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The Use of the Expanded Health Belief Model (EHBM) To Evaluate Osteoporosis Attitudes, Knowledge, Beliefs and Self Efficacy of Nez Perce Tribal and Non Nez Perce Tribal Members in Nez Perce County, ID

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THE USE OF THE EXPANDED HEALTH BELIEF MODEL (EHBM) TO EVALUATE OSTEOPOROSIS ATTITUDES, KNOWLEDGE, BELIEFS AND SELF-EFFICACY OF NEZ PERCE TRIBAL AND NON NEZ PERCE TRIBAL MEMBERS IN NEZ PERCE COUNTY, ID

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A Dissertation

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DISSERTATION APPROVAL

THE USE OF THE EXPANDED HEALTH BELIEF MODEL (EHBM) TO EVALUATE OSTEOPOROSIS ATTITUDES, KNOWLEDGE, BELIEFS AND SELF-EFFICACY OF NEZ PERCE TRIBAL AND NON NEZ PERCE TRIBAL MEMBERS IN NEZ PERCE COUNTY, ID

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A Dissertation Submitted in Partial Fulfillment of the Requirements
for the Degree of Doctor of Philosophy
in the field of Education with a concentration in Health Education

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AN ABSTRACT OF THE DISSERTATION OF

VICTOR NOLLEN WHITE, for the Doctor of Philosophy degree in HEALTH EDUCATION, presented On NOVEMBER 14, 2014, at Southern Illinois University Carbondale.

Title: THE USE OF THE EXPANDED HEALTH BELIEF MODEL (EHBM) TO EVALAUTE OSTEOPOROSIS ATTITUDES, KNOWLEDGE, BELIEFS AND SELF-EFFICACY OF NEZ PERCE TRIBAL AND NON NEZ PERCE TRIBAL MEMBERS IN NEZ PERCE COUNTY, IDAHO.

Major Professor: Dr. Dhitinut Ratnapradipa

According to the State of Idaho, the National Osteoporosis Foundation, and the U.S. Department of Health and Human Services, osteoporosis is a public health concern nationally among non-Native American (NNA) and Native American (NA) populations. The purpose of this research project is to obtain written survey data on osteoporosis attitudes, knowledge, beliefs, and self-efficacy among male and female members of the Nez Perce Tribe (Nimiipuu) and non-Tribal members, aged 18 and over via voluntary completion of a written survey questionnaire based on the expanded health belief model (EHBM). The study was conducted in Nez Perce County, ID. The research involved determining whether or not there is a statistically significant difference in osteoporosis attitudes, knowledge, beliefs and self-efficacy among males and females, aged 18 and over Nez Perce Tribal members as compared to Non-Tribal members in Nez Perce County, ID. Non-Nez Perce tribal members are individuals whom are 1) Native Americans who are not members of the Nez Perce Tribe and 2) all Non-Native Americans in the research study.

Exercise self-efficacy and gender seem to be the most significant variables showing evidence against the null hypotheses and in favor of the research hypothesis (Null Hypothesis: H_0: Native American=Non-Native American. Research Hypothesis: H_1: Native American ≠ Non-Native American). Age also shows evidence against the null hypothesis and in favor of the research hypothesis, but not as strongly as exercise and gender. Seriousness of osteoporosis was the most concern to all respondents and female Native Americans perceived the greatest barrier to preventing osteoporosis was being unable to access dietary calcium on a regular basis.

DEDICATION

This research and dissertation is dedicated to Dr. Dhitinut Ratnapradipa, Committee Chairperson and members of the dissertation committee, Dr. Robert Rados, Dr. John Reeve, Dr. Dale O. Ritzel and Dr. Peggy Wilken, to whom I am forever grateful for their patience, kindness and understanding.

I would also like to dedicate this dissertation to all study participants, Dr. Paul Sarvela, Ms. Julia Shrout, Mrs. Deloris McVey, Mr. Robert G. White, Mr. Larry Armstrong, Dr. Steven B. Dowd, Professor Charles Schweighauser, Dr. Bill Warren, Dr. John Munkirs, Dr. Anita Zavodska, Dr. David Hey, Dr. Bill McKinley, Dr. Michael Lineberry, Dr. Michelle D'Arcy-Evans, Matthew Evans, Michael Evans, C. Scott Sheeler, Paul Murrell and Andrea Decker, all good friends and/or former teachers and professors whose support was instrumental in completion of this research and dissertation.

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INTRODUCTION

Background of the Problem

Osteoporosis is a metabolic disease in which bone density decreases, making bones extremely brittle and prone to fracture (Merck, 1997, p.1 and Taber's Cyclopedic Medical Dictionary, 2009, p. 1658). According to the World Health Organization (WHO) "Osteoporosis causes more than 8.9 million fractures annually worldwide, of which more than 4.5 million occur in the Americas and Europe. The lifetime risk for a wrist, hip or vertebral fracture has been estimated to be in the order of 30% to 40% in developed countries. Osteoporosis is not only a major cause of fractures, it also ranks high among diseases that cause people to become bedridden with serious complications" (World Health Organization (WHO), 2004). "In the United States, over 10 million people have osteoporosis, and 18 million more are at risk of developing the disease. Another 34 million Americans are at risk of osteopenia, or low bone mass, which can lead to fractures and other complications" (American Academy of Orthopedic Surgeons, 2009). Osteoporosis has been operationally defined on the basis of bone mineral density (BMD) assessment. According to the WHO criteria, osteoporosis is defined as a BMD that lies 2.5 standard deviations or more below the average value for young healthy women (a T-score of <-2.5 SD) (World Health Organization (WHO, 2004). Increased bone fragility leads to an increased risk of extremity, spine, and rib fractures in men and women (Murphy, Attico, Rhodes, Dodge & DeRoin, 2004, p. 1-2). Common osteoporosis risk factors include family history, being female, being menopausal, being Caucasian or Asian heritage and being under 127 pounds.

Factors that may be precursors to osteoporosis and important facts about osteoporosis are demonstrated in Tables 1 and 2 below:

Table 1

Factors That May Be Precursors to Osteoporosis

Family history of bone disease. Low body weight. Weight loss or more than 1% per year in the elderly. Late onset of sexual development. Unusual cessation of menstrual periods. Anorexia nervosa (often related to marked weight reduction). Athletic amenorrhea syndrome (related to intense physical activity). Patients being treated with drugs that affect bone metabolism (e.g., glucocorticoids). Patients with disease linked to secondary osteoporosis. High levels of serum calcium or alkaline phosphates in otherwise healthy patients. Hyperparathyroidism, hyperthyroidism, or treatment with high doses of thyroid hormone. Height loss or progressive spinal curvature.

Source: U.S. Department of Health and Human Services. (2004). Bone Health and Osteoporosis: A Report of the Surgeon General, p. 190.

Table 2

Facts About Osteoporosis

Over 10 million Americans have osteoporosis. 4 out of 5 of them are women. 18 million Americans are at risk of developing osteoporosis. More than 2 million men have osteoporosis in the United States. Osteoporosis is the cause of over 1.5 million fractures annually in the United States. The direct medical costs of osteoporosis and osteoporosis related fractures are $14 billion annually in the United States. It is estimated that, at age 50, 50% of women and 25% of men will have an osteoporosis related fracture in their lifetime. A women's lifetime risk of hip fracture alone is equal to the combined risk of developing breast, uterine, and ovarian cancer. Approximately 50% of those who suffer a hip fracture never fully recover.

Source: American Academy of Orthopedic Surgeons, (2009), Merck, Inc., (1997). p.3, Murphy, N., Attico, N., Rhodes, C., Dodge, S., & DeRoin, D. (2004). National Indian Women's Health Resource Center: Osteoporosis in American Indian/Alaska Native Women, p. 1, 2014).

Detection of osteoporosis has been available for years via ultrasound (US), x-ray, nuclear medicine, and computed tomography (CT) methods (Bonnick, 1998, p. 1). Standard radiographs were the initial imaging modality used to assess skeletal bone density. According to Bonnick (1998) however, "plain skeletal radiographs have never been useful for quantifying bone density [because] demineralization becomes visually apparent only after 40% or more of the bone density has been lost (p. 1)".

The development of treatment medications such as alendronate and risendronate (National Institutes of Health, 2010), along with the use of estrogen and/or hormone replacement therapy in some cases has made treatment of osteoporosis more effective than ever, yet accurate and timely diagnosis must be made before treatment can be initiated.

Unfortunately, osteoporosis is a progressive disease that is not readily apparent and many individuals do not know that they are susceptible to osteoporosis and hence do not seek diagnosis

or treatment until osteoporosis related fractures occur. Individuals whom should be tested for osteoporosis are demonstrated below in Table 3:

Table 3

Individuals Whom Should Be Tested for Osteoporosis

All women age 65 and older
Low body weight (less than 127 pounds)
Low trauma fractures as an adult
Hyperthyroidism
Hyperparathyroidism
Vitamin D deficiency (osteomalacia)
Rheumatoid arthritis
Medications that cause bone loss (glucocorticoids, etc.)

Source: U.S. Department of Health and Human Services. (2004). Bone Health and Osteoporosis: A Report of the Surgeon General, p. 199, and the National Osteoporosis Foundation (NOF) Guidelines, 2011.

Need for the Study

Increasing osteoporosis incidence, prevalence, and severity in women and men is recognized by clinicians and researchers as a problem that may be under or undiagnosed in certain gender and ethnic groups. For example, Murphy, Attico, Rhodes, Dodge, & DeRoin (2004) indicate in the conclusion section of their article entitled "Osteoporosis in American Indian/Alaska Native Women", "These findings show that osteoporosis among American Indian and Alaska Natives needs further investigation" (p. 7).

According to Bleeker (2001), "more investigations are needed in the incidence of osteoporosis in men among races other than blacks and whites, and "another area of research that needs to be investigated is the occurrence of early symptoms in young men" (p, 43). According

to Smith, Leyva & Baker (2009), “There is not much information about osteoporosis risk in Native Americans that may hinder access to treatment” (p. 1).

According to the Rhode Island Commission on Women (2003), “Current data are limited for Native American and Mexican American populations, therefore making their level of risk unknown. Given the available statistics and the scarcity of osteoporosis-related information on Hispanic and Native American women, more research on ethnic differences related to bone density and treatment is needed” (p. 2). The International Society of Clinical Densitometry (ISCD) (2007) recommends “use of a single normative database (i.e.: not adjusted for ethnicity) to calculate T-scores in non-White as well as White postmenopausal women, and use of a male normative database to calculate T-scores for men” (p. 1). Additionally, it has been recommended by the National Osteoporosis Foundation (NOF) (National Osteoporosis Foundation, 2011) that men and Native Americans get tested for osteoporosis if they show specific risk factors.

Researchers at the Northwest Portland Area Indian Health Board, 527 SW Hall Street, Suite 300, Portland, OR 97201-5296 in one of their behavioral risk factor surveillance system (BRFSS) programs for monitoring health risk behaviors, along with the State of Idaho Osteoarthritis and Bone Disease prevention programs and Idaho Physical Activity and Nutrition (IPAN) program asked for this study to be conducted at Lapwai, ID under the general direction of the Nez Perce Tribal Medical and Executive Director, respectively.

Dr. Valerie Fox, Medical Director of the Nez Perce Tribal Clinic, and an Ojibwe Native American herself, worked for the Indian Health Service (IHS) and was a liaison with the Portland IHS and a member of the Idaho IAN Committee. She asked me to complete this study.

Dr. Fox's request. My interest in Native American Health and my role as a health education doctoral student at SIUC compelled me to complete this research study. Dr. Fox approved the intent and scope of the study after extensive consultation between myself and the Nez Perce Tribe Executive Committee, Medical Advisory Board and Nez Perce Tribal Legal Counsel and the Executive Director of the Nez Perce Tribal Clinic.

Based upon this request, my dissertation research will focus on the use of an Expanded Health Belief Model (EHBM) based survey instrument to determine Nez Perce Tribal members and non-tribal members, male and female, aged 18 and older osteoporosis attitudes, knowledge, beliefs and self-efficacy concerning osteoporosis.

Dearth of Data on Osteoporosis and Native Americans

In spite of the availability of osteoporosis detection and treatment options, there remains minimal data regarding the incidence, prevalence, and severity of osteoporosis among Native Americans. "The Department of Health and Human Services, Office on Women's Health has identified osteoporosis as a priority health topic and the National Indian Women's Health Resources Center has also identified the need to increase knowledge of health care providers in the standards of screening, diagnosis and treatment of osteoporosis" (Murphy, Attico, Rhodes, Dodge & DeRoin, 2004, p. 1).According to the World Health Organization (WHO)(2004) and the Rhode Island Commission on Women (2003), "…osteoporosis [is] the second largest public health problem for women" (p.1). According to Duke University endocrinologist Tom Weber, MD (2004), "two million men in this country have osteoporosis. The risk of hip fracture in men will increase by 300% by 2050, more so than the increase that will occur in women. This sort of information is needed to educate both the medical community and the lay public as to the

importance of identifying and treating men with osteoporosis [and] in some ways it's more serious for men" (Oskin, p.1-2). According to Eric S. Orwoll, MD (1999) "osteoporosis is a devastating disease, especially to older men and women [and] we have studied its causes and treatment in women, but we know little about it in men" (Orwoll, p. 1). According to Bleeker (2001), "The occurrence of osteoporosis in men should be a concern worldwide because by the year 2025, the number of hip fractures occurring in men, will be similar to what they are for women now (1.2 million)" (p. 1).

Purpose of Study

The purpose of this study is to implement an EHBM based written survey to determine if there is a difference in osteoporosis attitudes, knowledge, beliefs and self-efficacy among Nez Perce Tribal members, male and female, age 18 and older as compared to non-Nez Perce Tribal members residing in Nez Perce County, ID. Non-Nez Perce tribal members are individuals whom are 1) Native Americans who are not members of the Nez Perce Tribe and 2) all Non-Native Americans in the research study.

Null Hypothesis

> There is not a difference in osteoporosis knowledge, attitudes, beliefs, and self-efficacy among Nez Perce Tribal members and non-Nez Perce Tribal members, male and female, aged 18 and older residing in Nez Perce County, ID as evidenced by completion of the EHBM based osteoporosis survey instruments.

H_0: Native American = Non-Native American

Research Hypothesis

There is a difference in osteoporosis knowledge, attitudes, beliefs, and self-efficacy among Nez Perce Tribal members and non-Nez Perce Tribal members, male and female, aged 18 and older residing in Nez Perce County, ID as evidenced by completion of the EHBM based osteoporosis survey instruments.

$H_{1:}$ Native American ≠ Non-Native American

Research Questions

This study sought to answer the following research questions:

1. What do Nez Perce Tribal members and non-Nez Perce Tribal members know about osteoporosis?
2. Is there a statistically significant difference in osteoporosis knowledge, attitudes, beliefs and self-efficacy among Nez Perce Tribal members and non Nez Perce Tribal members, male and female, aged 18 and over residing in Nez Perce County, ID as evidenced by completion of an EHBM based osteoporosis survey instrument?
3. Does ethnicity have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?
4. Does gender have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?
5. Does age have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self- efficacy regarding osteoporosis?
6. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between nutrition and osteoporosis?

7. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between exercise and osteoporosis?

Independent and Dependent Variables

Age (18 and over), gender (male/female) and race (Nez Perce Tribal member/Non-Nez Perce Tribal member) are the independent variables, and osteoporosis knowledge, attitudes, beliefs and self-efficacy are the dependent variables in this research study.

Nez Perce Tribe and Study Setting

The Nez Perce Tribal homelands are currently based in Lapwai and Kamiah, ID respectively, but historically Nez Perce lands stretched from "…Southeastern Washington, Northeastern Oregon with usual and accustomed areas in Western Montana and Wyoming. The Nimiipuu aboriginal territory was approximately 17 million acres or approximately 70 thousand square kilometers or 27 thousand square miles; including the Clearwater River Basin, the South and Middle Forks of the Salmon River Basin and their tributaries"(Accessed on 01/30/2011 from www.nezperce.org/history/nimiipuu.htm.)

The French term nayz piers or nays piers (those with pierced noses), or the English translation, Nez Perce, was used to describe the Nimiipuu by a French interpreter for Lewis and Clark during their 1804-1806 cross country western expedition. This name stuck even though the cultural practice of nose piercing was not routinely practiced by the Nimiipuu (Accessed on January 28, 2011 from http://www.mnsu.edu/emusuem/cultural/northamerica/nez_perce.html). Nimiipuu is the Native American word that members of the Nez Perce Tribe used to describe themselves.

Loosely translated, it means “real people” or “we the people” (Accessed on 01/30/2011 from, www.nezperce.org/history/nimiipuu.htm).

The Nimiipuu were hunters and gatherers and primarily lived in “…tule mat covered, double lean to long houses” (Accessed on 01/28/2011 from www.nezperce.org/history/nimiipuu.htm). Nimiipuu primarily subsisted on game, Salmon, roots, berries and a root called khouse. The food eaten changes with the seasons and the Nimiipuu moved through various parts of their territory with each changing season in order to maximize food security for the tribe. “The basic roots gathered for winter storage included camas bulb (kehmmes), bitterroot (thlee-than), khouse (qawas), wild carrots (tsaweetkh), wild potato (keh-keet), and other root crops” (Accessed on 01/30/2011 from www.nezperce.org/history/nimiipuu.htmp).

“Large game animals that were hunted include deer, elk, moose, bear (black, brown, and grizzly), mountain sheep and goats” [and] “today, deer, elk, and salmon are still important foods for the Nimiipuu, but they are no longer our only foods. We also frequent restaurants and eat modern foods (TV dinners, microwave dishes, canned foods…)” (Accessed on 01/30/2011 from

www.nezperce.org/history/nimiipuu.htmp).

The diet of the Nimiipuu changed after European conquest and particularly at the end of the Nez Perce War on October 5, 1877, when Chief Joseph, leader of the Nez Perce, surrendered to U.S. Calvary forces and vowed …” I will fight no more forever” (Accessed on 01/30/2011 from www.nezperce.org/history/nimiipuu.htmp).

As the diet of the Nimiipuu changed and became more westernized over the years, and as exercise activities diminished with a lack of travel over their territorial lands, many Nez Perce Tribal members adopted modern conveniences and a sedentary lifestyle. Lack of exercise and adoption of a non-Native, nutrient poor, calorie rich diet has led to increased obesity, diabetes, and cardiovascular disease among many Native Americans including some members of the Nez Perce Tribe.

This change in diet and diminished exercise capacity may have a negative impact on bone density in members of the Nez Perce Tribe. It is possible that there may be diminished bone density in some members of the Nez Perce Tribe, thereby increasing the incidence, prevalence and severity of osteoporosis in this Native American group.

Socioeconomic Status of the Nez Perce Tribe

Members of the Nez Perce Tribe have a sovereign form of tribal government, but their socioeconomic status is one of relative poverty and dependency on the United States government, particularly the Bureau of Land Management (BLM), the Department of the Interior, and Indian Health Services (HIS). Lapwai and Kamiah, ID, respectively, are both small towns that are relatively isolated within the Northern to Mid-Idaho region. Socioeconomic depression of members of the Nez Perce Tribe involves restricted access to public transportation, and an inability for most tribal members to own a car. There is bus transportation for members of the tribe to the Nez Perce Tribal casino nearby and to Lewiston, ID and Clarkston, WA, 12 and 15 miles away, respectively, for shopping and healthcare services, but the hours of operation are limited.

Members of the tribe have tribal health care services paid for by the Indian Health Service (IHS) regional office in Portland, OR, but such services are only paid for if treatment is given at a designated Native American clinic. Osteoporosis testing is not paid by IHS unless a physician, nurse practitioner, or physician assistant employed by the clinic orders it and can justify the order, which occurs only if the individual is already diagnosed with osteoporosis and is also a female 60 years of age (YOA) or older. Other osteoporosis screening services would have to be paid out of pocket or via other means.

Significance to Health Education

"Simonds (1976) defined health education as aimed at "bringing about behavioral changes in individuals, groups, and larger populations from behaviors that are presumed to be detrimental to health, to behaviors that are conducive to present and future health "(Glanz, 1997, p. 7). "In 1980 Green defined health education as "any combination of learning experiences designed to facilitate voluntary adaptations of behavior conducive to health" (Glanz, 1997, p. 7). "Health education includes not only instructional activities and other strategies to change individual health behavior but also organizational efforts, policy directives, economic supports, environmental activities, and community-level programs" designed to enhance health status (Glanz, 1997, p. 8).

An important, if not seminal behavior model in health education is the health belief model (HBM). The HBM was developed by U.S. Public Health Psychologists Victor Strecher, Irwin Rosenstock and Godfrey Hochbaum in the 1950's. The theory was developed as a result of expectancy theory and concerns about the limited success of public health tuberculosis (TB) x-ray screening programs (Glanz, 1997, p. 42-43). "Beginning in 1952, Hochbaum studied

probability samples of more than 1,200 adults in three cities that had conducted recent TB screening programs in mobile X-ray units" (Glanz, 1997, p. 43). "He assessed these individual's readiness to obtain x-rays [and]…whether respondents believed that X-rays could detect tuberculosis prior to the appearance of symptoms and whether they believed that early detection and treatment would improve their prognosis" (Glanz, 1997, p. 43). Themes of the health belief model include an individuals or groups perceived susceptibility to a certain illness, or condition, the perceived seriousness of the illness or condition, socioeconomic and knowledge factors, (i.e.: awareness of the disease, having medical insurance in order to pay for diagnosis and treatment of to diagnose, etc.), the perceived threat of being diagnosed with the illness or condition, benefits and barriers to action to get diagnosed and treated for the illness or condition, and cues to action (i.e.; family support, physician access, treatment options, etc.). Further research led to model refinements, with all components of the complete model listed in Fig. 1.

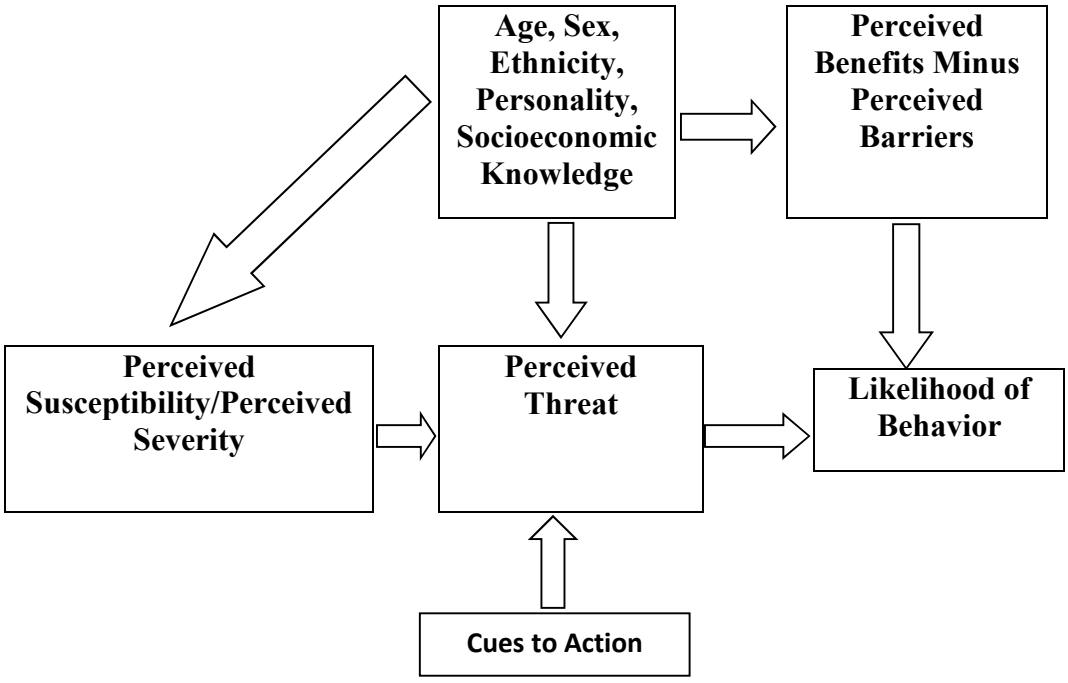


Fig 1. Health Belief Model (Glanz, K., Rimer, B.K., Lewis, F.M. & Wallace, L.S. (2002).

"For over four decades, the HBM has been one of the most widely used conceptual frameworks in health behavior" (Glanz, 1997, p. 41). "In 1974, Health Education Monographs devoted an entire issue to the HBM and personal health behavior (Becker, 1974, p. 1-8). That issue summarized findings from research on the HBM to understand why individuals did or did not engage in a wide variety of health-related actions, and it provided considerable support for the model in explaining behavior pertinent to prevention and behavior in response to symptoms or to a diagnosed disease" (Glanz, 1997, p. 48). "Summary results provide substantial empirical support for the HBM, with finding from prospective studies at least as favorable as those obtained from retrospective research "(Glanz, 1997, p. 49).

"Bandura's inclusion of the concept of self-efficacy in the HBM in 1977 led to what is known as the Expanded Health Belief Model (EHBM)" (Wallace, 2002, p. 164). Research by Horan, Gendler, Kim, Froman, and Patel at Grand Valley State University in Allendale, MI from 1991-2010 has demonstrated the value and utility of using the EHBM for osteoporosis inquiry and research. Based upon the research of Horan, Gendler, Kim, Froman and Patel, I believe that the EHBM is an appropriate and useful model for determining male and female, aged 18 and over, Nez Perce Tribal and non-tribal member voluntary participant's attitudes, knowledge, beliefs, and self-efficacy regarding osteoporosis. The Expanded Health Belief Model (EHBM) is shown in Fig 2 below:

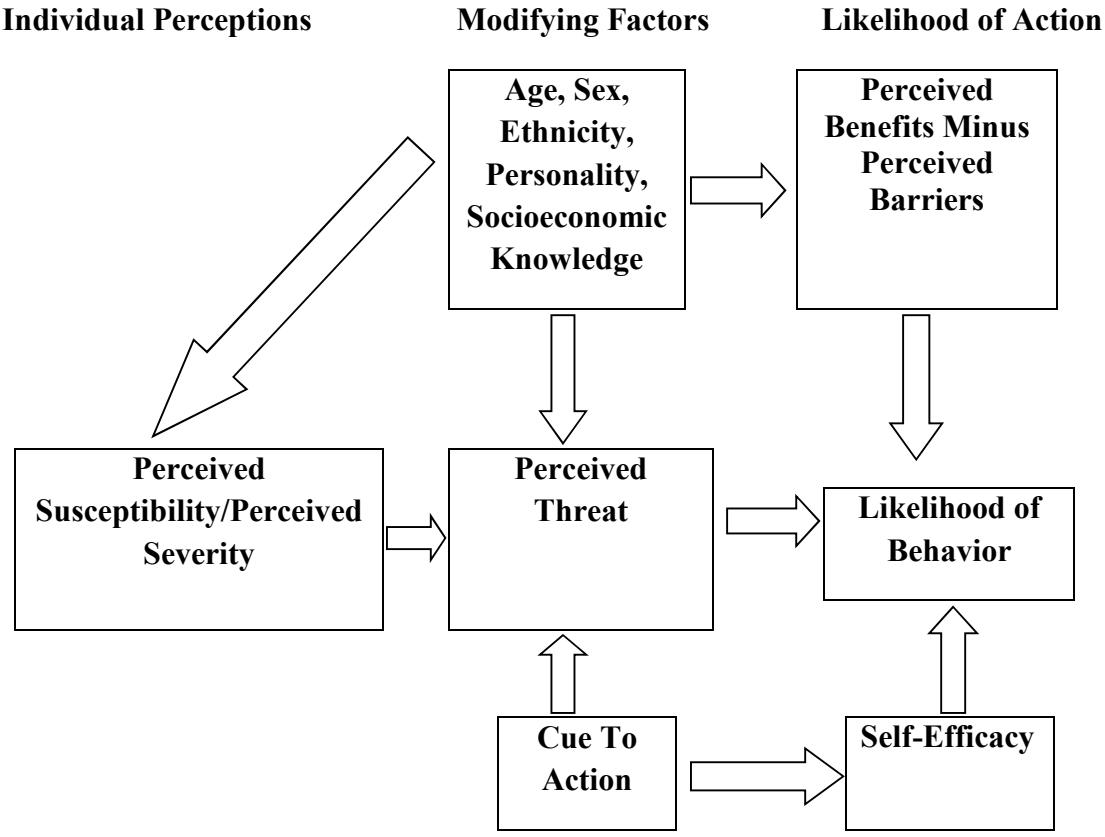


Fig 2. Components of the Expanded Health Belief Model Related to Voluntary Osteoporosis Testing (Glanz, K., Rimer, B.K., Lewis, F.M., & Wallace, L.S. (2002).

Research Design/Method

The study design for this dissertation research project was based upon the EHBM described in detail in Fig 2, based on the work of Kim, Horan, Gendler, & Patel, and the social science research paradigm found in Appendix 1 (Babbie, 1992, p. 104).

Study Instrument

The EHBM served as the behavioral model used by Katherine K. Kim, Mary L. Horan, Phyllis Gendler, and Mini K. Patel, nursing professors and researchers at Grand Valley State University in Allendale, MI to develop the Osteoporosis Health Belief Scale (OHBS). According to the aforementioned researchers, "The Osteoporosis Health Belief Scale (OHBS) was

developed to measure health beliefs related to osteoporosis" (Kim, 1991, p. 155). The purpose of developing the OHBS was to develop and test an instrument designed to measure personal attitudes and beliefs related to the potential for developing osteoporosis" (Kim, 1991, p. 156). The instrument that these researchers developed consisted of two additional risk reduction behaviors; the barriers and benefits related to calcium intake and those related to physical exercise" (Kim, 1991, p. 157). "The addition of these two measurements in the EHBM helps "…demonstrate the importance of health motivation in influencing health related behavior" [and] the developers of this model encourage further use and revision of the instrument and recommend the inclusion of self-efficacy as an additional dimension (Kim, 1991, p. 161).

Reliability Coefficients of the OHBS

Table 4 demonstrates the reliability coefficients for the OHBS-Calcium Subscales and the OHBS Exercise Subscales:

Table 4

Internal Consistency for the OHBS Subscales (Calcium and Exercise)

Subscale	Number of Items	Cronbach Alpha Calcium	Cronbach Alpha Exercise
Susceptibility	5	.80	.80
Seriousness	5	.65	.65
Health Motivation	5	.61	.61
Benefits	5	.68	.74
Barriers	5	.73	.72

Approval to Conduct the Study

Approval to conduct this study was granted by the SIUC Human Subjects Committee. The signed approval documents also include SIUC HSC Form A, protocol # 13240 (Appendix 2) and the USDHHS Office of Human Research Protection Assurance letter, # FWA00005334 (Appendix 3). The approval letter is dated August 9, 2013, signed by Jane L. Swanson, PhD, Chair, Human Subjects Committee at SIUC in 2013. Research approval letters from Nimiipuu Health addressed to Dr. Swanson, Dr. Ratnapradipa, and primary investigator (PI) Victor White are contained in Appendix 4, 5 and 6. Appendix 7 contains the research script. The study consent form is found in Appendix 8. The study brochure describing the nature of the study, date, time and location of the study is found in Appendix 9.

Study Protocol

The study was quantitative and descriptive in nature. True randomization was not achievable in this study because it is based on volunteer participation (i.e.: self-selection by participants) regarding completion of a survey instrument that measures osteoporosis attitudes, knowledge, beliefs, and self-efficacy of male and female, aged 18 and older, Nez Perce Tribal members and Non Nez Perce Tribal members, aged 18 and older, residing in Nez Perce County, ID.

