

FACTORS ASSOCIATED WITH KNOWLEDGE OF AND PREVENTIVE
BEHAVIORS FOR OSTEOPOROSIS IN ADULTS IN THE UNITED STATES

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Abstract

In the United States, approximately 44 million adults over the age of 50 are affected by osteoporosis – 10 million already have the disease while the other 34 million have low bone mass (NOF, 2009). Though osteoporosis is preventable, it is unclear what determines whether or not a U.S. adult will not only possess the knowledge to implement preventive behaviors for osteoporosis, but also utilize it. The problem of the study was to examine the literature to determine what factors, if any, were associated with knowledge of and preventive behaviors for osteoporosis in adults in the United States. This literature review was conducted by searching databases using keywords to obtain applicable results; this search yielded 12 full-text articles published between 1995 and 2007 from six different databases. All of the articles (N=12, 100%) studied adults and almost all (n=11, 91.7%) had fewer than 500 participants. Most of the studies (n=8, 66.7%) used cross-sectional survey designs and all (N=12, 100%) were conducted on local populations. In general, these articles did not agree in their findings; while some claimed specific variables did impact knowledge, others claimed that those same variables did not impact knowledge. The same held true for variables affecting osteoporosis preventive behaviors; while some studies show that specific variables do, indeed impact behavior, others refute this claim. Findings indicated that participation in an osteoporosis education program had a positive association with osteoporosis knowledge, knowing someone/having a family member with osteoporosis had a positive association with osteoporosis

knowledge, Caucasians were more likely to have a higher knowledge of osteoporosis than other races or ethnic groups, and a high level of knowledge did not impact likelihood to engage in weight-bearing physical activity. The lack of similar variables in studies and thus an inability to draw concrete conclusions suggests that further research should examine those variables that were understudied or had inconsistent findings.

CHAPTER I

THE PROBLEM

Introduction

Osteoporosis, often referred to as “The Silent Disease,” is a painless weakening of the bones that allows bones to fracture and break more easily. Though any bone can be affected, the bones that most often break are located in the wrist, hip, and spine (National Osteoporosis Foundation [NOF], 2009). The disease can continue to progress until even a slight twisting or bending motion can cause bones to fracture and break (Bohme & Budden, 2001). Risk factors for developing osteoporosis include both those that are controllable, such as nutrition, physical activity level, smoking, and consumption of alcohol, and those that are uncontrollable, like sex, family history, and ethnicity. Anyone can develop osteoporosis, however, the Centers for Disease Control and Prevention [CDC] specifies several risk factors that can increase risk: being female, white/Caucasian, post-menopausal, an older adult, small body size, physically inactive, and a diet low in calcium (2009). Osteoporosis is preventable for most people, especially if building strong bones is a priority before 30 years of age. Despite the ability people have to possibly prevent osteoporosis from developing, there is no cure for the disease. If left untreated, osteoporosis can lead to severe pain, deformity, physical impairment, disability, and even death (NOF, 2009b).

In the United States, approximately 44 million adults over the age of 50 are affected by osteoporosis – 10 million already have the disease while the other 34 million have low bone mass (NOF, 2009). Eight million of the aforementioned 10 million that have the disease are female. Twenty percent of non-Hispanic Caucasian and Asian females aged 50 or over and 7% of non-Hispanic Caucasian and Asian males aged 50 or over are estimated to have osteoporosis; with 52% and 35% respectively having low bone mass.

According to the World Health Organization (WHO), “As populations age the world over, osteoporosis or loss of bone mineral density, will generate an increasing burden of disease... because people with osteoporosis have much higher risk of fractures... in even the most resource-rich health care systems, the resources that will be consumed by treatment and care of such fractures is expected to grow exponentially” (WHO, 2009, ¶1). The NOF reported that in 2005, \$19 billion was spent on osteoporosis-related fractures in the United States. Moreover, experts predict that costs will reach \$25.3 billion by 2025 (NOF, 2009). In fact, because of the current increase in the number of hip fractures (a fracture primarily occurring in people with osteoporosis and linked with an increased risk of death), an estimated \$240 billion will be spent on hip fractures alone by 2050 (Adams & Lukert, 1999).

Much research has been conducted on factors associated with knowledge of and preventive behaviors for osteoporosis in adults in the United States. Representative of literature on knowledge of osteoporosis are those presented by Taggart and Connor (1995), Wallace (2002), and Ailinger, Braun, Lasus, and Whitt (2005). First, Taggart and Connor (1995) found that the older the female college student, the more she knew about

osteoporosis, was aware of her own susceptibility, and was motivated in her general health behaviors. However, the older students were more inclined to believe there were greater barriers to exercise. Second, in her study, Wallace (2002) found that a high number of women did not have adequate calcium intake and exercise patterns. The best predictors of exercise and calcium intake were exercise self-efficacy and barriers to exercise. Finally, Ailinger, Braun, Lasus, and Whitt (2005) studied several factors that influenced knowledge of osteoporosis in a convenience sample of 255 women and men. Risk factors that had a significant correlation with knowledge of osteoporosis were age, knowing someone with osteoporosis vs. not knowing someone with osteoporosis, being pre- vs. postmenopausal, being a member of an ethnic group, and finally those having received previous osteoporosis information had more knowledge about osteoporosis than those who had not.

Statement of the Problem

The focus of this study was to examine the literature to determine what factors, if any, were associated with knowledge of and preventive behaviors for osteoporosis in adults in the United States.

Purpose of the Study

By studying the problem stated above, health care workers can discover which factors influence osteoporosis knowledge and preventive behaviors, enabling them to tailor education about osteoporosis to specific groups of people based on risk factors. Though osteoporosis is preventable, it is unclear what determines whether or not a U.S.

adult will not only possess the knowledge to implement preventive behaviors for osteoporosis, but also utilize it. The results of this study may be useful to professionals such as health educators, teachers, and physicians in educating adults about osteoporosis and how to prevent it. In turn, this study could result in more in-depth osteoporosis education during high school and early college years, such that students would understand that it is important to build strong bones while they are young.

Questions to be Answered

1. What factors affect knowledge of osteoporosis among adults in the United States?
2. What factors affect preventive behaviors for osteoporosis among adults in the United States?

Delimitations

This study was delimited in the following ways:

1. Literature used for this research project was located using the databases listed on the Ball State University Library Web page.
2. Only literature published between years 1995 and 2008 was used for this research project.
3. Only peer-reviewed articles and documents from government and private agencies were included in the literature reviewed for this research project.
4. Only databases that produced full-text articles presented in English were used for this research project.

