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Exploring the knowledge and behavior needed to prevent osteoporosis among Saudi women

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EXPLORING THE KNOWLEDGE AND BEHAVIOR NEEDED TO PREVENT OSTEOPOROSIS AMONG SAUDI WOMEN

An Abstract of a Thesis

Submitted

in Partial Fulfillment

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Zahra Al khidhr

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ABSTRACT

The purpose of this research is to evaluate the knowledge as well as the behavior necessary to prevent osteoporosis among Saudi women. Also, this study aims to evaluate the level of knowledge on osteoporosis prevention activities and determine women's perception about the most important factors that increase the occurrence of osteoporosis. This study sheds light on women's understanding of the connection between physical activity and calcium intake to prevent osteoporosis as well as determining how education programs can increase women's understanding of preventing osteoporosis. A quantitative cross-sectional design was utilized for this study and self-administered questionnaire was used for data collection. The findings showed that most participants had a limited knowledge about osteoporosis. Some participants were aware of some knowledge about osteoporosis, but many other of participants were not aware of various important knowledge related to osteoporosis. A considerable number of Saudi women were aware of osteoporosis risk factors. Saudi women had a limited level of knowledge regarding physical activity and calcium intake associated with osteoporosis. A few participants had received education about osteoporosis, but the majority of participants recognized the need for osteoporosis education programs as important to increase participants' willingness to prevent osteoporosis and improve healthy lifestyles and behaviors. These findings suggest educational programs are needed to increase knowledge and healthy lifestyle practices in preventing osteoporosis among women.

Key words: osteoporosis, knowledge, preventive activities, women, education program, risk factors, calcium intake, physical activity.

Definition of Terms

Bone Mineral Density (BMD): a test used to diagnose osteoporosis and measure the density of bone (Al-Ghamdi et al., 2017).

Fragility fractures: any fall from a standing height or less that results in fracture with a low amount of trauma (Giangregorio et al., 2010).

Knowledge: the ability to use, obtain, and acquire information through experience; combination of understanding, skills, and discernment (Haq, Tahir, Iqbal, & Naseem, 2015).

Osteoporosis: a disease characterized by reduction of bone mass and deterioration in bone that increases bone fragility and fracture risk (Varahra, Rodrigues, MacDermid, Bryant, & Birmingham, 2018).

Osteoporosis Health Belief Model Scale (OHBS): an instrument used to perceive and measure health beliefs about osteoporosis (Al-Otaibi, 2015).

Osteoporosis Knowledge Assessment Tool (OKAT): an instrument used to understand various of aspects related to osteoporosis such as symptoms, risk factors, risk of fractures, prevention factors, and available treatment (Al-Otaibi, 2015).

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has been approved as meeting the thesis requirement for the

Degree of Master of Arts

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DEDICATION

I humbly dedicate this thesis to my beloved people who have meant and still mean so much to me. First, I dedicate this work to my mother and father, who taught me that even the most challenging task can be accomplished if we put effort in it. Mom, even though you are no longer existing in this world, your memories and encouragement continue to regulate my life. I did my best to achieve your dream mom, and my dream to become a successful woman in the future.

I also dedicate this work to all my beloved brothers and sisters. In particular, I devote this to my dearest brother, Jassim, and my twin, Fatimah, who has stood by me, encouraged, and supported me during my entire master studies. Thanks for every single help or support you have given me. Additionally, to my sisters, Hawra and Kadijah, and my brother, Jawad, who live back in my home country, thank you. I know it was really hard to be far away from you, but actually your supportive words, and encouragement help me to pass any struggle that I faced. Since I am the oldest sister, I hope to be a good model for you with regards to achieving success in your scientific and practical journey.

Last but not least, I wish to dedicate this work to my friends who encouraged and supported me, to all my family members, and to everyone in my life who touched my heart and worked very hard to provide help for me.

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CHAPTER I

INTRODUCTION

Osteoporosis is a major health problem worldwide. Osteoporosis and related fractures increase the cause of death and injury (Ediriweera de Silva et al., 2014). As a result of osteoporosis, over 200 million women worldwide are affected (Moayyeri, 2008), and over 8.9 million fractures occur every year. Osteoporosis fractures occur every 3 seconds. These fractures are a major financial problem in some developed and developing countries (ElTohami, Sami, Eidan, Mubarak, & Alotaibi, 2015). In 2000, it was estimated that over 9 million fractures happened and many of these fractures were caused by osteoporosis (Al-Ghamdi et al., 2017). Nearly half of all women and one-third of all men throughout their lifespan may experience a fragility fracture (Moayyeri, 2008). One in two women and one in five men who are over 50 years old are expected to experience a bone fracture as a consequence of bone weakness (Barzanji, Alamri, & Mohamed, 2013). Therefore, women are more likely to develop osteoporosis than men (Ediriweera de Silva et al., 2014). First, the nature of women's bodies has a lower peak bone mass compered to men. Second, women experience rapid decrease of bone mass resulting from hormone changes linked to menopause. Third, women usually live longer than men; therefore they are more likely to experience loss of bone mass linked to aging for a long period of time (Alshammari, 2014).

There are two types of osteoporosis: type 1 osteoporosis (primary) and type 2 osteoporosis (secondary). Primary osteoporosis is known as postmenopausal osteoporosis, which most frequently occurs during the menopause period. Secondary

osteoporosis is known as senile osteoporosis, which more apparently occurs over the age of 75. Type 2 osteoporosis is prevalent between both genders at a ratio of 2:1 (females, males) and is a result of specific diseases or use of particular medications (Osman, 2013). The prevalence of primary osteoporosis is significantly higher than secondary osteoporosis in both females and males (Sadat-Ali, Al-Habdan, Al-Turki, & Azam, 2012).

Sadat-Ali et al. (2012) reported that since 1990 the issue of osteoporosis was more serious in Saudi Arabia compared to other counties with an estimated prevalence between 30% to 48%. Currently, it is projected around 30% of women aged ≥ 56 years and 30.7% of men aged ≥ 60 years suffer from osteoporosis in Saudi Arabia. The etiology for increased prevalence of osteoporosis among Saudi is related to many potential causes and factors, such as inherited factors, vitamin D deficiency and practices of an unhealthy lifestyle (Tlt, Barghash, & Al-Salamah, 2016). Additionally, the prevalence of osteoporosis is predicted to increase more among Saudi people because the average lifespan has risen from 45-67 years in 1960 to 75.7 years in 2013 (Al-Bahrani et al., 2016).

In the United States, osteoporosis affects about 28 million people, and nearly all are women since bone mass loss is common during menopause (Sedlak, Doheny, & Jones, 2000). According to the National Osteoporosis Foundation (NOF), approximately 12 million Americans who were over 50 years had osteoporosis and 40 million had low bone mass in 2010. By 2020, it is predicted that cases of osteoporosis will increase to 14

million and cases of low bone mass will increase to more than 47 million (Alqahtani, 2014).

The prevalence of osteoporosis has expanded and impacted health care costs in the world (Almalki, Algahtany, & Alswat, 2016). The annual health care costs of osteoporosis fractures in the United States are estimated at $10 to $18 billion. By 2020, these costs are anticipated to increase to over $60 billion yearly (Sedlak et al., 2000). In contrast, in Saudi Arabia, among the 1,461,401 individuals over the age of 50, 8768 may suffer from femoral fractures annually and the health care costs are $1.14 billion. It is estimated that osteoporosis has affected about 67% of Saudi women and has caused serious issues in women' lives (ElTohami et al., 2015).

Osteoporosis is a silent disease in which the bone mass is reduced, often contributing to the formation of debilitating fractures (Anderson-Wurf, Harding, & Seal, 2018); this means that a weakened bone mass results in disability and pain (Sedlak et al., 2000). The risk of osteoporosis can be decreased through improving bone mass in childhood, preserving bone mass in adulthood, and reducing bone mass damage in older age (Hernandez-Rauda & Martinez-Garcia, 2004). When corrective action has taken place, it can slow down the progression of bone loss and prevent osteoporosis (Edmonds, Turner, & Usdan, 2012). A few ways to reduce risk of osteoporosis are to follow healthy habits such as weight-bearing physical activity, consuming diets with high levels of calcium and vitamin D, stopping smoking, and not drinking excessive amounts of alcohol or caffeine (Hernandez-Rauda & Martinez-Garcia, 2004).

Individuals who have osteoporosis or are at risk of developing the condition can be identified, treated, and assessed (Laslett, Lynch, Sullivan, & McNeil, 2011). However, osteoporosis has no cure; thus the aim of treating osteoporosis is to preclude fractures, protect, and make the bones stronger. Treatment predominantly depends on an integration between lifestyle changes and medications in order to help reduce the rate of bone resorption by the body (Al-Ghamdi et al., 2017). Osteoporosis is frequently treated with medications such as bisphosphonates. These medications are effective to reduce the fractures; however, they are not effective for long-term complications (Laslett et al., 2011). There are other effective strategies to cope for osteoporotic people including hormone therapy, lifestyles changes, consuming enough calcium and vitamin D, and physical exercise (Al-Ghamdi et al., 2017). The most consistent predictor of osteoporotic fracture is bone mineral density (BMD). Further, "the magnitude of the association between BMD and fracture risk is equivalent to, or stronger than, the association between blood pressure and stroke or cholesterol and cardiovascular disease" (Ho-Pham, Nguyen, & Nguyen, 2009, p.943).

Several studies carried out in various countries found that individuals diagnosed with osteoporosis had poor knowledge about the disease. Even though there is important evidence that the first fracture increases the risk of the next fracture by two-to three-fold, they did not assume osteoporosis was a serious disease (Anderson-Wurf et al., 2018). Further, a large number of women do not know that osteoporosis risk can be precluded (Sedlak et al., 2000).

Since many risk factors for osteoporosis are avoidable, it is important that these be widely discussed and that the community is educated about them. Risk factors include being less physically active and having an inadequate amount of dietary calcium intake (Laslett et al., 2011). Bone disorders should be prevented early at birth and continue through lifetime (Edmonds et al., 2012). Educational strategies are usually an ideal method for primary prevention of osteoporosis (Laslett et al., 2011). Physical activity can reduce the adverse effects of chronic disorders and aging on the musculoskeletal system. Individuals who suffer from osteoporosis are encouraged to be involved in a multicomponent exercise program, especially resistance strength training and balance training (Varahra et al., 2018).

The essential factor to maintain bone health is diet. However, diets contain different types of foods, including complex combinations of nutrients, and an ideal diet doesn't include merely calcium and vitamin D intake, but also requires taking phosphorus, vitamin K, strontium, and magnesium (Monma et al., 2010). The recommended levels of calcium intake to maintain bone health and prevent fractures are between 1000 to 1200 mg/day. In western countries, the average calcium intake in the diet is between 700 to 900 mg/day, and in Asian and African countries the average intake of calcium is even less than the recommended levels. As a result, a majority of the elderly population would be required to intake calcium supplements to reach the recommended levels (Bolland et al., 2015). Compared to Saudi Arabia, the average levels of calcium intake in Saudi women are also lower than the recommended levels (El-Sayed & Abdel Megeid, 2013).

The purpose of this research is to evaluate the knowledge as well as the behavior necessary to prevent osteoporosis among Saudi women. This study aims to evaluate the level of knowledge of osteoporosis prevention activities and determine the understanding of Saudi women regarding the most important factors that increase the occurrence of osteoporosis. Additionally, this study aims to evaluate the understanding of Saudi women in regard to the relationship between physical activity and calcium intake to prevent osteoporosis as well as determine how receiving formal preventing osteoporosis education program can increase Saudi women's understanding of preventing osteoporosis.

The research questions that have been established to guide this research include:

1. What is the current level of knowledge on osteoporosis prevention activities among Saudi women?
2. What percentage of Saudi women understand the most important factors that increase the occurrence of osteoporosis among women?
3. What do Saudi women know about the association between physical activity and calcium intake to prevent osteoporosis?
4. Have Saudi women ever received any formal public health education program about preventing osteoporosis? If so, how do educational programs increase Saudi women's understanding of preventing osteoporosis?

Women are disproportionately affected by osteoporosis since bone mass loss accelerates at menopause (Sedlak et al., 2000). Osteoporosis affects about 36% of women who are 50 years and older in Saudi Arabia compared to nearly 10% of women

in this age group in the United States (Almalki et al., 2016). Some studies stated that people surveyed in Saudi Arabia had a lack of general osteoporosis knowledge and little understanding of risk factors and prevention strategies (El-Sayed & Abdel Megeid, 2013; AlHarthi et al., 2017). Evaluating the understanding of osteoporosis with this research can help to refine our understanding and knowledge, which will assist in the design of behavior modification and educational programming.

For this study, the researcher will evaluate Saudi women about knowledge and behavior necessary to prevent osteoporosis. The researcher will also make women more aware that osteoporosis can be prevented by activities related to osteoporosis prevention. Osteoporosis is a very serious illness that thousands of Saudi women suffer from every year, and it may increase the burden on older adults in the future (Quasim, Saad, & Amin, 2015). This study can help to understand risk factors and increase the level of knowledge about osteoporosis among Saudi women.

CHAPTER II

LITERATURE REVIEW

The increased prevalence of osteoporosis is associated with limited knowledge and prevention activities among women (Osman, 2013). In regards to increasing the osteoporosis awareness and preventing behaviors among adult females, the initial step should start with understanding of what they recognize and believe about this disease (Sayed-Hassan, Bashour, & Koudsi, 2013). Osteoporosis awareness has a potential impact on health behaviors and improves osteoporosis-related knowledge, which helps determine the most effective approach to prevent osteoporosis fractures (Kim et al., 2012). Understanding the benefit of both physical exercise and food sources high in calcium can contribute to preventing osteoporosis (Edmonds et al., 2012). Establishing osteoporosis prevention programs and initial identification of osteoporosis risk factors is necessary to reduce the increasing occurrence of the disease and lower the health costs of fracture treatment (Sedlak et al., 2000). Health education programs can be effective in increasing knowledge and awareness in the public as well as retraining the knowledge again, but rarely change the beliefs and behaviors (El-Sayed & Abdel Megeid, 2013).

Pathophysiology of Osteoporosis

Osteoporosis is a bone disease that is characterized by low bone density and reduction of bone mass. It may lead to fragile bone and increase the risk of fracture. Most of the time, fracture is a life-threatening outcome of osteoporosis (Quasim et al., 2015). The loss of bone happens silently and gradually (Alqahtani, 2014). The World Health Organization (WHO) roughly defines osteoporosis as the value of BMD that is more than

2.5 standard deviations below the average of peak bone mass or the mean of normal young healthy women as measured by dual-energy X-ray absorptiometry (ElTohami et al., 2015). Women are at three times higher risk of osteoporosis than men because women experience a change in hormone levels during menopause and a decrease in bone mass (Al Seraty & Ali, 2014).

In the early stages of osteoporosis, there are usually no symptoms (Quasim et al., 2015) until the first fracture happens (Alqahtani, 2014). People predominately will have a fracture, then they become aware that they are suffering from this disease. The pain often begins in any area of the spine, so it can cause fractures in the bones of the spine. These fractures frequently happen without risk of injury, but the pain happens progressively or immediately overtime along with loss of height (Quasim et al., 2015). Fractures related to osteoporosis are associated with adverse outcomes such as an early death, disability, poor quality of life, and financial consequences (Barzanji et al., 2013). In addition, fractures cause deterioration in physical function and that leads to soreness, distortion, and fear of falling (Giangregorio et al., 2010).