Instrument

The instruments used in conducting the survey research regarding osteoporosis attitudes, knowledge, beliefs and self-efficacy of Nez Perce Tribal members as compared to Non Nez Perce Tribal members are the Osteoporosis Knowledge Test (OKT), the Osteoporosis Health Belief (OHBS) Scale, and the Osteoporosis Self Efficacy Scale (OSES). These are Likert scale items, developed by Katherine Kim, PhD., Mary Horan, PhD., and Phyllis Gendler, PhD in 1991

at Grand Valley State University in Grand Rapids, MI. These instruments were revised by Phyllis Gendler, PhD, Cynthia Coviak, PhD, Jean Martin, PhD, and Katherine Kim, PhD in 2010 and 2011.

The OKT (revised in 2011) has two subscales: Osteoporosis Knowledge Test Nutrition (items 1-11 and 18-32) and Exercise (items 1-17 and 30-32). The OKT Nutrition (Revised 2011) and OKT Exercise (Revised 2011) share 14 common items (items 1-11 and 30-32). The reliability coefficients for internal consistency (KR 20) for the OKT (Revised 2011) are as follows: 0.849 for the total scale, 0.83 for the Nutrition subscale, and 0.81 for the Exercise subscale. Test-retest analysis resulted in Pearson Correlation of 0.872. Validity of the OKT was evaluated by content validity by a panel of HBM and Osteoporosis experts. Questions were examined for difficulty, effectiveness of distracters and discrimination (Horan, Kim, Gendler, Froman & Patel, 1998).

The Osteoporosis Health Belief Scale (OHB) has five subscales; the Susceptibility subscale, (questions 1-6), the Seriousness subscale, (questions 7-12), the Benefits of Exercise subscale (questions 13-18), the Benefits Calcium Intake subscale (questions 19-24), the Barriers to Exercise subscale, (questions 25-30), the Barriers to Calcium Intake, (questions 31-36) and the Health Motivation subscale, (questions 37-42) (Horan, Kim, Gendler, Froman & Patel, 1998).

Validity of the OHBS was evaluated by factor analysis and discriminate function analysis (Horan, Kim, Gendler, Froman & Patel, 1998).

The Osteoporosis Self-Efficacy Scale (OSES 21 items) has two sub scales: The Osteoporosis Self-Efficacy Exercise Scale, which has 10 items (questions 1-10). The OSES Calcium Scale has 11 items (questions 11-21). Reliability coefficients for internal consistency (Cronbach alpha) of

both subscales are .90. Validity of the OSES was evaluated by factor analysis and discriminate function analysis (Horan, Kim, Gendler, Froman & Patel, 1998).

Sample

Osteoporosis survey data was gathered via voluntary participant completion of an EHBM based written survey instrument from 209 individuals. A power analysis was conducted with a 10% margin of error, a 95% confidence interval, and a population of 3,499 Nez Perce Tribal members provides a recommended sample size of 94 Nez Perce tribal members. A power analysis was conducted for non-Nez Perce Tribal members in Nez Perce County, ID with a 10% margin of error, a 95% confidence interval (CI) on a population of 39,531 individuals residing in Nez Perce County, resulting in a recommended sample size of 96 non-Nez Perce Tribal members.

For my sample size, I needed a minimum of 94 Nez Perce tribal members and 96 non-Nez Perce tribal members for a total of 190 participants, but I sought at least 200 participants in case of non-respondents, outliers, etc., with 209 actually completing the survey instruments successfully. The following equations were used to determine sample size and margin of error:

$$(x = Z(^{c}/_{100})^{2}_{r}(100\text{-}r)$$

$$n= {}^{N\,x}/_{(N\text{-}1)\,E2 + x)}$$

$$E =\mathrm{Sqrt}\,[{}^{(N-n)\,x}/_{n\,(N\text{-}1)}]$$

(Raosoft, Inc., 2015, http://www.raosoft.com/samplesize.html).

Survey data was analyzed with statistical software SPSS v.21.The targeted population was any male or female Nez Perce tribal member or non-Nez Perce tribal member volunteers residing

in Nez Perce County Idaho, aged 18 or above. The site where the EHBM based Osteoporosis Survey was conducted is the Nimiipuu Health Clinic, P.O. Box 367, Lapwai, ID 83540. This site was approved by Nimiipuu Health and the SIUC HSC Committee.

Theoretical Framework

The study design for this dissertation research project was partially based upon the EHBM described in detail in Fig. 1, the work of Kim, Horan, Gendler, & Patel, and the social science research paradigm found in Appendix 1 (Babbie, 1992, p. 104). The study was quantitative and descriptive in nature. The study design was a convenience sample in which participants self-select. True randomization was not possible (Isaac & Michael, 1997, p. 77-79 & 84-86).

Data Collection

Three EHBM based Likert scale survey questionnaires were filled out by each participant for data collection purposes. The general consent form for this study is located in Appendix 8. Appendix 9 is the information flyer describing the nature of the study, location, date and time of the study. Appendix 10 is a scan of the permission letter from Phyllis Gendler, PhD of Grand Valley State University in Grand Rapids, MI to use the Osteoporosis Knowledge Test (OKT) (Appendix 11), Osteoporosis Health Belief Scale (OHBS) (Appendix 12), and the Osteoporosis Health Efficacy Scale-21 (OHES) (Appendix 13). Participants completed the OKT, the OHBS and the OHES. These survey instruments are based upon osteoporosis and EHBM research completed by Phyllis Gendler, Ph.D. and associates surveying 201 women, 35 years of age or older at Grand Valley State University in Allendale, MI from 1991 through 2010. The three EHBM based surveys include questions regarding overall health status, gender, medication use, smoking, vitamin intake, exercise, diet, and the diagnosis and treatment of osteoporosis (Kim,

Horan, Gendler, & Patel, 1991, p. 155-163 and Horan, Kim, Gendler, Froman, & Patel, 1998, p. 395-403, and Wallace, 2002, p. 163-172).

Data Analysis

Data was analyzed with statistical software, SPSS v. 21. Descriptive statistics generated included age, ethnicity, frequencies, gender, means, standard deviations and ranges. Non parametric tests used included Chi Square, chi coefficient, Mann-Whitney U and Kruskall Wallis. Parametric tests included Levene's equality of variances and means *t* test, hierarchical linear regression, ANOVA and MANOVA.

Assumptions

Assumptions can be defined as the manner in which "…researchers approach their studies with a certain paradigm or worldview, a basic set of beliefs or assumptions that guide their inquiries. These assumptions are related to the nature of reality (the ontology issue), the relationship of the researcher to that being researched (the epistemological issue), the role of values in a study (the axiological issue), and the process of research (the methodological issue)" (Creswell, 1998, p. 74). In this research project, the following assumptions are made:

1. Volunteer study participants responded to the EHBM based survey questions based upon their actual perceptions.
2. EHBM survey items were interpreted by participants as the primary investigator intended for them to be interpreted.
3. The EHBM surveys are valid and accurately measured each of the intended constructs.
4. The EHBM surveys are reliable.

5. SPSS statistical analysis was properly conducted and suitable for this research project and dissertation.

6. Research results accurately correlate to the research question.

7. Participant's response to the EHBM based survey questions were not altered or attenuated by use of the EHBM survey instrument wording, which is at the 5th grade reading level (Kim, et.al., 1991).

8. The researcher's personal relationship to some of the volunteer subjects (i.e.: colleagues, students, patients, and healthcare providers) did not skew the research participation or results.

Limitations

Study limitations are those factors which may limit the internal validity of a specific study. The following known limitations of this study are identified below:

1. Transportation problems in getting to the Nez Perce Tribal Clinic.

2. There could have been significant variations in participant's ability to remember and tabulate exercise and dietary activities over a period of time.

3. EHBM osteoporosis survey participants perhaps were not representative of non-participants.

4. EHBM instrument length (I.e.: 3 forms) may have influenced responses of different individuals.

6. EHBM readability may affect participant responses. The EHBM survey was at the 5th grade reading level (Kim, et. al, 1991).

7. Participants may have had social bias and responded in an effort to enhance their likelihood of participation in the EHBM Based Survey.

8. Relatively small sample size

Delimitations:

Study delimitations are those factors which may limit the external validity of a study. The following are known delimitations of this study:

1. There was limited contact with the study participants and the survey instrument was kept intentionally brief in order to facilitate survey instrument use.
2. Participation in this study was on a volunteer basis.
3. Participants were residents of Nez Perce County, ID.
4. Participant health behavior could not be controlled prior to and during this study.
5. Participants with insufficient survey data were excluded from this study.
6. Some Nez Perce Tribal and non-Tribal members were prevented from participating in this study due to a variety of factors beyond the primary investigators control.

Protection of Privacy and Confidentiality

All individual participants had their identities kept confidential at all times. Participants were able to decline to participate at any time with no penalty or restriction of care at the Nez Perce Tribe clinic or any other health/medical facilities. All raw data was coded with reference to demographic data of the voluntary participants of this study. Access to raw data was available only to the primary investigator. All coded data was coded without reference to demographic aspects of the study participants. Hard copy data was kept in a locked file cabinet located at Victor Whites residence. Computer data was contained on a password protected, restricted access computer at Victor Whites residence. All participant data was held in the strictest confidence and adhered to all confidentiality requirements of the Nez Perce Tribe and SIUC HSC.

In addition, primary investigator (PI) Victor N. White, MA, MSRS, RT(R), CHES completed a National Institutes of Health (NIH) Human Participants Protection Education for Research Teams seminar at the University of Idaho in Moscow, ID. A certificate of completion for this seminar is contained in Appendix 14. Complete participant anonymity was unable to be ensured because individual participants could have seen each other entering and leaving the Nez Perce Tribal clinic. In addition, Idaho State law indicates that confidentiality may not be maintained completely if there is a compelling legal reason to know participants in a research project, but "much of the biomedical and behavioral research conducted in the United States is governed by the rule (i.e.: Common Rule) entitled Federal Policy for the Protection of Human Subjects (HHS Subpart A of Title 45 CFR, Part 46), which supersedes state law regarding protection of human subjects in research projects" (National Institutes of Health, 2011, p. 1). In this study, there was not a compelling legal reason to know any participant's identity to anyone other than the PI, so confidentiality was maintained.

Benefit and Risk Dichotomy

Potential Benefits to Volunteer Participants Include the Following:

1. Opportunity to learn more about osteoporosis.
2. Opportunity for osteoporosis mitigation and prevention strategies to be implemented on an individual, tribal, and non-tribal basis.
3. Bone health benefits to individuals, Nez Perce Tribal members, the Nez Perce Tribe as a group, and non-Nez Perce Tribal members.

Potential Risks to Volunteer Participants Include the Following

1. Small risk of disclosure of knowledge of study participants by physical "sightings" of participants going to the Lapwai, ID clinic for completion of the EHBM based osteoporosis survey instruments, mitigated by confidentiality precautions used to complete the study and store data.

Definition of Terms

Important terms with accompanying definitions are indicated below. These terms and definitions may be found throughout this dissertation.

Alendronate: "Trade name is Fosamax". This is a medication used to treat osteoporosis (National Institutes of Health, 2010, p. 1).

Expanded Health Belief Model (EHBM): "The EHBM includes self-efficacy (i.e.: ones perceived confidence in carrying out the behavior), which was introduced by Bandura in 1977" (Wallace, 2002, p. 164).

Health Belief Model: "The health belief model (HBM) is a conceptual belief framework used to understand health behavior and possible reasons for non-compliance with recommended health action" [and]" the HBM addresses four major components for compliance with recommended health action: perceived barriers of recommended health action, perceived benefits of recommended health action, perceived susceptibility of the disease, and perceived severity of the disease" (Turner, Hunt, DiBrezzo, & Jones, 2004, p. 116).

Incidence: "The number of new cases of a disease in a population-at-risk during a particular period of time (or per year)" (Greenhalgh, 2007, p. 50 and McKenzie & Pinger, 1999, p. 667).

Native-American: "…indigenous peoples of the America's [and]…those living in a specific country or sharing certain cultural attributes" (Native American, 2011. http://www.tribaldirectory.net).

Nez Perce Tribe: "The Nez Perce (nays piers) actually represents many distinct tribes with many cultural differences that all existed together peacefully, and for that reason they are usually thought of as being one tribe" (Kittleson, 2011.http://www.mnsu.edu/emusuem/cultural/northamerica/nez_perce.htm).

Nimiipuu: "We the Nez Perce people call ourselves Nimiipuu, which means the "real people" or "we the people". The traditional homeland of the Nimiipuu (Nez Perce) is North Central Idaho, including areas in Southeastern Washington, Northeastern Oregon with usual and accustomed areas in Western Montana and Wyoming. The Nimiipuu aboriginal territory was approximately 17 million acres or 27 thousand square miles; including the Clearwater River Basin and the South and Middle forks of the Salmon River Basin and their tributaries" (Nimiipuu,2011. http://www.nezperce.org/history/nimiipuu.htm).

Osteoporosis: "loss of bone mass that occurs throughout the skeleton, predisposing patients to fractures. Healthy bone constantly remodels itself by taking up structural elements from one area and patching others. In osteoporosis, more bone is reabsorbed than laid down, and the skeleton loses some of the strength that it derives from its intact trabeculation. Aging causes bone loss in both men and women predisposing them to vertebral and hip fractures. This is called type II osteoporosis. Type I osteoporosis occurs as a result of the loss of the protective effects of estrogen on bone that takes place at menopause" (Taber's Cyclopedic Medical Dictionary, 2009, p. 1658). The World Health Organization (WHO) operationally defines osteoporosis as bone

density 2.5 or more S.D.'s (standard deviation as expressed via T scores) below the mean for young adult white women (University of Michigan Health Sciences Osteoporosis Guidelines, 2010, p. 2).

Prevalence: "The overall proportion of the population (new and old cases) divided by the total population" (Greenhalgh, 2007, p. 50 and McKenzie & Pinger & Kotecki, 1999, p. 66).

Risendronate: "Trade name is Actonel and/or Atelvia". This is a medication used to treat osteoporosis (National Institutes of Health, 2010, p. 1).

T-Score: "A type of standard score that relies upon the mean value and the standard deviation (SD) for a set of numerical data" (Bonnick, 1998, p. 69). "T scores are standard scores with a mean of 50 and a standard deviation of 10" (Glass & Hopkins, 1996, p. 87). "When an individual's bone mineral density (BMD) is compared to the mean BMD in a young healthy population, this standard deviation measurement is referred to as a T-score. The T score is calculated using the following formula:

Patients BMD-Young Normal Mean/Standard Deviation of Young Normal Mean"

(U.S. Department of Health and Human Services, 2004, p. 204).

t-Test: ""The three assumptions made in the mathematical derivation of the central t-distribution (i.e., the sampling distribution of t-ratios when H_0 is true) are as follows: (1) the X_i's within each of the two populations are normally distributed; (2) the two population variances, σ_1^2 and σ_2^2, are equal; and (3) the individual observations, X_i's, are independent" (Glass & Hopkins, 1996, p. 290).

Z-Score: "A Z score can be defined as a measure of how many standard deviation units away from the mean a particular value of data lies" (Bone Density, 2009, p. 3). "In osteoporosis DXA testing, a Z score is a comparison of your score to someone else of the same age, weight, ethnicity, and gender. According to the international society of clinical densitometry (ISCD), Z scores are used when evaluating premenopausal women and children for osteoporosis…" (U.S. Department of Health and Human Services, 2004, p. 206).

Summary

The purpose of this study is to implement an EHBM based written survey to determine if there is a difference in osteoporosis attitudes, knowledge, beliefs and self-efficacy among Nez Perce Tribal members, male and female, age 18 and older as compared to non-Nez Perce Tribal members residing in Nez Perce County, ID.

Osteoporosis is a significant public health problem that affects millions of Americans and has a negative health and socioeconomic impact on Native Americans. However, with the advent of safe, readily accessible US and DXA based densitometry units, behavior change from a diet and weight-bearing exercise perspective, and the availability of various prescription medication, the diagnosis, treatment, and outcomes of this disease can be greatly improved. The use of an EHBM based survey instrument to learn more about Nez Perce Tribal members and Non-Nez Perce tribal member's attitudes, knowledge, beliefs and self-efficacy regarding osteoporosis is a valid area of research and is worthy of further inquiry.

CHAPTER 2

LITERATURE REVIEW

Purpose of Study

The purpose of this study is to implement an EHBM based written survey to determine if there is a difference in osteoporosis attitudes, knowledge, beliefs and self-efficacy among Nez Perce Tribal members, male and female, age 18 and older as compared to non-Nez Perce Tribal members residing in Nez Perce County, ID.

Null Hypothesis

There is not a difference in osteoporosis knowledge, attitudes, beliefs, and self-efficacy among Nez Perce Tribal members and non-Nez Perce Tribal members, male and female, aged 18 and older residing in Nez Perce County, ID as evidenced by completion of the EHBM based osteoporosis survey instruments.

$H_{0:}$ Native American = Non-Native American

Research Hypothesis

There is a difference in osteoporosis knowledge, attitudes, beliefs, and self-efficacy among Nez Perce Tribal members and non-Nez Perce Tribal members, male and female, aged 18 and older residing in Nez Perce County, ID as evidenced by completion of the EHBM based osteoporosis survey instruments.

$H_{1:}$ Native American ≠ Non-Native American

Research Questions

This study sought to answer the following research questions:

1. What do Nez Perce Tribal members and non-Nez Perce Tribal members know about osteoporosis?
2. Is there a statistically significant difference in osteoporosis knowledge, attitudes, beliefs and self-efficacy among Nez Perce Tribal members and non Nez Perce Tribal members, male and female, aged 18 and over residing in Nez Perce County, ID as evidenced by completion of an EHBM based osteoporosis survey instrument?
3. Does ethnicity have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?
4. Does gender have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?
5. Does age have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self- efficacy regarding osteoporosis?
6. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between nutrition and osteoporosis?
7. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between exercise and osteoporosis?

Literature Review

This literature review addresses osteoporosis from a general Caucasian and Native American perspective. The research will address osteoporosis from a Nez Perce Tribal and non Nez Perce tribal perspective in Nez Perce County, ID.

Definition of Osteoporosis

Osteoporosis can be defined as "a systemic skeletal disease, characterized by low bone mass and micro architectural deterioration of bone tissue with a consequent increase in bone fragility and susceptibility to fracture" (Bonnick, & Lewis, 2002, p. 222). This definition was first conceived in 1991 at a "consensus development conferences sponsored by the National Osteoporosis Foundation, European Foundation for Osteoporosis and Bone Disease, and the National Institute of Arthritis and Musculoskeletal and Skin Diseases" (Bonnick, & Lewis, 2002, p. 222).

This definition was further refined in 1994 by the World Health Organization (WHO) (World Health Organization (WHO), 2004) and is shown in Table 5.

Table 5

World Health Organization (WHO) Osteoporosis Diagnosis Criteria.

Diagnosis	Bone density criteria	T-score criteria
Normal	Not more than 1 SD below the average peak young adult value	Better than or equal to -1
Osteopenia (low bone mass)	More than 1 but not yet 2.5 SDs below the average peak young adult value	Lower than -1 but better than -2.5
Osteoporosis	2.5 SDs or more below the average peak young adult value	-2.5 or lower
Severe (established osteoporosis)	2.5 SDs or more below the average peak young adult value + a fracture	-2.5 or lower + a fracture

(Source: Adapted from Bonnick, 2002, p. 224 Table 9-1 and WHO, 2004).

According to Bonnick and Lewis, (2004)" The WHO was actually not attempting to specify bone density that would be used clinically in individuals to diagnose osteoporosis, but was instead defining criteria that could be used to estimate the prevalence or percentage of individuals in different countries who might have osteoporosis" (Bonnick, & Lewis, p. 223). According to the May 5-7 Brussels, Belgium Consensus WHO Report, "Osteoporosis causes more than 8.9 million fractures annually worldwide, with more than 4.5 million in the Americas and Europe. The lifetime risk for a wrist, hip or vertebral fracture has been estimated to be in the order of 30% to 40% in developed countries [and] in the Americas and Europe, osteoporotic fractures account for 2.8 million disability-adjusted life years (DALYS) annually (World Health Organization, (WHO), 2004, p. 1).

Other definitions of osteoporosis have been developed by governmental and non-governmental agencies (NGO's) such as the National Institutes of Health (NIH) and the International Society of Clinical Densitometry (ISCD), but the WHO definition is accepted as the

current standard definition worldwide. Because of this, the WHO definition of osteoporosis will be used in this study.

The WHO reference standard for which the T-score is calculated is taken from data of Caucasian females regarding bone density found in the National Health and Nutrition Examination (NHANES) Survey for White, female individuals aged age 20-29 years. NHANES III occurred between 1988-1994, and "was conducted on a nationwide probability sample of approximately 33, 994 persons. The survey was designed to obtain nationally representative information on the health and nutritional status of the populations of the United States through interviews and direct physical examinations" (Center for Disease Control & Prevention (CDC), 2010).

General Risk Factors for Osteoporosis

Some general risk factors for osteoporosis that are most clinically relevant are shown below.

Table 6

Important Clinical Factors Regarding Osteoporosis Diagnosis

Age related changes in bone density
Chronic use of corticosteroids and anticonvulsants
Evidence of osteopenia
Excessive smoking, alcohol, and caffeine intake.
Hysterectomy

Table 6 (Continued)

Lack of regular weight-bearing exercise
Lifelong low calcium intake
Males with hypogonadism and low testosterone levels and a history of alcohol abuse.
Menopause
Over age 65 years of age
Family History
Anatomic sites (e.g., vertebrae, wrist, hip, and pelvis) Prolonged immobilization (more than 6 weeks)

(Source: Based on data from Merck, Inc., (1997), p. 3 and Osteoporosis Clinics of America, (1997), p. 8, & Bonnick, (1998), p. 203).

Descriptive Epidemiology of Osteoporosis

Descriptive epidemiology can be defined as …" the occurrence, distribution, size, and progression of health and disease in the population" (Dever, 2006, p. 40). Descriptive epidemiology can also be used "to provide data that will contribute to the understanding of the etiology of health and disease" [and] "to promote the utilization of the epidemiological concepts to the management of health services" [by] "description of morbidity and mortality data: by service area, by diagnosis related groups (DRGs)" (Dever, 2006, p. 41)."The epidemiological method has been described as consisting of careful clinical observation, precise counts of well-defined cases, and demonstration of relationships between cases and the characteristics of the populations in which they occur"(Christoffel & Gallagher, 1999, p. 47).

In an epidemiological diagnosis, "decisions should be guided by the desires of the community members themselves, with consideration given to health problems with the greatest impact, those

that have been previously underserved, and those for which solutions are realistically available" (Glanz. P. 365.). Dr. Valerie Fox, who is a Native American, is the Chief Medical Officer at the Nimiipuu Health Clinic in Lapwai, Idaho. Dr. Fox and the Director of Community Health have an interest in osteoporosis and have formally asked me to conduct an osteoporosis research project comparing osteoporosis knowledge beliefs, attitudes and self-efficacy of members of the Nez Perce tribe as compared to non-Native Americans to see if there is a statistically significant difference between the two groups.

According to Brewer (1998), "Osteoporosis is so common that it has been described as the silent epidemic" (p. 7). "Researchers now know that osteoporosis develops when [bone] remodeling activity becomes unbalanced so that too much bone is absorbed and not enough laid down. This causes bones to become thin, brittle, and fracture more easily" (Brewer, 1998, p. 7-8). The use of WHO criteria for osteoporosis has served as a useful guide, but according to Bonnick (2002), "strictly speaking, then, the WHO criteria should be applied only to Caucasian women" (p. 225). Also according to Bonnick (2002) "The WHO did note in 1994 that in the absence of other criteria, it might not be inappropriate to apply the WHO criteria to mature Caucasian men" (p. 225). James Norman, MD indicates that "Although these criteria [WHO Osteoporosis criteria] are widely used, they were based on Caucasian females, so there will be some differences when these levels are applied to non-Caucasian females or males in general.

Despite this flaw, BMD measurement is still the most common method used in all groups (Norman, 2010). According to the 2004 U.S. Surgeon General's Report entitled "Bone Health and Osteoporosis: A Report of the Surgeon General, "Both the public and health care professionals need to be aware of a number of known, easy to identify risk factors for osteoporosis and other bone disease. These factors relate to either the intrinsic strength of bone

or the propensity to suffer injurious falls [and] "All individuals, young and old, should be assessed to determine how many (if any) of these risk factors they have, and then those with a sufficient degree of risk need to undergo further evaluation (often a BMD test) to determine the appropriate next course of action (e.g., changes to lifestyle, pharmacologic treatment) (U.S. Department of Health and Human Services Bone Health and Osteoporosis: A Report of the Surgeon General, 2004, p. 188). According to the U.S. Surgeon General's 2004 report, there are a number of risk factors that might indicate the presence of osteoporosis.

A World Health Organization (WHO) meeting was held in Brussels, Belgium on May 5-7, 2004 in which osteoporosis experts from the WHO met in order to examine and update osteoporosis diagnosis criteria. According to this WHO report, "The scope of the report is to direct attention away from the sole use of BMD to determine who will receive treatment and to shift towards the assessment of absolute fracture risk, whether this be determined by BMD testing or other validated instruments" (World Health Organization (WHO), 2004, p. 5). New osteoporosis diagnosis criteria recommended by the WHO now include reliance on a 10-year probability of fracture risk on models developed in Sweden because the "hazard functions of fractures and deaths in Sweden are used because of the robustness and extent of the epidemiological data available in that country "(World Health Organization (WHO), 2004, p. 4).

Potential risk factors were examined by a series of meta-analyses using Poisson models for each risk factor in each of the study cohorts and for each sex. Covariates examined included age, sex, BMD, time since assessment and the covariate itself, e.g. to determine whether BMD or body mass index (BMI) are equally predictive for fracture at different levels of BMD or BMI. Results from the different studies were merged using the weighted ß- coefficients" (World Health Organization (WHO) 2004, p. p. 4-5).

Osteoporosis in Native American's

In spite of the availability of osteoporosis detection and treatment options, there remains minimal data regarding the incidence, prevalence, and severity of osteoporosis among Native Americans. "The Department of Health and Human Services, Office on Women's Health has identified osteoporosis as a priority health topic and the National Indian Women's Health Resources Center has also identified the need to increase knowledge of health care providers in the standards of screening, diagnosis and treatment of osteoporosis" (Murphy, Attico, Rhodes, Dodge & DeRoin, 2004, p. 1). According to the World Health Organization (WHO) (2004) and the Rhode Island Commission on Women (2003), "…osteoporosis [is] the second largest public health problem for women" (p.1). According to Smith, B.S., Leyva, M., and Baker, M.Z. (2009) at the University of Oklahoma Health Science Center in Oklahoma City, OK, " currently there is not much information available about osteoporosis risk in Native Americans and factors that may hinder access to treatment" [and] "…"to determine how common osteoporosis is in Native American women who receive treatment at area Indian Health Clinics" (Accessed from the web on 11/19/2009 at http://gcrc.ouhsc.edu/Smith0129.asp).

According to Nicholas and Chen (2002), "The impact of osteoporosis and its complications is largely unknown among Native Americans" (Nicholas and Chen, 2002, p. 94). Preventing and managing osteoporosis in the Native American population is somewhat more challenging than in other populations due to research deficiencies and a lack of knowledge regarding osteoporosis knowledge, attitudes, beliefs and self-efficacy amongst Native Americans. The purpose of this dissertation is to examine these issues in the Nez Perce tribe.

Native Men

Even less information is known about the incidence and prevalence of osteoporosis among Native American men as compared to Native American women or other groups. According to Duke University endocrinologist Tom Weber, MD (2004), "two million men in this country have osteoporosis. The risk of hip fracture in men will increase by 300 percent by 2050, more so than the increase that will occur in women. This sort of information is needed to educate both the medical community and the lay public as to the importance of identifying and treating men with osteoporosis [and] in some ways it's more serious for men" (Oskin, p.1-2).

According to Eric S. Orwoll, MD (1999) "osteoporosis is a devastating disease, especially to older men and women [and] we have studied its causes and treatment in women, but we know little about it in men" (Orwoll, p. 1). According to Bleeker (2001), "The occurrence of osteoporosis in men should be a concern worldwide because by the year 2025, the number of hip fractures occurring in men, will be similar to what they are for women now (1.2 million)" (p. 1).

Native Adolescents

Osteoporosis is less studied in adolescents then adult men and women. This dearth of research is more exacerbated when investigating osteoporosis in Native American adolescents. Only individuals 18 years of age or older will be allowed to participate in this study, thereby precluding any further discussion of Native American adolescents with osteoporosis in this dissertation.

Osteoporosis in Nez Perce Tribal Members Compared to Other Native Americans

The Nez Perce Tribe has been understudied in regards to osteoporosis incidence, prevalence, and severity within the tribe. The purpose of this dissertation is to rectify this scenario**.** The Medical Director of the Nez Perce Tribe wishes for this osteoporosis study to be conducted and members of the Nez Perce Tribe and local non-tribal residents of Nez Perce County, Idaho have a personal interest in being scanned for osteoporosis and finding treatment options. Even though osteoporosis is not an immediate life threatening illness, it can still lead to greatly diminished quality of life and increased morbidity due to fractures.

According to Gehrig (2010), "According to the U.S. Census Bureau (2008 data), an estimated 4.9 million American Indians and Alaska Natives (AI/AN) live in the United States. Information on hip fracture prevalence among AIAN population is limited and relies on a few studies conducted during the past 20 years. These studies seem to indicate that disparities exist and that they may be increasing" (http://www.aaos.org/news/aaosnow/jan 10/research4.asp).

Knowledge about disparities regarding health care provision and outcomes in Native American populations is relatively well known (Wietor, 2003) but obtaining more information about the use of the Expanded Health Belief Model (EHBM) to examine Nez Perce Tribal members understanding about osteoporosis, osteoporosis testing methodologies and participation in a voluntary osteoporosis screening program will be examined in this dissertation.

Nez Perce County, ID

The 2013 population estimate for Nez Perce County, ID is 39, 531 individuals. Caucasians make up 90.3% of the population, Native Americans make up 5.9% of the population, and Native Hawaiian and other Pacific Islanders makes up 0.1% of the population in Nez Perce

County, ID. The land area of the Nez Perce Tribal reservations in Lapwai and Kamiah, ID, respectively total 848.09 square miles, with 46.3 individuals per square mile. Female population is 50.5%, or 20, 157 individuals. Male population is 49.5%, or 19, 757 individuals. Per capita income in 2012 was $24, 130. Median household income in 2012 was $45, 587. Persons below the poverty line in 2012 was 11.6%. (Retrieved August 19, 2014 from http://quickfacts.census.gov/qfd/)

Lapwai, ID

According to the U.S. Census Bureau (2014), the population in Lapwai, ID was 3,499 individuals**.** Males made up 48.6% of the population and females made up 51.4% of the population. Caucasians made up 21.8% of the population and Nez Perce tribal members made up 45.9% of the population. Per capita income in 2012 was $14, 509. Median household income in 2012 was $36, 723. Percentage of people below the poverty line in 2012 was 22.5%. (Retrieved August 18, 2014, from http://www.city.data.com/city/Lapwai-Idaho.html).

Nez Perce Tribal Culture

The Nez Perce Tribe are currently based in Lapwai and Kamiah, ID respectively, but historically Nez Perce lands stretched from "…Southeastern Washington, Northeastern Oregon with usual and accustomed areas in Western Montana and Wyoming. The Nimiipuu aboriginal territory was approximately 17 million acres or approximately 70 thousand square kilometers or 27 thousand square miles; including the Clearwater River Basin, the South and Middle Forks of the Salmon River Basin and their tributaries"(Accessed on 01/30/2011 from www.nezperce.org/history/nimiipuu.htm.)