5. Only research that included participants aged 18 years and over was used for this research project.

Limitations

The limitations of this study included the following:

1. Literature used for the review was limited to that available on the Ball State University database Web page.
2. Not all literature regarding the knowledge of and preventive behaviors for osteoporosis may appear in peer-reviewed journals and documents from government and private agencies.
3. Only literature that was free for use was utilized in this study.
4. Some literature may report on local studies and will therefore not be generalizable to a national population.

Assumptions

The assumptions of the study included the following:

1. The literature analyzed for this research paper was presented in an unbiased fashion.
2. The literature was current, accurate, and complete.
3. The researcher correctly interpreted the content of the literature.

Definition of Terms

Terms below are defined as they are used in this literature review.

1. Adult: A male or female of 18 or more years of age.
2. Calcium-rich: Foods that contain 20% or more of the daily value of calcium (Food and Drug Administration [FDA], 2007).
3. Osteopenia: A condition in which the bones have a decreased amount of calcium and phosphorous, thus increasing risk for fracture (Medline Plus, 2007).
4. Osteoporosis: A skeletal disorder in which bones become fragile, thus more likely to break (NIH, 2000; NOF, 2009a).
5. Osteoporosis knowledge: acquaintance with facts, truths and principles associated with osteoporosis.
6. Resistance exercises: Exercises that employ muscular strength to further develop muscle mass and strengthen bone (NOF, 2009c).
7. Weight-bearing exercises: Exercises that force bones and muscles to work against gravity (NOF, 2009c).

Significance of the Problem

Osteoporosis affects a large number of people; about 55% of adults 50 years of age or older (NOF, 2009b). It is not limited to a specific sex or race; it can develop in any person. Of the aforementioned 10 million Americans that are estimated to have the disease, approximately 80% of these are females and 20% are males (NOF, 2009b).

The physical and emotional effects of osteoporosis can be significant. It causes severe physical deformity and disability, leading to potential emotional issues. These factors have a great impact on quality of life. For example, 80% of women over the age of 75 claimed to prefer death to hip fractures resulting from osteoporosis (NIH, 2000).

The disease also causes skeletal deformity, increases difficulty of daily activities, and reportedly results in fear, anxiety, and depression (NIH, 2000). Billions of dollars continue to be spent on osteoporosis annually.

Because of the mass of people affected, the physical and emotional effects, and the cost, it is necessary to look at primary prevention, interventions that help to delay or prevent onset of a disease, the most cost-effective level of prevention, and the surest way to avoid many of the physical and emotional effects. Osteoporosis is a disease that can be prevented – or at least decreased in severity – if proper actions are taken. In order to succeed in this, people must have knowledge about osteoporosis so that they can engage in the appropriate behaviors in order to prevent osteoporosis. Demographic characteristics and other factors are often indicative of the level of knowledge because people in different groups have access to various sources and amounts of information. It is vital to examine factors associated with knowledge levels of and preventive behaviors for osteoporosis in order to determine if there is a gap in dissemination of osteoporosis education. If program planners are aware of knowledge levels and behaviors associated with the prevention of osteoporosis, they may be able to tailor osteoporosis education to specific types of people and more easily identify priority populations for intervention programs.

CHAPTER II

METHODOLOGY

Introduction

The problem of this study was to examine the literature to determine what factors, if any, were associated with knowledge of and preventive behaviors for osteoporosis in adults in the United States. In this chapter, the methods used to explore the problem are presented. The following sections are included: 1) design of the study, 2) arrangements for conducting the study, 3) procedures for gathering data and information, and 4) data analysis.

Design of the Study

An in-depth literature review was used to carry out the study. Data and information were gathered from two types of sources; 1) peer-reviewed journals and 2) documents from governmental and private agencies.

Arrangements for Conducting the Study

In order to conduct this study, the researcher met with her advisor and discussed the goals and parameters of the study. They decided to split the study into the following

four chapters: Chapter I – an introduction of the problem, delimitations, limitations, and definition of terms; Chapter II – the methods used to conduct the study; Chapter III – a thorough review of the related literature; and Chapter IV – analysis and discussion of the literature reviewed and important findings, limitations of findings, summary, conclusions, and recommendations/implementation for future research.

Procedures

Indexes Selected and Key Words Used

First, related literature was identified through Ball State University's databases found on its library Web page. A wide variety of health-related databases were searched via the following link: <http://www.bsu.edu/libraries/databases/index.php?tab=subject>, starting with the letter "A" and continuing through the alphabet. A health-related database was defined as a database that yielded full-text, peer-reviewed articles all pertaining to health subjects. Sixteen databases were identified through the search and the results were compiled into a six column, 17-row database table (see Table 1). The researcher listed all 16 databases in alphabetical order; the table included database name, publisher, subject heading, time period for indexing, type of materials indexed, and type of information included in each database.

Table 1

Database Table

Database	Publisher	Subject Heading	Time Period	Type of Documents	Information Included
Academic Search Premier*	EBSCO	Education, Health, Philosophy & Religion, Psychology, Science, Social Sciences	1965-present	Journal articles	Some full-texts
Annual Reviews	Annual Reviews	Health, Psychology, Science, Social Sciences	1930-present	Annual reviews	Some full-texts
Cumulative Index to Nursing and Allied Health Literature (CINAHL)*	EBSCO	Health	1982-present	Books, conference proceedings, dissertations, journal articles	Abstracts, some full-texts
Education Resources Information Center (ERIC [EBSCOhost])	EBSCO	Education	1985-present	Journal articles	Abstracts, citations, some full texts
Google Scholar*	Google	Philosophy & Religion	Varies	Citations, journal articles	Abstracts, citations
GreenFILE	EBSCO	Health, Science	1973-present	Journal articles	Some full texts
Health Source: Consumer Edition	EBSCO	Health	1985-present	Periodicals, reference books	Full texts

Health Source: Nursing/Academic Edition*	EBSCO	Health	1975-present	Journal articles	Abstracts, some full texts
Highwire: Library of the Sciences and Medicine Journal Storage (JSTOR)	Stanford University JSTOR	Health Education, Philosophy & Religion, Psychology, Science, Social Sciences	1960s-present 2000-present	Journal articles Conference proceedings, journal articles	Abstracts, some full texts Abstracts, full texts
Medline*	National Library of Learning	Health	1966-present	Abstracts, some full-text	Abstracts, some full-texts
Medline (EBSCOhost)	EBSCO	Health	1965-present	Journal articles	Full texts
ProQuest Nursing and Allied Health Source*	ProQuest Information and Learning	Health	1986-present	Journal articles	Abstracts, full texts
PubMed	National Library of Medicine and National Institutes of Health	Health	1966-present	Journal articles	Abstracts, citations
PubMed Central	National Institutes of Health	Health	1900s-present	Journal articles	Abstracts, citations, some full texts
Science.gov	USA.gov	Health, Science	1966-present	Journal articles, technical reports, web pages	Abstracts, citations, some full texts

* selected for use in this study

Six of the 16 databases were selected to use as primary databases for the literature review from the above list after review. Academic Search Premier was chosen because of the researcher's familiarity with the database. The database ProQuest Nursing and Allied Health Source was picked because it had many relevant articles. The last four were selected because they had at least some relevant, full-text articles; these included: Cumulative Index to Nursing and Allied Health Literature (CINAHL), Google Scholar, Health Source: Nursing/ Academic Edition, and Medline.

