider. This project has the potential for making positive social change by raising awareness of osteoporosis and by

improving participants health through education on osteoporosis risk-factors and prevention measures.

Summary

Osteoporosis is a growing concern in the United States. However, evidence suggests that rates of osteoporosis in Alaska are even higher than other regions of the United States. In addition, lack of access to a DXA scan in sparsely populated and remote areas of Alaska made the recommended DXA scan screening difficult to accomplish. The CHU scan offered an opportunity to provide this screen to underserved populations at high risk for osteoporosis in Alaska. In Section 2, I discuss the review of literature and the conceptual framework.

Section 2: Background and Context

Introduction

While evidence suggests that rates of osteoporosis in Alaska are higher than the U.S. country data, lack of screening made this difficult to assess. Lack of access to a DXA scan in sparsely populated and remote areas of Alaska made the actual DXA scan screening, as recommended by the USPSTF, difficult to accomplish. The CHU scan offered an opportunity to provide this screen to underserved populations at high risk for osteoporosis. AHF was able to bring the CHU and educational materials on osteoporosis to health fairs throughout the state. It was hoped this new screen would raise awareness of osteoporosis, its risk factors, and suggest ways to decrease that risk.

Concepts, Models, and Theories

Ezeonwu and Berkowitz (2014) used Green and Kreuter's PRECEDE-PROCEED model (Figure 1) to plan and coordinate a nurse-organized, multi-disciplinary community health fair for underserved populations. The model was used by nurses, nursing students, and nursing faculty to plan, implement, and evaluate the fair (Ezeonwu & Berkowitz, 2014). In Green and Kreuter's PRECEDE–PROCEED model, PRECEDE stands for Predisposing, Reinforcing, and Enabling Constructs in Educational/Ecological Diagnosis and Evaluation; PROCEED stands for Policy, Regulatory, and Organizational Constructs in Educational and Environmental Development (as cited in Ezeonwu & Berkowitz, 2014). There are eight phases to Green and Kreuter's PRECEDE–PROCEED model, four in PRECEDE and four in PROCEED (Ezeonwu & Berkowitz, 2014). The first four phases of the model are social assessment, epidemiological assessment,

educational and ecological assessment, and administrative and policy assessment; the last four phases are implementation, process evaluation, impact evaluation, and outcome evaluation (Ezeonwu & Berkowitz, 2014, p. 120).

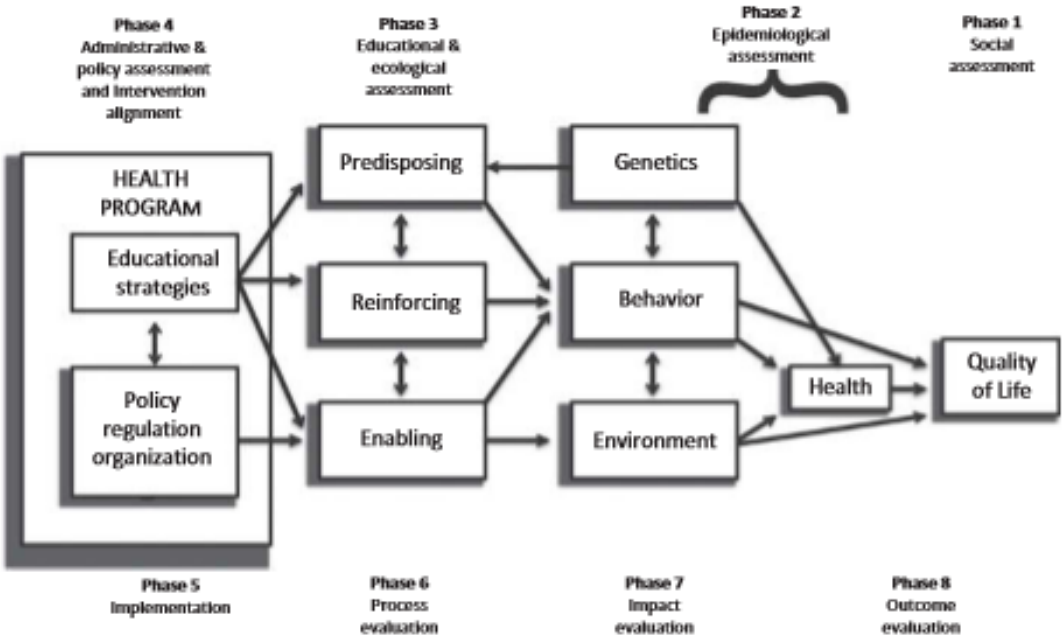

Figure 1. Green & Kreuter's PRECEDE–PROCEED Model (as cited in Ezeonwu & Berkowitz, 2014, p. 120)