The French term nays piers (those with pierced noses), or in English, Nez Perce, was used to describe the Nimiipuu by a French interpreter for Lewis and Clark during their 1804-1806 cross country western expedition. This name stuck even though the cultural practice of nose piercing was not routinely practiced by the Nimiipuu (Accessed on January 28, 2011 from http://www.mnsu.edu/emusuem/cultural/northamerica/nez_perce.html). Nimiipuu is the Native American word that members of the Nez Perce Tribe used to describe themselves. Loosely translated, it means "real people" or "we the people" (Accessed on 01/30/2011 from, www.nezperce.org/history/nimiipuu.htm)

The Nimiipuu were hunters and gatherers and primarily lived in "…tule mat covered, double lean to long houses" (Accessed on 01/28/2011 from www.nezperce.org/history/nimiipuu.htm). Nimiipuu primarily subsisted on game, Salmon, roots, berries and a root called khouse. The food eaten changes with the seasons and the Nimiipuu moved through various parts of their territory with each changing season in order to maximize food security for the tribe. "The basic roots gathered for winter storage included camas bulb (kehmmes), bitterroot (thlee-than), khouse (qawas), wild carrots (tsaweetkh), wild potato (keh-keet), and other root crops" (Accessed on 01/30/2011 from www.nezperce.org/history/nimiipuu.htmp).

"Large game animals that were hunted include deer, elk, moose, bear (black, brown, and grizzly), mountain sheep and goats" [and] "today, deer, elk, and salmon are still important foods for the Nimiipuu, but they are no longer our only foods. We also frequent restaurants and eat modern foods (TV dinners, microwave dishes, canned foods…)" (Accessed on 01/30/2011 from www.nezperce.org/history/nimiipuu.htmp).

The diet of the Nimiipuu changes after European conquest and particularly at the end of the Nez Perce War on October 5, 1877, when Chief Joseph, leader of the Nez Perce, surrendered to U.S. Calvary forces and vowed …" I will fight no more forever" (Accessed on 01/30/2011 from www.nezperce.org/history/nimiipuu.htmp).

As the diet of the Nimiipuu changed and became more westernized over the years, and as exercise activities diminished with a lack of travel over their territorial lands, many Nez Perce Tribal members adopted modern conveniences and a sedentary lifestyle. Lack of exercise and adoption of a non-Native, nutrient poor, calorie rich diet has led to increased obesity, diabetes, and cardiovascular disease among many Native Americans including some members of the Nez Perce Tribe.

This change in diet and diminished exercise capacity may have a negative impact on bone density in members of the Nez Perce Tribe. It is possible that there may be diminished bone density in some members of the Nez Perce Tribe, thereby increasing the incidence, prevalence and severity of osteoporosis in this Native American group.

Socioeconomic Status of the Nez Perce Tribe

Members of the Nez Perce Tribe do have a sovereign form of tribal government, but their socioeconomic status is one of poverty. The tribal base is in Lapwai, ID and Kamiah, ID respectively. Both of these locations are small towns that are relatively isolated within the Northern to Mid-Idaho region. Socioeconomic depression of members of the Nez Perce Tribe involves restricted access to public transportation, and the inability to afford a car. There is bus transportation for members of the tribe from Lapwai to the nearby Nez Perce Tribal casino and to

Lewiston, ID and Clarkston, WA, 12 and 15 miles away, respectively, for shopping and healthcare services.

Members of the tribe have tribal health care services paid for by the Indian Health Service (IHS) of Portland, OR, but such services are only paid for if treatment is given at a designated Native American clinic. Osteoporosis testing is not paid by IHS unless a physician, nurse practitioner, or physician assistant employed by the clinic orders it and can justify the order, which occurs only if the individual is already diagnosed with osteoporosis and is also a female 60 years of age (YOA) or older. Other osteoporosis screening services would have to be paid from a grant or via other means.

Difference between Osteoporosis Research in Native Americans as Compared to Non-Natives

As indicated previously, there is very little osteoporosis research that has been done with Native Americans as compared to other races and ethnicities. Reasons for this may be cultural, socioeconomic, and limited access to osteoporosis testing facilities near or on the reservation. According to Gehrig (2010), "controlled studies looking at hip fracture in the American Indian and Alaskan American (AIAN) population are still in their infancy" [and]" uncovering the prevalence of osteoporosis, hip fracture rate, and any unique characteristics or comorbidities (such as diet, lifestyle, and effect of latitude) that affect bone metabolism and fracture risk would enhance cultural competency within this population" (Accessed from the web on 03/01/2013 at http://www.aaos.org/news/aaosnow/jan 10/research4.asp

Detection of Osteoporosis in Native Americans and Non-Native Americans

According to Bonnick (1998), "Two of the most common applications for bone densitometry today are in the diagnosis of osteoporosis and the assessment of fracture risk. These applications depend on comparisons of the absolute BMD to the reference data bases that are supplied by the manufacturers of bone densitometry equipment" (Bonnick, 1998, p. 184).

Bonnick (1998) indicates that "it is logistically impossible to have every member of a population in a given country undergo bone-density measurements in order to create a reference database. Therefore, a sample of the population is studied to create this reference population. From that sample, the average BMD value for the young adult, and for each age group, can be calculated" [and]" fracture risk for an individual patient can then be calculated, based on the knowledge of the number of SD's below the peak young-adult BMD that the patients BMD lies" (Bonnick, 1998, p. 184).

The problem is that the reference data bases for the young adults that everyone is compared to in order to assess bone density does not include a statistically significant number of Native Americans. NHANES III data was used, with a collection of data from "71,116 men and women aged 20 and older, with a total of 3217 non-Hispanic whites, 1831 non-Hispanic Blacks and 1840 Mexican-Americans in this study population" (Bonnick, 1998, p. 186).

Although all three major U.S. manufacturers of DXA equipment contain extensive databases of reference data, there is a paucity of Native American data. This can obviously influence scan results and ultimately diagnosis and treatment of Native Americans for osteoporosis. This dissertation involves collecting and analyzing osteoporosis survey data, but future research may

involve collection of DXA and QUS data from members of the Nez Perce Tribe that could then be put into manufacturers DXA and QUS reference databases.

Osteoporosis Detection Technologies

For osteoporosis to be effectively treated, it must first be diagnosed properly. Imaging technologies that are readily available, cost effective, and use no ionizing or minimal to moderate ionizing radiation include quantified ultrasound (QUS) and dual–energy x-ray absorptiometry (DXA).

The benefits of using QUS and DXA to detect osteoporosis stems from the following:

- Clinical history is an important reason for osteoporosis testing.
- Value of bone mass measurement /bone concentration in relationship to osteoporosis.
- Value of DXA testing for osteoporosis testing.
- Bone mass measurement can help predict future fracture risk.

The aforementioned technologies are accurate, reproducible and are superior to standard radiographic imaging methods in detecting osteoporosis is various populations. In addition, these

Technologies are reimbursable by third party payers. Common osteoporosis testing methods, amounts of radiation, and anatomic areas evaluated are indicated in Table 7.

Table 7

Imaging Methods to Detect Osteoporosis, Radiation Type, Dose and Location

Methods **(Machine Type)**	**Radiation Type**	**Radiation Dose (Millisieverts) (mSv)**	**Area of Body**
Dual Energy X-Ray Absorptiometry (DXA)	X-Ray (Ionizing)	<0.1 mSv	PA Spine Femoral Neck Total Hip Forearm
Single X-Ray Absorptiometry/Dual Energy X-Ray Absorptiometry (SXA)/(DXA)	X-Ray (ionizing)	<0.1 mSv	Heel or wrist
Radiographic Absorptiometry	X-Ray (ionizing)	<0.1 mSv	Heel or wrist
QCT	CT (ionizing)	0.1-1 mSv	L-Spine Proximal Femur
pQCT	CT (ionizing)	<0.1 mSv	Forearm
X-Ray	X-Ray (ionizing)	1-10 mSv	Spine or Hips
QUS	Ultrasound (non-ionizing)	None	Calcaneus (Heel)

(Source: Adapted from the American College of Radiology (ACR) 2012 & Radiologic Society of North America (RSNA) 2012 & Gemalmaz, Disagil & Ceylan, 2007).

Of the above osteoporosis testing methods, only QUS and DXA will be explored in further detail because the portability, cost, ready availability and the use of non-ionizing and ionizing radiation has allowed QUS and DXA to become the primary imaging methods used to detect osteoporosis.

Quantitative Ultrasound (QUS)

Advantages of QUS as compared to bone densitometry detection technologies is that it is 1) portable, 2) is non-ionizing and 3) is less costly to the patient, and 4) anyone can be properly trained to operate this device in about 1 hour. Non-ionizing means that the ultrasound energy used in QUS is unable to strip the orbital electrons away from the tissues of a patient's body. According to Hans & Krieg (2008) "Quantitative ultrasound (QUS) appears to be developing into an acceptable, low cost and readily accessible alternative to dual x-ray absorptiometry (DXA) measurements of bone mineral density (BMD) in the detection and management of osteoporosis. Hans and Krieg further state that "Likely, QUS is most effective when combined with an assessment of clinical risk factors (CRF); with DXA reserved for individuals who are not identified as either low or high risk using QUS and CRF" (Hans & Krieg, 2008, p. s25-s26).

Dual Energy X-Ray Absorptiometry (DXA)

Dual energy x-ray absorptiometry (DXA) works using two different energy levels of x-rays a set of detectors and a scanning arm that "sweeps" over the patient and can be used to scan the total spine, lumbar spine, pelvis, bilateral hips and total body. DXA can distinguish x-ray attenuation variations of different tissues such as bone, adipose tissue and muscle tissue, thereby making it useful not just in detecting bone density but also in detecting the amount and density of adipose and muscle tissue in any individual. DXA x-ray energy can potentially remove electrons from the valence orbit of patient's tissues being scanned, but in general, exposure levels are so low with DXA that the technologist operating the unit does not have to monitor the radiation exposure from the device. Table 7, which was previously shown, demonstrates the different types and levels of energy used in bone densitometry.

In DXA, low energy x-ray photon (i.e.: 30-50 keV) absorption is subtracted from high energy (i.e.: 70 keV) absorption by the DXA computer to form an isolated bone profile (Wilson, 2003, p. 21). The scan data from each patient is compared to the database of similar patients and a standard normal patient, which results in calculated T and Z scores respectively (Wilson, 2003, 18).

Comparison of QUS T Scores and DXA T Scores

According to a study conducted by Gemalmaz, Discigil and Ceylan in 2007, "of 116 postmenopausal women according to DXA measurements, 34.5% of the women [in this study] were considered osteoporotic and 49.1 % osteopenic. There were weak-moderate positive correlations between QUS measurements and DXA T scores of lumbar spines and femoral necks ($r=0.231$ and $r=0.286$, respectively, $P<0.05$). Using DXA as the gold standard, the cut-off value of QUS T-Scores was -2.2 with 77.5% sensitivity and 50% specificity for osteoporosis" (Gemalmaz, Discigil, & Ceylan, 2007, p. 303-309). Gemalmaz, Discigil & Ceylan's research indicates that prospective QUS cut off scores that correlate to DXA t-scores is statistically and scientifically supported.

Use of T Scores in DXA Analysis

A T score can be defined as "a type of standard score that relies upon the mean value and the standard deviation (SD) for a set of numerical data" (Bonnick, 1998, p. 69. "T scores are standard scores with a mean of 50 and a standard deviation of 10" (Glass and Hopkins, 1996, p. 87). When an individual 's bone mineral density (BMD) is compared to the mean BMD score in a young healthy population in the following manner;

Patients BMD - Young Normal Mean /Standard Deviation of Young Normal Mean

This standard deviation measurement is referred to as a T score. The T Score is calculated using the following formula: (U.S. Department of Health and Human Services Bone Health and Osteoporosis: A Report of the Surgeon General, 2004, p. 204).

$$t = [\bar{x} - \mu]/[S/SQRT\ (N)\ ]$$

t= t score

$\bar{x}$ = mean sample mean

μ = population mean

s= standard deviation of sample

Sqrt= square root

N= sample size

T- scores are used in osteoporosis research because "any individual tested for osteoporosis can, from a statistical perspective, fit on a normally distributed, symmetrical, unimodal, bell shaped curve for comparison purposes (Glass and Hopkins, 1996, p. 95).Osteoporosis cut off T scores for QUS is -1 SD or below for osteoporosis and the DXA T score ranges are BMD above -1.0 standard deviation (SD) below young normal's (normal range), BMD -1.0 to -2.5 below young normal's (osteopenic range), a BMD below -2.5 below young normal's (osteoporotic range) (Eisenberg & Johnson, 2003, p. 108) and established osteoporosis (osteoporosis with existing fractures) per the World Health Organization (www.who.int/entity/chp/topics/osteoporosis.pdf).

Even though T scores from QUS and DXA units can be compared clinically, it is critical to note however that a T score derived from QUS data is not the same as a T score derived via the

use of DXA. This makes equivalent comparisons of T scores with different technologies difficult. In fact, it is suggested by Wilson and others that comparison of T scores obtained with different machines, machine model numbers or different technologies should not be done from a scientific and statistical perspective (Wilson, 2003, p. 64). In spite of this recommendation, it is still possible to use T scores garnered from different technologies as independent T score measurements to accurately predict fracture risk due to osteoporosis in certain populations. In other words, the QUS stiffness index and/or T Score and the DXA T score can be utilized by a physician, in conjunction with other clinical risk factors, to provide a comprehensive skeletal assessment (General Electric, 2004).

Z Scores and Osteoporosis Screening

Z scores are also used in osteoporosis testing. A z score can be defined as a measure of how many standard deviations units away from the mean a particular value of data lies (Accessed from the Web on 02/19/10 at: www.en.wiktionary.org/wiki/Z.score

The formula for a Z score is shown below:

$$z = x- \mu/\sigma$$

z= Z score

x= raw score to be standardized

μ= mean of the population

σ= standard deviation of the population

In osteoporosis DXA testing, a Z score is a comparison of your score to someone else of the same age, weight, ethnicity and gender. According to the ISCD, "Z scores are used when evaluating premenopausal women and children for osteoporosis, and furthermore, the term osteoporosis is not to be used in diagnosing children, "since the WHO criteria do not apply to them" (Bone Health and Osteoporosis: A Report of the Surgeon General, 2004, Chap 8, p. 206). A Z score is an observation [score] expressed in standard deviation units from the mean" [and] "a z score tells us how many standard deviations the given score is above or below the mean" (Glass and Hopkins, 1996, p. 83). Calculation of a z score from an osteoporosis perspective is as follows: Z score= (patient's BMD-expected BMD)/SD from the mean for matched individuals (i.e.: age, gender and ethnicity). (Ott, S. Osteoporosis and Bone Physiology. Accessed from the web on 12/02/09 at: http://courses.washington.edu/bonephys/opbmd.html.

"Z scores are not used for diagnosis because a person's Z scores can remain constant throughout life, even as BMD declines with age. However, the Z score is useful in determining how an individual's BMD compares with what is expected for a person of a given age and body size" (Bone Health and Osteoporosis- A Report of the Surgeon General, 2004, p. 204, Chap. 8). "Z scores are also useful in children to determine how their bone density compares to that of their peers. Since they have not reached adult peak bone mass, T-scores should not be used for children "(Bone Health and Osteoporosis-A Report of the Surgeon General, 2004, Chap 8, p. 204).

T and Z Scores in DXA Databases

Of note is the fact that T and Z scores for Caucasian women are found in the DXA machine databases as the standard comparison model. This may introduce problems reliability and

validity concerning comparison of stored Caucasian female data with that of Nez Perce tribal members (i.e.: men and women). One possible resolution to this statistical dilemma is the fact that a Canadian panel of the ISCD "has developed guidelines for the diagnosis of osteoporosis in men, premenopausal women, and children (Kahn et al. 2004). "This panel recommended that BMD measurements be used only in patients with fragility fractures or major secondary causes of bone loss. The panel also recommends that Z-scores, not T-scores, be used in children and pre-menopausal women" (Bone Health and Osteoporosis; A Report of the Surgeon general, 2004, Chap 8, p. 206).

Bone Mineral Density and Bone Mass

Although a DXA scan is used to diagnostically confirm osteoporosis from an imaging perspective, the DXA results should be used in tandem with other clinical indicators to actually determine if a person is osteoporotic. The DXA unit uses x-rays to estimate bone mineral density (BMD). Bone density can be defined as "the amount of bone tissue in a certain volume of bone (g/cm^3). DXA units however usually express bone density in surface area rather than volume, or (g/cm^2)" (Accessed from the web on 12/02/09 at: http://hypertextbook.com/facts/2002/AnnaYarusskaya.shtml.) unlike QCT units, which demonstrate bone density three dimensionally in the x, y and z planes.

"Bone mineral density (BMD) [tests] measures the amount of calcium in a special region of bones. From this information, an estimate of the strength of the bones can be made. BMD helps predict the risk of a future fracture of the bone, measures the amount of bone mass, and also can be used to monitor the effectiveness of treatment "(Accessed from the web on 12/02/09 at: http://hyperteextbook.com/facts/2002/AnnaYarusskaya.shtml.)

According to Lohman, "estimated total bone mineral density for males is 3.88 g/cm^2 and for females 2.909 g/cm^2" (Lohman, T., 1992, p. 32) and according to Ott, "using standardized bone density measurements of the total hip, "normal" bone is greater than 833 mg/cm^2, "osteopenia is between 833 and 648 mg/cm^2, "osteoporosis" is lower than 648 mg/cm^2 and "severe" osteoporosis is when there has been a fragility fracture" (Ott, S. 2002)

It is worth noting however, that although osteoporotic bone is lacking in bone mass density, it still retains standard matrix and mineralization levels similar to normal bone (Sheldon, et.al., 1992). According to Mekary, "Bone strength primarily implies the combination of bone matrix (quality) [and] bone density, which is expressed as grams of mineral per surface (g/cm^2) (i.e.: DXA) or volume (g/cm^3) (i.e.: QCT) (Mekary, 2005). In addition, as previously indicated, "The World Health Organization (WHO) operationally defines osteoporosis as bone density 2.5 S.D.'s (standard deviation as expressed via T scores) below the mean for young white adult women (Mekary, 2005). T scores of Caucasian women is used because of the availability of T score data and represents mean value of young adults at of the same gender at peak bone mass (Mekary, 2005).

Treating Osteoporosis

Use of Prescription Medications to Prevent or Treat Osteoporosis

Antiresorptive medications are used to prevent or treat osteoporosis. The way in which these medications work is that they "inhibit bone loss rather than stimulate new bone formation" (Bonnick, 2002, p.236).

Types of FDA approved antiresorptive osteoporosis medications include the following:

- Raloxifene (Evista)
- Calcitonin (Miacalcin)

Raloxifene (Evista)

Raloxifene was approved for use to prevent and treat osteoporosis in 1999. Compared to their baseline bone density, women receiving 60 mg of raloxifene/day had an increase of approximately 3% at the PA lumbar spine and 1% at the femoral neck. There was a 30% reduction in the risk of new spine fractures in these women over the course of the 3-year study" (Bonnick, 2002, p. 237).

Calcitonin (Miacalcin)

In the Prevent Recurrence of Osteoporotic Fractures (PROOF) 5-year study, "the women receiving 200 I.U. of synthetic salmon calcitonin nasal spray had a 33% reduction in the risk of new spine fractures" (Bonnick, 2002, p. 237).

Bisphosphonates

Bisphosphonates are the type of drug that helps prevent bone loss and are used to treat osteoporosis and other diseases. Types of bisphosphonates include Alendronate (Fosamax), risendronate (Actonel), and ibandronate (Boniva).

Alendronate (Fosamax)

According to Bonnick, "Alendronate is approved for the prevention and treatment of osteoporosis in women as well as for the treatment of osteoporosis in men" (Bonnick, 2002,

p. 238). “In the 3-year Fracture Intervention Trial (FIT), women receiving 10 mg of alendronate daily had a 51% reduction in the risk of hip fractures. Bone density at the PA lumbar spine increased by more than 8% and at the femoral neck by approximately 3% compared with baseline in women receiving alendronate over the 3-year study period” (Bonnick, 2002, p. 238). “In a 2-year study of 241 men with osteoporosis, alendronate administered at a dose of10 mg/day resulted in significant increases in bone density at the spine and hip. The average increase from baseline at the PA lumbar spine was 7.1% and at the femoral neck, 2.5%” (Bonnick, 2002, p. 239).

Risendronate (Actonel)

According to Bonnick, ‘the efficacy of risendronate in reducing spine fracture risk has been demonstrated in two large clinical trials, collectively called the VERT trials. Both of these trials were 3 year studies involving several thousand women with preexisting spine fractures. In the U.S. trial, women who received 5 mg of risendronate had a 41% reduction in the risk of new spine fracture. Bone density increased at the lumbar spine by 5.2% and at the femoral neck by 1.6% compared with baseline over the 3-year study” (Bonnick, 2002, p. 239)

Boniva

Boniva is the trade name for a generic type of osteoporosis prevention/treatment medication known chemically as ibandronate, a type of bisphosphonate. Bisphosphonate is a medication that alters bone formation and breakdown in the body so that bone loss is diminished and bone mass development is increased. Boniva is an injectable drug commonly taken every three months, and for some individuals once a year.

The injectable form is for individuals whom are unable to take the drug orally. Oral administration of Boniva can result in esophageal ulcers. An individual taking Boniva orally must be able to sit upright or stand for at least 1 hour after taking this medication. Because of this, many providers and patients prefer the injectable form.

Non-Clinical Methods for Treating Osteoporosis

A variety of dietary, pharmacological, and physiological methods/treatments for osteoporosis are available to anyone who thinks they may be susceptible or have been clinically diagnosed with osteoporosis. It is important to remember that each individual is ultimately responsible for their own health and in consultation with a healthcare provider can lead to an effective treatment plan that may involve beneficial changes in diet, exercise and vitamin use that may help prevent, mitigate or treat osteoporosis. Table 8 shows types of foods that in the right amount may prevent or mitigate osteoporosis.

Table 8

Foods Important in Preventing Osteoporosis

Essential Fatty Acids	Nuts and seeds, dark green, leafy vegetables and oily fish (i.e.: mackerel, salmon, etc.)	Helps protein synthesis.
Fiber	Nuts and seeds, complex carbohydrates, bran.	Allows for absorption of vitamins & minerals to prevent osteoporosis.
Saturated Fats	Peanut Butter, oils, butter	Helps with absorption of fat soluble vitamins A, D and E to help prevent osteoporosis.
Protein	Meat, cereals, milk, fruits, vegetables, fish and eggs	Protein helps form the framework on which calcium and other salts are deposited.

Table 8 (continued)

Salt	Common food additive, various sources.	Reducing salt intake reduces loss of calcium from urinary excretion.
Potassium	Fresh Fruits, seafood, yogurt, wholegrain cereals.	Diminished potassium leads to poor calcium absorption.
Sugar	Common food additive, various sources.	High sugar intake increases mineral loss (i.e.: calcium, chromium, copper, magnesium and zinc).
Water	Tap and Mineral Water	Contains calcium and magnesium, needed for good bone density.

(Source: Brewer, 1998, p. 52-55).

The Importance of Vitamins Regarding Bone Health

Minerals and appropriate RDI's that are important to good bone health are shown below.

Table 9

Minerals, Vitamins, and RDI's Important in Preventing and Treating Osteoporosis

Calcium	800 mg
Magnesium	300 mg
Phosphorous	800 mg
Zinc	15 mg
Vitamin A	800 mcg
Vitamin B6	2 mg
Vitamin B12	1 mcg
Folic acid	200 mcg
Vitamin C	60 mg
Vitamin D	5 mcg

(Source: Adapted from Bonnick, 2002, p. 35 & Brewer, 1998, p.57).

Calcium is essential for bone health. Table 10 demonstrates RDI for calcium for individual of different ages.

Table 10

Recommend Calcium Intake

Adolescents/Adults (both sexes)	**Recommended Calcium Intake (mg)**
9-18	1300
19-50	1000
51 +	1200
Pregnant or nursing women	1300

(Source: Bonnick, 2002, p. 234).

According to Bonnick, "Over the counter calcium supplements are an acceptable means of supplementing dietary calcium to ensure that the intake goals are met" (Bonnick, 2002, p. 234), and "Calcium fortified foods and beverages are also useful in increasing dietary calcium intake" (Bonnick, 2002, p. 234).

Health Behavior Models and Osteoporosis

Important health education/health promotion models such as the Theory of Reasoned Action, Theory of Planned Behavior, Social Cognitive Theory, and Transtheoretical/Stages of Change models will not be discussed in this prospectus since the EHBM is the model of choice for completion of this dissertation.

Expanded Health Belief Model and Osteoporosis

My rationale for the use of the Expanded Health Belief Model as compared to other health behavior models is based on the following premises:

1) Familiarity with the EHBM.
2) Historical context of the EHBM.
3) Cross applicability of the EHBM to a variety of health processes.
4) Utility of the EHBM.
5) Belief that the EHBM is better suited to this dissertation research than the HBM because of the self-efficacy component found in the EHBM model.

Before discussing the expanded health belief model in detail, it is appropriate to discuss the health belief model more thoroughly, since it is the foundational model that the EHBM is based upon.

Health Belief Model

The Health Belief Model (HBM) is a foundational model of health education. The HBM was developed by Godfrey Hochbaum, Stephen Kegels and Irwin Rosenstock, three health psychologists working for the U.S. Department of Public Health in the 1950's. This research came about when these health psychologists wanted to determine why certain people willingly got tested for Tuberculosis via portable chest radiography and why others did not choose to get tested for TB via portable chest radiography (Glanz, 2002).

Expanded Health Belief Model

The Expanded Health Belief Model (EHBM) has the HBM as its foundation, but with the addition of self-efficacy as proposed by Bandura in 1977 (Wallace, 2002, p. 164). The EHBM served as the behavioral model used by Katherine K. Kim, Mary L. Horan, Phyllis Gendler, and Mini K. Patel, nursing professors and researchers at Grand Valley State University in Allendale, MI to develop the Osteoporosis Health Belief Scale (OHBS). According to the aforementioned researchers, "The Osteoporosis Health Belief Scale (OHBS) was developed to measure health beliefs related to osteoporosis" (Kim, 1991, p. 155).

The authors also state that "…knowledge and skills gained from health education do not always translate into subsequent health behaviors. Therefore, it is important to consider the influence of psychological variables in effecting behavior change" [and] "…the purpose of this study was to develop and test an instrument designed to measure personal attitudes and beliefs related to the potential for developing osteoporosis"(Kim, 1991, p. 156).The instrument that these researchers developed consisted of two additional risk reduction behaviors; the barriers and benefits related to calcium intake and those related to physical exercise" (Kim, 1991, p. 157). Of this modification to the HBM, these two scales contained "…seven subscales; three of which are common to both the OHB Calcium and Exercise scales, two that that relate only to OHB calcium and two that relate only to OHB exercise" (Kim, 1991, p. 159). The addition of these two measurements in the HBM helps "…demonstrate the importance of health motivation in influencing health related behavior" (Kim, 1991, p. 161).

According to the authors, "The results of this study demonstrate the importance of health motivation in influencing health related behaviors" (Kim, 1991, p. 161). Additionally, "The

authors encourage further use and revision of the instrument. Consideration should be given to the inclusion of self-efficacy as an additional dimension" (Kim, 1991, p. 161-162).

Use of the Osteoporosis Health Belief Scale and the Expanded Health Belief Model, which includes self-efficacy as proposed by Bandura in 1977 (Wallace, 2002, p. 163-172) is the key underlying behavioral model that will be used for this dissertation. Researchers such as Kim, K.et. al, (1991), who developed the Osteoporosis Health Belief Scale in 1991 have been using the EHBM for years to investigate osteoporosis in women and men, Hispanic women and men and Native American women and men. Wallace (2002) conducted research regarding osteoporosis prevention in college women using the EHBM and Nicholas, J.S., & Chen, Z. (2002) described osteoporosis in Native Americans. Hazavehei, S.M., Taghdisi, M.H., and Saidi, M., (2007) examined application of the HBM to osteoporosis prevention in middle school girls in Garmsar, Iran and Turner, L.W., et al. (2004) used the HBM to design and implement an osteoporosis prevention program for women using the HBM.

In essence, the HBM and the EHBM has been one of the most widely used health behavior models in the social sciences and has been used to study the likelihood of women conducting breast self-exams, individuals choosing to quit smoking and drinking, and osteoporosis prevention among junior high, high school and college aged women, among a long list of other health related behaviors.

Literature Review Summary

The literature search was conducted using online databases. Some journal article and textbook searches were conducted physically in person at the SIUC library, University of Idaho library, Idaho State University library, and the Lewis-Clark State College library. The electronic

database search was conducted using key words such as osteoporosis, BMD, bone density, DXA, QCT, QUS, t scores and z scores, Nez Perce Tribe, Nimiipuu, Nez Perce County, ID, Lapwai, ID Health Belief Model (HBM), Expanded Health Belief Model (EHBM) and osteoporosis in native Americans. Relevant literature was collected, evaluated and presented in Chap 2.

The WHO definition of osteoporosis was selected as the most appropriate with the most utility for this study. Examination of individuals most susceptible to osteoporosis was discussed, symptoms of osteoporosis, t and z scores, and the prevention of osteoporosis was discussed. Medications, diets and exercise was evaluated as to their ability to treat and prevent osteoporosis.

Examination of Native American and Nez Perce Tribal culture was evaluated as compared to Caucasian culture in Nez Perce County, ID. Use of the HBM and EHBM, OKT, OHBS and OSES instruments were examined for validity and reliability and utility for use in this dissertation. Evaluation of the research script, survey questionnaires, statistical tests, were discussed in detail as they related to this study.

CHAPTER 3

METHODS

Overview

This chapter provides a detailed overview of the methods used in this study including purpose of the study, null hypothesis, research hypothesis, research questions, research design, dependent variables, independent variables, Expanded Health Belief Model (EHBM) theory, survey responses, study instrument reliability and validity, recruitment of subjects, administration of survey, data collection procedures, study consent, statistical analysis and technique, sample size, confidence level, confidence interval, survey completion, volunteer notification, collaboration, protection of privacy and confidentiality, benefit and risk dichotomy, and summary.

Purpose of Study

The purpose of this study is to implement an EHBM based written survey to determine if there is a difference in osteoporosis attitudes, knowledge, beliefs and self-efficacy among Nez Perce Tribal members, male and female, age 18 and older as compared to non-Nez Perce Tribal members residing in Nez Perce County, ID.

Null Hypothesis

There is not a difference in osteoporosis knowledge, attitudes, beliefs, and self-efficacy among Nez Perce Tribal members and non-Nez Perce Tribal members, male and female, aged 18 and older residing in Nez Perce County, ID as evidenced by completion of the EHBM based osteoporosis survey instruments.

$H_{0:}$ Native American = Non-Native American

Research Hypothesis

There is a difference in osteoporosis knowledge, attitudes, beliefs, and self-efficacy among Nez Perce Tribal members and non-Nez Perce Tribal members, male and female, aged 18 and older residing in Nez Perce County, ID as evidenced by completion of the EHBM based osteoporosis survey instruments.

$H_{1:}$ Native American ≠ Non-Native American

Research Questions

This study sought to answer the following research questions:

1. What do Nez Perce Tribal members and non-Nez Perce Tribal members know about osteoporosis?
2. Is there a statistically significant difference in osteoporosis knowledge, attitudes, beliefs and self-efficacy among Nez Perce Tribal members and non Nez Perce Tribal members, male and female, aged 18 and over residing in Nez Perce County, ID as evidenced by completion of an EHBM based osteoporosis survey instrument?
3. Does ethnicity have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?
4. Does gender have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?
5. Does age have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self- efficacy regarding osteoporosis?
6. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between nutrition and osteoporosis?

7. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between exercise and osteoporosis?

Research Design

The study design for this dissertation research project was partially based upon the EHBM described in detail in Fig. 1, the work of Kim, Horan, Gendler, & Patel, and the social science research paradigm found in Appendix 1 (Babbie, 1992, p. 104). The study was a quantitative, cross-sectional descriptive study involving evaluation of written survey data regarding osteoporosis attitudes, knowledge, beliefs and self-efficacy (Issac & Michael, 1997). The written survey was administered in person by the primary investigator (PI) to all participants and involved a standard paper and pencil format. Advantages of the written survey involve low cost, ease of administration, and the ability for the PI to answer participant questions on-site. The written survey instruments are based on the EHBM. The survey instruments used were the 1) Osteoporosis Knowledge Test (OKT), the 2) Osteoporosis Health Belief Scale (OHBS) and the 3) Osteoporosis Self-Efficacy Scale (OSES).

The theoretical health behavior model that all three survey instruments used in this study is based upon is the Expanded Health Belief Model (EHBM). The constructs of the EHBM in this study includes susceptibility, which refers to the perceived risk of developing osteoporosis, seriousness, which is the perception of threat from having osteoporosis, including harmful consequences in relation to personal physical health, role and social status, and the ability to complete activities of daily living (ADL's). Benefits focus on the belief in the effectiveness of specific behaviors to prevent the occurrence of osteoporosis. Barriers are the beliefs about negative components in the behaviors which would be undertaken to prevent the disease. Health

motivation relates to a general tendency for an individual to engage in health behaviors. Self - efficacy is the belief that an individual can do something about preventing or getting diagnosed and effectively treated for osteoporosis. The OHBS has a calcium subscale and an exercise subscale. Fig 3 graphically demonstrates the relationship between the calcium and exercise subscales as presented in the OHBS and as it relates to aspects of the EHBM.

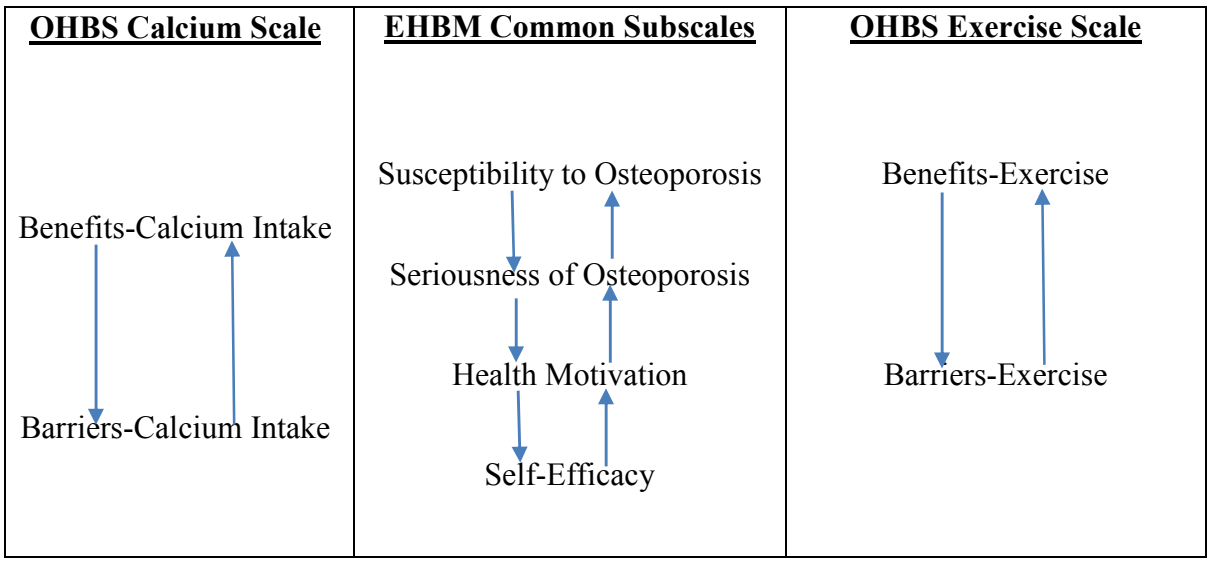


Fig 3. Relationship between the Subscales and the EHBM

Independent and Dependent Variables

In the Chi Square, phi coefficient, Cramer's V, Mann-Whitney U and Kruskall Wallis tests, the dependent variables were knowledge of exercise, knowledge of nutrition, susceptibility to osteoporosis, seriousness of osteoporosis, benefits of exercise, benefits of calcium, barriers to exercise, barriers to calcium, self-efficacy for exercise, self-efficacy for calcium and health motivation. Independent variables included age, ethnicity and gender.

In the hierarchical regression analysis (Table 37, p. 128), health motivation is the dependent variable for all four models. The independent variables for each model include the following:

Model 1: Age, gender, and ethnicity.

Model 2: Age, gender, ethnicity, knowledge of exercise, and knowledge of nutrition.

Model 3: Age, gender, ethnicity, knowledge of exercise, knowledge of nutrition, susceptibility, seriousness, benefits of exercise, benefits of calcium, barriers to exercise, and barriers to calcium

Model 4: Age, gender, ethnicity, knowledge of exercise, knowledge of nutrition, susceptibility, seriousness, benefits of exercise, benefits of calcium, barriers to exercise, barriers to calcium, self-efficacy for exercise, and self-efficacy for calcium

In the MANOVA (Table 38, p. 129), the dependent variables are knowledge of exercise, knowledge of nutrition, susceptibility, seriousness, benefits of exercise, benefits of calcium, barriers to exercise, barriers to calcium, self-efficacy for exercise, and self-efficacy for calcium. The independent variables are gender, ethnicity, and the interaction between gender/ethnicity were statistically significant, which meant that further exploration of the interaction between gender/ethnicity on each of the dependent variables was conducted because the MANOVA didn't specify exactly where the interaction was occurring)

For the various two-way ANOVAs for the interaction of gender/ethnicity, the dependent variables are knowledge of exercise, knowledge of nutrition, susceptibility, seriousness, benefits of exercise, benefits of calcium, barriers to exercise, barriers to calcium, self-efficacy for exercise, and self-efficacy for calcium. The independent variables are gender and ethnicity with interaction effect.

For the single two-way ANOVA for the only significant effect of gender*ethnicity on a dependent variable, the dependent variable is barriers to calcium and the independent variable is gender and ethnicity with interaction effect.

Figure 5 on p.132 demonstrates shows the interaction for gender and ethnicity on the dependent variable (i.e.: barriers to calcium).

Table 41 on p. 133 shows t-tests for simple main effects with the dependent variable being barriers to calcium intake and the independent variables being (1) Native vs. non-native American females, (2) Native vs. non-native American males, (3) Native American females vs. Native American males and (4) Non-native American females vs. non-native American males.

EHBM Theory and OHBS Survey Instruments

The EHBM has the Health Belief Model (HBM) as its foundation, but with the addition of self-efficacy as proposed by Bandura in 1977 (Wallace, 2002, p. 164). The EHBM served as the behavioral model used by Katherine K. Kim, Mary L. Horan, Phyllis Gendler, and Mini K. Patel, nursing professors and researchers at Grand Valley State University in Allendale, MI to develop the Osteoporosis Health Belief Scale (OHBS). According to the aforementioned researchers,

"The OHBS was developed to measure health beliefs related to osteoporosis" (Kim, 1991, p. 155). "The purpose of developing the OHBS was to develop and test an instrument designed to measure personal attitudes and beliefs related to the potential for developing osteoporosis" (Kim, 1991, p. 156). The instrument that these researchers developed consisted of two additional risk reduction behaviors; the barriers and benefits related to calcium intake and those related to physical exercise" (Kim, 1991, p. 157). The addition of these two measurements in the HBM helps "…demonstrate the importance of health motivation in influencing health related behavior" (Kim, 1991, p. 161). Additionally, the authors encourage further use and revision of the instrument and recommend inclusion of self-efficacy as an additional dimension (Kim, 1991).

Use of the OHBS and the EHBM, which includes self-efficacy as proposed by Bandura in 1977 (Wallace, 2002, p. 163-172) is the key underlying behavioral model that was used in this dissertation research.

Fig 4 demonstrates the relationship between the EHBM, the OHBS instruments, and the research questions used in this study.

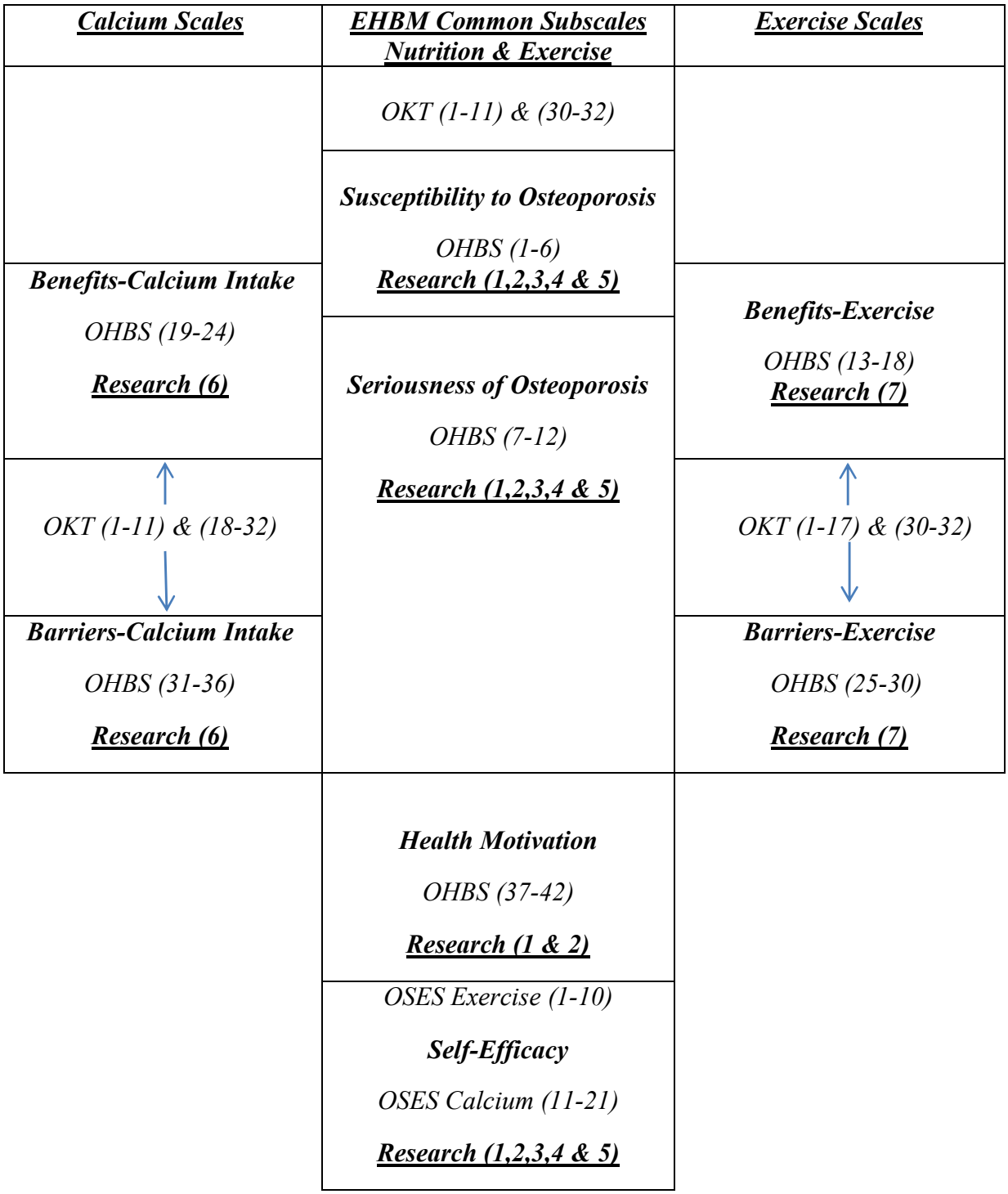


Fig 4. EHBM Components, Survey Responses and Research Questions

Study Instrument Reliability (OKT/OHBS/OSES)

The instruments used in conducting survey research regarding osteoporosis attitudes, knowledge, beliefs and self-efficacy of Nez Perce Tribal members as compared to Non Nez Perce Tribal members is the Osteoporosis Knowledge Test (OKT), the Osteoporosis Health Belief Scale (OHBS), and the Osteoporosis Self Efficacy Scale (OSES), developed by Katherine Kim, PhD., Mary Horan, PhD., and Phyllis Gendler, PhD in 1991 at Grand Valley State University in Grand Rapids, MI. These instruments were revised by Phyllis Gendler, PhD, Cynthia Coviak, PhD, Jean Martin, PhD, and Katherine Kim, PhD in 2010 and 2011.

The OKT (revised in 2011) has two subscales: Osteoporosis Knowledge Test Nutrition (items 1-11 and 18-32) and Exercise (items 1-17 and 30-32). The OKT Nutrition (Revised 2011) and OKT Exercise (Revised 2011) share 14 common items (items 1-11 and 30-32). The reliability coefficients for internal consistency (KR 20) for the OKT (Revised 2011) are as follows: 0.849 for the total scale, 0.83 for the Nutrition subscale, and 0.81 for the Exercise subscale. Test-retest analysis resulted in Pearson Correlation of 0.872. Validity of the OKT was evaluated by content validity by a panel of HBM and Osteoporosis experts. Questions were examined for difficulty, effectiveness of distracters and discrimination (Horan, Kim, Gendler, Froman & Patel, 1998).

The Osteoporosis Health Belief Scale (OHBS) has five subscales: the Susceptibility subscale, (questions 1-6), the Seriousness subscale, (questions 7-12), the Benefits of Exercise subscale (questions 13-18), the Benefits Calcium Intake subscale (questions 19-24), the Barriers to Exercise subscale, (questions 25-30), the Barriers to Calcium Intake, (questions 31-36) and the Health Motivation subscale, (questions 37-42) (Horan, Kim, Gendler, Froman & Patel, 1998).

The Osteoporosis Self-Efficacy Scale (OSES 21 items) has two sub scales: The Osteoporosis Self-Efficacy Exercise Scale, which has 10 items (questions 1-10). The OSES Calcium Scale has 11 items (questions 11-21). Reliability coefficients for internal consistency (Cronbach alpha) of both subscales are .90. Validity of the OSES was evaluated by factor analysis and discriminate function analysis (Horan, Kim, Gendler, Froman & Patel, 1998).

Cronbach alpha (α) scores may range from negative infinity to 1, however only positive values of α are generally used. Alpha coefficients are used to describe the reliability of factors extracted from dichotomous variables (that is, questions with two possible answers) and/or scales (i.e., rating scale: 1 = poor, 5 = excellent). Some statisticians insist on a reliability score of 0.70 or higher in order to demonstrate acceptable (fair) internal consistency (statistical reliability) between variables (Retrieved on October 20, 2015, from https://explorable.com/crobachs-alpha).

Table 11 demonstrates the reliability coefficients for the OHBS Calcium Subscales and the OHBS Exercise Subscales and Table 12 shows OSE Item Loading on Exercise and Calcium Self-Efficacy Factors**:**

Table 11

Internal Consistency for the OHBS Subscales (Calcium and Exercise)

Subscale	*Number of Items*	*Cronbach Alpha Calcium*	*Cronbach Alpha Exercise*
Susceptibility	*5*	*.80*	*.80*
Seriousness	*5*	*.65*	*.65*
Health Motivation	*5*	*.61*	*.61*
Benefits	*5*	*.68*	*.74*
Barriers	*5*	*.73*	*.72*

Table 12

OSE Item Loading on Exercise and Calcium Self-Efficacy Factors

Item #	*Loading*	
	Exercise	*Calcium*
1. Begin a new or different exercise program	*.70*	
2. Change your exercise habits	*.77*	
3. Put forth the effort required to exercise	*.81*	
4. Do exercises even if difficult	*.74*	
5. Maintain a regular exercise program	*.75*	
6. Exercise for the appropriate length of time	*.83*	
7. Do exercise even if they are tiring	*.78*	
8. Stick to your exercise program	*.81*	
9, Exercise at least three times a week	*.75*	
10. Do the type of exercises you are supposed to do	*.74*	
11. Begin to eat more calcium-rich foods		*.79*
12. Increase your calcium intake		*.66*
13. Consume adequate amounts of calcium-rich foods		*.82*
14. Eat calcium rich foods on a regular basis		*.86*
15. Change your diet to include more calcium rich foods.		*.84*
16. Eat calcium rich foods as often as you are supposed to		*.84*
17.Select appropriate foods to increase your calcium intake		*.77*
18. Stick to a diet which gives an adequate amount of calcium		*.78*
19. Obtain foods that give an adequate amount of calcium		*.72*
20. Remember to eat calcium rich foods		*.76*
21. Take calcium supplements if you don't get enough		*.38*
Cronbach's Alpha	*.94*	*.93*

Study Instrument Validity

The validity of the OHB calcium and exercise subscales, OSE calcium and exercise subscales, and the OKT subscales were evaluated by content validity, factor analysis and discriminate function analysis (Kim, Horan & Gendler, 1991 & 1998). Questions on the survey instruments were also evaluated for difficulty, effectiveness of distractors and discriminators by instrument developers Kim, Horan and Gendler. "The construct validity of the OHB calcium subscale and the OHB exercise subscale was determined by factor analysis. The percentages of variance explained by susceptibility, barriers, benefits, seriousness and heath motivation were 14.4, 12.4, 9.1, 7.7, and 5.8, respectively. The percentages of variance for the OHB exercise subscale accounted for susceptibility, benefits exercise, barriers exercise, seriousness, and health motivation were 15.9, 12.1, 9.2, 6.4, and 5.7" (Endicott, 2013).

Recruitment of Subjects.

Flyers approved by the Southern Illinois University Human Subjects Committee (SIUC HSC), the Nez Perce Tribal Executive Committee, Nez Perce Tribal Legal Counsel, the Nez Perce Tribe Clinic Administrator, the Medical Director of Nimiipuu Health (NMPH) and the Laboratory/Radiology Director of NMPH were posted on a bulletin board adjacent to the front entrance of the NMPH Clinic, located at 111 Bever Grade Road, PO Drawer 367, Lapwai, ID from August 19-30, 2013.

In addition, copies of the approved flyer were posted at the front registration desk, the X-Ray and Laboratory Departments and each physician, nurse practitioner and physician assistant's office at NMPH. The study start date was August 19, 2013 and the study end date was August 30, 2013. 215 individuals consented to the study, but only 209 properly completed the forms.

Temporary office occupancy at the NMPH Clinic by PI Victor White was M-F from 11:00AM to 19:00PM and 10:00AM to 18:00PM on Saturdays. Appendix 9 shows a copy of the flyer.

PI Victor White and NMPH clinical staff recruited volunteers for this study verbally using the script found in Appendix 7 and via distribution of the approved flyer when participants asked about the study or were present at the clinic for routine medical procedures and expressed an interest in participating in the study. Nez Perce tribal members and other Native Americans in North Idaho receive care that is paid for by the Indian Health Services office based in Portland, OR, but non Native Americans can receive care at the Nimiipuu Clinic, but they must pay for such care via governmental (Medicare, Medicaid) or non-governmental third party payers (private health insurance), or via self-pay.

All recruited individuals were Nez Perce Tribal members and/or Non-Nez Perce Tribal Member volunteers, male and female, ages 18 and met all necessary qualifications to complete the survey. The PI, Victor White, asked each participant to self-identify as a member of the Nez Perce Tribe determined by tribal membership policy and their self-reported blood quantum or to identify as a Non Nez Perce tribal member, respectively. Out of 215 initial volunteers, 209 self-identified as tribal or non-Tribal members and also correctly filled out all three survey instruments.

Administration of Survey

The survey was administered via written instrument at the Nimiipuu Health Clinic, P.O. Box 367, Lapwai, ID 83540. Telephone and/or cell phone surveys were not used because many Nez Perce Tribal members do not own a cell phone or have home land line phone services. Computer internet surveys were not conducted because many Nez Perce tribal members and some Non Nez

Perce tribal members lack home based or mobile internet service access. In addition, internet computer surveys are frequently ignored and not completed. True randomization was not achievable in this study because it was based on volunteer participation (i.e.: self-selection by participants). Word of mouth by Nez Perce tribal health care providers, and discussion among residents of the Nez Perce Tribe, Native and Non-Native residents of Nez Perce County, ID led to general awareness of the survey research.

PI Victor White occupied an empty office at NMPH assigned by NMPH Laboratory/X-Ray Administrator Constacio Cleto with the SIUC HSC approved flyer/brochure describing the survey study posted on the front door of the office. Self-referred subjects whom read the flyers, met the criteria and wished to take part in the survey were also included and were able to opt out at any time without penalty as were all participants throughout the duration of the study.

Medical professionals of NMPH had the flyers posted at their desks and in each patient treatment office. Any NMPH nursing or allied health medical professional; (i.e.: lab, x-ray, nursing) or medical providers (i.e.: physicians, physician assistants, nurse practitioners, etc.) were allowed to engage in self-referral and/or referred family members, friends and their patients to the temporary office for completion of the survey instrument.

Data Collection Procedures

All consent forms and survey data forms were passed out by PI Victor White. Victor White explained the purpose of the research; the survey instruments, how to complete the survey, and answered any questions about the survey or osteoporosis that the volunteer participants had. The survey was paper and pencil and all participants completed the survey on-site at NMPH in a secure unoccupied office at the clinic. Each participant completed the survey instruments in

approximately 20-30 minutes, but were allowed to work on the survey until they completed it or decided to opt out of completing the survey. Upon survey completion of the survey or non-completion, PI Victor White collected 215 survey forms, with 209 being filled out completely and correctly. Reasons why six of the surveys were not used include the following:

- Surveys were not completed or were incorrectly completed.
- No name, age, gender or ethnicity was put on the survey.
- Some participants refused to indicate their ethnicity.
- Some participants did not know or could not indicate their blood quantum/quartile regarding Indian Ethnicity.

Study Consent

A general consent form to participate in the survey study was signed by 215 participants. A copy of this consent form is found in Appendix 8. Data collection processes included having volunteer participants fill out the OKT, OHBS and OSES.

Appendix 10 is a scan of the permission letter from Phyllis Gendler, PhD of Grand Valley State University in Grand Rapids, MI to use the Osteoporosis Knowledge Test (OKT) (Appendix 11), the Osteoporosis Health Belief Scale (OHBS) (Appendix 12), and the Osteoporosis Health Efficacy Scale-21 (OHES) (Appendix 13). Participants completed the OKT, the OHBS and the OSES. These survey instruments are based upon osteoporosis and EHBM research completed by Phyllis Gendler, Ph.D. and associates surveying 201 women, 35 years of age or older at Grand Valley State University in Allendale, MI from 1991 through 2010. The three surveys include questions regarding overall health status, gender, medication use, smoking, vitamin intake, exercise, diet, and the diagnosis and treatment of osteoporosis (Kim, Horan, Gendler, & Patel,

1991, p. 155-163 and Horan, Kim, Gendler, Froman, & Patel, 1998, p. 395-403, and Wallace, 2002, p. 163-172).

Statistical Analysis

Descriptive statistic used in this study include counts, frequencies, averages, medians and modes. The data from this dissertation is descriptive, non-parametric and parametric, consisting of nominal and ordinal data. Non parametric means that random selection has not happened, so the sample may not be representative of the population in question, variables are measured in a manner that generates nominal or ordinal data, and the number of subjects in the sample is small. The assumed distribution means that "in probability theory, the normal (or Gaussian) distribution is a very common continuous probability distribution (central limit theorem)" [and] "are important in statistics and are often assumed to be normal as used in the natural and social sciences to represent real-value random variables whose distributions are not known"(Retrieved on October 20, 2015, from https://en.wikipedia.org/wiki/Normal_distribution). Parts of the study demonstrated a normal distribution, but other parts did not. Because of this, both non-parametric and parametric tests were used to analyze the data in this study.

A Cramer's V correlation was conducted to determine if there were relationships between dependent and independent variables for all OKT, OHBS and OSES research questions. Levene's independent equality of variance and means *t* test was used to evaluate OKT, OHBS and OSES questions with significance established at the $p < 0.05$ level. Multiple one-way ANOVA's were performed on the OKT, OHBS and OSES data, with a $p < 0.05$ significance level. A MANOVA was conducted on the OKT, OHBS and OSES questions, with a $p < 0.05$ significance level. Hierarchical linear regression was conducted to determine which of the

independent variables (i.e.: ethnicity and gender) contributed the most to the dependent health motivation variable at the $p < 0.05$ significance level.

Completed survey data was gathered via voluntary participant completion of an EHBM based written survey instrument from 209 volunteer participants and was analyzed with statistical software, SPSS v. 21 and SAS. Types of statistical tests used in this study, along with the research questions, independent and dependent variables and EHBM questions can be found in Tables 13 and 14.

Statistical Technique

Table 13

Considerations for Using Various Statistical Tests (Non-Parametric) Used in This Study.

Test	Applied To	Assumed Distribution	Test Use
Descriptive	Nominal or Ordinal	Normal	Methods used to examine data for measures of central tendency and measures of variability or dispersion
Chi Square	Nominal	Binomial	Testing the frequency of occurrence of an attribute to see if it is due to chance
Mann-Whitney	Ordinal	Ordered categories, unequal intervals	Used to test the null hypothesis that two populations are the same against an alternative hypothesis.
Kruskall Wallis	Ordinal	Any	Testing the significance of a difference between two group means

The following Table shows basic statistical tests that can be run on interval or ratio type data used in this study.

Table 14

Considerations for Using Various Statistical Tests (Parametric) In This Study

Test	Applied To:	Assumed Distribution	Test Use
Independent t tests (Levene's)	Interval or Ratio	Normal	Testing the significance of a difference between two group means
Hierarchical linear regression	Nominal or ordinal	Binomial or multinomial	Used to predict outcome of a categorical dependent variable based on one or more predictor variables
ANOVA	Nominal	Normal	Test the significance of group differences between two or more groups, but doesn't tell which is different.
MANOVA	Nominal	Normal	Same as ANOVA, but you can evaluate two or more related dependent variables while controlling for the correlation between the dependent variable.

Research Questions

Research Questions, survey items and the type of statistical analysis that was conducted for each research question and data set in this study is demonstrated below in Table 15.

Table 15

Research Questions, Statistics and EHBM Components

Research Questions		Statistics Used	EHBM Component and Survey Questions	
	Independent Variables	Dependent Variables		
1. What do Nez Perce Tribal members and Non Nez Perce Tribal members residing in Nez Perce County, ID know about osteoporosis?	Age, ethnicity/race, and gender	Osteoporosis knowledge, attitudes, beliefs and self-efficacy	Descriptive Stats: Counts, frequencies, median, mode, mean, range and standard deviation. Non Parametric: Chi Square, phi coefficient, Mann-Whitney U, Kruskall Wallis, Cramer's V. Parametric: Levene's t test, hierarchical linear regression, ANOVA and MANOVA's.	OKT (1-11) & (30-32). OHBS (1-6). OHBS (7-12). OHBS (37-42). OSES Calcium (11-21).

Table 15 (continued)

2. Is there a statistically significant difference in osteoporosis knowledge, attitudes, beliefs, and self-efficacy among Nez Perce Tribal members and Non Nez Perce Tribal Members, male and female, aged 18 and older residing in Nez Perce County, ID as evidenced by completion of an EHBM based osteoporosis survey instrument?	Age, ethnicity/race, and gender	Osteoporosis knowledge, attitudes, beliefs and self-efficacy	<u>Descriptive Stats:</u> Counts, frequencies, median, mode, mean, range and standard deviation. <u>Non Parametric</u> Chi Square, phi coefficient, Mann-Whitney U, Kruskall Wallis, Cramer's V. <u>Parametric</u> Levene's t test, hierarchical linear regression, ANOVA and MANOVA's.	OKT (1-11) & (30-32). OHBS (1-6). OHBS (7-12). OHBS (37-42). OSES Calcium (11-21).

Table 15 (continued)

3. Does ethnicity have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?	Age, ethnicity/race, and gender	Osteoporosis knowledge, attitudes, beliefs and self-efficacy	Descriptive Stats: Counts, frequencies, median, mode, mean, range and standard deviation. Non Parametric Chi Square, phi coefficient, Mann-Whitney U, Kruskall Wallis, Cramer's V. Parametric Levene's t test, hierarchical linear regression, ANOVA and MANOVA's.	OKT (1-11). OHBS (1-6). OHBS (7-12). OSES Calcium (11-21).

Table 15 (continued)

4. Does gender have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?	Age, ethnicity/race, and gender	Osteoporosis knowledge, attitudes, beliefs and self-efficacy	Descriptive Stats: Counts, frequencies, median, mode, mean, range and standard deviation. Non Parametric Chi Square, phi coefficient, Mann-Whitney U, Kruskall Wallis, & Cramer's V. Parametric Levene's t test, hierarchical linear regression, ANOVA and MANOVA's.	OKT (1-11). OHBS (1-6). OHBS (7-12). OSES Calcium (11-21).

Table 15 (continued)

5. Does age have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self- efficacy regarding osteoporosis?	Age, ethnicity/race, and gender	Osteoporosis knowledge, attitudes, beliefs and self-efficacy	Descriptive Stats: Counts, frequencies, median, mode, mean, range and standard deviation. Non Parametric Chi Square, phi coefficient, Mann-Whitney U, Kruskall Wallis, & Cramer's V. Parametric Levene's t test, hierarchical linear regression, ANOVA and MANOVA's.	OKT (1-11). OHBS (1-6). OHBS (7-12). OSES Calcium (11-21).

Table 15 (continued)

6. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between nutrition and osteoporosis?	Age, ethnicity/race, and gender	Osteoporosis knowledge, attitudes, beliefs and self-efficacy	Descriptive Stats: Counts, frequencies, median, mode, mean, range and standard deviation. Non Parametric Chi Square, phi coefficient, Mann-Whitney U, Kruskall Wallis, & Cramer's V. Parametric Levene's t test, hierarchical linear regression, ANOVA and MANOVA's.	OHBS (19-24). OHBS (31-36).
7. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between exercise and osteoporosis?	Age, ethnicity/race, and gender	Osteoporosis knowledge, attitudes, beliefs and self-efficacy	Descriptive Stats: Counts, frequencies, median, mode, mean, range and standard deviation. Non Parametric Chi Square, phi coefficient, Mann-Whitney U, Kruskall Wallis, & Cramer's V. Parametric Levene's t test, hierarchical linear regression, ANOVA and MANOVA's.	OHBS (13-18). OHBS (25-30).

Sample Size, Confidence Level and Confidence Interval

The sample size for Nez Perce tribal members at the 95% confidence level with a confidence interval of 10 is 94, out of a population of 3,499 Nez Perce tribal members living in Nez Perce County, ID. The sample size for Non-Nez Perce tribal members at the 95% confidence level with a confidence interval of 10 is 96, out of a population of 39,531 non-Nez Perce tribal members living in Nez Perce County, ID.

Because of the data presented above, a minimum sample size of 100 Nez Perce tribal members and 100 non-Nez Perce tribal members was sought. This sample size for both Nez Perce tribal members and non-Nez Perce tribal members diminishes the likelihood of a type II error. Type I error occurs when the researcher rejects the null hypothesis when it is true. The probability of a Type I error is represented by alpha (α). Type II error occurs when the researcher accepts the null hypothesis when it is false and the research hypothesis is true. The type II error is represented by the symbol beta (β) (Ott, L., 1984, p. 110). The number of Native Americans in this study was 128 and the number of non-Native Americans was 81. The number of females in this study was 108 and the number of males in this study was 101, for a total of 209 participants.