Of the ten databases in Table 1 that were not chosen, seven, Annual Reviews, Education Resources Information Center (ERIC [EBSCOhost]), GreenFILE, Health Source: Consumer Edition, Journal Storage (JSTOR), Medline (EBSCOhost), and Science.gov, had few or no relevant articles. Highwire: Library of the Sciences and Medicine had many articles, but most of these were not free for use. As similar articles could be found, the researcher did not find it necessary to purchase these articles. The remaining two, PubMed and PubMed Central, had no full-text articles that the researcher could use.

Once the databases were selected, it was necessary to select the key words to be used to search the databases. Because not all databases use the same key words with which to index, the key search words were selected using the thesaurus in each of the selected databases. Each of the databases and the keywords identified and used are listed below:

Academic Search Premier

1. Osteoporosis
2. United States

3. Knowledge
4. Behavior
5. Prevention
6. Adults

ProQuest Nursing and Allied Health Source

1. Osteoporosis
2. United States
3. Knowledge
4. Behavior
5. Prevention
6. Adults

CINAHL

1. Osteoporosis
2. United States
3. Adult, 19-44 years
4. Adults

Google Scholar

1. Osteoporosis
2. United States
3. Adults
4. Knowledge
5. Behavior

Health Source: Nursing/ Academic Edition

1. Osteoporosis
2. United States
3. Knowledge
4. Behavior

Medline

1. Osteoporosis
2. United States
3. Knowledge
4. Behavior

Inclusion/Exclusion Criteria

Once the key words were selected, the researcher conducted the search of each database using the key words. For an article or document to be included in the review of literature, the piece of literature had to be: 1) published between 1995 and 2008, 2) a full-length document, 3) a peer-reviewed article, 4) written in English, and 5) free for use. Only documents used between 1995 and 2008 were used in an effort to use only the most up-to-date studies and information. Articles had to be full-text so that the article could be reviewed in its entirety and all data considered when drawing conclusions. Documents must also have been peer-reviewed for validity. Finally, only documents written in English were used as this was the primary language of the researcher.

CHAPTER III

REVIEW OF LITERATURE

Introduction

The problem of the study was to examine the literature to determine what factors, if any, were associated with knowledge of and preventive behaviors for osteoporosis in adults in the United States. In order to study this problem, the related literature was reviewed and presented in the following major categories: (a) Background Information about Osteoporosis, (b) Factors Affecting Osteoporosis Knowledge, (c) Factors Affecting Preventive Behaviors for Osteoporosis, (d) Factors Affecting Knowledge of and Preventive Behaviors for Osteoporosis, and (e) Summary.

Background Information about Osteoporosis

Osteoporosis, literally *porous bone*, is a disease in which a person's bones become very fragile and thus, the bones are more likely to fracture (Bohme & Budden, 2001; National Osteoporosis Foundation [NOF], 2009a). Osteoporotic fractures include hip, vertebral, wrist, rib, and other sites; accounting for about 1.5 million fractures each year. This disease currently affects approximately 44 million (55%) Americans 50 years old or older (NOF, 2009b). Moreover, the percent of osteopenic persons developing osteoporosis is projected to increase at a rate of a two percent per year if nothing is done

about the disease. At this rate of increase, it is thought that osteoporosis will cost more than \$62 billion a year by the year 2025 for just hip fractures (Adams & Lukert, 1999).

Osteoporosis is much more common in women, who are four times more likely to develop the disease than men, and white women are more likely to develop it than any other race. However, risk factors are increasing fastest among Hispanic women (NOF, 2009b). In order to stave off this disease, people must strive to develop peak bone mass, or the maximum bone density able to be achieved in a lifetime, especially by age 30 (Bohme & Budden, 2001; NOF, 2009b). In fact, 85-90% of peak bone mass will be obtained by 18 years of age in women and 20 years of age in men, so preventive measures should begin at an early age (NOF, 2009b). Participating in weight-bearing physical activity and getting an adequate amount of calcium are two of the most effective ways to help develop peak bone mass.

The development of osteoporosis is also greatly influenced by genetics, being thin or small framed, and the resulting effects of menopause, amenorrhea, anorexia, vitamin D deficiency, cigarette smoking, and excessive use of alcohol (NOF, 2009b). First, a family history of low bone density makes it more likely that descendants will have low bone density (United States Department of Health and Human Services [DHHS], 2004). Also, being thin or small framed can cause the body to quit producing estrogen, which can lead to amenorrhea. The resulting low estrogen levels can cause a decrease in bone density (National Institutes of Health [NIH], 2005). In addition to these factors, anorexia can cause an increase in adrenal hormone cortisol, which also contributes to bone loss (NIH, 2005). Next, though bone mass begins decreasing with age, menopause accelerates bone loss. This occurs because there is an abrupt reduction of hormone production, and these

hormones provide some protection for bones (DHHS, 2004). Furthermore, because vitamin D is needed to absorb calcium, a deficiency can lead to weaker bones (DHHS, 2004). Finally, smoking and excessive use of alcohol can also decrease bone mass, thus making it more likely that a bone will break (DHHS, 2004).

Important measures to take against the development of osteoporosis include engaging in weight-bearing physical activity to help build bone mass, talking about bone health with a healthcare provider, receiving a bone mineral density (BMD) screening – which can detect osteoporosis – such as the dual energy x-ray absorptiometry (DEXA) scan, and/or using prescription medication as needed (Adams & Lukert, 1999; NOF, 2009b). Though there is no cure for osteoporosis, certain medications can help prevent it by slowing or stopping bone loss or treat it by helping to rebuild bone mass. These medicines include bisphosphonates, estrogen or hormone therapy, and selective estrogen receptor modulators (SERMS) (NOF, 2009b).