As the population age gets older, osteoporosis incidences are estimated to increase, particularly the fractures and falls associated with osteoporosis. The risk of falls increases with age and falls can cause fractures in 10% to 15% of older people. Additionally, a history of fall can increase the prediction of fall risk in the future. Due to higher deterioration in balance and weakness of muscle, older females who suffer from osteoporosis have a higher risk of falls (Burke-Doe, Hudson, Werth, & Riordan, 2008).

Osteoporosis fractures are the most serious complication that confronts people who suffer from osteoporosis. By 1995, over half a million people had been hospitalized and more than 800,000 had visited an emergency room due to osteoporosis-related fractures (Edmonds et al., 2012). Hip, spine, and wrist fractures are the three most common fractures related to osteoporosis (Alqahtani, 2014). However, hip fractures are the most serious kind of fracture that individuals have faced with osteoporosis (Edmonds et al., 2012). Osteoporosis fracture affects more than one in four persons who may lose their independent living in the first year of the fracture. Approximately one in five persons may need long-term care in a nursing home. By 1995, 140,000 individuals were accepted to a nursing home because they were suffering from hip fractures (Edmonds et al., 2012). El-Said Hossien, Tork, and El-Sabeely (2014) mentioned that osteoporosis is considered one of the top five conditions that cause impairment in physical function and long hospital stays among elderly adults. Globally, more than 1.6 million hip fractures happen every year. In 2050, the incidence of hip fractures is anticipated to increase to 6.3 million (Ediriweera de Silva et al., 2014).

Deaths related to bone disease predominantly do not have immediate causes. However, fractures and other complications of osteoporosis have a potential impact on a downward spiral. Nearly 20% of people with hip fractures die during the following year. Nine out of one hundred women who suffered from hip fracture may die as an outcome of the osteoporosis fracture. In addition, two million people have an early disability every year as a result of hip fractures (Edmonds et al., 2012).

Knowledge about Osteoporosis

There is no doubt that an understanding of osteoporosis is effective to promote good behaviors in preventing it. Understanding both the risk factors and protective activities is essential to preclude or postpone the development of osteoporosis and reduce the burden of the disease (Ediriweera de Silva et al., 2014).

Saudi women had a lack of knowledge toward osteoporosis (Osman, 2013). A study conducted by Al-Shahrani, Al-Zahrani, and Al-Haqawi (2010) among middle aged and older women revealed that more than 60% of the participants had not heard about osteoporosis before. Health care providers, television, and friends were the main sources of knowledge related to osteoporosis. Another study carried out by Al-Bahrani et al. (2016) in Al-Ahsa Governorate among people who were 40 years and older discovered that 40% of the participants knew the appropriate time to do screening for osteoporosis at age 40 years, and less than 3% of participants knew the recommended time to do screening between age 60 to 65 years.

Another study conducted by El-Sayed and Abdel Megeid (2013) of women working in King Saud University, Riyadh, Saudi Arabia found that most of the women had heard of osteoporosis, and most of them heard of it from television, but the other women had head of it from relatives and friends, newspapers, or physicians. The same results were obtained by Barzanji et al. (2013). The essential sources of knowledge related to osteoporosis in the participants were also family members and friends, newspapers, and doctors, respectively. Therefore, the media was the essential source of

knowledge about osteoporosis among women, but most of the information in the media was incorrect (Barzanji et al., 2013).

According to El-Sayed and Abdel Megeid (2013), less than half of the participants were able to describe osteoporosis properly, and more than half of them had known that osteoporosis was a dangerous disease. In another study conducted by Quasim et al. (2015), less than half of the participants were able to consider osteoporosis to be as serious disease as cancer.

A few studies reported that Saudi females had good knowledge of osteoporosis. A study conducted by ElTohami et al. (2015) of Saudi women living in Majmaah, Saudi Arabia found that nearly half of the subjects had a good degree of knowledge about osteoporosis. The majority of women knew and heard about osteoporosis primarily through media, newspaper, and pamphlets. The researchers noticed that participants who were surveyed in this study had high scores about osteoporosis knowledge, but most of the participants never attended osteoporosis educational programs. The same results were obtained by AlHarthi et al. (2017), but the main sources of knowledge related to osteoporosis in most of the participants were relatives and doctors. In that study, there was a significant difference in the level of knowledge between the participants. The researchers found that younger participants between the ages of 18 to 25 years had better average knowledge score than other group participants. Housewives had a higher knowledge score than other working women. In addition, women with less monthly income had better knowledge score than other socioeconomic participants.

Another study conducted by Al-Ghamdi et al. (2017) among Saudi women in Riyadh city, Saudi Arabia discovered that a large number of female participants (82%) had a good level of knowledge regarding osteoporosis. The researchers found there was a significant difference in "knowledge score," which correlated with marital status, field of study, and among women who had a background about osteoporosis before becoming involve in this study. Married females had a higher knowledge score compared to unmarried and single females. Working women in the health field had a higher knowledge score than working women in non-health fields. Women who had a background of knowledge about osteoporosis obviously received a high knowledge score compared to women who had not.

Zakai and Zakai (2015) conducted a study among female students who studied at King Abdulaziz University (KAU) found that the majority of study participants (77%) had a good level of osteoporosis knowledge. This is due to KAU's established osteoporosis campaign related to awareness and prevention through the Center of Excellence for Osteoporosis. The main goal of this campaign was to increase the level of knowledge about osteoporosis among KAU students as well as transfer this acquired knowledge to the entire community though students and their families. The researchers discovered significant positive association between the level of osteoporosis knowledge and length of study at KAU and marital status. In addition, there was a significant negative association between students' economic status and the degree of osteoporosis knowledge.

A recent study conducted by Alharthi (2018) among Saudi people for entire provinces of Saudi Arabia with a focus on Taif governorate to evaluate knowledge and awareness related to osteoporosis. The researcher showed that a large number of female participants had a high level of osteoporosis knowledge in regards to understanding and protective methods. The outcomes of this study demonstrated that female groups had better knowledge about osteoporosis compared to male groups. Furthermore, there was a significant difference between educational groups and osteoporosis awareness. This study indicated there was a negative correlation among younger people and osteoporosis awareness and a positive correlation among higher education and osteoporosis awareness.

Knowledge about Risk Factors

Saudi women have low knowledge concerning the risk factors of osteoporosis. El-Sayed and Abdel Megeid (2013) stated that a large percentage of study participants had limited knowledge related to osteoporosis, including risk factors such as smoking cigarettes, drinking soda products or caffeine, as well as protective behaviors and treatment. The researchers reported that nearly all of the women had a lack of knowledge about sex-related factors, the perception of the disease and risk factors, and protective behaviors. According to Al-Bahrani et al. (2016), participants also had not enough knowledge about risk factors of osteoporosis. Most of the study participants selected the risk factors of osteoporosis such as aging, eating unhealthy food, and genetic factors, respectively.

Knowledge on Osteoporosis Prevention Activities

Sunlight exposure contributes to lower the onset of osteoporosis. ElTohami et al. (2015) illustrated that regular exposure to sunlight has a significant effect in increasing BMD of vitamin D deficient bone and in protecting the bone from fractures. Women who entirely cover their skin with an abaya and veils had not received sunlight or received a little amount. The researchers found that the majority of Saudi women in this study were conscious of the benefit of sunlight exposure in regards to osteoporosis. Similarly, women know the role of sun exposure and food rich in calcium in the prevention of osteoporosis (Al-Shahrani et al., 2010).

A study by Barzanji et al. (2013) showed that Saudi women were less exposed to sunlight than men during the day: about 22% of women did not have exposure to sunlight comparing to 3% of men. Due to hot weather, a large number of women who participated in this study reported exposure to sun only in the cold weather. Furthermore, due to distinction in employment status, the vast majority of female participants in the study were housewives. Another study conducted by Alissa, Qadi, Alhujaili, Alshehri, and Ferns (2011) among postmenopausal Saudi women living in Jeddah, Saudi Arabia discovered that more than 70% of participants were exposed to sunlight, but they were not exposed regularly to sunlight. They were exposed to sunlight at least 15 minutes for 3 or more times per week. Al Seraty and Ali (2014) mentioned that in summer light skin people should be exposed to sunlight for 5-10 minutes compared to dark skin people who should be exposed to sunlight for 15-60 minutes 2-3 times per week either in midmorning or midafternoon. In winter, light skin people should be exposed to sunlight for 7-30

minutes while dark skin people should be exposed to sunlight 20 minutes to 3 hours 2-3 times per week around midday.

Physical activity and calcium intake have a significant impact in reducing the occurrence of osteoporosis. A study conducted by Osman (2013) in five healthcare centers in Abha, Saudi Arabia indicated that most of the women who participated in the study were not involved in physical exercise including that from outdoor work. None of these women had practiced sports as part of their daily routine. Alshammari (2014) mentioned that eating enough calcium is most important to help in bone formation. It is recommended that dietary calcium intake should be taken on a daily basis to create strong bones.

A study conducted by Alshammari (2014) among two different Saudi women's groups (housewives attending the primary center in Riyadh and working women at King Saud University) found the vast majority of participants in both groups had enough knowledge and attitude about osteoporosis. However, they did not meet the requirement of preventive behaviors and practices about osteoporosis. Working women had a little better knowledge compared to housewives. Regarding the practice and prevention of osteoporosis in this study, women in both groups had poor knowledge. For example, positive behaviors included adequate intake of calcium, physical activity, and sun exposure, whereas negative behaviors included drinking coffee, smoking cigarettes, and smoking shisha. Either smoking cigarettes or shisha can affect the level of bone mineral density, which results in less calcium absorbed from food.

A recent study conducted in Riyadh showed that women who smoked may experience early menopause, have low body weights, and have low serum estrogen concentrations compared to women who did not smoke. Excessive caffeine consumption frequently related to low bone mineral density which increased the risk of bone fractures (Alghadir, Gabr, & Al-Eisa, 2015).

In regard to positive and negative behavior among two different Saudi women's groups (housewives and working women), slightly less than half of women in both groups practiced physical activity. Also, most of the women in both study groups were exposed to sunlight, but not on a regular basis. A low percentage of these two women groups were smoking cigarettes as well as smoking shisha (Alshammari, 2014).

Better Osteoporosis Knowledge

Osteoporosis-related knowledge improved in advanced age (Barzanji et al., 2013). The most efficacious predictors of osteoporosis knowledge were income, education, and menopause before age 45. Another effective factor that had increased osteoporosis knowledge was through distributing brochures and magazines to women at schools, health care centers, supermarkets, malls, and university campuses by a local organization (Hernandez-Rauda, & Martinez-Garcia, 2004). Higher education levels were often associated with higher income and healthy lifestyle behaviors such as frequently performing physical activity and selecting healthy food (Alshammari, 2014). A cross-sectional study conducted in Riyadh city demonstrated that the participants had a greater knowledge about osteoporosis due to the attainment of higher education. Many studies have shown an association between awareness and education (Barzanji et al., 2013).

There was a greater connection among awareness with education, having a relative who suffered from osteoporosis, and working in the healthcare facilities (Osman, 2013). Women who had a family history of osteoporosis were more likely to have better knowledge and attitudes compared to women who did not (Barzanji et al., 2013).

Osteoporosis Risk Factors

Knowledge related to osteoporosis can increase preventive behaviors, but several studies found that women had a lack of knowledge about osteoporosis risk factors regardless of age (Al-Otaibi, 2015). To make osteoporosis preventable in women, they have to understand the risk factors (El-Sayed & Abdel Megeid, 2013). There are several well-known factors that increase the chance of developing osteoporosis among women. These include female gender, osteoporosis or fragility fracture as a family history, older adults, sedentary lifestyle, Caucasian or Asiatic race, early menopause, smoking cigarettes, drinking high amounts of alcohol and caffeine, low weight, and a diet with low intakes of calcium and vitamin D (Hernandez-Rauda & Martinez-Garcia, 2004). Vitamin D deficiency is one of the most important risk factors for developing osteoporosis and is very widespread in Saudi population. Vitamin D deficiency is expected to be 82% among Saudi females (Al-Ghamdi et al., 2017).

According to Alqahtani (2014), risk factors of osteoporosis are divided into two categories: changeable risk factors and non-changeable risk factors. Non-changeable risk factors are aging, gender, early menopause, family history of osteoporosis, and ethnicity, while changeable risk factors are smoking cigarettes, weight, alcohol, drugs, exposure to sunlight, sedentary lifestyle, and diet.

Understanding of the Most Important Factors of Osteoporosis

Most of Saudi female middle-aged and older adults are not conscious of osteoporosis-related risk factors (ElTohami et al., 2015). A cross-sectional study conducted by Al-Shahrani et al. (2010) among women aged 40 years and older at the health care center in Riyadh disclosed that women recognized the risk factors of osteoporosis from poor to fair. For example, 60% of the women recognized risk factors of osteoporosis as inadequate calcium intake, 39% drinking coffee, 37% female gender, and 22% a family history of osteoporosis. However, merely 48% of the women were able to recognize foods choices rich in calcium. Additionally, slightly less than 23% of women knew the first symptoms of osteoporosis, and that family history of osteoporosis and drinking alcohol are risk factors. This finding was similar to another study conducted by Alqahtani (2014).

Another study conducted by Quasim et al. (2015) to determine the understanding of risk factors for osteoporosis at four different settings in Shaqra, Saudi Arabia indicated that women identified the osteoporosis risk factors as 32.6% being overweight, (12.2% and 10.4% respectively) having a family history of hypertension and diabetes, (12.2 % and 23.5%, respectively) limited exposure to sunlight and passive cigarette smoking. Additionally, other risk factors of osteoporosis were recognized as low levels of physical activity and small amounts of calcium intake. The researchers reported that slightly more than half of studied participants were able to identify female gender and smoking cigarette as a risk factors of osteoporosis, but many other risk factors that participants did

not recognize as a risk factors were genetics, low level of physical activity, poor dietary calcium intake, low weight, and advanced age.

A cross-sectional study conducted by Alqahtani (2014) of women aged 40 and older visited the family medicine department at the King Abdulaziz military hospital in Tabuk city, Saudi Arabia. The researcher pointed out that 24% of women were aware of having a family history of osteoporosis as a risk factor. Also, 43.2% of women had known about female gender as a risk factor, whereas 24.5% of women recognized caffeine as a risk factor for osteoporosis. Lastly, about half of the women acknowledged that lower calcium intake classified as a risk factor of osteoporosis and were conscious of the benefit of physical activity among women.

Tlt et al. (2016) assessed the knowledge and understanding of the causes related to osteoporosis in various parts of Saudi Arabia. They found that around 40% of the participants were not familiar with past fractures from imbalance or falling as a risk factor of developing osteoporosis whereas around 36% were familiar. More than half of participants did not know that past hip fractures were a risk factor, and less than half of participants with a family history of osteoporosis did not consider it as a risk factor compared to around 30% who did. Additionally, the majority of participants were able to identify that poor diet lacking calcium rich foods was a risk factor. Nearly 60% and 70% of the participants also acknowledge a limited amount of physical activity and perimenopause as risk factors of osteoporosis, respectively. In that study, it showed that knowledge related to osteoporosis improved as people increased in age. The age range of participants from 51-65 years old had a good knowledge about osteoporosis and its

propensity to cause fractures. They were also aware of the risk factors associated with osteoporosis.

El-Sayed and Abdel Megeid (2013) reported that many previous sample studies were able to identify two main osteoporosis risk factors, such as female gender and advanced age. Conversely, many study participants were not aware about a few risk factors, including genetics, perimenopause, and cigarette smoking. Quasim et al. (2015) stated that women are twice as likely develop osteoporosis if they have a family history of the disease.