Volunteer Notification

Flyers were posted at the Nez Perce Tribal Clinic in Lapwai, ID from August 19-30, 2013. Healthcare providers, including physicians, nurse practitioners and physician assistants at NMPH also had access to these flyers and were able to mention the date, time and location of the educational program top interested patients, other healthcare workers, family and friends.

Collaboration

Local community groups that I collaborated with in this research include members of the dissertation committee, the Nez Perce Tribe, non-Nez Perce Tribal members, study participants, Nez Perce Tribal healthcare practitioners, and non-Nez Perce Tribal healthcare practitioners. Approval for the study was given by the SIUC Human Subjects Committee (HSC).

Protection of Privacy and Confidentiality

All individual participants had their identities kept confidential at all times. Participants were able to decline to participate at any time with no penalty or restriction of care at the Nez Perce Tribe clinic or any other health/medical facilities. All raw data was coded with reference to demographic data of the voluntary participants of this study. Access to raw data is available only to the primary investigator. All coded data was coded without reference to demographic aspects of the study participants. Hard copy data is kept in a locked file cabinet located at Victor Whites residence. Computer data is contained on a password protected, restricted access computer at Victor Whites residence. All participant data is held in the strictest confidence and adhered to all confidentiality and human subject requirements of the three Nez Perce Tribe approval letters all dated June 24, 2013. These letters are found in Appendices 4, 5 and 6. The Southern Illinois University Carbondale (SIUC) Human Subjects Committee (HSC) Form A dated 08/09/13 is found in Appendix 2 and the SIUC HSC Approval letter protocol# 13240 dated 08/09/13 is found in Appendix 3.

In addition, primary investigator (PI) Victor N. White, MA, MSRS, RT(R), CHES has completed a National Institutes of Health (NIH) Human Participants Protection Education for

Research Teams seminar at the University of Idaho in Moscow, ID. A certificate of completion for this seminar is contained in Appendix 14.

Complete participant anonymity could not be ensured because individual participants could have seen each other entering and leaving the Nez Perce Tribal clinic. In addition, Idaho State law indicates that confidentiality may not be maintained completely if there is a compelling legal reason to know participants in a research project, but "much of the biomedical and behavioral research conducted in the United States is governed by the rule (i.e.: Common Rule) entitled Federal Policy for the Protection of Human Subjects (HHS Subpart A of Title 45 CFR, Part 46), which supersedes state law regarding protection of human subjects in research projects" (National Institutes of Health, 2002, p. 1). For the aforementioned research, there was not a compelling legal reason to know the participants in this study, so HHS Subpart A of Title 45 CFR, Part 46 was upheld in this study.

Benefit and Risk Dichotomy

Potential benefits to volunteer participants include the following:

1. Opportunity for osteoporosis mitigation and prevention strategies to be implemented on an individual, tribal, and non-tribal basis.
2. Opportunity to learn more about osteoporosis by Nez Perce Tribal and Non Nez Perce tribal members.
3. Bone health benefits to individuals, Nez Perce Tribal members, the Nez Perce Tribe as a group, and non-Nez Perce Tribal members.

Potential risks to volunteer participants include the following:

1. Small risk of disclosure of knowledge of study participants by physical "sightings" of participants going to the Lapwai, ID clinic for completion of the EHBM Survey instrument.

Summary

This study was designed to use EHBM based survey questions to determine study participant's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis. The two study groups were Nez Perce Tribal members, male and female, age 18 and older as compared to non-Nez Perce Tribal members residing in Nez Perce County, ID.

The three survey instruments (OKT, OHSB, and OSES) included questions concerning respondent's knowledge, prevention and mitigation of osteoporosis, age, dietary intake, exercise level, ethnicity, gender, health status, medication use, smoking rate, vitamin and mineral use, and knowledge concerning prevention, diagnosis, mitigation and treatment of osteoporosis.

This study sought to determine variations in osteoporosis knowledge, attitudes, beliefs and self-efficacy among Nez Perce Tribal members and non Nez Perce Tribal members, male and female, aged 18 and over residing in Nez Perce County, ID as evidenced by completion of an EHBM based osteoporosis survey instruments. The study also was used to determine if age, gender and ethnicity have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis. Finally, the study was designed to determine whether or not Nez Perce Tribal members and non Nez Perce Tribal members understood the relationship between exercise, nutrition (calcium intake) and osteoporosis prevention.

CHAPTER 4

RESULTS

Purpose of the Study

The purpose of this study is to implement an EHBM based written survey to determine if there is a difference in osteoporosis attitudes, knowledge, beliefs and self-efficacy among Nez Perce Tribal members, male and female, age 18 and older as compared to non-Nez Perce Tribal members residing in Nez Perce County, ID. This chapter includes an analysis of the research questions and how the data derived in this study answers those questions.

Statistics

Descriptive statistics used in this study includes counts, frequencies, averages, medians modes, ranges and standard deviation. Although there is a degree of normalcy for exercise question responses, there was not a normal distribution for nutrition question responses. Because of these mixed results, both non-parametric and parametric tests were used to analyze the data. Non Parametric statistics used in this study include chi square, phi coefficient, Cramer's V, Mann-Whitney U and Kruskall Wallis. Parametric statistics used in this study include the Levine's equality of variance and means t test, ANOVA, MANOVA and hierarchical linear regression.

Description of the Sample

The total number of participants in this study is was 209. The number of Native American females was 65 (31.1%). The number of Non-Native females was 43 (20.6%). The number of Native American males was 63 (30.1%). The number of Non-Native males was 38 (18.2%). The

mean age for all participants was 46.53 years of age (YOA). The minimum age of all participants was 18 and the oldest participant was 92. The age range is 74 years. The age standard deviation is 9.389 years. Tables 16, 17, 18 and 19 demonstrate descriptive statistics used in this study.

Table 16

Descriptive Statistics

		Age	Ethnicity	Gender	EG
N	Valid	209	209	209	209
	Missing	0	0	0	0
Mean		46.53	1.48	1.39	1.536
Std. Error of Mean		.649	.035	.034	.0339
Median		46.00	1.00	1.00	1.200
Mode		46	1	1	1.1
Std. Deviation		9.389	.501	.488	.4898
Variance		88.154	.251	.238	.240
Range		74	1	1	1.1
Minimum		18	1	1	1.1
Maximum		92	2	2	2.2
Sum		9725	310	290	321.0

Table 17

Descriptive Statistics: Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	108	51.7	51.7	51.7
	2	101	48.3	48.3	100.0
	Total	209	100.0	100.0	

Table 18

Descriptive Statistics: Ethnicity

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1	128	61.2	61.2	61.2
	2	81	38.8	38.8	100.0
	Total	209	100.0	100.0	

Table 19

Descriptive Statistics: Total

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Native American/Female	65	31.1	31.1	31.1
	Native American/Male	63	30.1	30.1	61.2
	NN American/Female	43	20.6	20.6	81.8
	NN American/Male	38	18.2	18.2	100.0
	Total	209	100.0	100.0	

Non-Parametric Tests

Hypothesis Test Summary

For the Hypothesis Test Summary, Osteoporosis Knowledge Test (OKT) questions 3, 19 and 24 indicate retain the hypothesis and the remaining questions, ranging from 1-32 indicated reject the null hypothesis. The significance level is .10. This data is found in Appendix 15. The preponderance of evidence from this hypothesis test summary suggest the rejection of the null hypothesis (H0: Native Americans = Non-Native Americans) and acceptance of the research hypothesis (H1: Native Americans ≠ Non-Native Americans).

Chi Square

A Chi Square test is used to examine nominal data to see if the frequency of occurrence of an attribute is due to chance. The dependent variable in the Chi Square tests is completion of the survey. Chi Square was used to help answer research question 1 and 2.

Table 20

Chi Square Analysis

	Age	Gender	Ethnicity	Exercise	Nutrition
Chi-Square	138.828[a]	.234[b]	10.569[b]	56.005[d]	46.330[e]
df	23	1	1	5	11
Asymp. Sig.	.001	.628	.001	.001	.001

The Chi Square for age is 138.828 with a df of 23 and an asymp.sig (p value) of .001, which is significant. Chi Square for gender is .234 with 1 df and an asymp.sig (p value) of .628, which is not significant. Chi Square for ethnicity is 10.569 with 1 df and an asymp.sig (p value) of .001, which is significant. Chi Square for exercise is 56.205 with a df of 5 and an asymp.sig (p value) of .001, which is significant. Chi Square for nutrition is 46.330, with a df of 11 and an asymp.sig (p value) of .001, which is significant.

Analysis

The only item not considered statistically significant in the above Chi square dataset was gender, with a Chi square of .234, df of 1, and asymp. Sig (p value) of .628. I find this an interesting outcome because the Chi square results for age, ethnicity, exercise and nutrition lends support to the research hypothesis in these areas (Research Question 2) and demonstrate that there is a statistically significant difference in participant responses to exercise and nutrition questions on the EHBM survey. It is possible that through Nez Perce tribal healthcare providers and non-Tribal providers have discussed osteoporosis diagnosis and treatment with their patients, both female and male, thereby enhancing the health literacy of female and male Nez Perce Tribal members regarding osteoporosis to a level similar to that of the Non-Native female and male populations in Nez Perce County, ID.

Mann-Whitney U

The Mann-Whitney U test is used to test the null hypothesis that two populations are the same against an alternative hypothesis. The Mann-Whitney U test was used to help answer research questions 3, 4, 6 and 7.

Mann-Whitney U and Ethnicity

For research questions 3, 6 and 7, with ethnicity being the grouping variable, the Mann-Whitney U for the exercise subscale value is 4,725.500, the Wilcoxon W is 12,981.500, the Z is –1.106, and the asymp. sig (2 tailed) p value is .269, which is not statistically significant. The nutrition subscale Mann-Whitney U is 5,008.500, the Wilcoxon W is 13,264.500, the Z is -.45 and the asymp.sig (2 tailed) is .678, which is not statistically significant. The Mann-Whitney U with a grouping variable of ethnicity is higher for nutrition (5,008.500) than it is for exercise

(4,725.500). The mean rank for Native Americans (101.42) is lower than for Non-Native Americans (110.66). The Z for exercise is -1.106, whereas the Z for nutrition is -.415, both of which are below the group mean.

Table 21

Mann-Whitney Analysis of Ethnicity (Ranks of Exercise, Nutrition and Total)

	Ethnicity	N	Mean Rank	Sum of Ranks
Exercise	1	128	101.42	12981.50
	2	81	110.66	8963.50
	Total	209		
Nutrition	1	128	103.63	13264.50
	2	81	107.17	8680.50
	Total	209		
Total	1	128	102.34	13099.00
	2	81	109.21	8846.00
	Total	209		

Table 22

Mann-Whitney and Wilcoxon W Analysis of Ethnicity

	Exercise	Nutrition	Total
Mann-Whitney U	4725.500	5008.500	4843.000
Wilcoxon W	12981.500	13264.500	13099.000
Z	-1.106	-.415	-.809
Asymp. Sig. (2-tailed)	.269	.678	.418

Mann-Whitney U and Gender

For research questions 4, 6 and 7, with gender being the grouping variable, the Mann-Whitney U test for the exercise subscale value is 3550.500, the Wilcoxon W is 9436.500, the Z is -4.476, and the asymp.sig. (2 tailed) p value is .001, which is statistically significant at the 0.05 level. The nutrition subscale for Mann-Whitney U is 4831.500, the Wilcoxon W is 9436.500, the Z = -1.434, and the asymp.sig (2 tailed) p value is .152, which is not statistically significant.

Table 23

Mann-Whitney U and Gender Analysis (Ranks of Exercise, Nutrition and Total)

	Gender	N	Mean Rank	Sum of Ranks
Exercise	1	108	87.38	9436.50
	2	101	123.85	12508.50
	Total	209		
Nutrition	1	108	99.24	10717.50
	2	101	111.16	11227.50
	Total	209		
Total	1	108	97.38	10516.50
	2	101	113.15	11428.50
	Total	209		

Table 24

Mann-Whitney U and Gender Analysis

	Exercise	Nutrition	Total
Mann-Whitney U	3550.500	4831.500	4630.500
Wilcoxon W	9436.500	10717.500	10516.500

Table 24 (Continued)

Z	-4.476	-1.434	-1.905
Asymp. Sig. (2-tailed)	.001	.152	.057

a. Grouping Variable: Gender

Analysis

The Mann-Whitney U mean with a grouping variable of ethnicity is higher for Non-Native Americans (110.66) then for Native Americans (101.42). The Z for exercise is -1.106, whereas the Z for nutrition is -.415, both of which are below the group mean. The Z for exercise with a grouping variable of gender is more than four standard deviations below the group mean, indicating that EHBM survey questions regarding exercise and osteoporosis prevention were answered more correctly by men than women, thereby indicating a statistically significant difference in men and women and understanding of the relationship between exercise and osteoporosis prevention in this study.

This data indicates that 1) Non-Native Americans correctly answered more EHBM survey questions relating exercise to osteoporosis prevention then Native Americans, and 2) men answered questions more correctly than women on EHBM Survey questions relating exercise to osteoporosis prevention, which is of some research interest.

The data also indicates that 1) men answered more EHBM survey questions correctly that related nutrition and osteoporosis prevention then women and 2) Non-Native Americans answered more EHBM survey questions correctly that related nutrition to osteoporosis prevention than Native Americans. These results indicate that Nez Perce Tribal member's knowledge of the relationship between exercise and osteoporosis prevention is less robust than

that of Non Nez Perce Tribal members and that men's knowledge of the relationship between exercise, nutrition and osteoporosis prevention is better than women's in this study. Perhaps more education of Nez Perce Tribal members and women of both ethnicities could be conducted by Nez Perce Tribal healthcare providers and non-reservation healthcare providers to improve osteoporosis prevention knowledge of these groups. Based on this data, there is a difference in osteoporosis knowledge between Nez Perce Tribal members and Non Nez Perce Tribal members, and males and females, thereby answering research questions 1 and 2, and validating the research hypothesis (i.e.: H1: Native Americans ≠ Non-Native Americans).

Kruskall Wallis

Kruskall Wallis is a distribution free alternative to ANOVA. It is a non-parametric method for testing whether samples originate from the same distribution. It is used for comparing two or more samples that are independent and may have different sample sizes.

Table 25

Kruskall Wallis and Gender Ranks

	Gender	N	Mean Rank
Exercise	1	108	87.38
	2	101	123.85
	Total	209	
Nutrition	1	108	99.24
	2	101	111.16
	Total	209	
Total	1	108	97.38
	2	101	113.15
	Total	209	

Table 26

Kruskall Wallis (Gender) Test Statistics[a,b]

	Exercise	Nutrition	Total
Chi-Square	20.030	2.056	3.630
df	1	1	1
Asymp. Sig.	.001	.152	.057

a. Kruskall Wallis Test
b. Grouping Variable: Gender

For the Kruskall Wallis test with gender as the grouping variable, the exercise df is 1 and the asymp. Sig (p value) is .001, which is statistically significant. For nutrition, the df is 1 and the asymp.sig (p value) is .152, which is not statistically significant. For total, the df is 1 and the asymp. Sig (p value) .057, which is nearly statistically significant. The exercise and total data demonstrated above do show evidence against the null hypothesis, whereas, the nutrition means do not show evidence against the null hypothesis with gender as the grouping variable.

Table 27

Kruskall Wallis and Ethnicity

Ranks

	Ethnicity	N	Mean Rank
Exercise	1	128	101.42
	2	81	110.66
	Total	209	
Nutrition	1	128	103.63
	2	81	107.17
	Total	209	
Total	1	128	102.34
	2	81	109.21
	Total	209	

Table 28

Kruskall Wallis Test (Ethnicity)

Test Statistics[a,b]

	Exercise	Nutrition	Total
Chi-Square	1.223	.172	.655
df	1	1	1
Asymp. Sig.	.269	.678	.418

a. Kruskall Wallis Test
b. Grouping Variable: Ethnicity

With the Kruskall Wallis test using ethnicity as the grouping variable, the df for exercise is 1 and the asymp. Sig (p value) is .269, which is not statistically significant. For nutrition, the df is 1 and the asymp. Sig (p value) is .678, which is not statistically significant. For total, the df is 1 and the asymp. Sig (p value) .418, which is not statistically significant. Kruskall Wallis data using ethnicity as the grouping variable does not show evidence against the null hypothesis for exercise, nutrition and total means.

Table 29

Kruskall Wallis (Age)

Test Statistics[a,b]

	Exercise	Nutrition	Total
Chi-Square	152.643	166.543	157.375
df	23	23	23
Asymp. Sig.	.001	.001	.001

a. Kruskall Wallis Test
b. Grouping Variable: Age

In the Kruskall Wallis test, with a grouping variable of age, the df is 23 for exercise and the asymp. Sig (p value) for exercise is .001, which is statistically significant. For nutrition, the df is

23 and the asymp. Sig (p value) is .001, which is statistically significant. For total, the df is 23 and the asymp.sig (p value) is .001, which is statistically significant. The data does show evidence against the null hypothesis. In other words, results from the Kruskall Wallis test do show a difference between group means of exercise, nutrition and total, with a grouping variable of age.

Correlations

Correlation is the relationship between two variables. Cramer's V is a type of correlation that expresses the degree of relationship (0 to +1) between two nominal variables, with 0 being no relationship and +1 being a perfect relationship. Cramer V calculations were used to help answer research questions 3 and 4.

In research question 3 with ethnicity as the test variable, the Cramer's V for OKT Questions 1-32 is 0.0947, which demonstrates a weak relationship between ethnicity and OKT survey question responses. The Cramer's V for OHBS questions 1-42 is 0.2631, which demonstrates a very strong relationship between ethnicity and OHBS survey question responses.

In research question 4 with gender as the test variable, the Cramer's V for OKT questions 1-32 is 0.0320, which shows no or a negligible relationship between ethnicity and OKT survey question responses. The Cramer V for OHBS questions 1-42 is 0.1979, which demonstrates a strong relationship between gender and OHBS survey question responses.

Cramer's V Analysis

Correlation was strongest for ethnicity, gender and OHBS question responses as compared to ethnicity, gender and OKT question responses. The OHBS questions deal more with current and expected behavior regarding prevention, mitigation and treatment of osteoporosis, whereas the OKT questions deal more with respondents knowledge about osteoporosis prevention and treatment. Improvements in participant's knowledge about osteoporosis could be brought about by more formal education regarding osteoporosis conducted in a group setting. In addition, individual providers could offer more patient specific counseling regarding osteoporosis prevention and treatment in Nez Perce County, ID medical offices.

Parametric Tests

Levene's Equality of Variance t Test

A Levene's equality of variance *t* test "is an inferential statistic used to assess the equality of variances for a variable calculated for two or more groups. If the resulting *p*-value of Levene's test is less than some significance level (typically 0.05), the obtained differences in sample variances are unlikely to have occurred based on random sampling from a population with equal variances. Thus, the null hypothesis of equal variances is rejected and it is concluded that there is a difference between the variances in the population" (Retrieved on January 22, 2015, from https://en.wikipedia.org/wiki/Levene%27s_test).

Table 30

Levene's Test for Equality of Variances and Equality of Means.

```
T-TEST GROUPS=age(50)
  /MISSING=ANALYSIS
  /VARIABLES=exercise nutrition total
  /CRITERIA=CI(.95).
```

T-Test

```
[DataSet1] E:\VICTOR WHITE (2).sav Chi Square Calculations.sav
```

Group Statistics

	age	N	Mean	Std. Deviation	Std. Error Mean
exercise	>= 50	75	5.0400	1.27809	.14758
	< 50	134	4.3881	1.49641	.12927
nutrition	>= 50	75	9.9600	4.86421	.56167
	< 50	134	12.4552	4.42416	.38219
total	>= 50	75	15.0000	5.99324	.69204
	< 50	134	16.8433	5.31964	.45955

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means	
		F	Sig.	t	df
exercise	Equal variances assumed	2.960	.087	3.179	207
	Equal variances not assumed			3.323	174.094
nutrition	Equal variances assumed	8.128	.005	-3.773	207
	Equal variances not assumed			-3.673	141.511
total	Equal variances assumed	8.870	.003	-2.295	207
	Equal variances not assumed			-2.219	138.651

Independent Samples Test

		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
exercise	Equal variances assumed	.002	.65194	.20510
	Equal variances not assumed	.001	.65194	.19619
nutrition	Equal variances assumed	.000	-2.49522	.66139
	Equal variances not assumed	.000	-2.49522	.67937
total	Equal variances assumed	.023	-1.84328	.80321
	Equal variances not assumed	.028	-1.84328	.83072

Analysis

The Levene's equality of variance *t* test does demonstrate a statistically significant difference between the mean number of exercise in individuals older than 50 YOA, (M=5.0400, S= 1, 27809) and younger than 50 YOA, (M=4.3881, S=1.49641), *t* (207) = 3.179, p=.002, alpha = .05. This result rules against the null hypothesis, indicating that the research hypothesis (H1: Native American ≠ Non-Native American) is correct.

The Levene's test does demonstrate a statistically significant difference between the mean number of nutrition in individuals older than 50 YOA, (M=9.96000, S=4.86421 and younger than 50 YOA, (M=12.4552, S=4.42416), *t* (207) = -3.773, p= .000, alpha = .05. This result rules against the null hypothesis (H0: Native Americans = Non-Native Americans), indicating that the research hypothesis (H1: Native American ≠ Non-Native American) is correct.

Results by Research Question

Research Question 1

1. What do Nez Perce Tribal members and Non-Nez Perce Tribal members know about osteoporosis?

Answer: Both groups have some limited knowledge about osteoporosis.

EHBM Categories, Survey Data and Research Questions

The EHBM categories that were examined include a summary of knowledge (OKT questions) about exercise and osteoporosis prevention. Table 31 is a Summary of Knowledge about Exercise and Osteoporosis Prevention.

Table 31

Summary of Knowledge (OKT) about Exercise and Osteoporosis Prevention

Scale	Responses	
	Incorrect n (%)	**Correct n (%)**
Exercise subscale		
Eating diet low in dairy product	78 (37.3)	131 (62.7)
Being menopausal	92 (44.0)	117 (56.0)
Having parent or grandparent who has osteoporosis	104 (49.8)	105 (50.2)
Being white or Asian woman	118 (56.5)	91 (43.5)
Being elderly man	170 (81.3)	39 (18.7)
Having ovaries surgically removed	131 (62.7)	78 (37.3)
Taking cortisone for long time	131 (62.7)	78 (37.3)
Being overweight	144 (68.9)	65 (31.1)
Having eating disorder	131 (62.7)	78 (37.3)
More than 2 alcoholic drinks per day	118 (56.5)	91 (43.5)
Smoking daily	118 (56.5)	91 (43.5)
Number of days a week to do exercise	183 (87.6)	26 (12.4)
Exercise hard enough	52 (24.9)	157 (75.1)
Best way to reduce osteoporosis : swim, walk, stretching	92 (44.0)	117 (56.0)
Best way to reduce osteoporosis : bicycling , yoga, lift weights	131 (62.7)	78 (37.3)
Best way to reduce osteoporosis: jogging, golfing, gardening	92 (44.0)	117 (56.0)
Best way to reduce osteoporosis: bowling, doing laundry, aerobic dancing	65 (31.1)	144 (68.9)

Results: Summary of Knowledge about Exercise and Osteoporosis Prevention.

More respondents answered OKT questions correctly concerning exercise and osteoporosis in the following areas: Being menopausal (56%), having parent or grandparent who has osteoporosis (50.2%), exercises hard enough (75.1%), best way to reduce osteoporosis: swim, walk, stretching (56%), best way to reduce osteoporosis jogging, golfing, gardening (56), and the best way to reduce osteoporosis: bowling, doing laundry, aerobic dancing (68.9%).

Analysis: Summary of Knowledge about Exercise and Osteoporosis Prevention.

Respondents have a basic understanding of the relationship between exercise and osteoporosis. Health education in a group format (community presentation) and/or individual discussion with a healthcare provider could improve some respondents understanding about the relationship between exercise and osteoporosis prevention.

EHBM Categories, Survey Data and Research Questions

The EHBM categories that were examined include a Summary of Knowledge (OKT questions) About Nutrition and Osteoporosis Prevention. Table 32 is a Summary of Knowledge about Nutrition and Osteoporosis Prevention

Table 32

Summary of Knowledge about Nutrition and Osteoporosis Prevention

	Responses	
Scale	**Incorrect n (%)**	**Correct n (%)**
Nutrition Scale		
Best source of calcium: apple, cheese, cucumber	39 (18.7)	170 (81.3)
Best source of calcium : peanut butter, turkey, canned sardines	104 (49.8)	105 (50.2)
Best source of calcium: Chicken, broccoli, grapes	65 (31.1)	144 (68.9)
Best source of calcium: Yogurt, strawberries, cabbage	39 (18.7)	170 (81.3)
Best source of calcium : ice cream, grapefruit, radishes	65 (31.1)	144 (68.9)
Recommended amount of calcium	118 (56.5)	91 (43.5)
Amount of milk to drink to meet recommended calcium	105 (50.2)	104 (49.8)
Best reason for taking a calcium supplement	52 (24.9)	157 (75.1)
Vitamin required absorb calcium	52 (24.9)	157 (75.1)
Best source of vitamin to absorb calcium	39 (18.7)	170 (81.3)
Best food source of vitamin to absorb calcium	169 (80.9)	40 (19.1)
Recommended amount of vitamin to absorb calcium	183 (87.6)	26 (12.4)
Best time to build strong bones	170 (81.3)	39 (18.7)
Osteoporosis diagnosis	52 (24.9)	157 (75.1)
Once have osteoporosis	78 (37.3)	131 (62.7)

Results: Summary of Knowledge about Nutrition and Osteoporosis Prevention

Respondents correctly answered OKT questions related to nutrition and osteoporosis prevention in the following areas: Best source of calcium: apple, cheese, cucumber (81.3%), best source of calcium: peanut butter, turkey, canned sardines (50.2%), best source of calcium: chicken, broccoli, grapes (68.9%), best source of calcium: yogurt, strawberries, cabbage (81.3%), best source of calcium: ice cream, grapefruit, radishes (68.9%), best reason for taking a calcium supplement (75.1%), vitamin required to absorb calcium (75.1%), best source of vitamin to absorb calcium (81.3%), osteoporosis diagnosis (75.1%), and once you have osteoporosis (62.7%).

Analysis: Summary of Knowledge about Nutrition and Osteoporosis Prevention

Respondents have a good understanding of the relationship between sources of calcium as it relates to osteoporosis diagnosis and treatment. Areas where respondents had incorrect understanding regarding nutrition and osteoporosis prevention were recommended amounts of calcium, amount of milk to drink to get adequate calcium, and the relationship between the amount and sources of calcium need on a daily basis to prevent osteoporosis.

EHBM Categories, Survey Data and Research Questions:

The EHBM questions that were examined include OHBS question and responses.

Table 33 is a summary of study participant beliefs about the seriousness and susceptibility to osteoporosis and health motivation.

Table 33

Summary of Beliefs (OHBS) about Seriousness and Susceptibility to Osteoporosis and Health Motivation

	Responses				
Scale	**Strongly Disagree n (%)**	**Disagree n (%)**	**Neutral n (%)**	**Agree n (%)**	**Strongly Agree n (%)**
Susceptibility					
Chances of getting osteoporosis high	0 (0.0)	26 (12.4)	53 (25.4)	104 (49.8)	26 (12.4)
Body build likely to get osteoporosis	13 (6.2)	26 (12.4)	92 (44.0)	65 (31.1)	13 (6.2)
Extremely likely to get osteoporosis	0 (0.0)	78 (37.3)	79 (37.8)	39 (18.7)	13 (6.2)
Good chance will get osteoporosis	0 (0.0)	65 (31.1)	39 (18.7)	79 (37.8)	26 (12.4)
More likely than average person to get osteoporosis	13 (6.2)	66 (31.6)	52 (24.9)	78 (37.3)	0 (0.0
Family history makes it more likely will get osteoporosis	1 (0.5)	52 (24.9)	104 (49.8)	52 (24.9)	0 (0.0)
Seriousness					
Thought of having osteoporosis scares me	0 (0.0)	27 (12.9)	65 (31.1)	78 (37.3)	39 (18.7)
If had osteoporosis would be crippled	13 (6.2)	131 (62.7)	52 (24.9)	0 (0.0)	13 (6.2)
Feeling about self would change if got depressed	0 (0.0)	66 (31.6)	65 (31.1)	78 (37.3)	0 (0.0)

Table 33 (Continued)

Would be costly if got osteoporosis	1 (0.5)	13 (6.2)	117 (56.0)	65 (31.1)	13 (6.2)
When think about osteoporosis, get depressed	0 (0.0)	79 (37.8)	78 (37.3)	39 (18.7)	13 (6.2)
Would be serious if got osteoporosis	13 (6.2)	52 (24.9)	26 (12.4)	104 (49.8)	14 (6.7)
Health Motivation					
Eat well balanced diet	0 (0.0)	79 (37.8)	65 (31.1)	65 (31.1)	0 (0.0)
Look for new information related to health	0 (0.0)	26 (12.4)	66 (31.6)	104 (49.8)	13 (6.2)
Keeping healthy is very important for me	0 (0.0)	0 (0.0)	13 (6.2)	131 (62.7)	65 (31.1)
Try to discover health problem early	0 (0.0)	0 (0.0)	26 (12.4)	118 (56.5)	(65 (31.1)
Have regular health check-up when not sick	0 (0.0)	13 (6.2)	14 (6.7)	117 (56.0)	65 (31.1)
Follow recommendations to keep me healthy	0 (0.0)	0 (0.0)	66 (31.6)	117 (56.0)	26 (12.4)

Results: Susceptibility to Osteoporosis.

104 respondents (49.8%) agreed their chances of getting osteoporosis was high. 104 respondents (49.8%) were neutral regarding the question "family history makes it more likely you will get osteoporosis".

Analysis: Susceptibility to Osteoporosis.

Almost half (49.8%) of respondents felt their chance of getting osteoporosis was high, yet almost half (49.8%) of respondents also felt neutral in regards to the relationship between family history and osteoporosis. More education by Nez Perce County and Nez Perce Tribal clinic

health educators and clinical staff should be conducted in groups (i.e.: community presentations) or on an individual basis in provider's offices as needed about the importance of family history as it relates to susceptibility and seriousness of being diagnosed with osteoporosis.

Results: Seriousness of Osteoporosis

131 respondents (62.7%) did not agree with the survey question "if I had osteoporosis, I would be crippled". 117 respondents (56%) were neutral regarding the survey question "it would be costly if I got osteoporosis". 104 respondents (49.8%) agreed "it would be serious if I got osteoporosis".

Analysis: Seriousness of Osteoporosis

There was a belief by 62.7% of the respondents that having osteoporosis would not be crippling. 56% of respondents were neutral in their belief that osteoporosis would be costly and 49.8% agreed that getting osteoporosis would be serious. Respondents seem worried about the inability to ambulate freely and the cost of dealing with osteoporosis and its serious negative effect on their health status. Responses to survey questions show respondents concern about being able to work, and engage in normal activities of daily living (ADL's) if they were diagnosed with osteoporosis.

Results: Health Motivation and Osteoporosis

104 respondents (49.8%) agreed that they "would look for new information related to health (osteoporosis)". 131 respondents (62.7%) agreed that "keeping healthy is very important to me". 118 respondents (56.5%) agreed "they would try to discover health problems early on (osteoporosis)". 117 respondents (56%) agreed they should "have a regular health check-up even

when not sick". 117 respondents (56%) also afraid they would "follow provider recommendations to keep healthy".