Factors Affecting Osteoporosis Knowledge

A number of different studies were found in the literature reviewed examining the question of “What factors impact the osteoporosis knowledge of individuals?” These studies showed that there are, indeed, many factors that affect a person’s knowledge of osteoporosis. In 1998, using an experimental design, Sedlak, Doheny, and Jones used a convenience sample of 31 college freshman women majoring in pre-nursing and randomly assigned them to an experimental or control group. Each group was given the Osteoporosis Knowledge Test (OKT) (Kim, Horan, & Gendler, 1991) and completed

both the Osteoporosis Health Belief Scale (Kim, Horan, & Gendler, 1991) and the Osteoporosis Self-Efficacy Scale (Kim, Horan, & Gendler, 1991). Each of these instruments was given two times to the participants; once before an intervention was given to the experimental group and once afterwards. The experimental group received an osteoporosis prevention program developed by the National Osteoporosis Foundation (NOF, 1993) that consisted of instructional materials and a slide show about osteoporosis. After the prevention program had been given, results showed that the participants in the experimental group scored significantly higher in osteoporosis knowledge ($p < .001$) and health belief scores ($p < .001$) on their posttest vs. their pretest compared to the control group. However, the control group showed a greater increase in self-efficacy for exercise than did the experimental group ($p < .001$).

In another study, Ailinger, Braun, Lasus, and Whitt (2005) studied factors that influenced knowledge of osteoporosis in a convenience sample of 255 women and men in an Eastern university community. Subjects were asked to complete a demographic questionnaire before taking a quiz to determine osteoporosis knowledge. Of the 255 respondents, 215 were women, 37 were men, and 3 did not enter their sex; other demographic information collected included age, education level, and race and/or ethnicity. Researchers then used an instrument to measure osteoporosis knowledge developed by Ailinger, Lasus, and Braun (2003): the Facts on Osteoporosis Quiz (FOOQ), a quiz comprised of 20 “true” or “false” questions. After taking the quiz, answers and rationale were provided. Subjects had a mean score of 72%; researchers stated that this shows inadequate knowledge of osteoporosis. Risk factors that had a significant correlation with knowledge of osteoporosis were age ($p < .001$), knowing

someone with osteoporosis vs. not knowing someone with osteoporosis ($p=.045$) (those who knew someone scored higher), being pre- vs. postmenopausal ($p=.028$) (postmenopausal women scored higher), ethnic groups ($p=.001$) (Caucasians were the most knowledgeable, then Asians, African Americans and Hispanics had the same score and were the least knowledgeable), and finally those who had received previous information had more knowledge about osteoporosis than those who had not ($p=.001$). Those factors that did not have a significant correlation with osteoporosis knowledge were sex and use of hormone replacement therapy (HRT).

In a second study conducted with college students, Ford, Bass, and Keathley (2007) carried out a cross-sectional survey study that included 911 men and women from Florida Atlantic University and Sam Houston State University. Researchers examined osteoporosis knowledge, attitudes about perceived risk of osteoporosis, and knowledge of dietary calcium on intake of dairy products; this was done using an osteoporosis knowledge questionnaire (Anderson & Auld, 1996) which Ford et al. modified by adding questions addressing attitudes of perceived risk and dietary calcium knowledge. Ford et al. collected demographic information including age, sex, race or ethnicity, and marital status. Results showed that there was not a significant difference of osteoporosis knowledge by sex; however, there was a significant difference ($p<.05$) between men and women when it came to perceived risk (the mean score for men was significantly lower) and dietary calcium knowledge (the mean score for women was significantly higher). Finally, women scored significantly ($p<.05$) lower than men on dairy consumption. Researchers summarize that osteoporosis knowledge did not predict dairy product intake

in participants and that osteoporosis attitude did not determine dairy intake in women, though it did in men.

Kasper, Garber, and Walsdorf (2007) completed a similar study to the one conducted by Ford et al., but used only college-aged women (N=302) at a southeastern university. The problem of this study was to examine osteoporosis knowledge and beliefs in women. They used a cross-sectional survey of women enrolled in an elective physical activity class to collect the data. Participants were given the Multiple Osteoporosis Prevention Survey (Kasper, Peterson, & Allegrante, 1994) that screens for knowledge of and beliefs about osteoporosis; demographic information such as age, race or ethnicity (Caucasian and African American were the only two represented), weight, and whether or not the participants had heard about osteoporosis before were also collected. Overall, most participants were only somewhat concerned about developing osteoporosis and had a low level of osteoporosis knowledge – African American women scored significantly lower ($p < .001$) than Caucasian women – despite claiming they had heard about osteoporosis before.

In another study, Doheny, Sedlak, Estok, and Zeller (2007) conducted a secondary analysis of 444 healthy community-based men and women, 50 years of age and older, to compare osteoporosis knowledge, revised health belief model variables (RHBM), and DXA T-scores. Data were collected over an 18-month period of time, including demographic information such as age, race, marital status, education, income, and smoking history. To conduct this study, 377 of the men and women took the Osteoporosis Knowledge Test (OKT) (Kim, Horan, & Gendler, 1991) before having DXA scans, half of the participants started right away and the other half were assigned to

a group that was to schedule their DXA scans a year later. Researchers found that though neither women nor men had a high knowledge of osteoporosis, there was a significant difference ($p<.001$) in scores showing that women had more knowledge of osteoporosis than men. Seven of the nine RHBM variables were statistically significant; men scored significantly higher on barriers to calcium intake ($p=.038$), health motivation ($p=.034$), and exercise self-efficacy ($p<.001$), and women scored significantly higher on susceptibility ($p<.001$), seriousness ($p<.001$), benefits of calcium intake ($p=.038$), and barriers to exercise ($p=.019$). A little less than half of both men and women had low bone mass or were osteopenic and about one tenth of men and women were osteoporotic.

Factors Affecting Preventive Behaviors for Osteoporosis

Additional studies were examined to explore the question, “What factors affect osteoporosis preventive behaviors?” As with osteoporosis knowledge, osteoporosis preventive behaviors are affected by a wide variety of factors. One such study by Twiss, Dillon, Konfrst, Stauffer, and Paulman (2002) was conducted to examine perceived height vs. actual height and its effect on preventive behavior and risk factor awareness for osteoporosis. A convenience sample of 63 perimenopausal and menopausal women from three southwestern ambulatory outpatient health care clinics was used for the study. Height was measured and the Osteoporosis Questionnaire, designed by the researchers and including the Osteoporosis Risk Questionnaire (McMahon, Peterson, & Schilke, 1992), was used to collect data. Researchers found a significant relationship ($p=.0007$) between actual height loss and risk factors, but no relationship between actual height loss and health-seeking behaviors. Only two risk factors in the women had a significant

relationship with height loss: women with a history of smoking ($p=.0865$) and tooth loss ($p=.0021$). Only 20.6% of the women surveyed had a good understanding of osteoporosis; these women were more likely to use HRT ($p=.0068$) and calcium supplements ($p=.0044$).