Association Between Physical Activity and Calcium Intake

Healthy nutrition habits and lifestyle can play a significant role in maintaining bone density and preventing osteoporosis among women (Alissa et al., 2011). Inadequate calcium intake is associated with an increased risk of osteoporosis at the end of life. Calcium rich foods have a significant impact in helping individuals reach optimal peak bone density in the beginning of life and raising bone density in middle and later stages of life (Ediriweera de Silva et al., 2014). Strong evidence showed that poor dietary calcium intake can increase the occurrence of bone fractures (Alissa et al., 2011). Moreover, different mechanical loadings of physical exercise can have a significant effect on stimulating bone structure and help with regulating bone size, shape, and strength. Previous studies found that individuals who practiced moderate to high physical exercise had a significant increase in bone mineral density than individuals who had low level of physical exercise (Alghadir et al., 2015).

Calcium Intake

Calcium intake is important to develop healthy bones (Edmonds et al., 2012). Calcium intake also accounts for the protection and prevention of the onset of osteoporosis (Quasim et al., 2015). A study related to eating habits and lifestyle factors was conducted by El-Sayed and Abdel Megeid (2013), showing that most of the women participants at the King Saud University had an inadequate intake of calcium, phosphorus, and vitamin D rich foods. Therefore, researchers found that nearly all of the women had a lack of knowledge about their needs of calcium. Women were unable to recognize food rich in calcium except for dairy products. Another study by Alissa et al. (2011) demonstrated that more than half of the participants had less intake than the recommended levels of calcium, such as 769.23–923.10 mg, while whole groups of the participants had a limited intake of vitamin D with an average of 7.69–11.54 l μg. Quasim et al. (2015) indicated that almost half of the people who were involved in their study knew that taking enough calcium reduces the risk of developing bone fractures. Therefore, consuming inadequate levels of calcium can increase the prevalence of bone fractures. Previous studies mentioned that a majority of people failed to follow the recommended daily level of minimum calcium intake (Alissa et al., 2011).

Al-Otaibi (2015) conducted a study in middle age women (20 – 40 years) between two different Saudi women's groups attending health centers in Al-Hassa, Saudi Arabia, some who had a family history and others who did not have a family history of osteoporosis. The researcher found that female participants who had a family history of osteoporosis had highly significant consumption of calcium and vitamin D supplements

compared to female participants who did not have a family history of osteoporosis. This was due to women with family history understanding that they were more likely at risk of osteoporosis than other groups. However, the researcher discovered that women in both groups had a lack of calcium intake compared to the recommended level of 1000 mg/day. Women in the family history group had a higher intake of calcium, which is 789 mg/day, even though it is still lower than the recommended level, which means they still put themselves at risk of osteoporosis.

Physical Activity

Regular physical exercises are effective to decrease the risk of osteoporosis and improve bone density (El-Sayed, & Abdel Megeid, 2013). The recommended amount of exercise among adults is at least 30 minutes of moderate physical exercise per day (Al Seraty & Ali, 2014). The World Health Organization (WHO) recommended that adults who are between ages 18 to 64 years should perform moderate intensity aerobic exercise at least 150 minutes per week or perform vigorous intensity aerobic exercise at least 75 minutes per week (Tan, LaMontagne, Sarmugam, & Howard, 2013). Barzanji et al. (2013) revealed that Saudi women practiced prevention activities less often. Merely 10% of women had enough physical activity to help them to prevent osteoporosis, over 90 minutes per week. Similarly, less than one-third of the participants were aware of the role of physical exercise and were involved in some types of exercise, but not as a daily routine. On the other hand, almost half of the participants were aware of the benefit of physical exercise in regard to strong bone and decrease the incidence of bone fracture (Quasim et al., 2015).

Regular physical activity also has a significant effect on bone mass among all age groups and reduces the risk of osteoporosis (Quasim et al., 2015). With older age and occurrence of menopause, bone mass decreases (Alissa et al., 2011). Another study conducted by El-Sayed and Abdel Megeid (2013) mentioned that a large number of participants less often performed physical activity. The level of their physical activity was moderate to low. The researchers reported that a few women practiced an adequate high-intensity weight bearing exercise in order to increase bone mass. Also, they explained that several types of particular physical activities have a significant effect on bone strength, even short, repetitive, and multidirectional mechanical loading.

A recent study conducted by Al-Ghamdi et al. (2017) at five different locations of Riyadh city for women aged 18 years and older showed that women had poor knowledge about the significant effect of walking on bone health. In contrast, the majority of female participants understood well that weight training has a significant impact to develop healthy bones. Due to misunderstanding of walking, people do not consider walking to have a potential impact on bone density as well as exercise for overall health.

There is a significant effect of exercise on bone mineral density. For example, physical activity in older adult women can avert bone loss and increase bone mineral density by a small percentage (Moayyeri, 2008). Weight bearing physical activity can improve muscle size, increase bone mineral density and strengthen the growing skeleton (Al Seraty & Ali, 2014). Further evidence, physical activity, and walking programs can contribute to create strong bones and muscles and can be correlated to improve the balance, flexibility, and strength (El-Said Hossien et al., 2014).

Increasing Understanding Through Osteoporosis Education Program

Osteoporosis educational programs can contribute to preventing osteoporosis. In the absence of interventions like health educational programs, an increased number of postmenopausal women may be expected to be diagnosed with osteoporosis (Al Seraty & Ali, 2014). Because women have limited knowledge about osteoporosis, regardless of age, osteoporosis educational programs are effective at increasing various health beliefs and women's knowledge, regardless of if they have a family history of osteoporosis. Educational sessions are more likely to increase awareness and enhance healthy habits among women (Quasim et al., 2015). Furthermore, one study reported that after attending health education programs, women improved general knowledge and awareness related to osteoporosis and awareness (Sayed-Hassan et al., 2013).

Different Types of Osteoporosis Education Programs

There are a limited number of osteoporosis prevention education programs among Saudi women. However, the researchers identify a couple of intervention programs that have a potential impact in general knowledge and awareness about osteoporosis. According to El-Sayed and Abdel Megeid (2013), a one-day osteoporosis health education session had been provided to women who worked in King Saud University, located in Riyadh, Saudi Arabia. The participants were evaluated in osteoporosis knowledge prior the session (pre-test) and three months after the session (post-test). The researchers discovered that women had a significant increase in general osteoporosis-related knowledge after attending the intervention program. They increased their understanding about the impact of physical exercise, nutrition, and unhealthy lifestyles to

97% after participating in the intervention program. Women became more aware of the age of onset, how osteoporosis affects both genders, how physical activity benefits bone health, and risk factors of fracture on osteoporosis. Also, women knew much more about decreased bone mass during menopause, the side effects of smoking cigarettes and drinking caffeine, methods to prevent osteoporosis, rich foods with calcium and vitamin D, osteoporosis prevalence, and diagnostic tests for osteoporosis.

A study was conducted by Quasim et al. (2015) at four different settings in Shaqra, Saudi Arabia to evaluate the effectiveness of three education sessions per week. This program was given as an instructional program to women in order to perceive women's knowledge and their understanding of osteoporosis risk factors. They were evaluated before and after attending the health education sessions in osteoporosis prevention. A large number of participants improved their general knowledge about osteoporosis after the educational sessions were given. Women became more aware that osteoporosis was as serious an illness as cancer, and they understood the advantages of exercise on decreasing bone fractures and increasing bone strength. Moreover, the education program increased the perception about risk factors for osteoporosis, changed lifestyle, and how to diagnose osteoporosis early.

Al Seraty and Ali (2014) conducted a study among female students with an age range of 17-19 years in Al Dawadmi Applied Medical Science, Shaqraa University, Saudi Arabia to evaluate the effect of health belief model (HBM) based intervention for osteoporosis prevention. They evaluated the participants' knowledge about osteoporosis before and after one-month participation in the intervention program. The students' level

of knowledge toward osteoporosis was increased after HBM based intervention. In addition, students' perceptions about osteoporosis health belief scale were significantly increased before and after the HBM based intervention. Students' knowledge about osteoporosis preventive behaviors underwent a significant change after the intervention. There was a significant association between students' osteoporosis knowledge and daily amount of calcium consumption and weekly level of physical exercise. Also, Al Seraty and Ali (2014) found there is a significant association between health motivation, daily level of calcium intake, and physical exercise.

In contrast, the researcher found a few osteoporosis health education programs that did not fit with the study sample, but indicated health education programs are important to increase the knowledge and perception of osteoporosis. A study conducted by Sedlak et al. (2000) among elderly adult women, most of whom were Caucasian illustrated three different designs of osteoporosis prevention education programs, such as intense, intermediate, and brief programs. Sedlak et al. (2000) also evaluated participants' knowledge and behavior before and after three weeks. The intense program required the participants to attend three educational sessions over three weeks. The intermediate program required the participants to attend one three-hour session while the brief program required the participants to attend one forty-five-minute session. The three osteoporosis education programs increased the participants' knowledge of habits to prevent osteoporosis after attending the program, but it could not shift the participants' health beliefs, and did not increase osteoporosis prevention habits. An intermediate program increased participants' health beliefs only related to calcium intake helping

prevent osteoporosis compared to caffeine intake and weight bearing exercise. An intense program had a statistically significant reduction in the consumption of caffeine (283.87 to 123.87) compared to calcium intake and weight bearing exercise.

Comparing the effectiveness of a one-day education session with four-week education programs among adults aged 50 years and over showed both groups had a significant increase in knowledge and dietary calcium intake from a baseline to 3 months later. Medication use for osteoporosis declined in a one-session group, whereas it was improved in a four-week education group over 3 months. Both groups had the same competence in physical activity, calcium intake, and exercise. Therefore, researchers could not determine if one-session education was unlike four-week education programs in changing health habits, except the use of osteoporosis medications over-time (Laslett et al., 2011).

In conclusion, osteoporosis is still a serious illness, but it can be prevented. A large number of Saudi women are unaware of osteoporosis as well as the risk factors that increase the incidence of osteoporosis. In the absence of enough knowledge, women were not able to recognize their own risk of developing the disease and modify their health behaviors and beliefs (Sayed-Hassan et al., 2013). On the other hand, only depending on knowledge is inadequate to make a significant increase in protective behaviors. Knowledge can impact health related behaviors with a focus on attitude, belief, practice, and an efficient call to action (Alshammari, 2014). Education and awareness are the optimal methods to change bad behaviors and increase knowledge related to osteoporosis. A health education program related to osteoporosis can help to reduce related

complications and increase the understanding of how to prevent the illness among Saudi women.

CHAPTER III

METHODOLOGY

Overall Research Goal

It is anticipated that Saudi women are at the highest risk of getting osteoporosis, due to their limited knowledge about osteoporosis and unhealthy lifestyles and that a cross-sectional analysis will illustrate low percentages of knowledge, skills, and abilities related to osteoporosis etiologies and prevention.

Design Study

A quantitative cross-sectional design was utilized for this study to evaluate adult women's levels of knowledge and perceptions about prevention activities for osteoporosis. The researcher evaluated Saudi women to determine their understanding about the essential risk factors that increase the occurrence of osteoporosis, as well as evaluating their understanding toward the connection between exercise and calcium intake in preventing this illness. A quantitative design is also effective in surveying large groups in order to discern their knowledge and behaviors about osteoporosis. The data was collected by using a self-administered online questionnaire. The main purpose of the questionnaire was to evaluate general knowledge of Saudi women and their understanding of how to use various methods to prevent osteoporosis. This study was approved by Institutional Review Board (IRB) of University of Northern Iowa, which assured the protection of human subjects and proceeded only after full informed consent was obtained.

Participants

One-hundred and sixty-eight (168) participants were recruited into the study. All of the participants completed the initial survey, but many of those 168 where either dropped due to refusal to acknowledge informed consent or failure to meet inclusion criteria. The final number of participants included in the data analysis were 67 participants. They were surveyed to determine their awareness and knowledge of osteoporosis and osteoporosis risk factors. The research study was carried out in the Eastern Province of Saudi Arabia. Saudi women aged 18-50 years living in Eastern region, regardless of whether or not they had osteoporosis were eligible to include in the study. However, individuals who did not complete the questionnaire and did not agree to participate were excluded from the study. Females who are younger than 18 or older than 50 were also excluded from the study. In addition, Saudi females who live out of the Eastern region, male participants, or individuals whose did not report gender or age were excluded from the study.

Instrumentation

A pre-coded Arabic self-administered questionnaire was completed by the participants. Osteoporosis Knowledge Assessment Tool (OKAT) and Osteoporosis Health Belief Scale (OHBS) were the measurement tools related to osteoporosis used in this study. Both tools are known to be valid and reliable. OKAT was used to survey knowledge and awareness. OHBS was also used to evaluate the association between physical activity and calcium intake to prevent osteoporosis. The test-retest reliability based on Cronbach's alpha co-efficient for OKAT was 0.875, while the test-rest

reliability based on Cronbach's alpha co-efficient was 0.8895 reported by Al-Otaibi (2015). OKAT and OHBS were modified by the researcher to achieve the aim of the current study.

An English language questionnaire was translated into Arabic. Items on the questionnaire were developed through a comprehensive review of the literature and two valid and reliable questionnaires were revised. The questions were refined as an outcome of testing the questionnaire in a pilot study of ten participants before the data collection of the main study took place. The data collection of pilot study was excluded from the study to refine the procedure of the research project, test the clarity of the tools, as well as estimate the time needed for participants to be involved in the study. The questionnaire was validated by two health educator specialists. After the pilot questionnaires were reviewed by health educators, the researcher edited the questionnaire again for clarity. The final collected data was kept confidential and used in aggregate for statistical analysis.

Details of Questionnaire Survey

The questionnaire included five parts: demographic variables, the Osteoporosis Knowledge Assessment Tool (OKAT), risk factors of osteoporosis, Osteoporosis Health Belief Scale (OHBS), and understanding of how to prevent osteoporosis by health education program. The demographic variables contained questions about age, gender, marital status, levels of education, social class, residence, and general questions about osteoporosis. The OKAT included multiple choice questions to assess osteoporosis-related knowledge, attitude toward osteoporosis, and the perception of preventing

osteoporosis. The answers to these questions were three options *(true, false, or I don't know).* A couple of questions in the OKAT questionnaire were modified. One of the questions about alcohol was modified to drinking soft drinks because alcohol is not allowed in Saudi Arabia. The researcher included one question about sun exposure and eliminated one question that related to race. Risk factors of osteoporosis included were: gender, family history, older age, multiple bone fractures, etc. The answer to these questions were either *true or false*.

The OHBS questionnaire was divided into seven sections, but the researcher only used two sections: the benefits of preventive behavior related physical activity and calcium intake. OHBS included several questions regarding the relationship between physical activity and calcium intake to prevent osteoporosis. Each question was evaluated by Likert Scale, with a range of *1 strongly disagree to 5 strongly agree*. The last part of the questionnaire had some questions on how health education programs increases the understanding to prevent osteoporosis.

Procedure

Informed consent was obtained from the participants prior to them completing the questionnaire. It also included a brief descriptive about the advantages of being involved in this study to the participant and to the community. All participants were invited to participate in the online questionnaire by WhatsApp invitation. The questionnaire required 10 to 15 minutes to complete and participants could take it at any time in their home. All respondents voluntarily completed the questionnaire, and they could withdraw from participation at any time. The researcher did not offer any prizes for the participants.

Data Analysis

The data collected from the questionnaire survey was coded and transformed into an appropriate format. The data was then stored on a computer and was protected by a password. All entered data was verified for any errors. Data was analyzed by using JMP 13 software. Descriptive statistics were used to analyze the questionnaire responses.