Analysis: Health Motivation and Osteoporosis

From a health motivation perspective, anywhere from 49.8% to 62.7% of respondents felt that finding new information about health, trying to discover health problems in their early stages, getting regular health check-ups even when not sick and following provider health recommendations were important to respondents. This bodes well for osteoporosis prevention and treatment amongst respondents in Nez Perce County, ID.

Research Questions 2:

Is there a statistically significant difference in osteoporosis knowledge, attitudes, beliefs, and self-efficacy among Nez Perce Tribal members and Non Nez Perce Tribal Members, male and female, aged 18 and older residing in Nez Perce County, ID as evidenced by completion of an EHBM based osteoporosis survey instrument?

Answer: Yes, there is some statistically significant differences.

The EHBM categories that were examined include OSES question responses, along with data from Table 34, a summary of osteoporosis self-efficacy scale (OSES) examining the confidence scores in performing activities to prevent osteoporosis.

Table 34

Summary of Osteoporosis Self-Efficacy Scale (OSES) Examining the Confidence Scores in Performing Activities to Prevent Osteoporosis

	Responses	
Scale	**Mean (SD)**	**Median (IQR)**
Exercise scale		
Begin a new or different exercise program	56.3 (25.4)	50.0 (39.0-78.0)
Change exercise habits	57.4 (23.7)	54.0 (45.0-70.0)
Put forth effort required to exercise	62.0 (22.9)	55.0 (51.0-78.0)
Do exercise even if they are difficult	59.8 (23.7)	64.0 (42.0-72.0)
Maintain regular exercise program	50.0 (26.3)	58.0 (27.0-65.0)
Exercise for appropriate length of time	53.7 (29.6)	58.0 (28.0-81.0)
Do exercise even if they are tiring	54.0 (28.8)	58.0 (34.0-70.0)
Stick to exercise program	45.8 (28.1)	45.0 (32.0-58.0)
Exercise at least three times a week	50.6 (27.1)	44.0 (31.0-70.0)
Do type of exercises that you are supposed to do	49.0 (27.8)	42.0 (28.0-66.0)
Calcium scale		
Increase your calcium intake	60.2 (24.7)	60.0 (44.0-76.0)
Consume adequate amounts of calcium rich foods	58.2 (23.9)	62.0 (45.0-75.0)

Table 34 (continued)

Eat calcium rich foods on a regular basis	60.4 (25.7)	72.0 (46.0-80.0)
Change your diet to include more calcium rich foods	63.2 (25.3)	72.0 (46.0-80.0)
Eat calcium rich foods as often as you are supposed to do	63.4 (23.9)	68.0 (53.0-75.0)
Select appropriate foods to increase your calcium intake	63.8 (25.2)	68.0 (50.0-78.0)
Stick to diet which gives adequate amount of calcium	61.1 (26.3)	67.0 (38.0-80.0)
Obtain foods that give adequate amount of calcium	63.7 (24.9)	71.0 (45.0-78.0)
Remember to eat calcium rich foods	62.8 (25.0)	64.0 (43.0-78.0)
Take calcium supplements if don't get enough calcium from diet	63.6 (29.8)	64.0 (44.0-85.0)

Results: OSES Exercise Scale

The mean for the OSES exercise questions ranged from 45.8 to 62. The median for the same question ranged from 42 to 64.

Analysis: OSES Exercise Scale

There is not a significant difference in means or medians for OSES exercise scale questions. The data indicates that most respondents had self-efficacy or the ability to engage in exercise to prevent osteoporosis.

Results: OSES Calcium Scale

The mean for the OSES nutrition questions ranged from58.2 to 63.8. The median ranged from 60 to 72.

Analysis: OSES Calcium Scale

The means and medians were higher for the OSES calcium scale as compared to the OSES exercise scale. The ranges for the mean and median were less spread out for the calcium scale.

Self-efficacy is high for respondents in the nutrition (calcium) subscale, indicating that most respondents feel able to obtain proper types and varieties of calcium rich foods, on a regular basis.

Research Question 3:

3. Does ethnicity have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?

Answer: Yes.

EHBM Categories, Survey Data and Research Questions

The EHBM categories that were examined included incorrect versus correct knowledge (OKT questions) about exercise and nutrition in relationship to osteoporosis prevention.

Table 35 is a multivariate analysis of determinants of responses to incorrect vs. correct knowledge of exercise scales and osteoporosis prevention based on gender, ethnicity and age. Table 36 is a multivariate analysis of determinants of responses of incorrect vs. correct knowledge of nutrition scales and osteoporosis prevention based on gender, ethnicity and age.

Table 35

Multivariate Analysis of Determinants of Responses to Incorrect Versus Correct Knowledge of Exercise Scales and Osteoporosis Prevention.

	Exercise subscale[Ω]				
Characteristics	Being overweight OR[*](P-values)	Having eating disorder OR (P-values)	> 2 Alcoholic drinks per day OR (P-values)	Low dairy product[ł] OR (P-values)	Exercise hard enough OR (P-values)
Gender					
Female (Ref)	-	-	-	-	-
Male	0.77 (0.478)	1.14 (0.671)	0.72 (0.275)	0.48 (0.028)	1.73 (0.104)
Ethnicity					
Native American (Ref)	-	-	-	-	-
Non Native American	0.18 (< 0.0001)	0.56 (0.053)	0.59 (0.077)	0.91 (0.749)	0.46 (0.020)

Table 35 (continued)

Age group (yrs)					
<= 49 (Ref)	-	-	-	-	-
>=50	0.08 (<0.0001)	2.87 (0.004)	3.70 (0.0003)	2.93 (0.001)	0.75 (0.448)

[Ω]Responses to the knowledge of exercise to prevent osteoporosis were incorrect and correct
[*]Odds ratio (OR), p-value less than 0.05 is significant
[ł]Eating diet low in dairy product

Analysis of Table 35: Multivariate Analysis of Determinants of Responses to Incorrect Versus Correct Knowledge (OKT) of Exercise Scales and Osteoporosis Prevention.

Ethnicity

For being overweight, Non-Native Americans respondents answered this question more correctly (0.18) than Native American respondents (reference) (1.00).

For having eating disorder, Non-Native American respondents answered this question more correctly (0.56) than Native American respondents (reference) (1.00).

For > 2 alcoholic drinks per day, Non-Native American respondents answered this question more correctly (0.59) than Native American respondents (reference) (1.00).

For low dairy product, Non-Native Americans answered this question more correctly (0.91) than Native Americans (reference) (1.00).

For exercise hard enough, Non-Native American respondents answered this question more correctly (0.46) than Native Americans (reference) (1.00).

Table 36

Multivariate Analysis of Determinants of Responses of Incorrect Versus Correct Knowledge of Nutrition Scales and Osteoporosis Prevention

	Nutrition Scale[Ω]				
Characteristics	Recommended calcium[ł] OR[*](P-values)	Calcium supplement[∏] OR (P-values)	Osteoporosis diagnosis OR (P-values)	Strong bones[∞] OR (P-values)	Vitamin required[ǫ] OR (P-values)
Gender					
Female (Ref)	-	-	-	-	-
Male	2.82 (0.005)	0.98 (0.948)	0.44 (0.056)	0.30 (0.003)	0.68 (0.281)
Ethnicity					
Native American (Ref)	-	-	-	-	-
Non Native American	4.70 (< 0.0001)	2.49 (0.011)	1.02 (0.960)	0.12 (< 0.0001)	0.81 (0.522)
Age group (yrs)					
<= 49 (Ref)	-	-	-	-	-
>=50	0.11 (< 0.0001)	0.03 (0.001)	11.4 (< 0.0001)	0.48 (0.105)	2.37 (0.013)

[Ω]Responses to the knowledge of nutrition to prevent osteoporosis were incorrect and correct
[∞] Best time to build strong bones
[ǫ]Vitamin required to absorb calcium
[∏]Best reason for taking a calcium supplement
[ł]Recommended amount of calcium
[*]Odds ratio (OR), p-value less than 0.05 is significant

Analysis of Table 36: Multivariate Analysis of Determinants of Responses of Incorrect Versus Correct Knowledge (OKT) of Nutrition Scales and Osteoporosis Prevention.

Ethnicity

For recommended calcium, Non-Native Americans answered 4.70 times more incorrectly as compared to Native Americans (reference) (1.00).

For calcium supplement, Non-Native Americans answered 2.49 times more incorrectly as compared to Native Americans (reference) (1.00).

For osteoporosis diagnosis, Non-Native Americans answered 1.02 times more incorrectly as compared to Native Americans (reference) (1.00).

For strong bones, Native Americans answered incorrectly (1.00) more often than Non-Native Americans (0.12).

For vitamin required, Native American's answered incorrectly (1.00) more often than Non-Native Americans (0.81).

Overall Analysis for Table 35 and 36:

Non-Native respondents have a better understanding of the relationship between exercise and osteoporosis prevention than Native American respondents, but Native American respondents have higher self-efficacy concerning the willingness and ability to exercise. Native American respondents also have a better understanding between diet and osteoporosis prevention as compared to Non-Native respondents, but Non-Native respondents had a better understanding between strong bones, vitamins and osteoporosis prevention than Native Americans. Health education in a group format (community presentation) and/or individual discussion with a healthcare provider can ameliorate some of the misunderstanding about the relationship of the above categories and osteoporosis in the survey respondents.

Research Question 4:

4. Does gender have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?

Answer: Yes.

For data regarding multivariate analysis of determinants of responses to incorrect vs. correct knowledge of exercise scales and osteoporosis prevention and nutrition scales and osteoporosis prevention, see Table 35 and 36, respectively.

EHBM Categories, Survey Data and Research Questions:

The EHBM Categories that were examined include OKT questions about gender, exercise and nutrition in relationship to osteoporosis.

Results: Multivariate Analysis of Nutrition and Gender

For recommended calcium, males were 2.82 times more likely to answer incorrectly than females.

For calcium supplements, males answered 0.98 incorrectly. Since 0.98 is less than 1.00, these results indicated that females were more likely to answer incorrectly for calcium supplements than males, which is of research interest.

For osteoporosis diagnosis, males answered 0.44 incorrectly. Since 0.44 is less than 1.00, this results indicates that females were more likely to answer incorrectly for osteoporosis diagnosis than males, which is of research interest.

For strong bones, males (0.30) answered this question more correctly than females (reference) (1.00). This is of some research interest.

For vitamin required, males answered this question more correctly (0.68) than females (reference) (1.00). This is of some research interests.

Results: Multivariate Analysis of Exercise and Gender

For being overweight, male respondents answered this question more correctly (0.77) than female respondents (reference) (1.00).

For having an eating disorder, male respondents answered this question more incorrectly (1.14) than female respondents (reference) (1.00).

For > 2 alcoholic drinks per day, male respondents answered this question more correctly (0.72) than female respondents (reference) (1.00).

For low dairy product, males answered this question more correctly (0.48) than female respondents (reference) (1.00).

For exercise hard enough, males answered this question more incorrectly (1.73) than female respondents (reference) (1.00).

Analysis of Nutrition, Exercise and Gender

Male respondents had a better understanding of weight, alcohol consumption and low dairy product in relation to osteoporosis prevention, and women had a better understanding of how an eating disorder and exercising hard enough related to osteoporosis prevention.

Research Question 5:

5. Does age have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self- efficacy regarding osteoporosis?

Answer: Yes.

EHBM Categories, Survey Data and Research Questions:

The EHBM Categories examined include OKT and OHBS questions about age, exercise and nutrition in relationship to osteoporosis prevention. To examine survey responses for research question 5, please see Table's 35 and 36.

Results: Multivariate Analysis of Exercise and Age

Table 35 Responses:

For being overweight, respondents 50 YOA or older answered this question more correctly than respondents 49 YOA or younger (reference) (1.00).

For having eating disorder, respondents 50 YOA or older answered this question more incorrectly (2.87) than did respondents 49 YOA or younger (reference) (1.00)

For > 2 alcoholic drinks per day, respondents 50 YOA or older answered this question more incorrectly (3.70) than did respondents 49 YOA or younger (reference) (1.00)

For low dairy product, respondents 50 YOA or older answered this question more incorrectly (2.93) than did respondents 49 YOPA or younger (Reference) (1.00).

For exercise hard enough, respondents 50 YOA or older answered this question more correctly (0.75) than did respondents 49 YOA or younger (reference) (1.00).

Results: Multivariate Analysis of Nutrition and Age

Table 36 Responses

For recommended calcium, respondents 50 YOA (years of age) or older answered more correctly (0.11) than respondents 49 YOA or less (reference) (1.00).

For calcium supplements, respondents 50 YOA or older answered more correctly (0.03) than respondents 49 YOA or less (reference) (1.00).

For osteoporosis diagnosis, respondents 50 YOA or older answered significantly less correctly (11.4) then respondents 49 YOA or less (reference) (1.00). This is quite a variation that requires further evaluation.

For strong bones, respondents 50 YOA or older answered more correctly (0.48) that respondents 49 YOA or less (reference) (1.00).

For vitamin required, respondents 50 YOA or older answered more correctly (0.48) than respondents 49 YOA or younger (reference) (1.00).

Analysis

Respondents 50 years of age (YOA) and older had a better understanding of nutrition (calcium intake) and strong bones in regards to osteoporosis prevention, whereas respondents 49 years of age (YOA) and younger had a better understanding of weight, eating disorder, alcohol and dairy consumption in relationship to osteoporosis prevention.

Research Question 6:

6. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between nutrition and osteoporosis?

Answer: Yes.

The EHBM categories that were examined include OKT, OHBS and OSES questions that are found in Table 31, p. 103, Table 32, p. 105, Table 33, p. 107, Table 34, p. 111, Table 35, p. 114, Table 36, p. 116, Table 37, p. 123 and Table 38, p. 127.

Results: Knowledge about Nutrition and Osteoporosis Prevention

Respondents correctly answered OKT questions related to nutrition and osteoporosis prevention in the following areas: Best source of calcium: apple, cheese, cucumber (81.3%), best source of calcium: peanut butter, turkey, canned sardines (50.2%), best source of calcium:

chicken, broccoli, grapes (68.9%), best source of calcium: yogurt, strawberries, cabbage (81.3%), best source of calcium: ice cream, grapefruit, radishes (68.9%), best reason for taking a calcium supplement (75.1%), vitamin required to absorb calcium (75.1%), best source of vitamin to absorb calcium (81.3%), osteoporosis diagnosis (75.1%), and once you have osteoporosis (62.7%).

Analysis: Knowledge about Nutrition and Osteoporosis Prevention

Respondents have a good understanding of the relationship between sources of calcium as it relates to osteoporosis diagnosis and treatment. Areas where respondents had incorrect understanding regarding nutrition and osteoporosis prevention were recommended amounts of calcium, amount of milk to drink to get adequate calcium, and the relationship between the amount and sources of calcium need on a daily basis to prevent osteoporosis. Table 37 demonstrates participant's perspective on the benefits and barriers to calcium intake in order to prevent osteoporosis.

Table 37

Benefits and Barriers of Calcium

Scale	Responses				
	Strongly Disagree n (%)	**Disagree n (%)**	**Neutral n (%)**	**Agree n (%)**	**Strongly Agree n (%)**
Benefits of calcium intake					
Taking enough calcium prevents problems of osteoporosis	0 (0.0)	27 (12.9)	39 (18.7)	130 (62.2)	13 (6.2)
Have lots to gain taking enough calcium to prevent osteoporosis	0 (0.0)	0 (0.0)	26 (12.4)	131 (62.7)	52 (24.9)
Taking enough calcium prevents painful osteoporosis	0 (0.0)	0 (0.0)	91 (43.5)	105 (50.2)	13 (6.2)
Wouldn't worry as much about osteoporosis if enough calcium	0 (0.0)	13 (6.2)	39 (18.7)	157 (75.1)	0 (0.0)
Taking enough calcium cuts chances of broken bones	0 (0.0)	0 (0.0)	26 (12.4)	131 (62.7)	52 (24.9)
Feel good about self when enough calcium to prevent osteoporosis	1 (0.5)	13 (6.2)	52 (24.9)	130 (62.2)	13 (6.2)
Barriers to calcium intake					
Calcium rich foods cost too much	26 (12.4)	104 (49.8)	53 (25.4)	26 (12.4)	0 (0.0)
Calcium rich foods don't agree with me	13 (6.2)	91 (43.5)	53 (25.4)	52 (24.9)	0 (0.0)
Do not like calcium rich foods	52 (24.9)	91 (43.5)	66 (31.6)	0 (0.0)	0 (0.0)

Table 37 (continued)

Eating calcium rich foods diet changes hard to do	13 (6.2)	117 (56.0)	53 (25.4)	26 (12.4)	0 (0.0)
To eat more calcium foods have to give up other I like	27 (12.9)	143 (68.4)	39 (18.7)	0 (0.0)	0 (0.0)
Calcium rich foods have too much cholesterol	26 (12.4)	91 (43.5)	79 (37.8)	13 (6.2)	0 (0.0

Results: Benefits to Calcium Intake and Osteoporosis Prevention

130 respondents (62.2%) agree that taking enough calcium prevents problems with osteoporosis. 131 respondents (62.7%) agree that there are benefits to taking calcium to prevent osteoporosis. 105 respondents (50.2%) agree that taking enough calcium prevents osteoporosis that that is painful (i.e.: spinal compression fractures, hip and forearm fractures, etc.), 157 respondents (75.1%) agree that if they eat enough calcium and it was absorbed properly, they would not care as much about osteoporosis. 131 respondents (62.7%) agreed enough calcium can help prevent fractures. 130 respondents (62.7%) agree that they feel good about themselves when they obtained enough calcium to prevent osteoporosis.

Analysis: Benefits to Calcium Intake and Osteoporosis Prevention

Anywhere from 50.2% to 75.1% of respondents know that they can prevent or mitigate osteoporosis and osteoporosis related fractures if they get enough calcium that can be absorbed. This demonstrates good knowledge about the relationship between calcium intake and the prevention of osteoporosis. Educating all respondents in Nez Perce County, ID (Native American and Non-Native Americans) about what types of calcium to take, how much to take each day, where to get calcium rich foods, and how it is absorbed in the body could be beneficial to these individuals.

Results: Barriers to Calcium Intake and Osteoporosis Prevention

104 respondents (49.8%) did not agree that “calcium rich foods cost too much”. 117 respondents (56%) disagreed that “eating a calcium rich diet is hard to do”. 143 respondents (68.4%) did not agree that "to eat more calcium foods, I would have to give up foods I like”.

Analysis: Barriers to Calcium Intake and Osteoporosis Prevention

Anywhere from 49.8% to 68.4% of the respondents indicated that they would not have trouble purchasing and eating calcium rich foods. Community health education efforts and individual providers can reinforce this knowledge regarding the relationship between obtaining and eating calcium rich foods on a regular basis to prevent osteoporosis. Look at Table 34 on p. 111 for a summary of Osteoporosis Self-Efficacy Scale (OSES) Examining the Confidence Scores in Performing Activities to Prevent Osteoporosis

Results: OSES Calcium Scale

The mean for the OSES nutrition questions ranged from58.2 to 63.8. The median ranged from 60 to 72.

Analysis: OSES Calcium Scale

The means and medians were higher for the OSES calcium scale as compared to the OSES exercise scale. The ranges for the mean and median were less spread out for the calcium scale.

Self-efficacy seems good for respondents in the nutrition (calcium) subscale, indicating that most respondents are likely to obtain proper types and varieties of calcium rich foods, on a regular basis. Exercise self-efficacy is high for respondents, indicating that they are able or willing to exercise regularly to prevent osteoporosis.

Research Question 7:

7. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between exercise and osteoporosis?

Answer: Yes.

EHBM Categories, Survey Data and Research Questions

The EHBM categories that were examined include OKT, OHBS and OSES questions. Table 31 on p. 104 is a summary of knowledge (OKT) about exercise and osteoporosis prevention. Table 34 on p. 111 is a summary of osteoporosis self-efficacy scales (OSES) examining the confidence scores in performing activities to prevent osteoporosis. Table 38 on p. 127 is a summary of beliefs (OHBS) about barriers and benefits for exercise and osteoporosis prevention.

Results: Knowledge About Exercise and Osteoporosis Prevention

More respondents answered OKT questions correctly concerning exercise and osteoporosis in the following areas: Being menopausal (56%), having parent or grandparent who has osteoporosis (50.2%), exercises hard enough (75.1%), best way to reduce osteoporosis: swim, walk, stretching (56%), best way to reduce osteoporosis jogging, golfing, gardening ((56), and the best way to reduce osteoporosis: bowling, doing laundry, aerobic dancing (68.9%).

Analysis: Knowledge about Exercise and Osteoporosis Prevention

Respondents have a correct understanding of the relationship between exercise and osteoporosis, but an incorrect understanding between 1) diet, 2) gender, 3) ethnicity, and 4) age in relationship to osteoporosis. Health education in a group format (community presentation) and/or individual discussion with a healthcare provider can ameliorate some of the misunderstanding about the relationship of the above categories and osteoporosis in the survey respondents. Table 38 demonstrates participant's beliefs on the benefits and barriers of exercise to prevent osteoporosis.

Table 38

Summary of Beliefs about Barriers and Benefits of Exercise for Osteoporosis Prevention

	Responses				
Scale	**Strongly Disagree n (%)**	**Disagree n (%)**	**Neutral n (%)**	**Agree n (%)**	**Strongly Agree n (%)**
Benefits of Exercise					
Regular exercise prevents problems of osteoporosis	0 (0.0)	13 (6.2)	39 (18.7)	117 (56.0)	40 (19.1)
Feel better when exercise to prevent osteoporosis	0 (0.0)	0 (0.0)	40 (19.1)	130 (62.2)	39 (18.7)
Regular exercise helps build strong bones	0 (0.0)	0 (0.0)	14 (6.7)	130 (62.2)	65 (31.1)
Exercise for osteoporosis also improves body looks	0 (0.0)	13 (6.2)	14 (6.7)	130 (62.2)	52 (24.9)
Regular exercise cuts down chances of broken bones	0 (0.0)	0 (0.0)	27 (12.9)	130 (62.2)	52 (24.9)
Feel good about self when exercise to prevent osteoporosis	0 (0.0)	0 (0.0)	39 (18.7)	118 (56.5)	(52 (24.9)
Barriers to Exercise					
Feel like not strong enough to exercise regularly	26 (12.4)	53 (25.4)	26 (12.4)	78 (37.3)	26 (12.4)
Have no place where can exercise	39 (18.7)	79 (37.8)	52 (24.9)	39 (18.7)	0 (0.0)
Spouse /family discourage from exercising	104 (49.8)	66 (31.6)	39 (18.7)	0 (0.0)	0 (0.0)
Exercising regularly is new habit-hard to do	26 (12.4)	66 (31.6)	39 (18.7)	78 (37.3)	0 (0.0)
Exercising regularly makes uncomfortable	52 (24.9)	52 (24.9)	66 (31.6)	39 (18.7)	0 (0.0)
Exercising regularly upsets everyday routine	39 (18.7)	52 (24.9)	53 (25.4)	65 (31.1)	0 (0.0)

Results: Benefits of Exercise:

117 respondents (56%) agreed that “regular exercise prevents problems with osteoporosis”. 130 respondents (62.2%) agreed that they “feel better when they exercise to prevent osteoporosis”. 130 respondents (62.2%) agreed that “regular exercise builds strong bones”. 130 respondents (62.2%) agreed that “exercise for osteoporosis also improves body looks". 130 respondents (62.2%) agreed that “regular exercise cuts down on chances of broken bones”. 118 respondents (56.5%) agreed that they “feel good about themselves when exercising to prevent osteoporosis”.

Analysis: Benefits of Exercise:

Anywhere from 56% to 62.2% of respondents agreed that engaging in regular exercise to reduce the likelihood of osteoporosis, exercising to reduce the likelihood of fractures due to osteoporosis, exercising to make themselves look better physically and to feel better about themselves emotionally, and exercising to prevent osteoporosis indicates a good understanding of the relationship between regular exercise and osteoporosis prevention.

Results: Barriers to Exercise

104 respondents (49.8%) strongly disagreed with the question “spouse/family discourages one from exercising”. This was the most significant response statically and empirically.

Analysis: Barriers to Exercise

The respondents did not identify any significant barriers to exercise as ascertained by examination of the above survey responses and had good self-efficacy regarding the ability to exercise to prevent osteoporosis. Look at Table 34 on p. 111 for a summary of Osteoporosis Self-

Efficacy Scale (OSES) Examining the Confidence Scores in Performing Activities to Prevent Osteoporosis

Results: OSES Exercise Scale

The mean for the OSES exercise questions ranged from 45.8 to 62. The median for the same question ranged from 42 to 64.

Analysis: OSES Exercise Scale

There is not a significant difference in means or medians for OSES exercise scale questions. The data indicates that most respondents had self-efficacy or the ability to engage in exercise to prevent osteoporosis.

Multiple Regression Comparing All Independent Variables (IV) to Health Motivation as the Dependent Variable (DV)

A multiple regression analysis was conducted using the independent variables of age, gender, ethnicity, knowledge of exercise, knowledge of nutrition, susceptibility to osteoporosis, seriousness of osteoporosis, benefits of exercise, benefits of calcium, barriers to exercise, barriers to calcium, self-efficacy exercise and self-efficacy calcium with health motivation as the dependent variable. The results are shown below in Table 39.

Table 39

Unstandardized OLS Coefficients for Predictors of Health Motivation Based on the EHBM MULTIPLE REGRESSION ANALYSIS

Predictor	Model 1		Model 2		Model 3		Model 4	
Constant	20.069	***	23.085	***	47.953	***	65.854	***
Age	0.049	*	0.002		0.075	***	0.040	***
Gender	0.533		0.297		0.371		0.554	**
Ethnicity	0.540		–0.035		–0.525	*	–0.165	
Knowledge Exercise			0.572	***	1.016	***	1.504	***
Knowledge Nutrition			–0.437	***	–0.584	***	–0.827	***
Susceptibility					0.175	***	–0.025	
Seriousness					0.251	***	0.232	***
Benefits Exercise					–0.345	***	–0.876	***
Benefits Calcium					–1.197	***	–1.225	***
Barriers Exercise					0.248	***	0.542	***
Barriers Calcium					–0.439	***	–0.839	***
Self-Efficacy Exercise							0.098	***
Self-Efficacy Calcium							–0.069	***

Note. * < 0.05, ** < 0.01, *** < 0.001. Model 1 $R^2 = 0.035$. Model 2 $R^2 = 0.219$. Model 3 $R^2 = 0.829$. Model 4 $R^2 = 0.878$.

- DV = "Health Motivation" for all 4 models
- IVs =
- Model 1: Age, gender, and ethnicity
- Model 2: Age, gender, ethnicity, knowledge of exercise, and knowledge of nutrition
- Model 3: Age, gender, ethnicity, knowledge of exercise, knowledge of nutrition, susceptibility, seriousness, benefits of exercise, benefits of calcium, barriers to exercise, and barriers to calcium
- Model 4: Age, gender, ethnicity, knowledge of exercise, knowledge of nutrition, susceptibility, seriousness, benefits of exercise, benefits of calcium, barriers to exercise, barriers to calcium, self-efficacy for exercise, and self-efficacy for calcium

Table 40

Results of a Multivariate Analysis of Variance (MANOVA) for EHBM Constructs

MULTIVARIATE ANALYSIS OF VARIANCE

Sequence: MANOVA → Two-Way ANOVA for all DVs → Two-Way ANOVA for sig. DV → t-tests for simple main effects

Effect	Λ	F	df_1	df_2	p
Gender	0.850	3.139	11	195	0.000632
Ethnicity	0.554	14.254	11	195	< 0.0001
Gender*Ethnicity	0.645	9.749	11	195	< 0.0001

Note. Wilk's lambdas were used for the multivariate tests

- DVs = Knowledge of exercise, knowledge of nutrition, susceptibility, seriousness, benefits of exercise, benefits of calcium, barriers to exercise, barriers to calcium, self-efficacy for exercise, and self-efficacy for calcium
- IVs = Gender, ethnicity, and the interaction between gender/ethnicity.

Table 41

Results of Two-Way Analysis of Variance (ANOVA) Tests for the Interaction Effect of Gender and Ethnicity on EHBM Constructs

Dependent Variable	Type III Sum of Squares	df	Mean Square	F	p
Knowledge Exercise	0.750	1	0.750	0.390	0.844
Knowledge Nutrition	0.101	1	0.101	0.004	0.948
Susceptibility	53.537	1	53.537	3.410	0.066
Seriousness	15.926	1	15.926	1.070	0.302
Benefits Exercise	8.903	1	8.903	1.007	0.317
Benefits Calcium	25.179	1	25.179	3.939	0.048
Barriers Exercise	0.554	1	0.554	0.029	0.864
Barriers Calcium	76.761	1	76.761	9.441	0.002
Self-Efficacy Exercise	4,362.236	1	4,362.236	7.769	0.006
Self-Efficacy Calcium	1,479.006	1	1,479.006	2.635	0.106
Health Motivation	20.082	1	20.082	2.140	0.145

Note. All p-values were evaluated at a Bonferroni adjusted per-comparison alpha level of 0.0045 (i.e., 0.05 family-wise alpha ÷ 11 tests = 0.0045)

- DVs (separately) = Knowledge of exercise, knowledge of nutrition, susceptibility, seriousness, benefits of exercise, benefits of calcium, barriers to exercise, barriers to calcium, self-efficacy for exercise, and self-efficacy for calcium
- IVs = gender and ethnicity with interaction effect

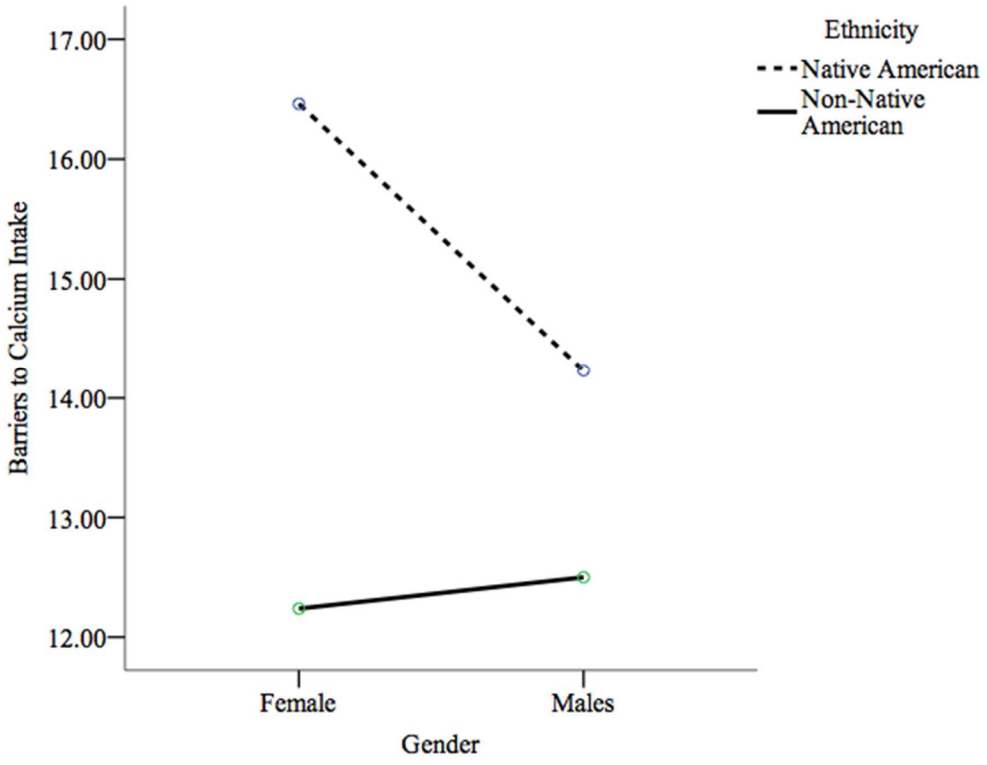
Table 42

Results of a Two-Way ANOVA for Perceived Barriers to Calcium Intake

Source	Type III Sum of Squares	df	Mean Square	F	p
Gender	47.871	1	47.871	5.888	0.016
Ethnicity	438.875	1	438.875	53.979	< 0.0001
Gender*Ethnicity	76.761	1	76.761	9.441	0.002
Error	1,666.757	205	8.131		
Total	43,364.000	209			

Note. $R^2 = 0.289$

- DV=Barriers to calcium.
- IV's=Gender and ethnicity with interaction effect.