In her study, Wallace (2002) used the Expanded Health Belief Model (EHBM) and personal characteristics to examine osteoporosis-protective behaviors in college females. The researcher was interested in three main objectives: to see if the participants had adequate calcium intake and weight-bearing exercise; to assess their osteoporosis knowledge; and to determine whether or not EHBM and personal characteristics can predict calcium intake and amount of weight-bearing exercise. Valid questionnaires that produced reliable data were sent out to 1,000 random nontraditional undergraduate women. The women were told that they would be entered into a cash drawing if they participated. Of the 1,000 questionnaires sent, 287 were returned; however, 14 were returned because of incorrect mailing addresses, so only 273 were used in the analysis. The nonresponse error was controlled by assuming that late respondents were similar to those that did not respond. Late respondents were found to have a significantly ($p<.05$) higher calcium self-efficacy, but significant differences were not found for demographic variables, current behaviors, or the other eight EHBM constructs. Respondents were then put into four different groups based on how much calcium they consumed and how much weight-bearing exercise they did. The author used the Facts on Osteoporosis Quiz (Ailinger, Harper, & Lasus, 1998) to determine knowledge of osteoporosis, the Osteoporosis Health Belief Scale (Kim, Horan, & Gendler, 1991) to measure health beliefs, the Osteoporosis Self-Efficacy Scale (Kim, Horan, & Gendler, 1991) to measure

osteoporosis self-efficacy, and the rapid assessment method (Hertzler & Frary, 1994) to measure calcium intake. A high number of women did not have adequate calcium intake and exercise patterns. Wallace found that the best predictors of exercise and calcium intake were exercise self-efficacy and barriers to exercise. She also found that the EHBM was indeed useful in predicting exercise and calcium intake.

Factors Affecting Knowledge of and Preventive Behaviors for Osteoporosis

Finally, studies were examined that addressed both of the above questions: “What factors affect osteoporosis knowledge?” and “What factors affect osteoporosis preventive behaviors?” Several studies have been conducted comparing knowledge to attitudes and behaviors. In one such study, Taggart and Connor (1995) examined how female college students’ exercise habits were affected by their knowledge about osteoporosis and their health beliefs. Participants for the study included 113 college students aged 18-53 years old and enrolled in a core requirement basic health course. Researchers used a self-response questionnaire booklet to obtain demographic data, to administer the Osteoporosis Health Belief Model Scale (Kim, Horan, Gendler, & Patel, 1991), and to administer an Osteoporosis Knowledge Test that they developed. The Osteoporosis Health Belief Model Scale was used to measure health beliefs that relate to osteoporosis: it included 30 items in a Likert-style format. The Osteoporosis Knowledge Test was created based on a literature review. A panel of experts was used to establish content validity. Researchers found that the older the female participant, 1) the more she knew about osteoporosis, 2) the more aware she was of her own susceptibility, and 3) the more motivated she was in her general health behaviors. However, the researchers found no

statistically significant relationship between exercise frequency and osteoporosis knowledge and health beliefs. Older participants were more inclined to believe there were greater barriers to exercise. The researchers concluded that the study confirms the need for early osteoporosis education and continuous physical activity to prevent osteoporosis.

In a study including only men, Sedlak, Doheny, and Estok (2000) analyzed the osteoporosis knowledge, health beliefs about osteoporosis, confidence in performing preventive behaviors, and actual performance of preventive behaviors in 138 men aged 65 or older. In order to do this, the participants had to complete a questionnaire that included the Osteoporosis Knowledge Test (Kim, Horan, & Gendler, 1991), Osteoporosis Health Belief Scale (Kim, Horan, & Gendler, 1991), and the Osteoporosis Self-Efficacy Scale (Kim, Horan, Gendler, & Patel, 1991). Researchers also included questions about osteoporosis preventing behaviors. Researchers found that the men had a low level of osteoporosis knowledge and did not think that they were susceptible to the disease. Furthermore, the men did not engage in preventive behavior such as consuming the recommended amount of calcium and participating in weight-bearing physical activity. The researchers concluded that men need more osteoporosis education and that osteoporosis awareness programs should be developed for men.

Sedlak and Doheny were joined by Jones (2000) to conduct another study on osteoporosis knowledge and preventive behaviors. This study included three educational programs with the same basic content but different in design, length, intensity, and method of presentation. All participants were women and were split into groups: the first group (n=31) consisted of young college women and were given the intense, three-week

program, the second group (n=35) included a community sample and received the intermediate, three hour program, and the last group of women (n=18) were all nurses and received the brief, 45 minute program. Participants were asked to complete the OKT (Kim, Horan, & Gendler, 1991) and OHBS (Kim, Horan, & Gendler, 1991); additionally, researchers included questions about osteoporosis preventing behaviors. Participants completed these questionnaires two times, once before the intervention and then three weeks after completing the intervention. All three groups showed significantly higher levels of osteoporosis knowledge after completing the intervention. The only impact on health beliefs occurred in the intermediate group; their belief that calcium intake was beneficial in preventing osteoporosis increased ($p < .05$). Only participants in the intense group reported a change in preventive behavior; they report significantly decreasing their caffeine consumption ($p < .05$).

Terrio and Auld (2002) examined the extent of women's knowledge of osteoporosis as determined by calcium intake and frequency of weight-bearing physical activity. The problem of the study was to determine if there were differences among young, middle-aged, and post-menopausal women. Participants were 75 white women split equally between the three different age groups: 25-35 years of age, 36-46 years of age, and post-menopausal or above 50 years of age (there were no subjects ranging from 47-49 years of age). Participants were asked nine questions about osteoporosis in a face-to-face interview. They were also given a questionnaire that collected demographic data, information on consumption of calcium-rich foods, and amount of weight-bearing physical activity. After pilot testing the instrument, researchers used it to test subjects twice (one week apart). Terrio and Auld found that the overall calcium intake was high

and that knowledge did not predict calcium intake or weight-bearing physical activity. They also found that there was no difference in these factors by age. None of the women showed a substantial amount of osteoporosis knowledge but post-menopausal women knew more about hormone replacement therapy. Knowledge scores were low, ranging from zero to 96 points out of a total of 183 points and averaging between 32 and 44 points.