Limitations

This study was limited by the following:

1. Time for distributing the survey was one of the limitations due to Ramadan, the Islamic holy month, and Eid Al-Fitr, the celebration after the holy month.
2. The possibility of participants may report invalid information in the questionnaire due to self-reporting responses.
3. There were 101 participants who were excluded from the study either before starting the questionnaire or due to incomplete the questionnaire. Additionally, some of the samples were not representative of the selected population.

Delimitations

This study was delimited by the following:

1. The major delimitations were Saudi women who were between ages 18 and 50 years living in the Eastern region of Saudi Arabia whether or not have osteoporosis.
2. Saudi female adults who were under the age 18 and over 50 or did not live in the Eastern region of Saudi Arabia were excluded from the study.

3. Male participants were excluded due to this research study only focused on females.
4. Participants missing any data variables of age and gender were excluded from the sample study.
5. This study is delimited to cross-sectional study design and descriptive statistics for analyzing the data.

CHAPTER IV

RESULTS

A total of 168 subjects were involved in this study through an online questionnaire. The respondents who represented inclusion criteria were N=67 women. This study was designed to evaluate the knowledge as well as the behavior needs to prevent osteoporosis among Saudi women.

Demographic characteristics

Sixty-seven of study participants (100%) were adult women. The age mean was 33 (SD=8.28) years. The majority of respondents were married 71%, while among the rest of respondents, 25% were single and 3% were divorced. More than two-thirds of women (68%) had a college degree, which represented most of the sample. Also, 15% of study participants had a post-graduate degree, 9% had a high school degree or equivalent, 6% had some college or community college but no degree, and only 1% had less than a high school diploma. More than half of women (51%) had monthly income less than 5000 Saudi Riyal (1333 USD), 25% had 5000-10,000 Saudi Riyal (1333- 2666 USD), and 22% had 10,000-20,000 Saudi Riyal (2666-5333 USD). Sixty-seven percent of the participants lived in Al Qatif, 19% lived in Saihat, 5% lived in Safwa, 2% lived in Al Ahsa, and 4% lived in the other cities of Eastern region i.e. Al Qudaih, Jubail, and Tarout. Table 1 below showing the most typical responses of demographic characteristics of study participants.

Table 1: Typical Responses of Participants' Demographic Characteristics

Demographic Characteristics	**Percentage/ mean (N=67)**
Gender	100% Women
Age	33 (SD=8.28)
Material Status	71% Married
Educational Level	68% College Degree
Monthly Income	51% Less than 5000 Saudi Riyal (1333 USD)
Residence	67% Al Qatif

Background on Osteoporosis Knowledge

The whole group of participants (100%) had heard about osteoporosis. Most of the women had heard/learned about osteoporosis from family and friends (32%) or physicians (22%). The other women had heard/learned about osteoporosis from health education campaigns (13%), 13% from internet, 13% from other sources, and only 4% from television. The other sources of information in which participants showed that they gather information from multiple sources.

Just over half of participants (52%) were not able to consider osteoporosis as serious a disease as cancer or heart disease. However, less than half of women (47%) were able to consider osteoporosis as serious. Out of 67 respondents, 66 (98%) participants were not suffering from osteoporosis and only one woman had been diagnosed with osteoporosis one year ago. The participants were asked to rate their current knowledge about osteoporosis prevention activities on a scale of 1 to 7, from *1 not all knowledgeable* to *7 extremely knowledgeable*. Five percent of women rated their knowledge as 1, 10% of women rated their knowledge as 2, 16% of women rated their knowledge as 3, 31% of women rated their knowledge as 4, 19% rated their knowledge

as 5, 5% rated their knowledge as 6, and 10% rated their knowledge as 7. The table below shows the typical background on osteoporosis knowledge of participants (Table 2).

Table 2: Typical Responses of Participants Background on Osteoporosis Knowledge

Background on Osteoporosis Knowledge	**Percentage**
Osteoporosis Background	100% had heard about osteoporosis
Sources of Information	32% Family and friends 22% Physician
Osteoporosis Serious Disease	52% No
Have Osteoporosis Disease	98% No
How Long Diagnosed with Osteoporosis	1% One year ago
Level of Knowledge from 1 to 7	31% rated knowledge as 4 19% rated knowledge as 5

The Osteoporosis Knowledge Assessment Tool (OKAT)

The researcher addressed the questions to measure the level of knowledge and awareness among study participants. The Osteoporosis Knowledge Assessment Tool (OKAT) included participant's knowledge, preventive practices, and treatment options. The *yes, no, and I don't know* responses were analyzed to address participants' knowledge regarding osteoporosis.

More than half of the questions were answered correctly with a percentage greater than 50% as highlighted in Table 3. Ninety-seven percent of respondents (N=67) indicated osteoporosis leads to an increased risk of bone fractures. Eighty percent of respondents reported osteoporosis is more common in men than women. Less than two-thirds of respondents (61%) believe both falls and low bone strength were important in causing fractures. Eighty-five percent of study participants reported most women have

osteoporosis disease by age 80. Family history of osteoporosis can be contributed to increase the risk of having osteoporosis as 59% of respondents believed family history of osteoporosis strongly predisposes a person to osteoporosis.

Regarding practice about osteoporosis, 53% of respondents believed any type of physical activity is beneficial for individuals have osteoporosis. Eighty percent of respondents were aware that sunlight exposure is protective for osteoporosis. Fifty-five percent of participants reported adequate calcium intake can be achieved from two glasses of milk a day and 67% of participants reported taking calcium supplements alone can prevent bone loss. The majority of respondents (96%) knew drinking soft drinks increases the occurrence of osteoporosis. Furthermore, 76% of respondents believe sardines and broccoli are good sources of calcium for people who cannot take dairy products.

The participants did not have enough knowledge about the rest of the questions that were answered less for 50% correctly as highlighted in Table 3. Only 11% of study participants reported osteoporosis usually causes symptoms (e.g. pain) before fractures occur. Sixteen percent of respondents believed having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life. Forty-seven percent of participants were aware of cigarette smoking can contribute to osteoporosis. Forty-three percent of respondents indicated from age 50, most women can expect at least one fracture before they die. More than one-third of study participants (38%) knew it is easy to discover if individuals are at risk of osteoporosis by their clinical risk factors. Consuming too much salty food increases the onset of osteoporosis and 46%

of respondents correctly reported a high salt intake is a risk factor for osteoporosis. Only 8% of participants believed there is a small amount of bone loss in the ten years following the onset of menopause. Regarding treatment options, 32% of respondents reported hormone therapy prevents further bone loss at any age after menopause. Also, 33% of respondents indicated there are no effective treatments for osteoporosis available. The results of OKAT are shown with correct responses and the percentage of correct answers in the questionnaire (Table 3).

Table 3: The Correct Responses and the Percentage of Correct Answers for Osteoporosis Knowledge Assessment Tool (OKAT).

Items	**Correct answer**	**Percentage of correct answer**
1. Osteoporosis leads to an increased risk of bone fractures.	True	97%
2. Osteoporosis usually causes symptoms (e.g. pain) before fractures occur.	False	11%
3. Having a higher peak bone mass at the end of childhood gives **no** protection against the development of osteoporosis in later life.	False	16%
4. Osteoporosis is more common in men.	False	80%
5. Cigarette smoking can contribute to osteoporosis.	True	47%
6. A fall is just as important as low bone strength in causing fractures.	True	61%
7. By age 80, the majority of women have osteoporosis.	True	85%
8. From age 50, most women can expect at least one fracture before they die.	True	43%
9. Any type of physical activity is beneficial for osteoporosis.	False	53%
10. It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors.	True	38%
11. Family history of osteoporosis strongly predisposes a person to osteoporosis.	True	59%

(table continues)

Items	Correct answer	Percentage of correct answer
12. Sun exposure is protective for osteoporosis.	True	80%
13. An adequate calcium intake can be achieved from two glasses of milk a day.	True	55%
14. Sardines and broccoli are good sources of calcium for people who cannot take dairy products.	True	76%
15. Calcium supplements alone can prevent bone loss.	False	67%
16. Drinking soft drinks increases the occurrence of osteoporosis.	True	96%
17. A high salt intake is a risk factor for osteoporosis.	True	46%
18. There is a small amount of bone loss in the ten years following the onset of menopause.	False	8%
19. Hormone therapy prevents further bone loss at any age after menopause.	True	32%
20. There are no effective treatments for osteoporosis available.	False	33%

Risk Factors of Osteoporosis

The true/false questions were analyzed to determine the understanding of Saudi women about the essential risk factors that increase the occurrence of osteoporosis. The majority of respondents (95%) highly recognized older age and lack of body exposure to sunlight as an osteoporosis risk factor. Eighty percent of participants knew female gender is one of risk factors of osteoporosis. Almost all participants (98%) were aware of diet that does not contain enough calcium and vitamin D as a risk factor of osteoporosis. Furthermore, less than three-fourths (70%) of study participants agreed women who experience early menopause before the age of 45 and had low body weight or thin bone mass were classified as a risk factor of osteoporosis.

Eighty-nine percent and 71% of respondents reported an inactive lifestyle with lack of physical activity on daily basis and family history of osteoporosis were risk

factors of osteoporosis, respectively. Only 38% of respondents considered previous bone fractures as a risk factor of osteoporosis. Additionally, drinking more than two soft drinks daily and drinking caffeine regularly or more than twice a day were recognized by participants as a risk factor (91% and 70%, respectively). Slightly more than three-quarters (77%) of study participants were aware of cigarette smoking as a risk factor. The results of understanding the risk factors of osteoporosis are shown with correct responses and the percentage of correct answers (Table 4).

Table 4: The Understanding of Osteoporosis Risk Factors with Correct Responses and the Percentage of Correct Answers.

Risk factors	**Correct answer**	**Percentage of correct answer**
1. Female gender	True	80%
2. Older age	True	95%
3. Low weight/thin bone	True	70%
4. Early onset of menopause (before the age of 45).	True	70%
5. An inactive lifestyle, with little daily exercise.	True	89%
6. Family history (parent, sibling, or child) who has had osteoporosis.	True	71%
7. Limit the amount of sun exposure.	True	95%
8. A diet with little calcium intake and vitamin D.	True	98%
9. Past bone fractures.	True	38%
10. Drink more than two soft drinks per day.	True	91%
11. Drink caffeine-containing drinks regularly or in significant amounts (more than two daily).	True	70%
12. Cigarettes smoking.	True	77%

Osteoporosis Health Belief Scale

A five-point Likert-type scale was analyzed to evaluate the understanding of the participants about the relationship of physical activity and calcium intake in order to prevent osteoporosis. The study participants rated their level of agreement about several statements regarding calcium intake and physical activity. In this section will be reported the correct responses of combine percentage of either agree with strongly agree or disagree with strongly disagree, for more details see (Table 5). More than three-quarters of participant agreed and strongly agreed that practicing physical activity regularly averts problems that would occur as a result of osteoporosis as well as help to build strong bones (84% and 93%, respectively). More than two-thirds of respondents (69%) agreed and strongly agreed that regular physical activity reduces the chances of bones fracture. Additionally, exercising to prevent osteoporosis also improves the way of the human body looks as 94% of respondents agreed and strongly agreed physical exercise has a benefit to prevent osteoporosis and improve the look of human body. Moreover, 75% of participating women agreed and strongly agreed that they feel better when they exercised to prevent osteoporosis. Feeling good after exercise was believed to prevent osteoporosis as 84% of participating women reported they feel good about themselves when they exercise to prevent osteoporosis.

Eighty percent and 67% of participants reported perceived benefits of enough calcium intake, such as taking in enough calcium prevents problems from osteoporosis and prevents painful osteoporosis, respectively. Moreover, less than three-fourths of participants (72%) agreed and strongly agreed that enough calcium intake reduces the

chances of broken bones. Only 47% of respondents were not concerned about osteoporosis as long as they took in enough calcium. Enough calcium intake has lots of benefits to prevent osteoporosis as 60% of respondents agreed and strongly agreed with the statement "You have lots to gain from taking in enough calcium to prevent osteoporosis." However, feeling good after enough calcium intake was believed to prevent osteoporosis as 73% of participants reported they feel good about themselves when they take in enough calcium to prevent osteoporosis. There is a table below shows the participants' responses in percentage to Osteoporosis Health Belief Scale (Table 5).

Table 5: Participants' Responses in Percentage to Osteoporosis Health Belief Scale.

Items	**SD (%)**	**D (%)**	**N (%)**	**A (%)**	**SA (%)**
Regular exercise prevents problems that would happen from osteoporosis.	0	1	13	59	25
You feel better when you exercise to prevent osteoporosis.	0	0	23	56	19
Regular exercise helps to build strong bones.	0	1	4	58	35
Exercising to prevent osteoporosis also improves the way your body looks.	1	0	2	56	38
Regular exercise cuts down the chances of broken bones.	0	7	22	56	13
You feel good about yourself when you exercise to prevent osteoporosis.	0	0	14	55	29
Taking in enough calcium prevents problems from osteoporosis.	1	4	13	46	34
You have lots to gain from taking in enough calcium to prevent osteoporosis.	1	8	28	44	16
Taking in enough calcium prevents painful osteoporosis.	1	4	25	47	20
You would not worry as much about osteoporosis if you took in enough calcium.	2	19	29	34	13
Taking in enough calcium cuts down on your chances of broken bones.	2	5	17	59	13
You feel good about yourself when you take in enough calcium to prevent osteoporosis.	1	5	17	47	26

SD: strongly disagree, D: disagree, N: natural, A: agree, SA: strongly agree.

Health Education Program

The researcher addressed these questions to determine how receiving health education programs can increase participants' perception to preclude osteoporosis. The yes/no questions, open ended question, and five points Likert-type scale questions were analyzed to assess participants' understanding to prevent osteoporosis by health education programs. Of 67 respondents, only 11 (16%) respondents had received/attended formal public health educational programs about osteoporosis. These 11 participants had received either one-session education or one-week education about osteoporosis.

The participants were asked where they had received formal public health educational programs about osteoporosis. Sources varied, with 20% of participants reporting having received education from course, 10% from hospital, 20% from Internet, and 50% from school. Furthermore, the participants were asked who gave the formal public health educational programs about osteoporosis to the participants. Half (50%) of respondents received education from a medical professional, 10% from social media, and 40% from a teacher.

In this section will be reported the correct responses of combine percentage of either agree with strongly agree or disagree with strongly disagree, for more details see (Table 6). Less than three-fourths of participants (72%) agreed and strongly agreed osteoporosis education programs are effective to increase the overall knowledge about osteoporosis. In addition, attending health education programs about osteoporosis can play important roles to shift participants' health belief as 96% of respondents agreed and

strongly agreed with this statement. Ninety-three percent of participants reported osteoporosis health programs can reduce unhealthy lifestyle and increase the understanding of preventing osteoporosis. Furthermore, 88% of participating women believed health education programs about osteoporosis have a significant positive impact on physical activity, risk factors of osteoporosis and fractures, and consumption of caffeine and calcium intake. Nearly three-quarters of participants (72%) believed one day of education program is effective to gain different methods in order to avert osteoporosis. On the other hand, 65% of respondents agreed and strongly agreed that an education program lasting longer than one day is more effective than short sessions to increase the awareness and enhance healthy habits. The table below shows the participants' responses in percentage to health education program increases of understanding to prevent osteoporosis (Table 6).

Table 6: Participants' Responses in Percentage to Health Education Program Increases Understanding to prevent osteoporosis.