- *Figure 5.* Interaction for Gender and Ethnicity on the DV (i.e., barriers to calcium).

Table 43

Main Effects-Results of Simple Main Effects t-tests for Barriers to Calcium Intake

	Mean Difference	df	t	p
1. Females:				
Native American – Non-Native American	4.22344	126	8.007	< 0.0001
2. Males:				
Native American – Non-Native American	1.73256	79	2.962	0.0040
3. Native American:				
Females – Males	2.22898	106	3.473	0.0007
4. Non-Native American:				
Female – Males	–0.26190	99	–0.548	0.5850

Note. All p-values were evaluated at a Bonferroni adjusted per-comparison alpha level of 0.0125 (i.e., 0.05 family-wise alpha ÷ 4 tests = 0.0125)

- DV = Barriers to calcium intake
- IVs =
  - (1) Native vs. non-native American females
  - (2) Native vs. non-native American males
  - (3) Native American females vs. native American males
  - (4) Non-native American females vs. non-native American males

Interpretation of t-Tests

1. Among females only, Native Americans perceived more barriers to calcium intake than Non-Native Americans.

2. Among males only, Native Americans perceived more barriers to calcium intake than Non-Native Americans

3. Among Native Americans only, females perceived more barriers to calcium intake than males.

4. Among Non-Native Americans only, there was no significant difference in perceived barriers to calcium intake between males and females.

5. Therefore, female Native Americans perceived the greatest barriers to calcium intake.

Summary

Correlation was strongest for ethnicity, gender and OHBS question responses as compared to ethnicity, gender and OKT question responses. The OHBS questions deal more with current and expected behavior regarding prevention, mitigation and treatment of osteoporosis, whereas the OKT questions deal more with respondent's knowledge about osteoporosis prevention and treatment. Female Native Americans perceived the greatest barriers to calcium intake of any of the groups, whereas exercise self-efficacy, barriers to calcium and benefits of calcium were statistically significant for ethnicity and gender in the two-way ANOVA analysis.

Regarding OSES questions, Native American respondents have better self-efficacy for exercise and osteoporosis prevention than for nutrition and osteoporosis prevention. Non-Native American respondents have a good basic understanding of nutrition and osteoporosis prevention, but both ethnic groups lack specific knowledge of how much, what types and how often to take calcium, which is somewhat disconcerting.

Both ethnic and gender group respondents have a good understanding of what osteoporosis is and what effect it will have on one's life (seriousness). In addition, this study helped get a better understanding of how likely respondents were to getting osteoporosis (susceptibility) and how diet, calcium intake, vitamin intake, and proper exercise can reduce the likelihood and/or severity of osteoporosis.

CHAPTER 5

DISCUSSION, CONCLUSIONS AND RECOMMENDATIONS

This chapter examines the purpose of the study, a summary of findings, conclusions, discussion, limitations, and recommendations for future study and a final overarching summary of this study.

Purpose of Study

This study sought to answer the following research questions:

1. What do Nez Perce Tribal members and non-Nez Perce Tribal members know about osteoporosis?
2. Is there a statistically significant difference in osteoporosis knowledge, attitudes, beliefs and self-efficacy among Nez Perce Tribal members and non Nez Perce Tribal members, male and female, aged 18 and over residing in Nez Perce County, ID as evidenced by completion of an EHBM based osteoporosis survey instrument?
3. Does ethnicity have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?
4. Does gender have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self-efficacy regarding osteoporosis?
5. Does age have an effect on Nez Perce Tribal and non Nez Perce Tribal member's knowledge, attitudes, beliefs and self- efficacy regarding osteoporosis?
6. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between nutrition and osteoporosis?

7. Do Nez Perce Tribal members and non Nez Perce Tribal members understand the relationship between exercise and osteoporosis?

Using the research questions previously stated, this study examined whether or not there were any differences in osteoporosis knowledge, attitudes, beliefs and self-efficacy between male and female, aged 18 and over, Nez Perce Tribal members as compared to Non Nez Perce Tribal members residing in Nez Perce County, ID. This was primarily a descriptive survey study.

Demographics

There were a total of 209 individuals completing the study successfully. 215 participants began the study, but 6 subjects either failed to note their respective ethnicity or to complete the survey instruments. There were 65 Native American females, 43 Native American males, 43 Non-Native American females and 38 Non-Native American males in the study. Age of the participants ranged from 18 to 92.

Survey Question Responses

Nez Perce Tribal members answered more survey questions correctly than Non Nez Perce Tribal members regarding nutrition and osteoporosis prevention in the following areas:

- Best source of calcium: (73.1% correct vs 65.4%, $p = 0.002$).
- Best food source of vitamin to absorb calcium: (20.4% correct vs. 17.8%, $p = 0.640$).
- Recommended amount of vitamin to absorb calcium: (13.9% correct vs 10.9%, $p = 0.512$).
- Once you have osteoporosis (77.8% correct vs 46.5, $p < 0.0001$).
- Recommended amount of calcium (59.3% correct vs 26.7%, $p < 0.0001$).

- Amount of milk to drink to meet recommended calcium levels (55.6% correct vs 43.6%, $p = 0.083$).
- Best reason for talking calcium supplement (84.3% correct, vs 65.4%), $p = 0.002$).

For questions regarding the association between ethnicity and knowledge of exercise to prevent osteoporosis, Non-Native Americans answered survey questions more correctly than Native Americans.

For questions related to an association between gender and knowledge of nutrition to prevent osteoporosis, females answered the following questions more correctly than males:

- Best source of calcium: apple, cheese, cucumber (85.2% correct vs 75.3%, $p = 0.075$).
- Best source of calcium: chicken, broccoli, grapes (72.85 correct vs 66.4%, $p = 0.328$).
- Best source of calcium: yogurt, strawberries, cabbage (84.8% correct vs 76.5%, $p = 0.157$).
- Best source of calcium: ice cream, grapefruit, radishes (69.5% correct vs 67.9%, $p = 0.804$).
- Recommended amount of calcium: (53.9% correct vs 27.2%, $p < 0.0001$).
- Amount of milk to drink to meet recommended calcium (57.0% correct vs 38.3%, $p = 0.008$).
- Best reason for taking a calcium supplement (77.3% correct vs 71.6%, $p = 0.350$).

Men answered the following questions relating to nutrition and osteoporosis prevention more correctly than females:

- Vitamin required to absorb calcium (81.5% correct vs 71.1%, p = 0.091).
- Best source of vitamin to absorb calcium (92.6% correct vs 74.2%, p < 0.0001).
- Best food source of vitamin to absorb calcium (25.9% correct vs 14.8%, p = 0.047).
- Best time to build strong bones (27.2% correct vs 13.3%, p = 0.012).
- Osteoporosis diagnosis (87.7% correct vs 67.2%, p = 0.001).
- Once you have osteoporosis (63% correct vs 62.5%)

For questions related to an association between gender and knowledge of exercise to prevent osteoporosis, men answered the following questions most correctly:

- Having parent or grandparent who has osteoporosis (63.0% correct vs 42.2%, p = 0.003).
- Taking cortisone a long time (46.9% correct vs 31.3%, p = 0.023).
- > 2 alcoholic drinks per day (51.9% correct vs 38.3%, p = 0.054).
- Smoking daily (51.9% correct vs 38.3%, p = 0.054).
- Best way to reduce osteoporosis: swim, walk, stretching (58.0% correct vs 54.7%, p = 0.636).
- Best way to reduce osteoporosis (45.7% correct vs 32.0%, p = 0.047).

For questions relating exercise to osteoporosis prevention, women answered these questions more correctly than males.

- Being white or Asian woman (43.8% correctly vs 43.2%, p = 0.939).
- Being an elderly man (25.8% correct vs 7.4%, p = 0.001).
- Being overweight (33.6% correct vs 27.2%), p = 0.328).
- Having eating disorder (36.7% correct vs 27.2%, p = 0.821).

- Number of days per week to do exercise (17.2% correct vs 4.9%, p = 0.009).
- Exercise hard enough (79.7% correct vs 67.9%, p = 0.055).
- Best way to reduce osteoporosis: jogging, golfing, gardening (56.3% correct vs 55.6%, p = 0.922).
- Best way to reduce exercise: bowling, doing laundry, aerobic dancing (70.3% correct vs 66.7%, p = 0.579).

Summary of Findings

Nez Perce tribal members answered survey questions more correctly than Non Native Americans on nutrition and osteoporosis prevention questions in the areas of best source of calcium, best food source of vitamins to absorb calcium, recommended amounts of vitamins to absorb calcium, recommended amount of calcium, amount of milk to drink and reason to take calcium supplements. Non-Native Americans answered more survey questions relating exercise and osteoporosis prevention more correctly than Native Americans.

Males answered survey questions relating nutrition to osteoporosis prevention more correctly than females in the areas of vitamins best to build strong bones, what to do once you have osteoporosis and an osteoporosis diagnosis. Females answered survey questions relating nutrition to osteoporosis, more correctly in areas of all best food sources for calcium, recommended amount of calcium and best reasons for taking calcium supplements.

Males answered survey questions relating exercise to osteoporosis prevention more correctly in areas of having parent or grandparent with osteoporosis, taking cortisone a long period of time, drinking more than 2 alcoholic drinks per day, smoking, and best way to reduce osteoporosis: swim, walk, stretching and the best way to reduce osteoporosis: bicycling, yoga,

lift weights. Women answered survey questions relating exercise to osteoporosis prevention more correctly in the areas of being a white or Asian woman, being an elderly man, being overweight, having an eating disorder, number of days per week to exercise, exercising hard enough, best way to reduce osteoporosis: jogging, golfing, gardening, and the best way to reduce osteoporosis: bowling, doing laundry, aerobic dancing.

Nez Perce Tribal members essentially have the same diet as Non Nez Perce Tribal members and do not participate anymore in the historical ways of capturing and preparing food (i.e.: salmon and eating camas roots, etc.). Economic and geographic access to store bought calcium laden foods is readily available on and off the Nez Perce reservation. Exercise levels are diminished in members of the Nez Perce Tribe overall because buses transport everyone to the grocery store, to the clinic and casinos on the reservation. If scheduled on the community bus service, Nez Perce Tribal members can even be driven to Lewiston, ID and Clarkston, WA for medical appointments. Because Nez Perce tribal members do not frequently walk or ride bicycles on the reservation, and many work nearby at the adjacent reservation casinos, there is a minimal effort or necessity to engage in regular, weight bearing exercise that could diminish the likelihood of Nez Perce tribal members getting osteoporosis.

Non-Native Americans not living on the reservation tend to ride a bicycle and to walk more along the Snake and Columbia Rivers because there are safe, well-lit trails in Lewiston and Clarkston, but such trails are not found in Lapwai, ID. It is less safe to walk along the river on the reservation and there is more gun violence and altercations on the reservation then off the reservation. This has a negative impact on regular weight-bearing exercise by Nez Perce tribal members, but the recent opening of a free, 24-hour access health and fitness center has increased

Nez Perce Tribal member exercise self-efficacy for those individuals whom live on the reservation in Lapwai, ID.

Conclusions

Self-Efficacy and Health Motivation

Knowledge of Nutrition and Osteoporosis = Health Motivation:

Health motivation was elevated even in cases were knowledge of nutrition was low. Respondents had a good understanding of the relationship between sources of calcium as it relates to osteoporosis, diagnosis and treatment. Areas where respondents had incorrect understanding regarding knowledge of nutrition and osteoporosis were recommended amounts of calcium, amount of milk to drink to get adequate calcium, and the relationship between the amount of and source of calcium needed on a daily basis to prevent osteoporosis. Perhaps knowledge of exercise is enough to produce motivation to prevent osteoporosis. Individuals with low levels of nutrition knowledge still have motivation to reduce their risk for osteoporosis. Knowledge of exercise was the greatest predictor of health motivation (Model 4: 1.504).

Susceptibility to Osteoporosis = Health Motivation:

Even though overall participants didn't think that they were very susceptible to osteoporosis, some respondents still thought that osteoporosis could negatively affect their health (I.e.: the "seriousness" variable). So, even though there was low perceived susceptibility to osteoporosis, respondents still had a high level of motivation to prevent osteoporosis because they were fearful of developing osteoporosis which could interfere with their activities of daily living (ADL's).

Benefits to Exercise to Prevent Osteoporosis and Calcium Intake to Prevent Osteoporosis = Health Motivation:

Some study participants mostly had low to moderate levels of knowledge about the benefits of exercise and calcium in the prevention of osteoporosis, but because of other variables, such as exercise self-efficacy, they were motivated to prevent osteoporosis.

Barriers to Exercise to Prevent Osteoporosis = Health Motivation:

Whiles some study participant's perceived barriers to exercise, there was also high self-efficacy for exercise. This means that these respondents are hopeful about the opportunity to exercise and would engage in exercise activities in the future. The Nez Perce Tribal Clinic, to which all Nez Perce Tribal members have access, had a new fitness constructed next to the clinic. This fitness center is open twenty-four hours a day, year round. The fitness center is frequently used by most tribal member not just as an exercise facility, but as a social gathering place, particularly in the winter. Free, twenty-four-hour access to this fitness center may account for increased exercise self-efficacy among many of the Nez Perce tribal respondents.

Self-Efficacy Calcium = Barriers to Calcium:

This was not a large problem for the study participants, so access is not the issue. It is possible however, that some study participants did not view calcium rich foods as being a part of their diet, therefore, they didn't think they could easily integrate these type of foods into their diet or lifestyle. However, because of the other positive beta coefficients, these respondents still had high health motivation to prevent osteoporosis.

Study Instrument Factors

The survey instruments are designed to be read at the 5th grade reading level. It is possible that some study participants could not or did not read the survey instruments at this level, and therefore comprehension of the questions were skewed by this lack of comprehension.

In addition, there were (3) survey instruments, with a total of 95 questions. It is possible that study participants underwent questionnaire fatigue and hurried through the surveys without answering all questions in a correct or truthful manner.

Discussion

Existing literature regarding use of the EHBM and Osteoporosis among Native Americans men and women was examined in this section. A comparison of the findings of this research study was made with findings of other studies dealing with osteoporosis. Filner (2001) found in his study of Alaska natives that Alaska Natives consumed less calcium than Caucasians due to a higher incidence of lactose intolerance in indigenous peoples on average. Nobmann (1992) found that Alaska native's women consumed 516 mg/day of calcium compared to 597 mg/day for Caucasian females in the NHANES II study (Nicholas and Chen, 2002).

Sunlight exposure is less in Northern Idaho than near the equator. Sunlight is important in minimizing osteoporosis because it is essential for converting 7-dehydrocholesterol into previtamin D3, which is needed to allow calcium absorption in the skeletal system (Bleeker, 2001). Since Nez Perce Tribal members and Non Nez Perce Tribal members living in North Idaho are exposed to less sunlight because of distance from the equator, both groups may have a higher incidence of osteoporosis than others located in different parts of the world.

According to Bleeker (2001), “a gender bias in osteoporosis research exists that is comparable to women in cardiac research “Such a bias may also exist in osteoporosis research, with men and non-Caucasians as the understudied groups. According to Bleeker (2001), predisposing factors for osteoporosis in men included advanced age, excessive alcohol intake, cigarette smoking, inadequate calcium intake, sedentary lifestyle, medication history (glucocorticosteroid use), and medical history (hypogonadism, calcium malabsorption). These factors were evaluated in this study via completion and evaluation of the EHBM Survey results.

According to the American Academy of Orthopedic Surgeons (AAOS), …”although more commonly seen in women, the burden of osteoporosis in men remains underdiagnosed and underreported” [and] ”there is little information available regarding racial difference in osteoporosis in men” (Retrieved February 14, 2014, from http://www.aaos.org/about/papers/position/1113.asp)

Calcium and Physical Activity

Survey questions regarding the relationship between calcium intake and physical activity are important because “the reason why the survey questions ask about whether or not respondents know about their calcium intake and physical activity levels is because approximately 35% of mineralized bone is made of calcium and physical activity enhances calcium deposition into the skeletal system” (Furlow, 2006, p. 230).

Native Americans and Osteoporosis

There is a lack of research and study data evaluating osteoporosis knowledge and incidence, prevalence and severity of osteoporosis in Native American populations in the United States. “According to the U.S. Census Bureau (2008), an estimated 4.9 million American Indians and

Alaska Natives live in the United States" [yet] "uncovering the prevalence of osteoporosis, hip fracture rate, and any unique characteristics or comorbidities (such as diet, lifestyle) that affect bone metabolism and fracture risk would enhance cultural competency with this population" **(**American Academy of Orthopedic Surgery. Retrieved January 2014, from http://www.aaos.org/news/aaosnow/jan10/research4.asp)

Calcium Intake and Vitamin D

Although this research study demonstrated a good understanding of the need for adequate calcium and vitamin D intake to prevent osteoporosis, "The second National Health and Nutritional Examination Survey (NHANES II) [indicated that] calcium intake in Native Americans was below the average range (561 -679 mg/day). The large amount of lactose intolerance reported among Native Americans may also account for low intake of calcium in dairy products of Native Americans (Nicholas & Chen, 2002, p. 95).

Sedentary Lifestyle and Low Body Mass Index (BMI)

Sedentary lifestyle is associated with low BMD. The 1997 Behavioral Risk Factor Surveillance System (BRFSS) and the U.S. Determinants study reported Native Americans participate in little or no leisure time (exercise, recreation or physical activities, such as running, native dances, calisthenics, gardening, or walking that are not performed as part of regular job duties. In the Northwest, out of 136 females and 108 males. It was found in surveys that 52.6% of individuals 18-29, 59.8% of individuals 30-39, and 60.6% of individuals 49 and older were not physically active (no participation in physical activity for > 20 mins > 3 times per week in the past month (Nicholas & Chen, 2002, p.97). Chen et. al., found weight and body mass index

(BMI) to be significant predictors of bone mineral density (BMD) in Native Americans women (Nicholas & Chen, 2002, p. 98).

Overall, BMI is higher for Native Americans and regular physical activity levels are lower among Native Americans than Non-native Americans. In this study however, Nez Perce Tribal members, possibly due to regular, unfettered access to the new 24-hour recreation facility had high self-efficacy for maintaining a regular exercise program.

Smoking

Smoking is predominant among Native Americans and influences bone density. Forty-three percent of Native American men and 54% of Native American women smoke in the Pacific Northwest, with approximately 42% of Native Americans smokers in Idaho and Montana (Nicholas & Chen, 2002, p. 98). Smoking interferes with calcium metabolism and deposition into the skeletal system via blood circulation.

Use of the Expanded Health Belief Model (EHBM) For This Study

An important, if not seminal behavior model in health education is the health belief model (HBM). The HBM was developed by U.S. Public Health Psychologists Victor Strecher, Irwin Rosenstock and Godfrey Hochbaum in the 1950's. The theory was developed as a result of expectancy theory and concerns about the limited success of public health tuberculosis (TB) x-ray screening programs (Glanz, 1997, p. 42-43). Themes of the health belief model include an individuals or groups perceived susceptibility to a certain illness, or condition, the perceived seriousness of the illness or condition, socioeconomic and knowledge factors, (i.e.: awareness of the disease, having medical insurance in order to pay for diagnosis and treatment of to diagnose, etc.), the perceived threat of being diagnosed with the illness or condition, benefits and barriers

to action to get diagnosed and treated for the illness or condition, and cues to action (i.e.; family support, physician access, treatment options, etc.). Bandura's inclusion of the concept of self-efficacy in the HBM in 1977 led to what is known as the Expanded Health Belief Model (EHBM)" (Wallace, 2002, p. 164). Research by Horan, Gendler, Kim, Froman, and Patel at Grand Valley State University in Allendale, MI from 1991-2010 has demonstrated the value and utility of using the EHBM for osteoporosis inquiry and research.

Study Instrument

The EHBM served as the behavioral model for this research study. According to Katherine K. Kim, Mary L. Horan, Phyllis Gendler, and Mini K. Patel, nursing professors and researchers at Grand Valley State University in Allendale, MI "The Osteoporosis Health Belief Scale (OHBS) using the EHBM as its foundation was developed to measure health beliefs related to osteoporosis" (Kim, 1991, p. 155). The purpose of developing the OHBS was to develop and test an instrument designed to measure personal attitudes and beliefs related to the potential for developing osteoporosis" (Kim, 1991, p. 156). The instrument that these researchers developed consisted of two additional risk reduction behaviors; the barriers and benefits related to calcium intake and those related to physical exercise" (Kim, 1991, p. 157). "The addition of these two measurements in the EHBM helps "…demonstrate the importance of health motivation in influencing health related behavior" [and] the developers of this model encourage further use and revision of the instrument and recommend the inclusion of self-efficacy as an additional dimension (Kim, 1991, p. 161).

Based upon the research recommendations of Horan, Gendler, Kim, Froman and Patel, I believe that the EHBM is an appropriate and useful model for determining male and female,

aged 18 and over, Nez Perce tribal member and Non-Tribal Members voluntary participant's attitudes knowledge, beliefs and self-efficacy regarding osteoporosis prevention. The relationship between the EHBM, the OHB Scale and the osteoporosis research conducted for this dissertation is indicated in Fig 6 below:

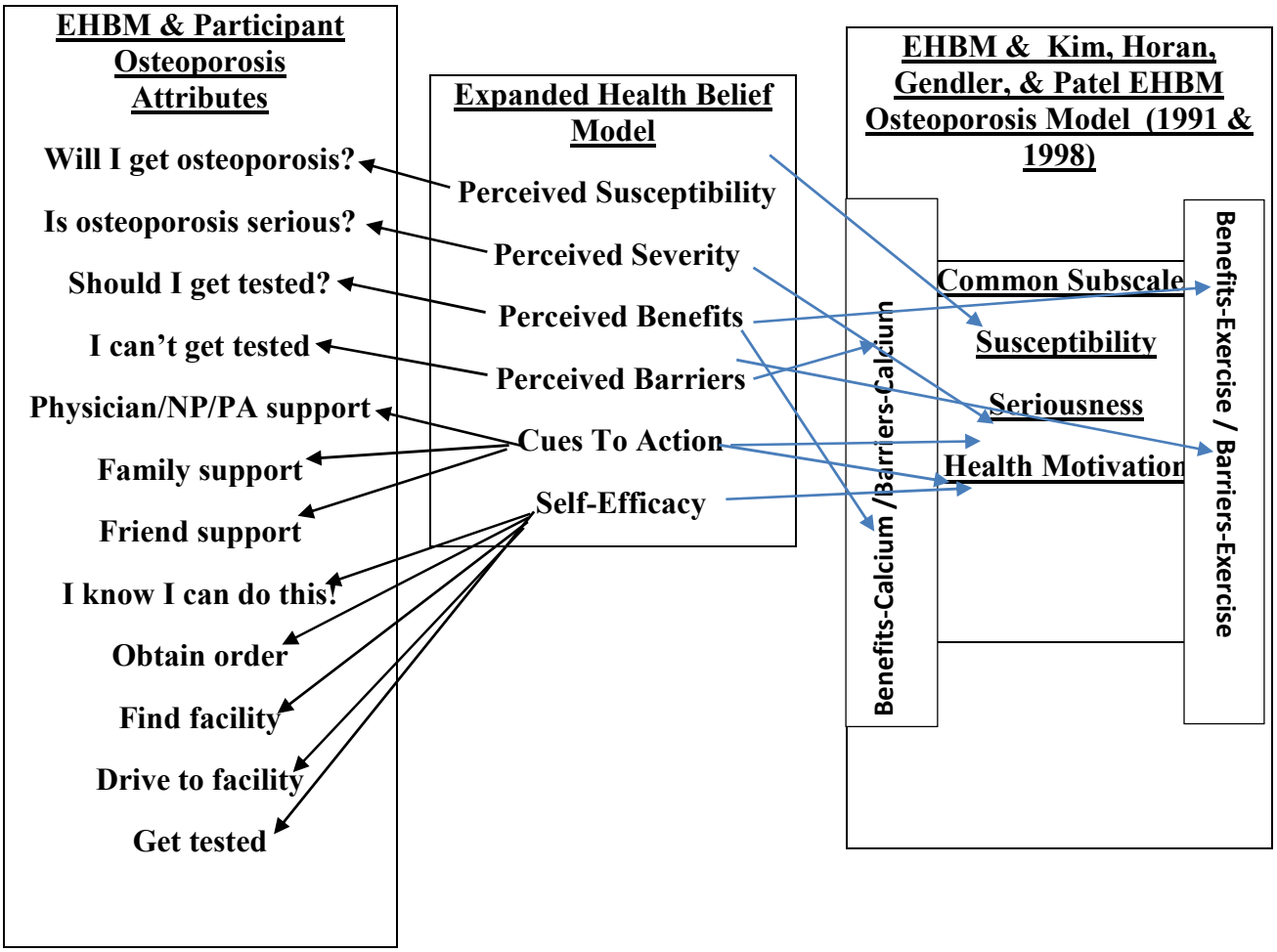


Fig.6. Relationship of the Expanded Health Belief Model (EHBM) and the Osteoporosis Health Belief Scale (OHBS) (White, 2014. Unpublished prospectus).

Study Results: EHBM and Osteoporosis Knowledge

According to Wallace (2002), "on average, women were able to correctly answer 65% of the questions used to assess osteoporosis knowledge" (p. 169). Most women consumed below the recommended 1200 mg/day of calcium. According to Wallace (2002), "in this sample, many women did not realize or understand the importance of many nonmodifiable (e.g.: race/ethnicity)

or modifiable (e.g.: cigarette smoking, alcohol consumption) risk factors associated with increased risk for osteoporosis" (p. 170).

Unfortunately, osteoporosis knowledge has been shown to be a non-predictor of osteoporosis prevention behavior (Wallace, 2002, p. 170). According to Wallace, "The finding indicate that women differ substantially in both the osteoporosis protective behaviors and beliefs regarding osteoporosis as defined by the EHBM" (Wallace, 2002, p. 171). Osteoporosis knowledge and perceived susceptibility were not considered preventive of osteoporosis in the studies in which women either felt that osteoporosis was a minor health problem (50%), they were not susceptible to osteoporosis (14%) and that it was a problem only for older women (32%) (Hazavehei, Taghdisi & Saidi, 2007).

Calcium poor diets, lack of exercise and a disconnect between knowledge of osteoporosis and behaviors needed to diminish or prevent it are the cause of osteoporosis and related skeletal health problems in men, women and individuals of varying ethnicities.

EHBM Osteoporosis Survey Instrument

The two key factors of the EHBM instrument used in this study (exercise and nutrition (calcium) are not redundant (10% question redundancy, 90% independent). The EHBM based survey questions used in this study are effective in accurately predicting self-efficacy in relationship to osteoporosis prevention. Respondents in this study appear to be intellectually associating behaviors (exercise, sufficient calcium intake etc.) with prevention of osteoporosis.

Examination of differences in osteoporosis knowledge, attitudes, beliefs and self-efficacy between the Native Americans and Non-Native Americans residing in Nez Perce County, ID using the EHBM instrument was conducted in this study. Life on and off the reservation was

examined with particular analyses of diet, exercise, osteoporosis knowledge and self-efficacy to prevent or mitigate osteoporosis. Study data indicated that gender was not that significant in any of the grouping variables except for female Native Americans perceiving the greatest barriers to calcium intake. It is possible that men and women's attitudes, knowledge and beliefs about osteoporosis may be similar. Both groups have good general knowledge about osteoporosis. Physicians, Physician Assistants, and Nurse Practitioners and other providers in Nez Perce County, ID may discuss among male and female, Native and Non-Native patient's osteoporosis prevention, diagnosis and treatment. Nez Perce County, ID and the Nez Perce reservation are relatively underpopulated with a large amount of daily interaction between Nez Perce Tribal members and Non Nez Perce Tribal members. Informal sharing of general population health information also occurs among the healthcare providers, many of which work at the tribal clinic and off the reservation in other parts of Nez Perce County, ID.

Answers on the survey questions may have been discussed by participants, may be too generalized, and may not be structured to accurately determine if there is any gender or ethnicity based differences concerning Native American and Non Native American attitudes about osteoporosis. Wrong statistical analysis, data entry errors, and/or ineffective use of the survey instruments may also partially account for data results (possible Type II error).

Almost half (49.8%) of respondents felt their chance of getting osteoporosis was high, yet almost half (49.8%) of respondents also felt neutral in regards to the relationship between family history and osteoporosis. More education by Nez Perce County and Nez Perce Tribal clinic health educators and clinical staff should be conducted in groups (i.e.: community presentations) or on an individual basis in provider's offices as needed about the importance of family history as it relates to susceptibility and seriousness of being diagnosed with osteoporosis.

Exercise self-efficacy, exercise, nutrition and ethnicity seem to be the most significant variables showing evidence against the null hypotheses and for the research hypothesis. Nutrition and age also show evidence against the null hypothesis and for the research hypothesis, but not as strongly as exercise and ethnicity.

H_0: Native American=Non-Native American (Incorrect for this study).

H_1: Native American ≠ Non-Native American (correct for this study).

Study Limitations

Study limitations are those factors which may limit the internal validity of a specific study. The following known limitations of this study are identified below:

1. Transportation problems in getting to the Nez Perce Tribal Clinic.
2. There could have been significant variations in participant's ability to remember and tabulate exercise and dietary activities over a period of time.
3. EHBM osteoporosis survey participants perhaps were not representative of non-participants.
4. EHBM instrument length (I.e.: 3 forms) may have influenced responses of different individuals.
6. EHBM readability may affect participant responses. The EHBM survey was at the 5th grade reading level (Kim, ET. Al., 1991).
7. Participants may have had social bias and responded in an effort to enhance their likelihood of participation in the EHBM Based Survey.
8. Relatively small sample size
9. This study needs replication in other Native American population centers.
10. Replicate the study in other rural areas if possible.

11. Replicate the study in urban areas if possible.
12. Replicate the study using individuals who meet different osteoporosis criteria if possible.

Recommendations

The purpose of this study was not to actually measure osteoporosis incidence prevalence and severity, but this could be accomplished in a future study. This study needs replication in other Native American population centers and in other rural areas if possible.
This study should be replicated in an urban area if possible and finally, this study should be replicated using individuals who meet different osteoporosis criteria if possible.

An ecological model showing how people are influenced by their physical and sociocultural surroundings developed by used by Evans and Taylor (Evans & Taylor, 2006, p.451) to evaluate osteoporosis in Hispanic Women. Such a model can be used in future osteoporosis studies in Native Americans.

An ecological approach can be used to study the likelihood of osteoporosis in Nez Perce Tribal members and other Native Americans. The relationship between Native Americans and osteoporosis is not well understood and may vary from that of other ethnicities and populations. This lack of understanding was one reason why this study was conducted.