In another study focusing on only women's knowledge of and preventive behaviors for osteoporosis, Larkey, Day, Houtkooper, and Renger (2003) examined how age and race or ethnicity affect osteoporosis knowledge and behaviors in women. Interviewers asked a random sample of 200 women, aged 25 to 55 years old, questions pertaining to osteoporosis knowledge and behaviors related to risk factors of osteoporosis. Researchers found that there was no significant difference between post-menopausal and young women in osteoporosis knowledge. Hispanic women were found to have similar beliefs as non-Hispanic whites; albeit there were a few items where Hispanic women had significantly ($p < .05$) less knowledge. On the other hand, Hispanic women were more likely to recognize that a higher body weight may decrease chances of developing osteoporosis. Though the findings are not generalizable, the researchers feel that this study is important in demonstrating differences between pre- and post-menopausal women and Hispanic and non-Hispanic women.

Summary

Osteoporosis is a growing problem in the United States that affects both men and women. The increasing cost of fractures due to osteoporosis has established a need for

education about osteoporosis and its prevention. Many studies have been conducted on osteoporosis knowledge and behavior; however, the only result that is consistent in the literature reviewed was that osteoporosis knowledge is generally low amongst all populations. Results of the studies reviewed varied as to which factors affected knowledge of and preventive behaviors for osteoporosis. Many researchers included the following factors as having a significant impact on knowledge of osteoporosis: osteoporosis education interventions, age, being pre- vs. post-menopausal, knowing someone with osteoporosis, race, using hormone replacement therapy (HRT), using calcium supplements, and sex. Some of the same factors, sex, age, and use of HRT were used in other studies as not seeming to impact knowledge; however, exercising and having previously heard of osteoporosis were also included as factors that did not impact knowledge. The same issue of inconsistency arises in factors that impacted preventive behaviors for osteoporosis: age, knowledge of osteoporosis, and osteoporosis education interventions appear as factors for both having an impact on osteoporosis preventive behaviors and not having an impact. Other factors thought to have an impact on osteoporosis preventive behaviors were sex, barriers to exercise, number of children, health efficacy, body mass index, education level, bone density test experience, and a family history of osteoporosis. The only additional factor researchers found that did not have an impact on osteoporosis preventive behaviors was loss of height over time. Many of the differences in these studies can be attributed to the number of different data collection instruments used.

CHAPTER IV
RESULTS, DISCUSSION, SUMMARY, CONCLUSIONS, AND
RECOMMENDATIONS

Results

The problem of the study was to examine the literature to determine what factors, if any, were associated with knowledge of and preventive behaviors for osteoporosis in adults in the United States. This literature review was conducted by searching databases using keywords to obtain applicable results; this search yielded 12 full-text articles published between 1995 and 2007 from six different databases (see Table 2). All of the articles (N=12, 100%) studied adults and almost all (n=11, 91.7%) had fewer than 500 participants. Most of the studies (n=8, 66.7%) used cross-sectional survey designs and were conducted on local populations. General findings of the articles can be found in Table 3.

Table 2

Articles generated by the database search

Database	Number of Articles Found	Years Covered
Academic Search Premier	2	2002-2005
Cumulative Index to Nursing and Allied Health Literature (CINAHL)	1	2000
Google Scholar	1	2000
Health Source: Nursing/ Academic Edition	2	2002-2007
MEDLINE	1	1995
ProQuest Nursing and Allied Health Source	5	1998-2007

Table 3

Articles Found

Author(s)	Year	Research Design	Number of Participants	General Findings
Ailinger, Braun, Lasus, and Whitt	2005	Cross-sectional survey	255	Variables that impacted knowledge of osteoporosis included: age, knowing someone with osteoporosis, being post-menopausal, ethnicity, and having received information about osteoporosis previously
Doheny, Sedlak, Estok, and Zeller	2007	Secondary analysis	377	Though both had a low level of knowledge of osteoporosis, women had a higher level of knowledge than did men, and seven of nine Revised Health Belief Model variables were significant
Ford, Bass, and Keathley	2007	Cross-sectional survey	911	Men felt they were less at risk for osteoporosis than women, women had a higher level of knowledge dietary calcium, and men consumed more dairy
Kasper, Garber, and Walsdorf	2007	Cross-sectional survey	302	Most women were only somewhat concerned that they may develop osteoporosis, African-American women scored lower in knowledge of osteoporosis than did Caucasian women, but both had a low level of osteoporosis knowledge
Larkey, Day, Houtkooper, and Renger	2003	Cross-sectional survey	200	Being pre-vs. post-menopausal did not affect knowledge of osteoporosis, and Hispanics and Caucasians had similar beliefs about osteoporosis

Sedlak, Doheny, and Jones	1998	Experimental	31	Women who participated in a prevention program scored higher on their posttests than on their pretests in knowledge of osteoporosis and on the Health Belief Scale; women who did not participate in the prevention program scored higher on their self-efficacy posttest vs. their pretest
Sedlak, Doheny, and Estok	2000	Descriptive	138	Men had a low level of knowledge of osteoporosis, did not think they were susceptible to osteoporosis, and did not participate in osteoporosis preventive behaviors
Sedlak, Doheny, and Jones	2000	Experimental	84	Women scored significantly higher in knowledge of osteoporosis after participating in educational programs, women who received intermediate-intensity program were more likely to believe that calcium intake was beneficial, and women in the high-intensity group reported that they decreased their caffeine intake after receiving the education program
Taggart and Connor	1995	Cross-sectional survey	113	Older women knew more about osteoporosis, were more aware of their susceptibility, and were more motivated to attain a healthy lifestyle
Terrio and Auld	2002	Cross-sectional survey	75	Women's knowledge of osteoporosis did not predict calcium intake or weight-bearing physical activity, calcium intake was high, most women had a low level of osteoporosis knowledge
Twiss, Dillon, Konfrst, Stauffer, and Paulman	2002	Cross-sectional survey	63	Actual height loss was correlated with risk factors of osteoporosis, but not with health-seeking behaviors; women who used Hormone Replacement Therapy and calcium supplements were more likely to have higher levels of knowledge of osteoporosis

Wallace	2002	Cross-sectional survey	273	The best predictors of exercise and calcium intake were exercise self-efficacy and barriers to exercise, though a higher number of women did not have adequate exercise patterns or calcium intake
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Discussion

The problem of the study was to examine the literature to determine what factors, if any, were associated with knowledge of and preventive behaviors for osteoporosis in adults in the United States. Osteoporosis, a disease that silently progresses until even a slight bend or twist can cause a break, is a preventable, but not curable, disease. In order to prevent osteoporosis, it is necessary to attempt to accrue peak bone mass by 30 years of age by engaging in osteoporosis preventive behaviors such as adequate calcium intake and weight-bearing physical activity. Despite the fact that one out of every two women and one out of every four men will experience an osteoporosis related fracture after 50 years of age (NOF, 2009), much of the literature examined shows that most people have a low level of knowledge of osteoporosis, do not feel they are at risk, and are not engaging in preventive behaviors of adequate calcium intake and weight-bearing physical activity.