Items	**Percentage**
Received/attend osteoporosis education program	16% Yes
How long was osteoporosis education program?	63% one session 27% one week
Where did you receive education about osteoporosis?	20% Course 10% Hospital 20% Internet 50% School
Who did offer the osteoporosis education program?	50% Medical professional 10% Social media 40% Teacher

Items	SD (%)	D (%)	N (%)	A (%)	SA (%)
Osteoporosis education programs are effective to increase general knowledge about osteoporosis.	2	5	17	43	29
Attending education programs about osteoporosis can play important roles to shift your health belief.	0	0	2	52	44
One-day education session is effective to learn various methods to prevent osteoporosis.	1	7	17	52	20
Public health educational program about osteoporosis reduces unhealthy lifestyles and increases the understanding of preventing osteoporosis.	0	1	4	56	37
A longer than one-day educational program is more sufficient than short session to increase the awareness and enhance healthy habits.	1	13	19	34	31
Osteoporosis education programs can have a positive impact on physical activity, risk factors of osteoporosis and fractures, and consumption of caffeine and calcium intake.	1	0	8	53	35

SD: strongly disagree, D: disagree, N: natural, A: agree, SA: strongly agree.

CHAPTER V

DISCUSSION, CONCLUSION, AND RECOMMENDATIONS

This chapter will provide a discussion of the findings that were described in the prior chapter. The discussion of the results, conclusion, and some recommendations for future research studies will be included in this chapter.

Demographic Characteristics

Sixty-seven participants were included in the study. This study included and average participant's age 33 years old. Most of them were married and had attained a college degree. Almost half of participants had monthly income less than 5000 Saudi Riyal (1333 USD). The majority of participants, 67% lived in Qatif in the Eastern region of Saudi Arabia.

Background on Osteoporosis Knowledge

Osteoporosis Background

This study found that all participants had heard about osteoporosis, sometimes called brittle or weak bone. This is dissimilar with the finding of Al-Shahrani et al. (2010) who reported more than 60% of sample participants had never heard about osteoporosis. This dissimilar result can be explained by the different participants of the two studies: most participants in the present study had a college degree while most other participants in Al-Shahrani et al. (2010) were illiterate. Other studies reported a similar finding: one of the studies in Turkish mentioned that almost 90% of the participants had heard of osteoporosis (Ungan, & Tümer, 2001).

Sources of Information

This study found family and friends were the first source of information about osteoporosis with a percentage of 32%. This can be explained by the very close culture of Saudi people who hear about osteoporosis from relatives or friends. Physicians were the source of information for only 22% of study participants; this may reveal the need to empower the roles of health care professionals to increase the awareness of the public. Also, 13% health education campaigns, 13% internet, 13% other sources, and only 4% television were the ways participants had heard about osteoporosis. Thirteen percent of participants who heard of osteoporosis from multiple sources were considered to pay more attention to this issue than other participants. This finding is consistent with the finding of AlHarthi et al. (2017) in which most of the participants had heard about osteoporosis from relatives and doctors.

Osteoporosis as a Serious Disease

The researcher revealed that 47% of participants were able to consider osteoporosis as serious a disease as cancer or heart disease. A similar finding was reported by Quasim et al. (2015). Most of the participants included in this study have not been diagnosed with osteoporosis, except for one woman who had been diagnosed with osteoporosis one year ago. This is not surprising, as this study assessed the knowledge and behavior needs of women, whether or not they have osteoporosis.

Level of Knowledge about Osteoporosis

Only 10 % of participants rated their current level of knowledge about osteoporosis as *7, extremely knowledgeable.* Additionally, less than one-third of

participants (31%) rated their current level of knowledge about osteoporosis as *4, fair level of knowledge*. This can be explained as Saudi women had limited knowledge related to osteoporosis and large numbers of participants were not aware of osteoporosis. One study found that Saudi women had a lack of knowledge about osteoporosis (Osman, 2013). Another study indicated that multiple studies in Saudi Arabia discovered a poor knowledge of osteoporosis (AlHarthi et al., 2017).

The Osteoporosis Knowledge Assessment Tool (OKAT)

There are a few questions answered by the participants that exhibited a high knowledge, including that they did not need to increase their knowledge in those areas. The researcher found the majority of participants (97%) knew osteoporosis leads to an increased risk of bone fractures. Individuals who have osteoporosis are more likely to experience bone fractures and a first fracture increases the risk of additional fractures. The risk of the next fracture is increased two-to three-fold due to the occurrence of first fracture (Anderson-Wurf et al., 2018).

Eighty percent of respondents correctly identified the following statement as false, *osteoporosis is more common in men*. Most participants are aware that osteoporosis is more common in women rather than men. Women are more likely to have osteoporosis since women experience hormone changes associated with menopause and lower peak bone mass. Ediriweera de Silva et al. (2014) indicated women are more likely to develop osteoporosis than men in their lifetime. Another study stated that the occurrence of osteoporosis in women is three times higher than in men due to the level of hormone changes at menopause and lower bone mass (Al Seraty & Ali, 2014).

The current study showed that 96% of respondents recognized drinking soft drinks increases the occurrence of osteoporosis. The reason for this could be the participants knew the adverse health effects of drinking soft drinks on bone health. Drinking soft drinks regularly could reduce bone mineral density and increase the onset of osteoporosis. El-Sayed and Abdel Megeid (2013) mentioned that there is a strong connection between drinking soft drinks and reducing the bone mineral density. Consistent results in Riyadh City showed a high percentage (81%) of awareness among Saudi females about drinking soft drinks linked to the occurrence of osteoporosis (Al-Ghamdi et al., 2017). This finding is not surprising, and it could be explained by the participants having received good information about drinking soft drinks, particularly that sugary beverages with caffeine are associated with lower bone mineral density.

In the present study, 80% of participants had adequate knowledge that sunlight exposure is protective in preventing osteoporosis. A similar finding reported by Al-Shahrani et al. (2010) mentioned that most Saudi women were aware of the benefit of sunlight exposure associated with osteoporosis. Additionally, the percentage of women who knew the majority of women have osteoporosis by age 80 was 85%. A high percentage of participants were aware that by age 80, most women can have osteoporosis. This is consistent with the finding of another study conducted in Saudi Arabia among medical interns, which showed 84% of participants believed most women have osteoporosis by age 80 (Almalki et al., 2016).

On the other hand, there are many questions answered by the participants that did not exhibit enough knowledge, and health education should focus in that in order to

increase their knowledge and behavior to prevent osteoporosis among Saudi women. This study found that many study participants had a lack of knowledge that cigarette smoking and family history of osteoporosis can contribute to developing osteoporosis. There is increased onset of osteoporosis in individuals who have a family history of osteoporosis and smoked cigarettes. Less than half (50%) of participants were unaware that falling is important as a low bone strength causes bone fracture; this may reflect many participants who do not consider that falls can cause bone fractures in individuals with low bone mass. In addition, more than 50% of participants did not know most women can expect at least one fracture before they die starting at age 50 and did not know it is easy to diagnose osteoporosis by clinical risk factors. The reason could be the participants did not discuss their clinical risk factors that may increase certain diseases with health care professionals.

This study discovered there are misconceptions that any type of physical activity and intake of calcium supplements alone can help to prevent osteoporosis. This can explain why the participants can not differentiate what kinds of exercise help to preclude osteoporosis and may replace their needs of calcium with taking only calcium supplements. A low percentage of respondents were able to consider enough calcium intake can be achieved from two glasses of milk a day and high intake of salt is a risk factor related to osteoporosis. Consumption of two glasses of milk daily can play important roles to keep bones strong and achieve the adequate needs of dietary products. The same result in milk intake was reported by (Almalki et al., 2016). Furthermore, not all of participants were aware that sardines and broccoli are good sources of calcium for

people who cannot take dairy products. Individuals who cannot eat dairy products need to look at food containing good sources of calcium. A previous study showed that most participants had a limited knowledge about their needs of calcium, and they were not able to identify food rich in calcium beside dairy products (El-Sayed, & Abdel Megeid, 2013).

The present study also found participants did not have enough knowledge regarding treatment options. Less than one-third (32%) of respondents knew hormone therapy prevents further bone loss at any age after menopause. This can be explained because many of participants have not yet experienced menopause periods, so they have a limited knowledge about benefits of hormone therapy. Also, this study found 33% of respondents reported there are no effective treatments for osteoporosis available. In spite of the fact that osteoporosis has no direct cure, there are effective treatments available to lower the risk of bone fracture. A previous study stated that treatment often relies on a combination of medication and changes in lifestyle (Al-Ghamdi et al., 2017). Another study conducted by Sayed-Hassan et al. (2013), on 353 young female students in Damascus, Syria found a similar result to the findings of the current study in regards to effective treatment. Only 31% of their participants were aware about the existence of effective treatments for osteoporosis.

The current study revealed a low degree of knowledge about symptoms, higher peak bone mass, and bone loss after menopause. A few respondents do not believe osteoporosis usually causes symptoms (e.g. pain) before fractures occur. It is more common to not notice about osteoporosis symptoms until the fracture occurs. Also, a small percentage of respondents believed having a higher peak bone mass at the end of

childhood gives no protection against the development of osteoporosis in later life. According to Hernandez-Rauda and Martinez-Garcia (2004), the risk of osteoporosis can be decreased through improving bone mass in childhood, preserving bone mass in adulthood, and reducing bone mass damage in older age. Moreover, 8% believed there is a small amount of bone loss in the ten years following the onset of menopause. Women largely experience bone mass loss at menopause and following years. Similar findings were reported by Sayed-Hassan et al. (2013) among female students in Damascus, Syria in which participants had also a limited knowledge in those questions.

Risk Factors of Osteoporosis

This study revealed knowledge of osteoporosis risk factors is high among Saudi women. The present study showed respondents had better knowledge regarding modifiable risk factors compared to non-modifiable risk factors. The modifiable risk factors included in this study were low weight/thin bone, limited exposure to sunlight, not enough intake of calcium and vitamin D, drinking more than two soft drinks daily, drinking caffeine regularly or twice daily, and smoking cigarettes. In contrast, non-modifiable risk factors included in this study were female gender, older age, early menopause, lack of physical activity, family history of osteoporosis, and past bone fractures.

Most of the participants were able to recognize most of these risk factors. The majority of participants highly recognized osteoporosis risk factors such as older age, female gender, an inactive lifestyle with little daily exercise, limited sun exposure, a diet with little calcium intake and vitamin D, and drinking more than two soft drinks per day.

In addition, about 70% of the participants were aware about low weight/thin bone, early menopause, and family history of osteoporosis. Past bone fractures were the least recognized risk factor in this study, and this can explain why the participants were not concerned that previous bone fractures can increase the risk of osteoporosis.

However, there are number of studies in Saudi Arabia which indicated poor knowledge about osteoporosis risk factors. One of the studies reporting participants had poor to fair knowledge was conducted in Riyadh. The researchers found that 60% of women recognized inadequate calcium intake, 39% drinking coffee, 37% female gender, and 22% a family history of osteoporosis as a risk factors of osteoporosis. (Al-Shahrani et al., 2010). Another study that surveyed 230 adult women about risk factors in four different locations in Shaqra of Saudi Arabia showed a limited knowledge on osteoporosis risk factors such as 32.6% being overweight, 12% having a family history of hypertension and 23% family history of diabetes, and 12% limited exposure to sunlight and 23% passive cigarette smoking (Quasim et al., 2015). One of the factors that made a difference in osteoporosis risk factors knowledge was education level. Most participants in the current study had a college degree compared to most of study participants in Al-Shahrani et al. (2010), who were illiterate, and 37% of study participant in Quasim et al. (2015), who had a college degree.

Osteoporosis Health Belief Scale

This study found the majority of participants had mid-level of agreement when it came to health beliefs in the benefit of physical activity and calcium intake to prevent

osteoporosis. It seems that the present study included participants with a limited level of knowledge regarding physical activity and calcium intake associated with osteoporosis.

Physical Exercise

This study found 84% and 93% of participants agreed that practicing physical activity regularly averts problems that would occur as a result of osteoporosis as well as helping build strong bones, respectively. Regular exercise has a significant effect to decrease health problems associated with osteoporosis and helps to structure strong bone. El-Sayed and Abdel Megeid (2013) illustrated that regular physical exercises are effective to decrease the risk of osteoporosis and improve bone density. Another study conducted in New Zealand among women aged between 20 to 49 years showed the majority of participants perceived the benefit of physical activity in preventing osteoporosis (von Hurst & Wham, 2007).

In the present study, 69% of participants perceived regular exercise cuts down the chances of broken bones. Individuals who practiced physical activity often decreased the chance of bone fractures. This finding is consistent with findings of previous research, which mentioned that almost half of participants knew the benefit of physical exercise in regard to strong bone and decrease the incidence of bone fracture (Quasim et al., 2015).

The present study also showed about 90% of participants agreed exercising to prevent osteoporosis also improves the way their body looks. This can explain why half of participants were aware that practicing physical activity to prevent osteoporosis is also important to improve the way of individual body looks. Moreover, this study revealed 75% of respondents believed they feel better when they exercised to prevent osteoporosis

and 84% believed they feel good about themselves when they exercise to prevent osteoporosis. This may reflect the participants who knew the burden of osteoporosis wanting to use protective methods to lower the occurrence of getting this disease.

Calcium Intake

The current study found that 80% and 67% of participants agreed that the benefits of taking enough calcium can prevent problems and pain from osteoporosis, respectively. Taking enough calcium can contribute to averting health problems and pain caused by osteoporosis. A number of past studies stated that large number of people failed to follow the recommended level of minimum calcium intake daily (Alissa et al., 2011).

This study also revealed 72% believed enough calcium intake reduces the chances of broken bones. A similar finding was reported by Alissa et al. (2011), indicating that inadequate intake of dietary calcium can increase the chance of bone fractures. Another study reported that about half of participants were aware that adequate calcium intake decreased the risk of occurrence bone fractures (Quasim et al., 2015).

This study found less than half of respondents were unconcerned about osteoporosis as long as they consume enough calcium. The reason for this could be having enough knowledge or understanding that a lack of calcium intake can structure weak bones and increase the risk of bone fractures. In addition, this study showed more than half of participants agreed there is lots to gain from taking in enough calcium to prevent osteoporosis. This can explain why the participants were able to identify food rich in calcium including dairy products and alternative sources to dairy products.

Slightly less than three-fourths of respondents perceived feeling good after taking enough calcium to prevent osteoporosis. This can be explained as respondents may understand that consuming enough calcium plays a significant role to build and maintain strong bones. It can also decrease the risk of developing osteoporosis in advanced age. One study conducted by Alissa et al. (2011) reported that not taking enough calcium is associated with an increase in the occurrence of bone fractures.

Health Education Program

The researcher found a small number of participants had received/attended a formal public health educational program about osteoporosis. Only 16% of women survey had received/attended formal public health educational programs about osteoporosis, either one session or one week. This can be explained because osteoporosis health education programs were limited among study participants. One study reported that educational sessions increase the level of knowledge and improve healthy behaviors among women (Quasim et al., 2015).

The present study found that most participants (50%) who had received education received formal public health educational programs about osteoporosis through school. Of the other of participants who had received health education, 20% received it from a course, 10% from a hospital, and 20% from the Internet. Five out of 67 participants received health education from school; it seemed school sectors provide more education about osteoporosis compared to others, but still not enough to improve participants' knowledge.

Additionally, most of individuals who provided formal public health educational programs about osteoporosis (50%) to participants were a medical professional. Of the rest of the participants who received education, 10% received it from social media and 40% from a teacher. Five out of 67 participants received education from a medical professional; it can explain that medical professionals still have not given enough education to the participants. It seemed they need to spend extra time to provide one-to-one education during their visit to the hospital as well as making osteoporosis education campaigns available in the public.

The researcher found most participants had mid-agreement about education programs to increase women's understanding of preventing osteoporosis. This study showed 72% of respondents agreed that osteoporosis education programs are effective to increase general knowledge about osteoporosis. Most of the participants were aware that they can increase their general osteoporosis-related knowledge through receiving osteoporosis education programs. One study has reported that after attending health education programs, women improved general knowledge related to osteoporosis and awareness (Sayed-Hassan et al., 2013).