The PRECEDE–PROCEED model works well for AHF. An initial Phase 1 social assessment identified a recommendation by USPSTF (2015) for osteoporosis screening. The Phase 2 epidemiological assessment showed a lack of screening in remote areas of Alaska. The Phase 3 educational assessment revealed that a portable CHU could be obtained to provide an initial osteoporosis screen, and a grant was written. In the policy assessment stage (phase 4), the CHU was purchased with grant money and the SOP was established. Phase 5 started when the CHU was implemented at the AHF in the northern part of the state. Process evaluation, Phase 6, began immediately with Phase 5: Nurses

trained to operate the CHU were asked for feedback and the SOP was adjusted based on that feedback. Phase 7, impact evaluation, was conducted with the anonymous, voluntary feedback from those who chose to have the CHU scan. Finally, the Phase 8 outcome evaluation was conducted by analyzing the de-identified data on all 494 participants who had the CHU scan. This model can continue to be used by AHF planners as they continue to develop a list of additional health fair objectives, activities, and responsible parties that were based on the assessed needs of the target population (Ezeonwu & Berkowitz, 2014).

Relevance to Nursing Practice

There are several sources of evidence to support the use of CHU screen for osteoporosis. Pfister, Starcher, and Welch (2003) compared results of the CHU to the DXA scan for osteoporosis screening in women. They calculated a 58% sensitivity and 80% specificity and suggested added screening questions to access for increased osteoporosis risk (Pfister, Starcher, & Welch, 2003). Based on this study, screening questions identifying personal and family risk factors for osteoporosis were added to the CHU protocol. Tan et al. (2008) showed that CHU could be used effectively in a community health fair for immigrant Chinese women in Chinatown, Chicago but that education on osteoporosis risk-factors and prevention techniques were needed in this population. Based on this study, education materials on osteoporosis are given to all who have the CHU.

The lack of vitamin D during the long Alaskan winters and the lack of calcium in the Native Alaskan diet are also thought to contribute to a higher incidence of osteoporosis in Alaskans (Lucas, 2002). Compounding the higher incidence was the

difficulty in being screened for osteoporosis, long distances from health care and lack of health care coverage combine to cause 18% of Alaskans age 18-64 to not having access to primary care and preventive services (Topol, 2012). Several sources acknowledge the uniqueness of providing services to the Alaskan population. The Alaska SNAP-Ed Needs Assessment 2014 (n.d.) reported the number of persons per square mile was 87.4 nationally but only 1.2 in Alaska. Approximately 28% live in areas only accessible by air, boat, or snow machine (Alaska Department of Health and Social Services, 2001), making health care challenging. In addition, while only 0.9% of the U.S. population identifies themselves as American Indian/Alaskan Native, 15.6% of the Alaskan population identifies themselves as American Indian/Alaska Native (Alaska Department of Health and Social Services, 2001). These differences emphasize the need for both screening and education on osteoporosis with a twist that recognized the increased risks to Native Alaskans.

The CHU scan was shown to be an effective screen for osteoporosis. One study showed an 86% specificity at predicting osteoporosis but a sensitivity of only 53%, meaning a CHU scan was better at ruling in osteoporosis than it was to rule it out (Hashmi & Elfandi, 2016). The authors also concluded that additional studies are needed to firmly establish the criteria for diagnosing osteoporosis based on CHU scans (Hashmi & Elfandi, 2016). Looking for an effective method to screen for osteoporosis in remote parts of Australia, Gould, et al. (2012) conducted a study with a CHU to determine baseline data. Results showed a negative relationship between age and CHU results and that the CHU was a useful screen for osteoporosis (Gould, et al., 2012). They did caution,

however, that baselines should be established for different populations to make the results more effective as a screen (Gould, et al, 2012).