Factors that affect knowledge of osteoporosis among adults in the United States

The first question that this literature review attempted to answer was, “What factors affect knowledge of osteoporosis among adults in the United States?”

Unfortunately, this question is approached differently in each of the 12 studies reviewed, so results varied widely. For example, while one study would examine demographic

variables on osteoporosis knowledge (e.g., sex, age, and race/ethnicity), another would examine things that an individual chooses to do (e.g., participate in an osteoporosis educational program) and how that affected knowledge. Several variables were addressed in relation to osteoporosis knowledge. Those that were analyzed by at least two or more studies included: age, sex, participating in an osteoporosis education program, use of calcium supplements, participation in weight-bearing physical activity, knowing someone with or having a family history of osteoporosis, being pre- vs. post-menopausal, use of Hormone Replacement Therapy (HRT), and race or ethnicity. Other factors that appeared in at least one study were: having received previous information on osteoporosis, dairy intake, and education level. Of the aforementioned variables, those that were shown to be significantly correlated with osteoporosis knowledge in at least one study included: age (Ailinger et al., 2005; Terrio & Auld, 2002; Taggart & Connor, 1995), knowing someone or having a family history of osteoporosis (Ailinger et al., 2005; Terrio & Auld, 2002), being pre- vs. post-menopausal (Ailinger et al., 2005; Terrio & Auld, 2002), using HRT (Ailinger et al., 2005; Twiss et al., 2002), race or ethnicity (Kasper et al., 2007; Ailinger et al., 2005), having received previous information about osteoporosis (Ailinger et al., 2005), sex (Doheny et al., 2007; Ford et al., 2007; Ailinger et al., 2005), participating in an osteoporosis education program (Sedlak et al., 2000; Sedlak et al., 1998), use of calcium supplements (Terrio & Auld, 2002; Twiss et al., 2002; Wallace, 2002), and education level (Terrio & Auld, 2002). It must be noted that some variables – age, being pre- vs. post-menopausal, using HRT, sex, and use of calcium supplements – were shown in some of the other studies not to have a significant correlation with osteoporosis knowledge.

Three studies looked at age as a factor that may influence osteoporosis. Of those studies, two (Ailinger et al., 2005; Taggart & Connor, 1995) showed that as age increased, so did knowledge of osteoporosis. However, the third study (Terrio & Auld, 2002) showed that age did not have an impact on osteoporosis knowledge.

Most studies focused only on women; however, three studies included both males and females and did compare levels of osteoporosis knowledge scores between sexes. Two of the studies (Ailinger et al., 2005; Ford et al., 2007) showed that sex did not have a significant impact on osteoporosis knowledge. The third study (Doheny et al., 2007), found that women scored significantly higher than men in osteoporosis knowledge.

Participation in an osteoporosis education program was also found to have a significant impact on osteoporosis knowledge (Sedlak et al., 1998; Sedlak et al., 2000). Both studies showed that participating in an osteoporosis education program was significantly correlated with higher osteoporosis knowledge scores when measuring pretest and posttest knowledge of osteoporosis.

Some studies examined the impact of use of calcium supplements on osteoporosis. Two of these studies (Terrio & Auld, 2002; Wallace, 2002) found that use of calcium supplements did not impact osteoporosis knowledge. The third study (Twiss et al., 2002) showed that women who used calcium supplements were more likely to score higher in knowledge of osteoporosis than those that did not.

Ailinger et al. (2005) and Terrio & Auld (2002) found that knowing someone with or having a family history of osteoporosis was significantly correlated with osteoporosis knowledge. Those participants that reported knowing someone with or having a family

history of osteoporosis scored higher than those that did not when tested for osteoporosis knowledge.

One study (Ailinger et al., 2005) showed that being pre- vs. post-menopausal did have an impact on osteoporosis knowledge. Those women that were post-menopausal scored significantly higher in osteoporosis than did women who were pre-menopausal. Conversely, Terrio & Auld (2002) found that being pre- vs. post-menopausal did not impact knowledge of osteoporosis.

As with several other variables, use of Hormone Replacement Therapy (HRT) and osteoporosis knowledge were not consistently related. One study (Twiss et al., 2002) found that women using HRT had significantly higher knowledge scores than women who were not on HRT. On the other hand, Ailinger et al. (2005) found that using HRT had no impact on knowledge.

Two studies (Ailinger et al., 2005; Kasper et al., 2007) that examined race and/or ethnicity as a factor in osteoporosis knowledge found that they did, in fact, have a significant impact: Caucasian women and men scored significantly higher in osteoporosis knowledge. Ailinger et al. found that Caucasians scored the highest, followed by Asians, and finally African-Americans and Hispanics. Kasper et al. studied only Caucasian and African-American women and found that Caucasian women scored significantly higher.

Two other variables were noted as having a significant impact on osteoporosis knowledge: having received previous information about osteoporosis (Ailinger et al., 2005) and education level (Terrio & Auld, 2002). Participants that had received information about osteoporosis in the past scored significantly higher on osteoporosis knowledge tests as did those with a higher education level.

Factors affect preventive behaviors for osteoporosis among adults in the United States

The next question the literature review attempted to answer was, “What factors affect preventive behaviors for osteoporosis among adults in the United States?” Just as with the first question, this question does not have a clear answer because there was little consistency in what preventive behaviors the researchers chose to examine. The preventive behaviors represented included dairy intake, calcium intake, use of calcium supplements, weight bearing physical activity, and caffeine intake.

Variables that were shown by at least one study to have a significant correlation with dairy intake were sex and attitudes about osteoporosis (Ford et al., 2007). Ford et al. found that men scored significantly higher on dairy intake than women and that men’s attitudes about osteoporosis had a significant impact on their dairy intake. Ford et al. also studied knowledge about calcium, but it was shown not to have a significant correlation with dairy intake for either men or women.