This study also found almost all participants (96%) agreed that attending education programs about osteoporosis can play important roles to shift their health belief. It is not necessary to attend health education program to experience shifts in an individual's health belief, but it can increase the level of osteoporosis knowledge. A study conducted by Sedlak et al. (2000) revealed that the three different types of osteoporosis education programs had increased the participants' knowledge to prevent

osteoporosis habits after attending the program, but it could not shift the participants' health beliefs. For example, an intermediate program had increased participants' health beliefs only about calcium intake helping prevent osteoporosis compared to caffeine intake and weight bearing exercise.

The current study discovered less than three-fourths of respondents (72%) believed a one-day education session is effective to learn various methods to prevent osteoporosis. Another study conducted by El-Sayed and Abdel Megeid (2013) reported women who had received one day of osteoporosis health education session increased their understanding about the impact of physical exercise, nutrition, and unhealthy lifestyles to 97% after participating in the intervention program.

In the present study, the majority of participants (93%) agreed that a public health educational program about osteoporosis reduces unhealthy lifestyles and increases the understanding of preventing osteoporosis. This can explain why most of the participants were aware of the benefit of receiving health education program in order to increase healthy lifestyle and increase the specific knowledge associated with osteoporosis. Quasim et al. (2015) mentioned that osteoporosis educational programs are effective at increasing various health beliefs and women's knowledge, regardless of if they have a family history of osteoporosis.

This study found more than half of participants agreed that a longer than one-day educational program is more sufficient than a short session to increase awareness and enhance healthy habits. The reason for this could be the participants perceived a longer than one-day education program is more effective to improve healthy behavior and

increase participant's knowledge related to osteoporosis. A study conducted by Laslett et al. (2011) showed both participants who attended either a one-day education session or a four-week education program had no significant differences in improving healthy habits, except the use of osteoporosis drugs over time.

This study showed a large number of participants (88%) believed osteoporosis education programs can have a positive impact on physical activity, risk factors of osteoporosis and fractures, and consumption of caffeine and calcium intake. A previous study found that study participants had a significant increase in knowledge related to physical activity, risk factors of osteoporosis and fractures, and consumption of caffeine and calcium intake after attending osteoporosis education programs (Sedlak et al., 2000; Quasim et al., 2015).

Conclusion

All participants had heard about osteoporosis. The majority of them had heard/learned about osteoporosis from family and friends or physicians. Nearly half of participants were aware that osteoporosis is as serious a disease as cancer or heart disease. A small number of Saudi women rated their current knowledge about osteoporosis prevention activities as *high level of knowledge (7).* Therefore, this leaves a noticeably large number of participants who did not have enough knowledge to prevent osteoporosis.

Most of the Saudi women who were involved in this study had a limited knowledge about osteoporosis. In this study, Saudi women were not aware of cigarette smoking and family history of osteoporosis as factors that can increase the onset of

osteoporosis. Also, they were not aware that falling is important as a low bone strength causes bone fracture. Not all of Saudi women recognized the type of physical activity and adequate amount of calcium intake can help to prevent osteoporosis. They also had inadequate knowledge in regards to treatment options for osteoporosis and alternative sources to dairy products that rich in calcium. However, this study discovered most participants had a good knowledge in other areas such as the fact that osteoporosis is more common in women. They also were aware of the benefit of sunlight to prevent osteoporosis and drinking soft drinks increasing the onset of osteoporosis.

A considerable number of Saudi women were aware of osteoporosis risk factors, but osteoporosis prevention programs are needed to increase the understanding of risk factors. In this study, the participants had better knowledge regarding modifiable risk factors compared to non-modifiable risk factors. Past fractures were least recognized as risk factors among Saudi women.

The findings revealed most participants had mid-level of agreement about the health beliefs regarding the benefits of physical activity and calcium intake to prevent osteoporosis. About half of participants perceived the benefit of regular exercise and taking enough calcium playing roles to reduce the occurrence of osteoporosis. Saudi women had a limited level of knowledge regarding physical activity and calcium intake associated with osteoporosis.

This lack of knowledge is not only associated with the failure of medical health professionals but also from the limited number of health education programs. A few participants had received health education programs about osteoporosis. On the other

hand, the majority of participants recognized the need of osteoporosis education programs which are important to improve their understanding for preventing osteoporosis and increase healthy lifestyles and behaviors.

Recommendations

Most participants had a limited level of knowledge regarding physical activity to prevent osteoporosis. As evidence of these research findings, 31% of participants were not aware that regular exercise cuts down the chances of broken bones. It is recommended to design and implement an osteoporosis health education program "exercising for better bones" targeting women. It focuses on encouraging women to practice exercises in order to reduce the onset of broken bones and increase bone strength. This program will educate women about the overall benefit of exercises and at the same time to protect bones from fractures. The program will provide educational sessions such as giving a brief background about the burden of osteoporosis and how regular exercise could prevent this disease. The practical part of the program is providing training sessions for women. By attending this program, women will receive exercise sessions by certified personal trainer.

The education program and training sessions will be hosted in a local gym so the individuals will be able to practice physical activity. The participants who will be involved in the program will receive a 50% discount for one month from the gym center. After the exercise sessions, women will have an opportunity to experience green-orange smoothie and kale chips and will be offered a recipe card. Women will also be given a handout after the education sessions are finished including knowledge regarding

osteoporosis and exercise, particularly a variety of exercises in color pictures that keep them continuing to practice exercise, even in their home.

A large number of participants had a lack of general osteoporosis knowledge in many areas. For example, as evidence of these research findings, more than 80% of participants were not aware that osteoporosis causes no symptoms until a fracture occur and more than 70% had a lack of knowledge about treatment options. Also, more than 50% of participants were not aware that cigarette smoking can contribute to osteoporosis. It is recommended to implement an osteoporosis awareness campaign in the health care center “love your bones” to increase knowledge and awareness about osteoporosis. It focuses on encouraging people to enhance healthy lifestyles and prevent osteoporosis.

This program will give a comprehensive education with general knowledge of osteoporosis and preventive strategies. The program will educate people about osteoporosis symptoms, treatment options for osteoporosis, adequate amount of calcium, alternative sources to dairy products, risk factors for osteoporosis, and how physical activity and calcium intake benefit bone health. This program should target both genders, who are at risk and possibly decreasing the risk. Moreover, extending this campaign program to public places will increase the understanding of preventing osteoporosis. Another part of the campaign will provide education via social media to reach other individuals in the community; thus we can ensure the Saudi population receives accurate information about osteoporosis.

The participants who will be involved in this campaign will receive a healthy snack such as kale chips with a recipe card, and freebies such as jump ropes and hand

sanitizer. Also, they will be given a handout that highlights ways to prevent osteoporosis and some tips to stay healthy. The program will have a corner to identify foods rich in calcium and alternative sources to dairy products to educate all participants, including vegans, to nourish themselves and have strong bones.

As evidenced by this study, only 22% of participants had heard about osteoporosis from physicians. Health care professionals should be involved in patient education about osteoporosis. More importantly, it is recommended to train health care professionals in using the clinic visit as an opportunity to provide one-to-one education about osteoporosis and ways of prevention. As evidenced by this research study, most participants had a limited knowledge about osteoporosis, including important topics such as family history, cigarette smoking, hormone therapy, falls, physical activity, calcium intake, and diagnosis by clinical risk factors. Therefore, health policy makers can use the results of this study to design and implement effective education programs in order to raise awareness and change health beliefs and behaviors of this important disease in different areas of Saudi Arabia.

In future research, men should be enrolled as study participants even though men have lower risk of developing osteoporosis. Because men could benefit from the knowledge of their bones and preventing osteoporosis. This would give an opportunity to compare the findings of knowledge among men and women. In regards to designing education programs, men should be targeted in education programs about osteoporosis for the Saudi population. Since husbands usually encourage their wives, their involvement would reinforce women’s health and involvement in these kind of education

programs. The cultural differences can contribute to this kind of program being more effective in the Saudi population because they are family oriented.

In addition, future research should survey a larger sample size to include participants who have been diagnosed with osteoporosis. The researcher would have to measure the participants' actual practice to determine if the participants use self-care practices to prevent osteoporosis, such as asking further information about practicing physical activity, eating foods rich in calcium and vitamins, and exposure to sunlight.

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APPENDIX A

INVITATION LETTER IN ENGLISH

Exploring the Knowledge and Behavior Needed to Prevent Osteoporosis among Saudi Women

Dear Saudi women,

I am inviting you to participate in Prevention Osteoporosis survey. I am conducting a research project as a part of my master's degree at the University of Northern Iowa. If you decide to participate in this research project, please make sure to answers all questions as best as you can. The survey will only take 10 to 15 minutes to complete.

The purpose of this research is to evaluate the knowledge and behavior needed to prevent osteoporosis among Saudi women. Your participation in this survey is completely voluntary and all your response will be kept confidential. None of the responses will be connected to identifying information. The data will be destroyed once your responses have been analyzed.

If you have questions regarding your participation in this study or about the study generally, please contact us at the email that listed below. If you have question about the rights of your participation in this study, you can contact Institutional Review Board (IRB) at UNI through rsp@uni.edu.

If you would like to participate in the study, please click the survey link to begin the study.

Thank you in advance for providing this important feedback and I really appreciated.

Sincerely,
Zahra Al khidhr
alkhidhz@uni.edu
Graduate Student at University of Northern Iowa

Catherine Zeman
Catherine.zeman@uni.edu
Faculty supervisor, University of Northern Iowa

APPENDIX B

INVITATION LETTER IN ARABIC

استكشاف المعرفة والسلوك اللازمين لمنع هشاشة العظام بين النساء السعوديات

عزيزتي المرأة السعودية،

أدعوكِ للمشاركة في استبيان الوقاية من هشاشة العظام. أقوم بمشروع بحث تخرُّج كجزء من درجة الماجستير في جامعة شمال أيوا. إذا قررت المشاركة في هذا البحث، فَيُرْجَى التأكد من الإجابة على جميع الأسئلة قدر الإمكان. يستغرق الاستبيان من 10 إلى 15 دقيقة فقط .

الغرض من هذا البحث هو تقييم المعرفة والسلوك اللازمين للوقاية من هشاشة العظام بين النساء السعوديات. مشاركتك في هذا الاستبيان تطوعية تمامًا وستظل جميع إجابتك سرية. لن يتم ربط أي من الردود بتحديد المعلومات. سيتم إتلاف البيانات عندما يتم الانتهاء من تحليل إجاباتك .

إذا كانت لديك أسئلة بخصوص مشاركتك في هذه الدراسة أو عن الدراسة بشكل عام، فَيُرْجَى التواصل معنا من خلال البريد الإلكتروني المُدْرَج أدناه. إذا كان لديك سؤال حول حقوق مشاركتك في هذه الدراسة، يمكنك التواصل مع مكتب لجنة أخلاقيات البحث العلمي في جامعة شمال أيوا من خلال البريد الإلكتروني rsp@uni.edu

إذا كنت ترغبين في المشاركة في الدراسة، يرجى النقر على رابط الاستبيان لبدء الدراسة.

شكرًا لكم مقدمًا على المشاركة في الاستبيان وأنا أقدر ذلك حقًّا.

مع خالص التحية،

زهرة ال خضر

alkhidhz@uni.edu

طالبة دراسات عليا في جامعة شمال أيوا

كاثرين زيمان

Catherine.zeman@uni.edu

مشرف المشروع، جامعة شمال أيوا

APPENDIX C

INFORMED CONSENT IN ENGLISH

UNIVERSITY OF NORTHERN IOWA
HUMAN PARTICIPANTS REVIEW
INFORMED CONSENT

Project Title: Exploring the Knowledge and Behavior Needed to Prevent Osteoporosis among Saudi Women.

Name of Investigator(s): Zahra Al khidhr

Invitation to Participate: I am kindly requesting your participation in a research project conducted through the University of Northern Iowa. The following information is provided to help you make an informed decision about whether or not to participate.

Nature and Purpose: The purpose of this research is to evaluate the knowledge and behavior needed to prevent osteoporosis among Saudi women.

Explanation of Procedures: The design of this study is to survey Saudi women. The participants will be asked to complete five surveys: demographic variables, the Osteoporosis Knowledge Assessment Tool (OKAT), the risk factors of osteoporosis, Osteoporosis Health Belief Scale (OHBS), and understanding of how to prevent osteoporosis by health education program. The participants won't need more than 10 to 15 minutes to complete the five surveys.

Privacy and Confidentiality: Information obtained during this study which could identify you will be kept confidential. Surveys won't be identified with names or ID numbers. No guarantees can be made regarding the interception of data transmitted electronically, even though this seems unlikely. The summarized findings with no identifying information may be published in a UNI publication/thesis or presented in Saudi women community group. The data will be kept for a maximal period of 3 years.

Discomforts, Risks, and Costs: There are minimal risks associated with participating in this study. If you are not comfortable with completing the surveys, you will be having a risk of discomfort. Additionally, the investigator and faculty sponsor will be the only have access to those surveys.

Benefits and Compensation: No direct benefits to participants are expected, but this research will help participants make improvements in their knowledge and behavior

needed to prevent the risk of osteoporosis. This research will help individuals change their behavior and make a healthy decision toward their personal and family health.

Right to Refuse or Withdraw: Your participation is completely voluntary. You are free to withdraw from participation at any time or to choose not to participate at all, and by doing so, you will not be penalized or lose benefits to which you are otherwise entitled. Refusal to participate or withdraw from the study will not involve a penalty or loss of the benefits.

Questions: If you have questions regarding your participation in this study or about the study generally, please contact Zahra Al khidhr at 319-383-9781, or the project investigator's faculty advisor Catherine Zeman at the Department of Allied Health of Human Services, or University of Northern Iowa at 319-273-7090. For answers to questions about the rights of research participants and the research review process at UNI, you may contact the office of the IRB Administrator at 319-273-6148.

Agreement:

> I have read the above information. I feel I understand the study well enough to make a decision about my involvement. By clicking the link below, I am at least 18-50 years old. I understand and agree to the terms described above. Please indicate your consent by clicking the link below.

Signature Lines: By clicking on the "Agree" button, you are agreeing to participate voluntary in the study. If you do not wish to participate please click on the "Disagree" button, you will not be part of the study.

If you would like a copy of the consent form, please print a copy before choosing a response below.

- Agree
- Disagree

APPENDIX D

INFORMED CONSENT IN ARABIC

جامعة شمال أيوا

موافقة مسبقة

عنوان المشروع: استكشاف المعرفة والسلوك اللازمين لمنع هشاشة العظام بين النساء السعوديات

اسم الباحثة: زهراء ال خضر

دعوة للمشاركة: أرجو التفضل بمشاركتك في مشروع البحث الذي يتم إجراؤه من خلال جامعة شمال أيوا. المعلومات التالية تقدم لكِ المساعدة في اتخاذ القرار بشأن المشاركة من عدمها في هذه الدراسة\ .

طبيعة الدراسة والغرض: الغرض من هذا البحث هو تقييم المعرفة والسلوك اللازمين للوقاية من هشاشة العظام بين النساء السعوديات.

شرح الإجراءات: تهدف هذه الدراسة لمسح المرأة السعودية. ينقسم الاستبيان إلى خمسة أجزاء:
المتغيرات الديموغرافية .
أداة تقييم المعرفة لهشاشة العظام .
عوامل الخطر لهشاشة العظام .
مقياس المعتقدات الصحية لهشاشة العظام .
وفهم كيفية الوقاية من هشاشة العظام عن طريق برنامج التثقيف الصحي .