Local Background and Context

As stated earlier, the USPSTF (2015) recommends women age 65 years and older, and younger women who are at the same risk for fracture as a healthy 65-year-old White female, be screened for osteoporosis and while the DXA scan is the standard, the USPTF does recognize the CHU scan as an alternative. A search of medical facilities in the northern half of the state, Fairbanks and north, showed a total of three with DXA scans. Given that Alaska's total land area is 665,384 square miles (World population review, 2017), that means three DXA scans spread over approximately 333,000 square miles. The State of Alaska Department of Labor and Workforce Development (2017) lists the 2016 population in this part of the state, the Interior Economic Region and the Northern Economic Region, to be 140, 981. While there are certainly population centers in Fairbanks and Nome, that population scattered over that large land area means there needs to be portable alternatives to providing health care and health care screens.

The portable CHU scan will enable osteoporosis screens to be conducted in remote areas of the state without easy access to a DXA scan. AHF conducts health fairs at 12 remote locations in the northern half of the state (S. Philips, personal communication, September 24, 2017). In addition, health promotion materials on osteoporosis and the impact of diet and exercise were provided. At the very least, bringing the health care information and the screens generates conversation on and awareness of health promotion topics.

Role of the DNP Student

I became involved with AHF about 3 years ago. Part of my role as the Deputy Commander for Nursing at the U.S. Army hospital on Fort Wainwright, AK, just outside of Fairbanks, was to liaison with local health organizations. AHF was always looking for volunteers and many of my young nurses, medics and other health professionals were looking for volunteer opportunities. I attended an American Association of Nurse Practitioner (AANP) conference in 2015 and one of the exhibitors was demonstrating a portable osteoporosis screen by using low dose x-rays of a finger. I took the results back to AHF and we started discussing if this was something we could add to the existing health screenings. After a few months of research, it became clear that the x-ray was not going to work, but the CHU scan was found to be a viable alternative. AHF personnel wrote the grant for the CHU and then purchased the scan once the grant was received. I then took the CHU and the instruction book and developed the SOP and trained the initial nurses to use the CHU at the health fairs. I analyzed the data obtained at the health screenings.

I was stationed at Fort Wainwright, AK three times over my Army career for a total of eleven years. It was obvious to those living there that Alaska is an amazing state, but it has some unique challenges and health care outside of the major areas of Anchorage, Juneau and Fairbanks is one of them. Even in those areas, there is a population of those who cannot afford healthcare. I worked collaboratively with AHF but at no time was I in a supervisory role to any of the stakeholders. When I started volunteering with AHF I was surprised at the number of attendees who would drive

significant distances to attend and at the gratefulness of the attendees. I was looking to contribute something new and worthwhile and the CHU seemed like the perfect addition.

Specifically, for the DNP project I analyzed the de-identified data obtained from the CHU to determine screening rates of osteoporosis in the Alaskan population who choose to attend AHF events and who chose to have the CHU osteoporosis screen. Participation was strictly voluntary. Male and female adults who volunteer will all be screened. Relevant additional feedback data will also be obtained from AHF participant surveys that have been in use for years. This data will give data on what participants thought of the event and gives them a chance to discuss that they liked and what they felt needed to be improved. It gives a chance to comment on the educational materials available. Together, this data will help determine if the CHU was helpful, relevant and provide useful data on osteoporosis in our northern most state.

Summary

The de-identified data obtained from the CHU will provide additional data on osteoporosis in Alaska. It will help to determine if the rates of osteoporosis between men and woman are closer to being equal as suspected. If this is the case than osteoporosis screens should target both men and women and not just women. The data will help to show if osteoporosis screens in Alaska should start at age 65 or does data suggest that screens should start at a younger age. Will just having the CHU scan and the patient education materials on osteoporosis enough to spark conversation and change dietary and exercise habits? Data collection and analysis methods are discussed in the next section.

Section 3: Collection and Analysis of Evidence

Introduction

This DNP project was a quality improvement (QI) project. It followed "four key principles:

- QI works across systems and processes
- QI focuses on patient outcomes
- QI focuses on being the healthcare team
- QI focuses on use of data" (Walden, 2017, p. 2).