More variables were shown by at least one study not to be significantly correlated with calcium intake than to be. Of the variables studied, only one was significantly correlated: greater self-efficacy toward calcium intake was shown to significantly increase the likelihood that the participant also had a higher calcium intake (Wallace, 2002). However, this was refuted in another study. Sedlak et al. (2002) has data that shows that despite greater self-efficacy toward calcium intake, most participants still did not meet calcium intake recommendations. Several variables were found not to be significantly correlated with calcium intake. They included self-efficacy toward calcium

intake, age, education programs, family history, education level, physical problems that make exercise difficult, and lactose intolerance.

Larkey et al. (2003) looked at calcium supplementation as a preventive behavior. Researchers found that non-Hispanics had a significantly higher level of calcium supplementation than Hispanics and that being pre- vs. post-menopausal did not have a significant correlation with calcium supplementation.

In another study, Sedlak et al. (2000) found that level of caffeine intake was significantly lower in a posttest after participants received a moderate intensity education program about osteoporosis.

The remaining studies looked at how various variables affected exercise (including weight-bearing physical activity). Variables that were found to be significantly correlated with exercise were self-efficacy towards exercise, perceived barriers to exercise, and perceived susceptibility to osteoporosis. Wallace (2002) found that participants that did not meet physical activity recommendations had significantly lower physical activity self-efficacy. Conversely, Sedlak et al. (2000) found that despite a moderate level of confidence, most participants did not achieve physical activity recommendations. Wallace also found that those that had greater perceived barriers to exercise and perceived susceptibility to osteoporosis were significantly less likely to achieve physical activity recommendations. Those variables found by at least one study not to have a significant correlation included education programs about osteoporosis, self-efficacy towards exercise, perceived susceptibility to osteoporosis, age, race, and being pre- vs. post-menopausal.

Summary

A review of six databases generated 12 full-length articles dealing with factors that affect knowledge of and/or preventive behaviors for osteoporosis. The researchers who conducted the studies and wrote these articles utilized several different research methods, but most often cross-sectional surveys were used. In addition to collecting data about osteoporosis knowledge, the following variables were studied: age, sex, participating in an osteoporosis education program, use of calcium supplements, participation in weight-bearing physical activity, knowing someone with or having a family history of osteoporosis, being pre- vs. post-menopausal, use of Hormone Replacement Therapy (HRT), race or ethnicity, having received previous information on osteoporosis, dairy intake, and education level. In addition, these data were collected with a variety of instruments. In general, these articles did not agree in their findings; while some claimed specific variables did impact knowledge, others claimed that those same variables did not impact knowledge. The same held true for variables affecting osteoporosis preventive behaviors; while some studies show that specific variables do, indeed impact behavior, others refute this claim. Preventive behaviors studied included dairy intake, calcium intake, use of calcium supplements, weight bearing physical activity, and caffeine intake. Variables examined with these behaviors include: sex, age, race, education level, family history, attitudes about osteoporosis, knowledge about calcium, self-efficacy toward calcium intake, osteoporosis education programs, physical problems that make exercise difficult, lactose intolerance, being pre- vs. post-menopausal, self-efficacy towards exercise, perceived barriers to exercise, and perceived susceptibility to osteoporosis.

Conclusions

Based on findings in the literature review and considering the limitations of this research project, the following conclusions were drawn:

1. In all the studies that examined osteoporosis knowledge and osteoporosis education programs, participation in an osteoporosis education program had a positive association with osteoporosis knowledge.
2. In all the studies that examined osteoporosis knowledge and how it is affected by knowing someone with or having a family history of osteoporosis, knowing someone/having a family member with osteoporosis had a positive association with osteoporosis knowledge.
3. In all studies that looked at ethnic group as a factor for osteoporosis knowledge, Caucasians were found to be more likely to have a higher knowledge of osteoporosis than other races or ethnic groups.
4. All studies that examined the impact of knowledge about osteoporosis on weight-bearing physical activity found that a high level of knowledge did not impact likelihood to engage in weight-bearing physical activity.

Recommendations for Implementation

Based upon the results and conclusions of the in-depth literature review, several recommendations for health care workers are offered. First, osteoporosis education programs, whether of high or low intensity, do positively impact osteoporosis knowledge.

Government agencies and osteoporosis foundations, such as the National Osteoporosis Foundation (NOF) should create programs about osteoporosis targeting specific populations (i.e., by sex, race/ethnicity, age). Those that seem to be in greatest need of these programs are young-adult men and women that are African-American or Hispanic, then young-adult men and women Asians, and finally young-adult men and women Caucasians. Health educators can then use these programs for different populations in their communities in order to promote osteoporosis knowledge and awareness.

One of the variables that positively impacted knowledge of osteoporosis was knowing someone with or family history of osteoporosis. This variable may be able to be influenced through promotion of osteoporosis awareness, thereby sparking conversations amongst families and friends. A possible channel for this promotion is through health care professionals that meet directly with patients and collect family history information. If this is not something that is already asked, it should be included in the family history section during intake interviews. If the question is answered as “I don’t know” then health care professionals should use it as an opportunity to talk with the patient about osteoporosis or refer the patient to a health educator or an osteoporosis education program.

Finally, though most of the studies showed that overall knowledge of osteoporosis was low, it was found to be significantly higher in Caucasians. Though non-Hispanic Caucasians and Asians are at highest risk for osteoporosis (20% of females over age 50 have osteoporosis and 52% have low bone mass) (NOF, 2009), other ethnic groups are still at risk (10% of Hispanic females over age 50 have osteoporosis and 49% have low bone mass; 5% of non-Hispanic black women over age 50 have osteoporosis and 35%

have low bone mass) (NOF, 2009). Because of this, it is important to target these groups of women and men for osteoporosis education. Again, government agencies and osteoporosis foundations such as the NOF could create osteoporosis programs targeting these specific groups. This will include targeting the content to specific segmented populations. For example, using pictures and examples of people from each of these ethnic and/or racial groups will enable individuals to identify with the material given.

Recommendations for Further Study

Much more research needs to be completed on factors that affect knowledge of and preventive behaviors for osteoporosis. Variables that may affect knowledge and preventive behaviors are so numerous and unsystematically studied that it is difficult to draw any concrete conclusions from the current studies. Further research should examine those variables that were understudied or had inconsistent findings. A clearer understanding of which factors impact osteoporosis knowledge and preventive behaviors will be helpful in creating education programs about osteoporosis and promoting awareness. It will allow tailored interventions for those segmented groups that are identified as having less knowledge or being less likely to engage in preventive behaviors; thereby increasing health care workers' ability to impact these individuals. Finally, all studies reviewed were small, localized studies. A study using a nationwide sample would help to further define the problem.

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