الخصوصية والسرية: المعلومات التي سوف يتم الحصول عليها خلال هذه الدراسة والتي يمكن أن تخصك ستبقى سرية. الاستبيان لن يتم تحديد المشاركين بأسماء أو أرقام تعريف. لا يمكن تقديم ضمانات فيما يتعلق باعتراض البيانات المرسلة إلكترونيًا، على الرغم من أن هذا يبدو غير مرجح. يمكن نشر النتائج التي لا تحتوي على معلومات تعريفية في جامعة شمال أيوا للنشر، أو يمكن عرض النتائج بين مجموعة مجتمع المرأة السعودية. سيتم الاحتفاظ بالبيانات لمدة أقصاها ثلاث سنوات.

مخاطر المشاركة: هناك حد أدنى من المخاطر المرتبطة بالمشاركة في هذه الدراسة. ستواجه الشعور بالانزعاج، إذا لم تكوني مرتاحة لاستكمال الاستبيان. بالإضافة إلى ذلك، سيكون الباحث والمشرف على الدراسة هما الوحيدين اللذين يمكنهما الوصول إلى تلك الاستبيانات .

الفوائد والتعويضات: لا يُتوقع حدوث فوائد مباشرة للمشاركات، لكن هذا البحث سيساعد المشاركات على إجراء تحسينات في معرفتهن وسلوكهن اللازمين لمنع خطر هشاشة العظام. سيساعد هذا البحث الأفراد على تغيير سلوكهم واتخاذ قرار صحي تجاه صحتهم الشخصية والعائلية .

الحق في الرفض أو الانسحاب: مشاركتك تطوعية تمامًا. أنت حرة في الانسحاب من المشاركة في أي وقت أو اختيار عدم المشاركة على الإطلاق، وبذلك، لن تتم معاقبتك أو تخسري المزايا التي يحق لك الحصول عليها. رفض المشاركة أو الانسحاب من الدراسة لن ينطوي عليها عقوبة أو خسارة الفوائد.

الأسئلة: إذا كانت لديك أسئلة بخصوص مشاركتك في هذه الدراسة أو عن الدراسة بشكل عام، فَيُرْجى الاتصال بزهراء ال خضر 9781-383-319، أو مشرف المشروع كاثرين زيمان في قسم الصحة العامة للخدمات الإنسانية،

أو الجامعة شمال ايوا 7090-273-319. للحصول على إجابات عن الأسئلة المتعلقة بحقوق المشاركين في البحث وعملية مراجعة البحث في جامعة شمال أيوا، يمكنك الاتصال بمكتب لجنة أخلاقيات البحث العلمي-273-319. 6148

الموافقة:
لقد قرأت المعلومات الواردة أعلاه. أشعر أنني أفهم الدراسة جيدًا بما فيه الكفاية لاتخاذ القرار بشأن مشاركتي. من خلال النقر على الرابط أدناه، لا يقل عمري عن 18 إلى 50 عامًا. أفهم وأوافق على الشروط الموضحة أعلاه. يُرْجى الإشارة إلى موافقتك من خلال النقر على الرابط أدناه.

خطوط التوقيع: من خلال النقر على زر "موافق"، فإنك توافقين على المشاركة التطوعية في الدراسة. إذا كنت لا ترغبين في المشاركة، فَيُرْجَى النقر على زر "غير موافق"، ولن تكون جزءًا من الدراسة .
إذا كنت ترغبين في الحصول على نسخة من نموذج الموافقة، فَيُرْجَى طباعة نسخة قبل اختيار الرد أدناه.

- موافق
- غير موافق

APPENDIX E

PREVENTION OSTEOPROSIS QUESTIONAIRE IN ENGLISH

Demographic Variables

1. What is your gender?
    - Female
    - Male
2. How old are you?

3. What is your marital status?
    - Married
    - Single
    - Divorced
    - Widow
4. What is your educational level?
    - Less than a high school diploma
    - High School degree or equivalent
    - Some college or community college -no degree
    - College Degree
    - Post-graduate Degree
5. What is your monthly income?
    - Less than 5000 SR
    - 5000-10,0000 SR
    - 10,000-20,000 SR
    - > 20,000 SR
6. Where do you live in Eastern province?
    - Dammam
    - Al Khobar
    - Al Qatif

- Al Ahsa
- Safwa
- Saihat
- Other:

7. Have you ever heard about osteoporosis, sometimes called brittle or weak bone?

- Yes
- No

8. If yes, from any of the following sources have you heard/learned about osteoporosis?

- Physician
- Television
- Family/ friends
- Newspaper
- Internet
- Health Education campaigns
- Other:

9. Do you consider osteoporosis serious disease as cancer or heart disease?

- Yes
- No

10. Do you have osteoporosis disease?

- Yes
- No

11. If yes, how long have you been diagnosed with osteoporosis?

12. How would you rate your current level of knowledge about osteoporosis prevention activities on a scale of 1 to 7, which '1' means "not at all knowledgeable" and '7' means "extremely knowledgeable"?

Not at all knowledgeable 1 2 3 4 5 6 7 extremely knowledgeable

The Osteoporosis Knowledge Assessment Tool (OKAT)
Please answer each of the following questions with True, False or Don't Know.

1. Osteoporosis leads to an increased risk of bone fractures.	☐ True	☐ False	☐ Don't know
2. Osteoporosis usually causes symptoms (e.g. pain) before fractures occur.	☐ True	☐ False	☐ Don't know
3. Having a higher peak bone mass at the end of childhood gives **no** protection against the development of osteoporosis in later life.	☐ True	☐ False	☐ Don't know
4. Osteoporosis is more common in men.	☐ True	☐ False	☐ Don't know
5. Cigarette smoking can contribute to osteoporosis.	☐ True	☐ False	☐ Don't know
6. A fall is jut as important as low bone strength in causing fractures.	☐ True	☐ False	☐ Don't know
7. By age 80, the majority of women have osteoporosis.	☐ True	☐ False	☐ Don't know
8. From age 50, most women can expect at least one fracture before they die.	☐ True	☐ False	☐ Don't know
9. Any type of physical activity is beneficial for osteoporosis.	☐ True	☐ False	☐ Don't know
10. It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors.	☐ True	☐ False	☐ Don't know
11. Family history of osteoporosis strongly predisposes a person to osteoporosis.	☐ True	☐ False	☐ Don't know
12. Sun exposure is protective for osteoporosis.	☐ True	☐ False	☐ Don't know
13. An adequate calcium intake can be achieved from two glasses of milk a day.	☐ True	☐ False	☐ Don't know
14. Sardines and broccoli are good sources of calcium for people who cannot take dairy products.	☐ True	☐ False	☐ Don't know
15. Calcium supplements alone can prevent bone loss.	☐ True	☐ False	☐ Don't know
16. Drinking soft drinks increases the occurrence of osteoporosis.	☐ True	☐ False	☐ Don't know

17. A high salt intake is a risk factor for osteoporosis. ☐ True ☐ False ☐ Don't know
18. There is a small amount of bone loss in the ten years following the onset of menopause. ☐ True ☐ False ☐ Don't know
19. Hormone therapy prevents further bone loss at any age after menopause. ☐ True ☐ False ☐ Don't know
20. There are no effective treatments for osteoporosis available. ☐ True ☐ False ☐ Don't know

Risk factors of osteoporosis

Which of the following are the risk factors that increase the incidence of osteoporosis among women? Please answer each of the following questions with True or False.

1. Female gender ☐ True ☐ False
2. Older age ☐ True ☐ False
3. Low weight/thin bone ☐ True ☐ False
4. Early onset of menopause (before the age of 45) ☐ True ☐ False
5. An inactive lifestyle, with little daily exercise ☐ True ☐ False
6. Family history (parent, sibling, or child) who has had osteoporosis. ☐ True ☐ False
7. Limit the amount of sun exposure ☐ True ☐ False
8. A diet with little calcium intake and vitamin D ☐ True ☐ False
9. Past bone fractures ☐ True ☐ False
10. Drink more than two soft drinks per day ☐ True ☐ False
11. Drink caffeine-containing drinks regularly or in significant amounts (more than two daily) ☐ True ☐ False
12. Cigarettes smoking ☐ True ☐ False

The relationship between physical activity and calcium intake to prevent osteoporosis? (Osteoporosis Health Belief Scale)

After reading each statement, please indicate whether you agree or disagree with each statement on a scale of 1 to 5 which '1' means "strongly disagree" and '5' which means "strongly agree" (please choose the best one describes your opinion).

Regular exercise prevents problems that would happen from osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

You feel better when you exercise to prevent osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Regular exercise helps to build strong bones.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Exercising to prevent osteoporosis also improves the way your body looks.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Regular exercise cuts down the chances of broken bones.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

You feel good about yourself when you exercise to prevent osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Note: "taking in enough calcium" means taking enough calcium by eating calcium rich foods and/or taking calcium supplements.

Taking in enough calcium prevents problems from osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

You have lots to gain from taking in enough calcium to prevent osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Taking in enough calcium prevents painful osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

You would not worry as much about osteoporosis if you took in enough calcium.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Taking in enough calcium cuts down on your chances of broken bones.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

You feel good about yourself when you take in enough calcium to prevent osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Increase the understanding of Saudi women to prevent osteoporosis by health education program

1. Have you ever received/attended any formal public health educational program about osteoporosis?

- Yes
- No

2. If yes, A) how long was the formal public health educational program about osteoporosis?

- One session
- One week
- One month
- Other:

B) Where did you receive the formal public health educational program about osteoporosis?

C) Who did give you the formal public health educational program about osteoporosis?

3. I want to know your opinion about each statement, please indicate whether you agree or disagree with each statement on a scale of 1 to 5 which '1' means "strongly disagree" and '5' which means "strongly agree" (please choose the best one describes your opinion)

Osteoporosis education programs are effective to increase general knowledge about osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Attending education programs about osteoporosis can play important roles to shift your health belief.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

One-day education session is effective to learn various methods to prevent osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Public health educational program about osteoporosis reduces unhealthy lifestyles and increases the understanding of preventing osteoporosis.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

A longer than one-day educational program is more sufficient than short session to increase the awareness and enhance healthy habits.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

Osteoporosis education programs can have a positive impact on physical activity, risk factors of osteoporosis and fractures, and consumption of caffeine and calcium intake.

Strongly Disagree	Disagree	Natural	Agree	Strongly Agree
1	2	3	4	5

APPENDIX F

PREVENTION OSTEOPROSIS QUESTIONAIRE IN ARABIC

البيانات الشخصية

1. ما هو جنسك؟
   - o أنثى
   - o ذكر
2. كم عمرك؟

3. ما هي حالتك الاجتماعية؟
   - o متزوجة
   - o عزباء
   - o مطلقة
   - o أرملة
4. ما هو مستواك الدراسي؟
   - o أقل من ثانوي
   - o ثانوي أو ما يعادلها
   - o دبلوم
   - o جامعي
   - o دراسات عليا
5. ما هو دخلك الشهري؟
   - o أقل من 5000 ريال سعودي
   - o 10000-5000 ريال سعودي
   - o 20000-10000 ريال سعودي
   - o أكثر من 20000 ريال سعودي
6. أين تسكنين في المنطقة الشرقية؟
   - o الدمام
   - o الخبر

- o القطيف
- o الأحساء
- o صفوى
- o سيهات
- o أخرى:

7. هل سبق لك أن سمعتي عن مرض هشاشة العظام، الذي يطلق عليه في بعض الأحيان عظام هشة أو عظام ضعيفة؟

- o نعم
- o لا

8. إذا كانت الإجابة بنعم، من أي المصادر التالية سمعتي أو تعرفتي على هشاشة العظام؟

- o الطبيب
- o التلفاز
- o العائلة أو الأصدقاء
- o الصحف
- o الإنترنت
- o حملات التوعية الصحية
- o أخرى: _____

9. هل يعتبر مرض هشاشة العظام مرضًا خطيرًا كخطورة مرض السرطان أو مرض القلب؟

- o نعم
- o لا

10. هل لديك مرض هشاشة العظام؟

- o نعم
- o لا

11. إذا كانت الإجابة بنعم، منذ متى تم تشخيصك بمرض هشاشة العظام؟

12. كيف تقييم مستواك الحالي من المعرفة حول أنشطة الوقاية من هشاشة العظام على مقياس من 1 إلى 7، بحيث "1" تعني "غير مطلعة على الإطلاق" و "7" "مطلعة للغاية"؟

غير مطلعة على الإطلاق 1 2 3 4 5 6 7 مطلعة للغاية

أداة تقييم المعرفة لهشاشة العظام

يُرْجَى الإجابة على كل سؤال من الأسئلة التالية بـ صح أو خطأ أو لا أعلم

1. هشاشة العظام تؤدي إلى زيادة خطر الإصابة بكسور العظام. ☐ صح ☐ خطأ ☐ لا أعلم
2. هشاشة العظام عادة ما تسبب أعراضًا (مثل ألم) قبل حدوث الكسر. ☐ صح ☐ خطأ ☐ لا أعلم
3. وجود كتلة عظام عالية في نهاية مرحلة الطفولة لا يعطي حماية ضد تطور مرض هشاشة العظام في وقت لاحق من الحياة. ☐ صح ☐ خطأ ☐ لا أعلم
4. هشاشة العظام هي الأكثر شيوعًا في الرجال. ☐ صح ☐ خطأ ☐ لا أعلم
5. تدخين السجائر يمكن أن يسهم في هشاشة العظام. ☐ صح ☐ خطأ ☐ لا أعلم
6. السقوط لا يقل أهمية عن انخفاض قوة العظام في التسبب في الكسور. ☐ صح ☐ خطأ ☐ لا أعلم
7. في سن 80، الغالبية من النساء تصاب بهشاشة العظام. ☐ صح ☐ خطأ ☐ لا أعلم
8. من سن 50، يمكن لمعظم النساء أن تتوقع كسرًا واحدًا على الأقل قبل وفاتهن. ☐ صح ☐ خطأ ☐ لا أعلم
9. كل أنواع النشاط البدني مفيد لمرض هشاشة العظام. ☐ صح ☐ خطأ ☐ لا أعلم
10. من السهل معرفة ما إذا كنت معرضة لخطر الإصابة بهشاشة العظام من خلال عوامل الخطر السريرية. ☐ صح ☐ خطأ ☐ لا أعلم
11. التاريخ العائلي لمرض هشاشة العظام يجعل الشخص معرضًا بشدة لهشاشة العظام. ☐ صح ☐ خطأ ☐ لا أعلم
12. التعرض لأشعة الشمس يقي من مرض هشاشة العظام. ☐ صح ☐ خطأ ☐ لا أعلم
13. يمكن الحصول على كمية كافية من الكالسيوم من خلال شرب كوبين من الحليب يوميًّا. ☐ صح ☐ خطأ ☐ لا أعلم
14. السردين والبروكلي مصدران جيدان للكالسيوم للأشخاص الذين لا يستطيعون تناول منتجات الألبان. ☐ صح ☐ خطأ ☐ لا أعلم
15. تناول مكملات الكالسيوم وحدها يمكن أن تمنع فقدان العظام. ☐ صح ☐ خطأ ☐ لا أعلم
16. شرب المشروبات الغازية يزيد من حدوث هشاشة العظام. ☐ صح ☐ خطأ ☐ لا أعلم
17. تناول كميات كبيرة من الملح هو عامل خطر للإصابة بهشاشة العظام. ☐ صح ☐ خطأ ☐ لا أعلم
18. هناك كمية صغيرة من فقدان العظام في السنوات العشر التالية من بداية انقطاع الطمث. ☐ صح ☐ خطأ ☐ لا أعلم