This DNP project met all four principles. Bringing the CHU osteoporosis screen to AHF offerings involved working with several health care professionals in a variety of settings. It took a multidisciplinary team to introduce a new health care screen. The project focused on using the de-identified data from the CHU to look at osteoporosis rates and to provide education on osteoporosis to eventually decrease osteoporosis rates.

Practice-Focused Questions(s)

The initial practice-focused question was as follows: In adults 65 years of age or older?, or who were screened and shown to be at increased risk of osteoporosis, or who were interested in a baseline bone density screen, and who attend a health fair sponsored by Alaska Health Fairs, how does offering CHU scans (as recommended as an alternative screen by the USPSTF, 2015) and patient education on osteoporosis impact the identification of osteoporosis and patients' knowledge of the disease as measured 6 months post-implementation when compared to the current practice of not offering CHU

scans? The data were also used to see if the osteoporosis rates in men and women in Alaska were, indeed, closer to being equal compared with the national average.

Sources of Evidence

There are several sources of evidence in this project. The first was the de-identified data from the CHU. The CHU records sex, age, town of residence, ethnicity and the T-score for every person who has the CHU scan. It also records the Z-score for every female. According to the National Osteoporosis Foundation (NOF, 2017) the T-score compares the bone density to that of a healthy 30-year old adult and anything of -1.0 or higher is normal. The Z-score compares the bone density of the individual to the bone density of others of their age and sex (NOF, 2017). AHF attendees have also always been given a survey on their thoughts of that particular event (Appendix A), what went well and what could be improved, what health screens and educational offerings did they like and what could be added/removed? That data will also be used to determine thoughts on applicability of this new screen/patient information. All participation at AHF events was strictly voluntary.

Analysis and Synthesis

Basic demographic data were statistically analyzed to compare sex, age, ethnicity, and T-score results. The T-score results were also compared for the different locations to determine whether location influenced the T-score. Data were analyzed with SPSS, version 24, and started with basic *t*-tests and ANOVA data. The Pearson correlation coefficient was also used to show if there was a correlation between the data. The survey

feedback was analyzed for trends in perception of the usefulness and effectiveness of the CHU scan and the patient information material provided.

Summary

There was a definite need to obtain osteoporosis data in the state of Alaska and to provide osteoporosis screening and information to Alaskans. The Alaska Department of Health and Social Services (2002) has "collect baseline data to describe the number of adults hospitalized for hip, vertebral or wrist fractures associated with osteoporosis" (p. 20-2) as one of its goals, indicating that osteoporosis data was lacking. Frequently, it seems, osteoporosis was diagnosed after a fracture has occurred. The goal of this project was to raise awareness of osteoporosis through education and increase access to at least a CHU scan to help increase screening rates. The next section will discuss the results of this project.

Section 4: Findings and Recommendations

Introduction

The CDC (2016) reported that 16% of women and 45% of men, age 50 years and older, have osteoporosis. The USPSTF (2015) recommends that women age 65 years and older—and younger women who are at the same risk for fracture as a healthy 65-year-old White female—be screened for osteoporosis. There was evidence to suggest that osteoporosis presented differently in Alaska, that is, men could have the same risk as women. While actual incidence rates of osteoarthritis in Alaska are unknown, arthritis rates are nearly equal, 50.6% for women versus 49.45% for men, while the national rates were 61.5% for women and 38.5% for men (Lucas, 2002). This was important since arthritis and its resultant lack of activity is a known risk factor for osteoporosis (Lucas, 2002).

While DXA scans are the preferred method of screening for osteoporosis, they are not effective at reaching small, remote populations; CHU, however, is recognized as an alternative screening method for osteoporosis (USPSTF, 2015). After obtaining approval from its board, the AHF obtained a grant and purchased a CHU. In January 2017, the AHF started offering CHU scans for adults who attended their health fair events. Participation was voluntary. Educational materials on osteoporosis obtained from the National Institutes of Health (NIH) were also available for AHF attendees to pick up. The goal was, at the very least, to raise awareness of osteoporosis while obtaining some data on osteoporosis rates in Alaska.

After IRB approval was obtained (IRB Approval No. 11-03-17-0626737), de-identified data on sex, ethnicity, age, town of residence and T-score values were obtained on all those who had a CHU scan with AHF. T-scores compare the participant's bone density to that of a healthy 30-year-old (NOF, 2017). The data were analyzed using SPSS.