Follow-up studies should involve the use of a pre-survey osteoporosis educational plan. That was to have been completed in this study, but was not completed due to logistical reasons outside the researcher's control. Participants and providers felt that it was unfortunate that QUS and/or DXA scanning were not available to actually measure bone matrix and bone density of the participants. It is recommended that in future studies, QUS and DXA be available as a screening

tool for those found to be likely to have osteoporosis in order to better scientifically document osteoporosis incidence, prevalence and severity among study participants.

Summary

In this study, the null hypothesis is rejected and the research hypothesis is accepted. The two key factors in the survey (exercise and nutrition) are redundant in only 10% of the questions, with 90% of the questions being independent of each other. This study was particularly effective in accurately predicting exercise self-efficacy in relationship to osteoporosis prevention. Study participants appeared from their survey responses to be intellectually associating behaviors (exercise, sufficient calcium consumption, etc.) with aiding in osteoporosis prevention. Native Americans had better knowledge relating nutrition to osteoporosis prevention (Nez Perce = 53.34% vs Non Nez Perce = 46.66%) and Non-Native American had better knowledge relating exercise to osteoporosis prevention (Nez Perce = 0.11% and Non Native Americans = 89%). For men compared to women, it was more equivalent regarding the relationship between nutrition and osteoporosis prevention (men= 46.60% and women + 53.40%) and exercise related to osteoporosis prevention (men =52.90% and women= 47.10%). A MANOVA and TWO-WAY ANOVA analyses led to t-Tests results, indicating that female Native Americans perceived the greatest barriers to calcium intake for preventing osteoporosis as compared to other groups in the study.

While exercise self-efficacy is very high and calcium self-efficacy is good for most study participants, there is some lack of understanding about how much exercise and how much and what types of calcium to consume to mitigate or prevent osteoporosis. This is of concern for this study and future research may be developed to more thoroughly address this deficiency.

Ultimately, osteoporosis prevention relies on respondent's ability and willingness to consume 1) enough calcium, 2) the right types of calcium, 3) engage in regular, weight-bearing exercise on a consistent basis, and 4) seek diagnostic and therapeutic medical advice and treatment when needed to prevent bone loss and/or to enhance bone density.

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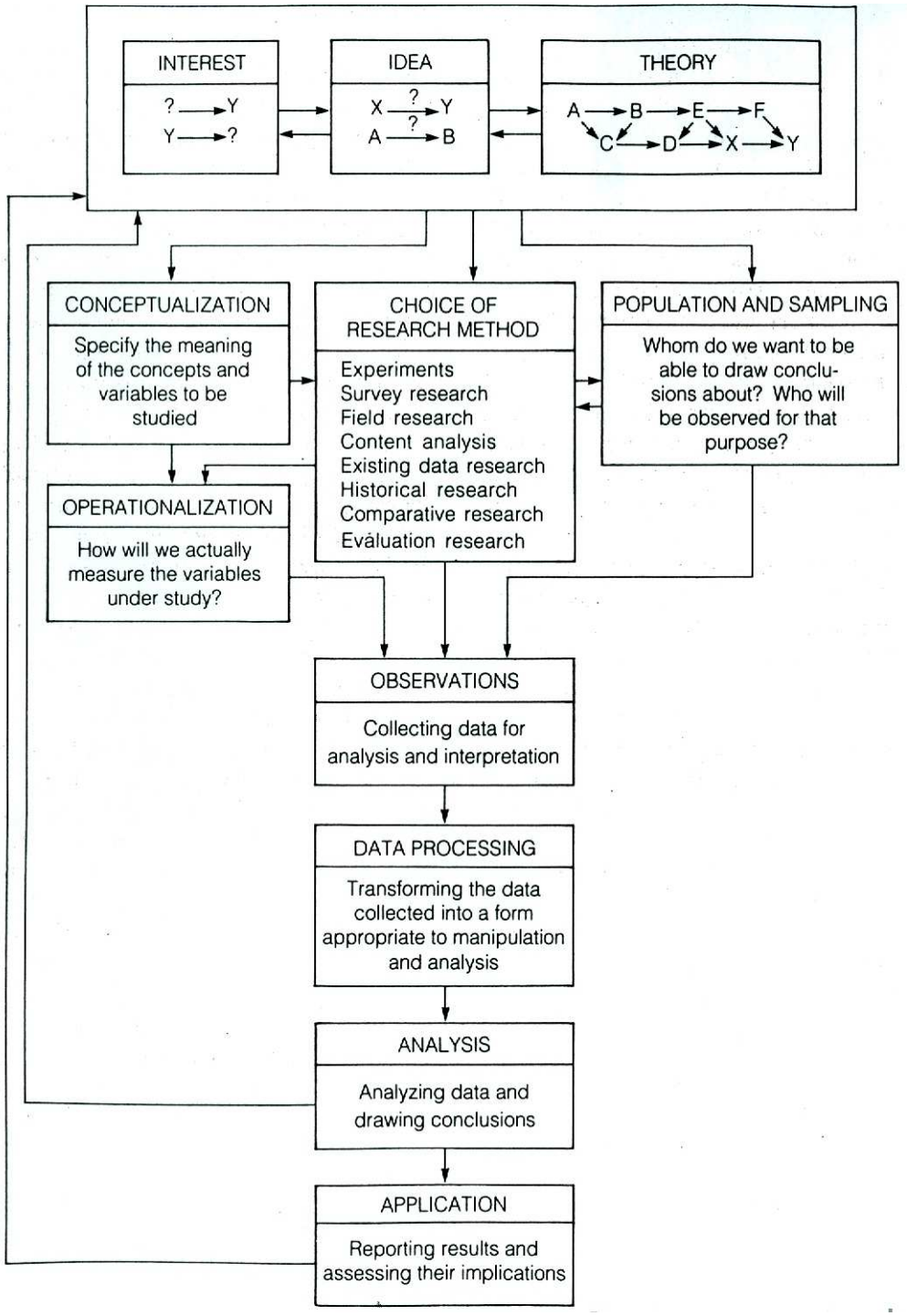
APPENDICES

Appendix 1: Social Science Research Paradigm/Process.



Source: Babbie, E. (1992). *The Practice of Social Research*. Belmont, CA: Wadsworth Publishing Company. P. 104.

Appendix 2. SIUC Form A

SIUC HSC FORM A

REQUEST FOR APPROVAL TO CONDUCT RESEARCH ACTIVITIES INVOLVING HUMAN SUBJECTS

CERTIFICATION STATEMENT

By making this application, I certify that I have read and understand the University's policies and procedures governing research activities involving human subjects. I agree to comply with the letter and spirit of those policies. I acknowledge my obligation to:

1. Accept responsibility for the research described, including work by students under my direction.
2. Obtain written approval from the Human Subjects Committee of any changes from the originally approved protocol **BEFORE** implementing those changes.
3. Retain signed consent forms in a secure location separate from the data for at least **three** years after the completion of the research.
4. Immediately report any adverse effects of the study on the subjects to the Chairperson of the Human Subjects Committee, SIUC, Carbondale, Illinois - 618-453-4533 and to the Director of the Office of Sponsored Projects Administration, SIUC.
   Phone 618-453-4531. E-mail: **siuhsc@siu.edu**

Project Title
"Use of The Expanded Health Belief Model (EHBM) To Evaluate Osteoporosis Attitudes, Knowledge, Beliefs and Self-Efficacy of Nez Perce Tribal and Non-Nez Perce Tribal Members in Nez Perce County, ID"

RESEARCH ADVISOR'S ASSURANCE: My signature on this application certifies that the student is knowledgeable about the regulations and policies governing research with human subjects. I am aware of my obligations stated on Form A and will be available to supervise the research. When on sabbatical leave or vacation, I will arrange for an alternate faculty sponsor to assume responsibility during my absence. I will advise the Human Subjects Committee by letter of such arrangements.

Researcher(s) or Project Director(s) Victor Nollen White Date 06/03/13
Please print or type name below signature.

Researcher's Advisor (required for all student projects) Dhitinut Ratnapradipa, PhD Date 06/03/13
Please print or type name below signature.

The request submitted by the above-named researcher(s) was approved by the SIUC Human Subjects Committee.

This approval is valid for one year from the review date. Unless the protocol is approved as Category I (exempt), researchers must request an extension to continue the research after that date. This approval form must be included in all Master's theses/research papers and Doctoral dissertations involving human subjects that are submitted to the Graduate School.

Chairperson, Southern Illinois University Human Subjects Committee 8-9-13 Date

Appendix 3. SIUC HSC Form an Approval Letter

SIUC HSC FORM A

REQUEST FOR APPROVAL TO CONDUCT RESEARCH ACTIVITIES INVOLVING HUMAN SUBJECTS

CERTIFICATION STATEMENT

By making this application, I certify that I have read and understand the University's policies and procedures governing research activities involving human subjects. I agree to comply with the letter and spirit of those policies. I acknowledge my obligation to:

1. Accept responsibility for the research described, including work by students under my direction.
2. Obtain written approval from the Human Subjects Committee of any changes from the originally approved protocol **BEFORE** implementing those changes.
3. Retain signed consent forms in a secure location separate from the data for at least **three** years after the completion of the research.
4. Immediately report any adverse effects of the study on the subjects to the Chairperson of the Human Subjects Committee, SIUC, Carbondale, Illinois - 618-453-4533 and to the Director of the Office of Sponsored Projects Administration, SIUC.
   Phone 618-453-4531. E-mail: **siuhsc@siu.edu**

Project Title
"Use of The Expanded Health Belief Model (EHBM) To Evaluate Osteoporosis Attitudes, Knowledge, Beliefs and Self-Efficacy of Nez Perce Tribal and Non-Nez Perce Tribal Members in Nez Perce County, ID"

RESEARCH ADVISOR'S ASSURANCE: My signature on this application certifies that the student is knowledgeable about the regulations and policies governing research with human subjects. I am aware of my obligations stated on Form A and will be available to supervise the research. When on sabbatical leave or vacation, I will arrange for an alternate faculty sponsor to assume responsibility during my absence. I will advise the Human Subjects Committee by letter of such arrangements.

Victor N White

Researcher(s) or Project Director(s) Victor Nollen White Date 06/03/13
Please print or type name below signature.

Researcher's Advisor (required for all student projects) Dhitinut Ratnapradipa, PhD Date 06/03/13
Please print or type name below signature.

The request submitted by the above-named researcher(s) was approved by the SIUC Human Subjects Committee.

This approval is valid for one year from the review date. Unless the protocol is approved as Category I (exempt), researchers must request an extension to continue the research after that date. This approval form must be included in all Master's theses/research papers and Doctoral dissertations involving human subjects that are submitted to the Graduate School.

8-9-13

Chairperson, Southern Illinois University Human Subjects Committee Date

Appendix 4. Research Permission Letter (NMPH)

NIMIIPUU HEALTH

LAPWAI CLINIC • 111 BEVER GRADE • P.O. DRAWER 367 • LAPWAI, IDAHO 83540 • (208) 843-2271
KAMIAH CLINIC • 313 3RD STREET • P.O. BOX 1108 • KAMIAH, IDAHO 83536 • (208) 935-0733

June 24, 2013

Dr. Jane L. Swanson
c/o Jane L. Swanson, PhD
Human Subjects Committee
Woody Hall C-214 Mailcode 4709
Office of Sponsore Projects Administration
Southern Illinois University
Carbondale, IL 62901

Dear Dr. Jane L. Swanson,

The purpose of this letter is to provide notification that Mr. Victor N. White has permission to complete the Osteoporosis Study at Nimiipuu Health.

If you have questions or need further information please feel free to contact Constancio Cleto at (208) 843-2271 x2823.

Sincerely,

for ED Carl C. Victor

Tanya McElfresh
Executive Director

Appendix 5: Research Permission Letter (NMPH)

NIMIIPUU HEALTH

LAPWAI CLINIC • 111 BEVER GRADE • P.O. DRAWER 367 • LAPWAI, IDAHO 83540 • (208) 843-2271
KAMIAH CLINIC • 313 3RD STREET • P.O. BOX 1108 • KAMIAH, IDAHO 83536 • (208) 935-0733

June 24, 2013

Dhitinut Ratnapradipa, PHD
Associate Professor of Health Education and Recreation
Pulliam Hall, Southern Illinois University
Carbondale, IL 62901

Dear Dhitinut,

The purpose of this letter is to provide notification that Mr. Victor N. White has permission to complete the Osteoporosis Study at Nimiipuu Health.

If you have questions or need further information please feel free to contact Constancio Cleto at (208) 843-2271 x2823.

Sincerely,

for Carl C. Visitacion

Tanya McElfresh.
Executive Director

Appendix 6. Research Permission Letter (NMPH)

NIMIIPUU HEALTH

LAPWAI CLINIC • 111 BEVER GRADE • P.O. DRAWER 367 • LAPWAI, IDAHO 83540 • (208) 843-2271
KAMIAH CLINIC • 313 3RD STREET • P.O. BOX 1108 • KAMIAH, IDAHO 83536 • (208) 935-0733

June 24, 2013

Mr. Victor White
2786 Hidden Arbor Court, Apt 205
Memphis, TN 38128

Dear Mr. White,

The purpose of this letter is to provide notification that you were given permission to complete the Osteoporosis Study at Nimiipuu Health.

If you have questions or need further information please feel free to contact Constancio Cleto at (208) 843-2271 x2823.

Sincerely,

for ED Carl C. Victor

Tanya McElfresh
Executive Director

Appendix 7. Research Script

Hello, my name is Victor White. I am currently a doctoral candidate at Southern Illinois University Carbondale am completing my dissertation, which involves the use of a 30 minute Expanded Health Belief Model written survey, an 1 hour osteoporosis educational program, and a free bone assessment screening project to determine whether the incidence, prevalence, and severity of osteoporosis as determined by dual energy x-ray absorptiometry (DXA) and heel ultrasonography (US) is similar in members of the Nez Perce Tribe, 21 years of age and older, male and female, to Non-Tribal members of the same age and gender.

During this study, if you wish to participate, you will attend a free educational seminar about osteoporosis, and receive a free dual energy x-ray absorptiometry (DXA) and heel ultrasound (US) scan to determine your bone density. Both of these tests are considered safe and non-invasive. (i.e.: approximately 166.8 micro Gray of radiation exposure for Spine, Dual Femur, and Total Body studies).

Also, as part of this study, you will be required to fill out an informed consent form and health, diet, medication, and exercise questionnaire, and you may be asked to complete a food record. **Participation in this study is completely voluntary and you may withdraw from this study at any time if you so desire.**

If you would like to participate, please stay after this introduction. If you have any question (at any time) please feel free to contact Victor White, MA, MSRS, RT (R) CHES at victor1xray@gmail.com or the Southern Illinois University Institutional Review Board (IRB) at (618) 453-4533.

Thanks for your consideration and time to participate in this study.

Appendix 8: General Study Informed Consent Form

The purpose of this study is to develop an osteoporosis screening program comparing the incidence, prevalence, and severity of members of the Nez Perce Tribe male and female, twenty-one years of age and older as compared to non-tribal members. You have been asked to participate in this study because you have attended the osteoporosis educational seminar(s), are a member of the Nez Perce Tribe, and/or have a desire to participate in this osteoporosis screening program.

Your participation in this research study is strictly voluntary, and all reasonable steps will be taken in order to protect your privacy. Your name will not be connected to your survey responses in any way. **Your name on the informed consent provides a way to keep track of individual responses, but will not be used to identify you. You may decide not to participate in this study at any time without penalty.**

Your task will be to respond questions about your perceptions about osteoporosis and to undergo an osteoporosis educational program; you will be asked to fill out a survey based on your impressions about osteoporosis and your diet, exercise, and medication history that relates to osteoporosis. You will also receive an ultrasound heel (QUS) and dual energy x-ray absorptiometry (DXA) scan. As you fill out this survey instrument, there may be several questions that you have about osteoporosis. You address these questions by writing them down in the final assessment section at the end of the survey. Also, you may add or elaborate on any item of the survey. There will be several items on this survey that inquire about your personal perceptions or activities regarding being tested for osteoporosis, use of medications, weight bearing exercise, etc.

You may refuse to answer any item on this survey without penalty. Your participation in this research project is entirely voluntary. No payment is being offered to study participants.

Any inquiries about this study or any concerns you may have should be directed to Victor White, MA, MSRS, RT (R), CHES Principle Investigator at (208) 305-1323 or via email at victor1xray@gmail.com. You may also contact the Institutional Review Board (IRB) at Southern Illinois University at Carbondale at (618) 453-4533.

I have read the material above, and any questions regarding this study have been answered to my satisfaction. By continuing, I have agreed to participate in this research, realizing that I may withdraw without penalty at any time.

Participant Name: _____Date: _____

Researcher Name: _____Date: _____

Appendix 9. Research Announcement

What: Osteoporosis Written Survey

Where: Nimiipuu Health Clinic, 111 Bever Grade Road, Lapwai, ID 83540

(208) 843-2271

When: August 19-30, 2013

Activity: Take a brief written survey to learn more about osteoporosis.

Contact: The researcher is Victor White, MA, MSRS, RT (R), CHES.

Phone: (208) 305-1323

Email: victor1xray@gmail.com

This project has been reviewed and approved by the SIUC Human Subjects Committee. Questions concerning your rights as a participant in this research may be addressed to the Committee Chairperson, office of Sponsored Projects Administration, Southern Illinois University, Carbondale, IL 62901-4709. Phone (618) 453-4533. E-mail siuhsc@siu.edu

Appendix 10. Permission to Use OHBS/OKT/OSES Scale Forms.

GRANDVALLEY
STATE UNIVERSITY
www.gvsu.edu

August 9,2010

Victor White
3866 West Ave, Apt G
Greensboiro, NC 27407

Dear Mr. White,

Thank you for your interest in the Osteoporosis Health Belief Scale (OHBS), Osteoporosis Knowledge Test (OKT), Osteoporosis Self-Efficacy Scale-21(OSES) and Osteoporosis Self-Efficacy Scale-12 (OSES). You have my permission to use the instruments. Please keep us informed of any publications and/or presentations and send us an abstract or summarize your study results when completed.

I wish you much success with your study.

Sincerely,

Phyllis Gendler, PhD, RN, NP
Professor
Cook-DeVos Center for Health Science
Kirkhof College of Nursing
Grand Valley State University
301 Michigan St. NE
Grand Rapids, MI 49503

Phone: 616-331-7161
Fax: 616-331-7362
E-mail: gendlerp@gvsu.edu

Appendix 11: Osteoporosis Knowledge Test (Revised 2011).

Osteoporosis (os-te-o-po-ro-sis) is a condition in which the bones become very brittle and weak so that they break easily.

MORE LIKELY TO GET OSTEOPOROSIS, or

LESS LIKELY TO GET OSTEOPOROSIS, or

NEUTRAL, IT HAS NOTHING TO DO WITH GETTING OSTEOPOROSIS, or
DON'T KNOW.

When you read each statement, circle **ONE** of the 4 choices for your answer.

ML = MORE LIKELY

LL = LESS LIKELY

NT = NEUTRAL

OK = DON'T KNOW

1. Eating a diet LOW in dairy products	ML	LL	NT	OK
2. Being menopausal; "change of life"	ML	LL	NT	OK
3. Having a parent or grandparent who has osteoporosis	ML	LL	NT	OK
4. Being a white or Asian woman	ML	LL	NT	OK
5. Being an elderly man	ML	LL	NT	OK
6. Having ovaries surgically removed	ML	LL	NT	OK
7. Taking cortisone (steroids e.g. Prednisone) for long time	ML	LL	NT	OK
8. Being overweight	ML	LL	NT	OK
9. Having an eating disorder	ML	LL	NT	OK
10. Consuming more than 2 alcoholic drinks per day	ML	LL	NT	OK
11. Smoking on a daily basis	ML	LL	NT	OK

For the next group of questions, circle one answer from the 4 choices. Be sure to circle **ONLY ONE** answer. If you think there is more than one correct answer, choose the **BEST** answer. If you are not sure, circle D. Don't know.

12. To strengthen bones, it is recommended that a person exercise at a moderately intense level for 30 minutes a day at least

A. 3 days a week
B. 4 days a week
C. 5 days a week
D. Don't know

13. Exercise makes bones strong, but it must be hard enough to make breathing

A. Just a little faster
B. Much faster, but talking is possible
C. So fast that talking is not possible
D. Don't know

14. Which of the following activities is the best way to reduce a person's chance of getting osteoporosis?

A. Swimming
B. Walking briskly
C. Stretching
D. Don't know

15. Which of the following activities is the best way to reduce a person's chance of getting osteoporosis?

A. Bicycling
B. Yoga
C. Lifting weights
D. Don't know

16. Which of the following activities is the best way to reduce a person's chance of getting osteoporosis?

A. Jogging or running
B. Golfing using golf cart
C. Gardening
D. Don't know

17. Which of the following activities is the best way to reduce a person's chance of getting osteoporosis?

A. Bowling
B. Doing laundry
C. Aerobic dancing
D. Don't know

For the next group of questions, circle one answer from the 4 choices. Be sure to circle **ONLY ONE** answer. If you think there is more than one correct answer, choose the **BEST** answer. If you are not sure, circle D. Don't know.

18. Which of these is the best source of calcium?

A. Apple
B. Cheese
C. Cucumber
D. Don't know

19. Which of these is the best source of calcium?

A. Peanut Butter
B. Turkey
C. Canned Sardines
D. Don't know

20. Which of these is the best source of calcium?

A. Chicken
B. Broccoli
C. Grapes
D. Don't know

21. Which of these is the best source of calcium?

A. Yogurt
B. Strawberries
C. Cabbage
D. Don't know

22. Which of these is the best source of calcium?

A. Ice cream
B. Grape fruit
C. Radishes
D. Don't know

23. Which of the following is the recommended amount of calcium intake for an adult?

A. 600 mg - 800 mg daily
B. 1000 mg - 1200 mg daily
C. 1400 mg - 1600 mg daily
D. Don't know

24. How much milk must an adult drink to meet the recommended amount of calcium?

A. 1 glass daily
B. 2 glass daily
C. 3 or more glasses daily
D. Don't know

For the next group of questions, circle one answer from the 4 choices. Be sure to circle **ONLY ONE** answer. If you think there is more than one correct answer, choose the **BEST** answer. If you are not sure, circle D. Don't know.

25. Which of the following is the best reason for taking a calcium supplement?

A. If a person skips breakfast
B. If a person does not get enough calcium from diet
C. If a person is over 45 years old
D. Don't know

26. Which vitamin is required for the absorption of calcium?

A. Vitamin A
B. Vitamin C
C. Vitamin D
D. Don't know

27. Which is the best source of the vitamin required for the absorption of calcium?

A. Carrots
B. Oranges
C. Sunlight
D. Don't know

28. Which is the best food source of the vitamin required for the absorption of calcium?

A. Spinach
B. Cheese
C. Salmon
D. Don't know

29. Which of the following is the recommended amount of the vitamin required for the absorption of calcium for an adult, 50 years old and older?

A. BOO-1000 IU daily
B. 1200-1400 IU daily
C. *1600-1BOO* IU daily
D. Don't know

30. When is the best time to build strong bones?

A. Childhood
B. Adolescence
C. Young adulthood
D. Don't know

31. Osteoporosis can be diagnosed by

A. Blood test
B. DXA scan
C. Symptoms
D. Don't know

For the next question, circle one answer from the 4 choices. Be sure to circle **ONLY ONE** answer. If you think there is more than one correct answer, choose the **BEST** answer. If you are not sure, circle D. Don't know.

32. Once you have osteoporosis

A. There is nothing you can do about it D. Don't know
B. You can take medication to treat it
C. You must be careful lifting objects

Thank you for completing the survey.
Please check to be sure you answered all of the questions

NO: _____

Appendix 12: Osteoporosis Health Belief Scale.

Osteoporosis (os-te-o-po-ro-sis) is a condition in which the bones become excessively thin (porous) and weak so that they are fracture prone (they break easily).

Below are some questions about your beliefs about osteoporosis. There are no right or wrong answers. We all have different experiences which will influence how we feel. After reading each statement, circle if you STRONGLY DISAGREE, DISAGREE, are NEUTRAL, AGREE, or STRONGL Y AGREE with the statement.

It is important that you answer according to your actual beliefs and not according to how you feel you should believe or how you think we want you to believe. We need the answers that best explain how you feel.

Read each statement. Circle one best option that explains what you believe.

SD = STRONGLY DISAGREE

D=DISAGREE

N=NEUTRAL

A=AGREE

SA = STRONGLY AGREE

SD	D	N	A	SA	1. Your chances of getting osteoporosis are high.
SD	D	N	A	SA	2. Because of your body build, you are more likely to develop osteoporosis.
SD	D	N	A	SA	3. It is extremely likely that you will get osteoporosis.
SD	D	N	A	SA	4. There is a good chance that you will get osteoporosis.
SD	D	N	A	SA	5. You are more likely than the average person to get osteoporosis.
SD	D	N	A	SA	6. Your family history makes it more likely that you will get osteoporosis.
SD	D	N	A	SA	7. The thought of having osteoporosis scares you.
SD	D	N	A	SA	8. If you had osteoporosis you would be crippled.

SD D N A SA 9. Your feelings about yourself would change if you got

SD D N A SA 10. It would be very costly if you got

SD D N A SA 11 When you think about osteoporosis you get depressed.

SD D N A SA 12. It would be very serious if you got osteoporosis.

SD D N A SA 13. Regular exercise prevents problems that would happen from osteoporosis.

SD D N A SA 14. You feel better when you exercise to prevent osteoporosis.

SD D N A SA 15. Regular exercise helps to build strong bones.

SD D N A SA 16. Exercising to prevent osteoporosis also improves the way looks.

SD D N A SA 17. Regular exercise cuts down the chances of broken bones.

SD D N A SA 18. You feel good about yourself when you exercise to prevent osteoporosis.

For the following 6 questions, "taking in enough calcium" means taking enough calcium by eating calcium rich foods and/or taking calcium supplements.

SD D N A SA 19. Taking in enough calcium prevents problems from osteoporosis.

SD D N A SA 20. You have lots to gain from taking in enough calcium to prevent osteoporosis.

SD D N A SA 21. Taking in enough calcium prevents painful osteoporosis.

SD D N A SA 22. You would not worry as much about osteoporosis if you took in enough calcium.

SD D N A SA 23. Taking in enough calcium cuts down on your chances of brittle bones.

SD D N A SA 24. You feel good about yourself when you take in enough calcium to prevent osteoporosis.

SD = STRONGLY DISAGREE

D=DISAGREE

N=NEUTRAL

A=AGREE

SA = STRONGLY AGREE

SD	D	N	A	SA	25. You feel like you are not strong enough to exercise regularly.
SD	D	N	A	SA	26. You have no place where you can exercise
SD	D	N	A	SA	27. Your spouse or family discourages you from exercising.
SD	D	N	A	SA	28. Exercising regularly would mean starting a new habit which is hard for you to do.
SD	D	N	A	SA	29. Exercising regularly makes you uncomfortable.
SD	D	N	A	SA	30. Exercising regularly upsets your every day routine.
SD	D	N	A	SA	31. Calcium rich foods cost too much.
SD	D	N	A	SA	32. Calcium rich foods do not agree with you.
SD	D	N	A	SA	33. You do not like calcium rich foods.
SD	D	N	A	SA	34. Eating calcium rich foods means changing your diet which is hard to do.
SD	D	N	A	SA	35. In order to eat more calcium rich foods you have to give up other foods that you like.
SD	D	N	A	SA	36. Calcium rich foods have too much cholesterol
SD	D	N	A	SA	37. You eat a well-balanced diet.
SD	D	N	A	SA	38. You look for new information related to health.
SD	D	N	A	SA	39. Keeping healthy is very important for you.
SD	D	N	A	SA	40. You try to discover health problems early.
SD	D	N	A	SA	41. You have a regular health check-up even when you are not sick.
SD	D	N	A	SA	42. You follow recommendations to keep you healthy.

Please check to see that you have answered all items.

Appendix 13: Osteoporosis Self Efficacy Scale. ID #: _____

We are interested in learning how confident you feel about doing the following activities. We all have different experiences, which will make us more or less confident in doing the following things. Thus, there is no right or wrong answers to this questionnaire. It is your opinion that is important. In this questionnaire, EXERCISE means activities such as walking, swimming, golfing, biking, aerobic dancing. Place your" X" anywhere on the answer line that you feel best describes your confidence level.

1. Begin a new or different exercise program.

Not at all confident _____Very Confident

2. Change your exercise habits.

Not at all confident _____ Very Confident

3. Put forth the effort required to exercise.

Not at all confident _____ Very Confident

4. Do exercises even if they are difficult.

Not at all confident _____ Very Confident

5. Maintain a regular exercise program.

Not at all confident _____ Very confident

6. Exercise for the appropriate length of time.

Not at all confident _____ Very confident

7. Do exercises even if they are tiring.

Not at all confident _____ Very confident

8. Stick to your exercise program.

Not at all confident _____ Very confident

9. Exercise at least three times per week.

Not at all confident _____ Very confident

10. Do the type of exercises that you are supposed to do.

Not at all confident _____ Very confident

11. Begin to eat more calcium rich foods.

Not at all confident _____ Very confident

12. Increase your calcium intake.

Not at all confident _____ Very confident

13. Consume adequate amounts of calcium rich food.

Not at all confidant _____ Very confident

14. Eat calcium rich food.

Not at all confident _____ Very confident

15. Change your diet to include more calcium rich foods.

Not at all confident _____ Very confident

16. Eat calcium rich foods as often as you are supposed to do.

Not at all confident _____ Very confident

17. Select appropriate foods to increase your calcium intake.

Not at all confident _____Very confident

18. Stick to a diet which gives an adequate amount of calcium.

Not at all confident _____ Very Confident

19. Obtain foods that give adequate amount of calcium.

Not at all confident _____ Very confident

20. Remember to eat calcium rich foods.

Not at all confident _____ Very confident

21. Take calcium supplement if you don't get enough calcium from your diet.

Not at all confident _____ Very confident

Source: Horan, M., Kim, K., Gendler, P. (1991). *Osteoporosis Self-Efficacy Scale*. Grand Rapids, MI: Grand Valley State University.

Appendix 14. Human Subjects Protection Certificate

Completion Certificate

This is to certify that

Victor White

has completed the **Human Participants Protection Education for Research Teams** online course, sponsored by the National Institutes of Health (NIH), on 02/13/2006

This course included the following.

- key historical events and current issues that impact guidelines and legislation on human participant protection in research
- ethical principles and guidelines that should assist in resolving the ethical issues inherent in the conduct of research with human participants
- the use of key ethical principles and federal regulations to protect human participants at various stages in the research process
- a description of guidelines for the protection of special populations in research
- a definition of informed consent and components necessary for a valid consent
- a description of the role of the IRB in the research process
- the roles, responsibilities, and interactions of federal agencies, institutions, and researchers in conducting research with human participants

National Institutes of Health
http://www.nih.gov

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Co-author of a peer reviewed article entitled: "The Risk of Exposure to Non-Ionizing Radiation from Cell Phone Usage" published in the Spring 2014, Vol 3, No. 1 edition of *The Quest*.

White, V. (2013). Risk behaviors: Physical inactivity. In D. Wiley, & A. Cory (Eds.), *Encyclopedia of school health.* (Vol. 15, pp. 506-509). Thousand Oaks, CA: SAGE Publications, Inc. doi: http://dx.doi.org/10.4135/9781452276250.n204

White, V. (2013). Education content areas: Body systems. In D. Wiley, & A. Cory (Eds.),

Encyclopedia of school health. (Vol. 15). Thousand Oaks, CA: SAGE Publications, Inc. doi: http://dx.doi.org/10.4135/9781452276250.n204

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