Findings and Implications

Incidence of Osteopenia and Osteoporosis

Data on T-score results for males and females is presented in Table 1. The results show no significant difference and support the initial suggestion that rates of osteoporosis in males and females in Alaska are closer to being equal than the nationwide CDC data of 13-18% of women and 3-6% of men 50 years old or older having osteoporosis (2016).

Table 1

T-Score Results

	Mean	Std. Deviation	F	Sig. (2-tailed)
Female	-0.184	1.1378	0.001	0.071
Male	0.056	1.1206		

Demographic Findings

The data were collected on 494 adults with an age range from 18 to 89 years. Basic frequency data are described in Table 2. The next three tables show the results of X^2 tests comparing rates classification of bone health as normal, osteopenia, or osteoporosis versus age group of less than 50 years old, 50 to 64 years old, and 65 years old and older. With the CHU, bone health is considered normal with a T-score greater

than -1, a score between -2.5 to -1 is indicative of osteopenia, and a score less than -2.5 is indicative of osteoporosis.

Table 2

Descriptive Data

Variable		*N*	**%**
Sex	Female	405	82
	Male	89	18
Ethnicity	Caucasian	418	84.6
	Black	16	3.2
	Hispanic	6	1.2
	Asian	25	5.1
	Native Alaskan	17	3.4
	Other	12	2.4
Location	Fairbanks	270	54.7
	North Pole	33	6.7
	Nenana	31	6.3
	Salcha	23	4.7
	Healy	24	4.9
	Tok	41	8.3
	Central	20	4
	Delta	29	5.9
	Two Rivers	23	4.7
Age Range	< 50 y.o.	121	24.5
	50-64 y.o.	210	42.5
	≥ 65 y.o.	162	32.8
	unknown	1	0.2
Foot	Left	116	23.5
	Right	378	76.5

There was a significant difference in both health by age group (X^2 = 28.2, *df* = 4, p <0.00), such that men and women older than 50 years of age were more likely to have osteopenia or osteoporosis than younger Alaskans. Also, there was a significant difference in women's bone health by age group (X^2 = 31.9, *df* = 4, p <0.00); whereby women older than 50 years of age were more likely to have osteopenia and osteoporosis than younger women. These findings support the literature noting a statistically significant difference between age group and bone disease progression.

Table 3 shows the categories of bone health by age group for men and women, table 4 shows the results for women only, and table 5 shows the results for men only. One of the 494 participants did not have an age recorded so their T-score data was not shown.

Table 3

T-score Results by Age Group - Total Results

	Normal (N / %)	Osteopenia (N / %)	Osteoporosis (N / %)	Total (N / %)
< 50 y.o.	115 / 95%	6 / 5%	0 / 0%	121 / 24.5%
50-64 y.o.	169 / 80.5%	40 / 19%	1 / 0.5%	210 / 42.5%
≥ 65 y.o.	115 / 71%	43 / 26.5%	4 / 2.5%	162 / 33%
Total	399 / 81%	89 / 18%	5 / 1%	493 / 100%

Table 4

T-score Results by Age Group - Female Only Results

	Normal (N / %)	Osteopenia (N / %)	Osteoporosis (N / %)	Total (N / %)
< 50 y.o.	104 / 96%	4 / 4%	0 / 0%	108 / 27%
50-64 y.o.	139 / 80%	34 / 19.5%	1 / 0.5%	174 / 43%
≥ 65 y.o.	83 / 68%	35 / 29%	4 / 3%	122 / 30%
Total	326 / 81%	73 / 18%	5 / 1%	404 / 100%

Table 5

T-score Results by Age Group - Male Only Results

	Normal (N / %)	Osteopenia (N / %)	Osteoporosis (N / %)	Total (N / %)
< 50 y.o.	11 / 85%	2 / 15%	0 / 0%	12 / 15%
50-64 y.o.	30 / 83%	6 / 17%	0 / 0%	36 / 40%
≥ 65 y.o.	32 / 80%	8 / 20%	0 / 0%	40 / 45%
Total	73 / 82%	16 / 18%	0 / 0%	89 / 100%

This same significance did not show in Table 5 because no male had a T-score low enough to indicate osteoporosis. However, it was interesting that a much higher percentage of males met the T-score criteria for osteopenia in the < 50-year-old age group than did the females, 15% males compared to only 4% females. Female rates of osteopenia and osteoporosis then continued to climb with age while male rates of osteopenia increased only slightly.

The study also looked at incidence rates of osteoporosis in different ethnic backgrounds. Using the Tukey HSD, the only significant differences were between Black and White (p = .000) and Black and Asian (p = .005) groups. This was not surprising since White and Asian ethnicity are known risk factors for osteoporosis (Women's Health.gov, 2017).

Appendix A shows the evaluation questionnaire used by AHF and completion of this questionnaire was strictly voluntary. The CHU scan was new this year and the questionnaire had not been updated to include it specifically. Therefore, Question 3, "which screening tests did you have done?" did not have bone density screen as an option. Some participants did write in the bone density screen under "other", but that was only a total of 47 of the 494 who chose to have the CHU scan. Twenty-nine participants

listed the bone density screen as their “favorite exhibit” (question 12) and four mentioned it as what they “liked most about the health fair event” (question 13). No one mentioned it as their “least favorite aspect” of the event (question 14). Finally, four participants did comment on the bone density in the general “suggestions or comments” in question 15 to express appreciation of adding this screen to the health fair events and providing information on bone health. This questionnaire served the purpose of raising awareness about bone health in Alaskans attending the Health Fairs.

Recommendations

While men in this study did not meet the T-score standard for osteoporosis, they did meet criteria for osteopenia based on T-scores at an earlier age and at a higher rate. While they might not, then, require the DXA scan they should be aware of the potential for decreasing bone strength. The same is true for women and should apply equally across ethnic backgrounds. Education materials on bone health and providing an opportunity for CHU scans to at least give a baseline screen of bone health are both ways to raise awareness on bone health. There are life style changes that can decrease risk of disease progression if people are made aware.

Strength and Limitations of the Project

A significant strength of this project was the number of participants. Data on 494 individuals significantly strengthens the conclusions drawn from the data analysis. A limitation of the study is the significant difference in data between men and women, only 89 men were screened in comparison to 404 women. Perhaps this is one reason no men

were found to meet the criteria for osteoporosis when such a high percentage, comparatively, met the criteria for osteopenia.

Most of the data was collected from people who resided in the northern half of the state of Alaska. It would be interesting to see if the findings are replicated in the southern half, more temperate, part of the state. While the study did have some Native Alaskans, 17, it would have been preferable to have more participate in the study.

Summary

There were some key points to highlight. First, there was no statistical difference between the T-scores of men and women, indicating men in Alaska should also be screened. In addition, men met criteria for osteopenia at higher rates earlier than women indicating, again, that men should also be screened. A significant strength of this project was the large number of people screened. While it did reach a diverse population of both males and females, reaching a more equally distributed ethnic population would be an improvement. Providing educational materials on bone health was also an important component of this project. Many AHF attendees took the materials or asked questions but did not wait to have the CHU scan; however, distributing the educational materials served to raise awareness of bone health. The next section will discuss the dissemination plan.

Section 5: Dissemination Plan

The results of this project will initially be shared with Alaska Health Fair, Inc., their personnel, volunteers, and their Board. I also plan to create a poster to present at the American Association of Nurse Practitioners national conference which would allow dissemination and encourage conversation with not only a national but an international audience. This is important because the results are widely applicable to an aging population.

Analysis of Self

I have learned much about myself during this journey. During this program I worked at two different practicum sites, worked as an Affiliate faculty for an Associate Degree Nursing program, retired from the military after 23 years as an Army Nurse and just started a new position as a Family Nurse Practitioner as an Army civilian. Through it all, the concepts of communication and team work have always applied. When people listen and work as an integrated team they are much more likely to be successful. When they don't, failure is almost a certainty. This is key to applying evidence-based-practice in health care settings. The team also may include people or disciplines that had never been included before. The more multidisciplinary the team, the better.

There have been challenges in this program, time management was a huge issue. For me, the practicums were a major time challenge. However, I enjoyed the practicums, the people, their missions, and I learned so much about areas of nursing I had never been in before.

My current goal is to learn the process of my new job. I can see already where the skills learned in this program can assist in my new role. Ultimately, I would also like to return to the role of Affiliate Faculty, even if only part time. There is nothing like training a group of new, bright, eager nursing students. They are the future of nursing and health care.

Summary

This doctoral project focused on offering CHU scans for osteoporosis screening at health fair events in the state of Alaska. It recognized that while the USPSTF (2015) guidelines recommend osteoporosis screening by DXA scan for women starting at age 65 years old or younger if they are at increased risk, DXA scans are not always readily accessible. It also did not recognize that rates in Alaska could be closer to equal in females and males, so males should also be screened. The results of the project did find that the T-scores from the CHU scans were not statistically different between males and females. Interestingly, the T-scores for men indicated a higher incidence of osteopenia in the youngest age group, < 50 years old then it did for women. However, women then caught up with osteopenia rates and then progressed to osteoporosis. None of the men in the study had a T-score indicative of osteoporosis. The much smaller amount of men compared to women, 89 compared to 405, may be why no osteoporosis was indicated in men. Part of the project also focused on education on bone health and educational materials were readily available at the events where the CHU scans were offered. Providing opportunity for a bone density screen, providing education on bone health,

starting the conversation on bone health – all of these goals were successfully met in this project.

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Appendix A: Evaluation Questionnaire from AHF

Evaluation Questionnaire

Thank you for your participation. Please take a few moments to let us know how we did so we can improve the health fair experience for you and others. **Please turn this in at Check Out Station.**

1) **Based on your experience today, how likely are you to recommend Alaska Health Fair to a friend? Please use the scale where "10" means "Extremely Likely" and "1" means "Extremely Unlikely."**
Circle one: Extremely Unlikely – 1 2 3 4 5 6 7 8 9 10 – Extremely Likely

2) **Why did you come to the health fair? (mark all that apply)**
- ☐ To learn about health
- ☐ My healthcare provider sent me
- ☐ Screening Test
- ☐ Wandered by/found by accident
- ☐ Receive blood test results directly
- ☐ Sent by employer/worksite health fair
- ☐ Variety of education and services
- ☐ Convenience/accessibility
- ☐ Affordable pricing
- ☐ Second opinion
- ☐ Other:_____

3) **Which screening tests did you have done?**
☐ Blood Pressure ☐ Blood Tests ☐ Vision ☐ Hearing ☐ Height/Weight/BMI/WC
☐ Oral Cancer ☐ Glaucoma ☐ Other: _____

4) **How did you learn about this event? (mark and name all that apply)**
☐ Newspaper, magazine:_____ ☐ TV:_____ ☐ Radio:_____
☐ Website:_____ ☐ Flyer ☐ Postcard/bookmark ☐ Facebook ☐ AHF Newsletter
☐ Notification from Employer ☐ Doctor's referral:_____ ☐ Other:_____

5) **Is this your first AHF health fair?** ☐ YES ☐ NO

6) **Are you satisfied with the way you were treated by screeners & educators?** ☐ YES ☐ NO

7) **If you marked "NO" above, please suggest ways we can improve:**_____

8) **After attending the health fair, did you gain a better understanding of some ways you can have healthier behaviors?** ☐ YES ☐ NO **In what ways are you likely to make lifestyle changes? (mark all that apply)**
☐ Eating healthier ☐ Exercising/physical activity ☐ Managing stress ☐ Stopping/decreasing alcohol use
☐ Quitting smoking, chewing or other tobacco use ☐ Better Hydration ☐ Proper Sleep
☐ Other: _____

9) **If you learn of a health condition through screenings or test results from today, do you plan to follow up with a healthcare provider?** ☐ YES ☐ NO

10) **When did you last see a healthcare provider?**
☐ In the past year ☐ 1-2 years ago ☐ 3-4 years ago ☐ 5 or more years ☐ Never

11) **Do you have an improved quality of life because you attended a health fair?** ☐ YES ☐ NO

12) **What was your most favorite exhibit and why?**_____

13) **What did you like most about this event?**_____

14) **What was your least favorite aspect of this event?**_____

15) **Please make any suggestions or comments about your experience, feel free to continue on the reverse side of this form:** _____

Thank you, we appreciate your feedback.