19. العلاج الهرموني يمنع المزيد من فقدان العظام في أي عمر بعد انقطاع الطمث. ☐ صح ☐ خطأ ☐ لا أعلم

20. لا توجد علاجات فعالة لمرض هشاشة العظام. ☐ صح ☐ خطأ ☐ لا أعلم

عوامل الخطر لهشاشة العظام

أي من العوامل التالية هي عوامل الخطر التي تزيد من حدوث مرض هشاشة العظام بين النساء؟ يُرْجَى الإجابة عن كل من الأسئلة التالية بـ صح أو خطأ

1. الجنس الأنثوي ☐ صح ☐ خطأ
2. الكبر في السن ☐ صح ☐ خطأ
3. انخفاض الوزن أو العظام الضعيفة ☐ صح ☐ خطأ
4. انقطاع الطمث المبكر (قبل سن 45) ☐ صح ☐ خطأ
5. أسلوب حياة غير نشط، مع القليل من ممارسة التمارين الرياضية اليومية ☐ صح ☐ خطأ
6. تاريخ العائلة (الوالد أو الأخ أو الطفل) الذي أصيب بهشاشة العظام ☐ صح ☐ خطأ
7. قلة التعرض للشمس ☐ صح ☐ خطأ
8. اتباع نظام غذائي قليل من الكالسيوم وفيتامين د ☐ صح ☐ خطأ
9. كسور العظام الماضية ☐ صح ☐ خطأ
10. شرب أكثر من اثنين من المشروبات الغازية يوميًّا ☐ صح ☐ خطأ
11. شرب المشروبات التي تحتوي على الكافيين بانتظام أو بكميات كبيرة (أكثر من اثنين يوميًّا) ☐ صح ☐ خطأ
12. تدخين السجائر ☐ صح ☐ خطأ

العلاقة بين النشاط البدني وتناول الكالسيوم للوقاية من هشاشة العظام؟ (مقياس هشاشة العظام الصحية)

بعد قراءة كل عبارة، يُرْجَى الإشارة إلى ما إذا كنت توافق أو لا توافق على كل عبارة بمقياس من 1 إلى 5 والتي تعني "1" تعني "لا أوافق بشدة" و "5" مما يعني "أوافق بشدة" (يُرْجَى اختيار أفضل عبارة تصف رأيك)

ممارسة التمارين الرياضية بانتظام تمنع المشاكل التي يمكن أن تحدث من مرض هشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

تشعرين بتحسن عند ممارسة الرياضة لمنع هشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

ممارسة التمارين الرياضية بانتظام تساعد على بناء عظام قوية.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

التمارين الرياضية لمنع هشاشة العظام تُحسن أيضًا من مظهر الجسم.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

ممارسة التمارين الرياضية بانتظام يقلل من احتمال كسر العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

تشعرين بالرضا عن نفسك عند ممارسة الرياضة لمنع هشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

ملاحظة: "تناول كمية كافية من الكالسيوم" يعني تناول كمية كافية من الكالسيوم عن طريق تناول الأطعمة الغنية بالكالسيوم أو تناول مكملات الكالسيوم.

تناول كمية كافية من الكالسيوم يمنع من مشاكل هشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

لديك الكثير لتكسبينه من تناول ما يكفي من الكالسيوم لمنع هشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

تناول ما يكفي من الكالسيوم يمنع هشاشة العظام المؤلمة.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

لن تقلقي كثيرًا بشأن مرض هشاشة العظام إذا كنت تتناولين كمية كافية من الكالسيوم.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

أخذ ما يكفي من الكالسيوم يقلل من احتمال كسر العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

تشعرين بالرضا عن نفسك عندما تتناولين كمية كافية من الكالسيوم لمنع هشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

زيادة فهم المرأة السعودية للوقاية من هشاشة العظام عن طريق برنامج التثقيف الصحي

1. هل سبق أن تلقيتِ أو حضرت أي برنامج تعليمي رسمي للصحة العامة حول مرض هشاشة العظام؟
   - o نعم
   - o لا
2. إذا كانت الإجابة بنعم، أ) كم كان طول البرنامج التعليمي الرسمي للصحة العامة حول هشاشة العظام؟
   - o جلسة واحدة
   - o أسبوع واحد
   - o شهر واحد
   - o أخرى: _____

ب) من أين تلقيتِ البرنامج التعليمي الرسمي للصحة العامة حول مرض هشاشة العظام؟

ج) من الذي أعطاكِ البرنامج التعليمي الرسمي للصحة العامة حول مرض هشاشة العظام؟

3. أريد أن أعرف رأيك حول كل عبارة، يُرْجَى الإشارة إلى ما إذا كنت توافقين أو لا توافقين على كل عبارة بمقياس من 1 إلى 5 والتي تعني "1" تعني "لا أوافق بشدة" و "5" مما يعني "أوافق بشدة" (يُرْجَى اختيار أفضل واحد يصف رأيك)

تعد برامج التعليم الخاصة بهشاشة العظام فعالة لزيادة المعرفة العامة بهشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

يمكن أن يؤدي حضور البرنامج التعليمية حول مرض هشاشة العظام أدوارًا مهمة لتغيير اعتقاداتك الصحية.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

جلسة التعليم ليوم واحد فعالة لتعلم طرق مختلفة للوقاية من هشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

البرنامج التعليمي للصحة العامة حول هشاشة العظام يقلل أنماط الحياة غير الصحية ويزيد من فهم الوقاية من هشاشة العظام.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

يعد البرنامج التعليمي الذي أطول من يوم واحد فعال أكثر من جلسة قصيرة لزيادة الوعي وتعزيز العادات الصحية.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

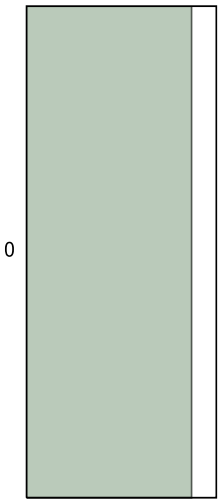
يمكن أن يكون لبرامج التعليم الخاصة بهشاشة العظام تأثيرٌ إيجابي على النشاط البدني وعوامل خطر الإصابة بهشاشة العظام والكسور واستهلاك الكافيين والكالسيوم.

لا أوافق بشدة	لا أوافق	محايد	أوافق	أوافق بشدة
1	2	3	4	5

APPENDIX G

COMPLETE DISTRUBUATION ANALYSIS IN JMP

What is your gender?

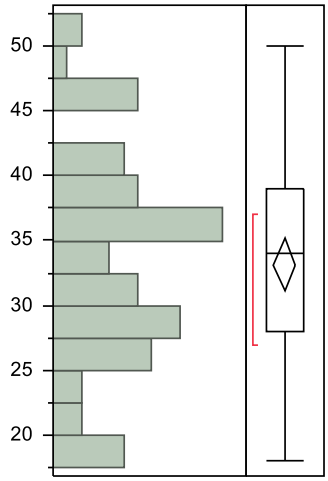


Frequencies

Level	Count	Prob
female	67	1.00000
Total	67	1.00000

N Missing
0
1 Levels

How old are you?



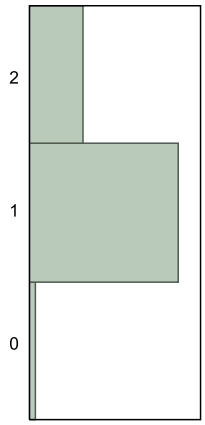
Quantiles

100.0%	maximum	50
99.5%		50
97.5%		50
90.0%		45.2
75.0%	quartile	39
50.0%	median	34
25.0%	quartile	28
10.0%		20.8
2.5%		18
0.5%		18
0.0%	minimum	18

Summary Statistics

Mean	33.134328
Std Dev	8.2808569
Std Err Mean	1.0116677
Upper 95% Mean	35.154188
Lower 95% Mean	31.114469
N	67

What is your marital status?

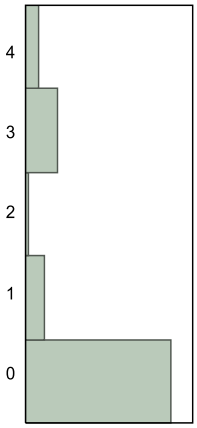


Frequencies

Level	Count	Prob
Divorced	2	0.03030
Married	47	0.71212
Single	17	0.25758
Total	66	1.00000

N Missing
1
3 Levels

What is your educational level?

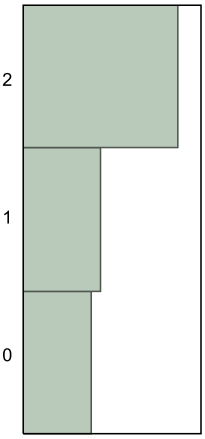


Frequencies

Level	Count	Prob
college degree	45	0.68182
high school degree or equivalent	6	0.09091
less than a high school diploma	1	0.01515
post-graduate degree	10	0.15152
some college or community college -no degree	4	0.06061
Total	66	1.00000

N Missing
1
5 Levels

What is your monthly income?

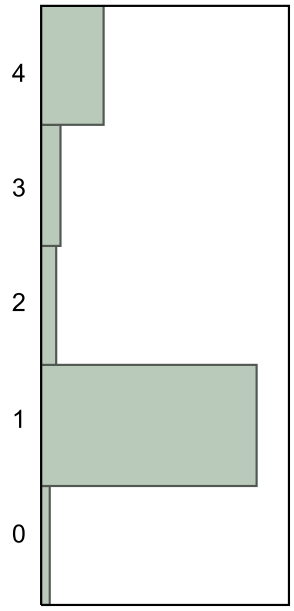


Frequencies

Level	Count	Prob
10,000-20,000 SR	15	0.22727
5000-10,0000 SR	17	0.25758
Less than 5000 SR	34	0.51515
Total	66	1.00000

N Missing
1
3 Levels

Where do you live in Eastern province?

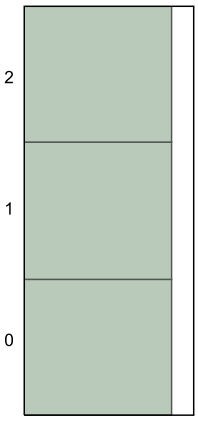


Frequencies

Level	Count	Prob
Al Ahsa	2	0.02985
Al Qatif	45	0.67164
Other	3	0.04478
Safwa	4	0.05970
Saihat	13	0.19403
Total	67	1.00000

N Missing
0
5 Levels

Other

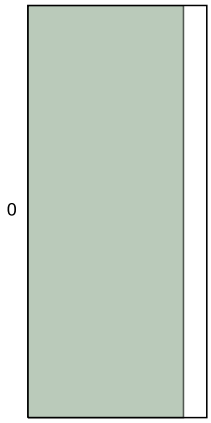


Frequencies

Level	Count	Prob
Al Qudaih	1	0.33333
Jubail	1	0.33333
Tarout	1	0.33333
Total	3	1.00000

N Missing
64
3 Levels

Have you ever heard about osteoporosis, sometimes called brittle or weak bone?

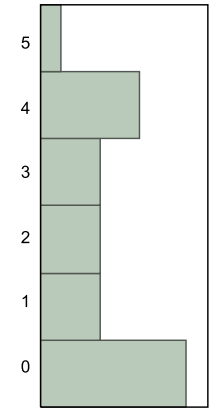


Frequencies

Level	Count	Prob
Yes	67	1.00000
Total	67	1.00000

N Missing
0
1 Levels

If yes, from any of the following sources have you heard/learned about osteoporosis?

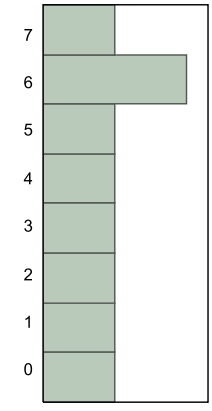


Frequencies

Level	Count	Prob
Family and friends	22	0.32836
Health Education campaigns	9	0.13433
Internet	9	0.13433
Other	9	0.13433
Physician	15	0.22388
Television	3	0.04478
Total	67	1.00000

N Missing
0
6 Levels

Other 2

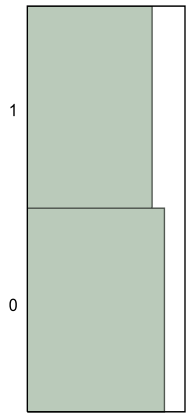


Frequencies

Level	Count	Prob
Family and friends as well as health education campaigns	1	0.11111
All of the above	1	0.11111
During my study	1	0.11111
I'm a doctor.	1	0.11111
Reading	1	0.11111
Secondary School	1	0.11111
Studying	2	0.22222
University	1	0.11111
Total	9	1.00000

N Missing
58
8 Levels

Do you consider osteoporosis serious disease as cancer or heart disease?

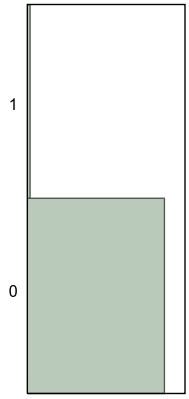


Frequencies

Level	Count	Prob
No	35	0.52239
Yes	32	0.47761
Total	67	1.00000

N Missing
0
2 Levels

Do you have osteoporosis disease?

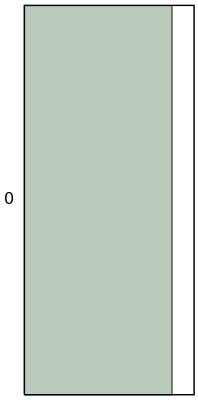


Frequencies

Level	Count	Prob
No	66	0.98507
Yes	1	0.01493
Total	67	1.00000

N Missing
0
2 Levels

If yes, how long have you been diagnosed with osteoporosis?

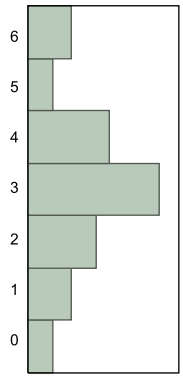


Frequencies

Level	Count	Prob
one year ago	1	1.00000
Total	1	1.00000

N Missing
66
1 Levels

How would you rate your current level of knowledge about osteoporosis prevention activities on a scale of 1 to 7, which '1' means "not at all knowledgeable" and '7' means "extremely knowledgeable"?

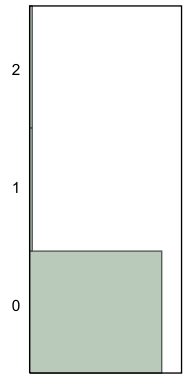


Frequencies

Level	Count	Prob
1	4	0.05970
2	7	0.10448
3	11	0.16418
4	21	0.31343
5	13	0.19403
6	4	0.05970
7	7	0.10448
Total	67	1.00000

N Missing
0
7 Levels

Osteoporosis leads to an increased risk of bone fractures.

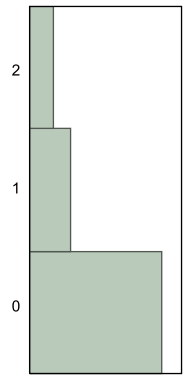


Frequencies

Level	Count	Prob
True	65	0.97015
Don't know	1	0.01493
False	1	0.01493
Total	67	1.00000

N Missing
0
3 Levels

Osteoporosis usually causes symptoms (e.g. pain) before fractures occur.

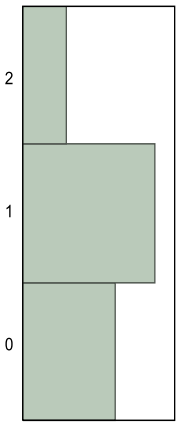


Frequencies

Level	Count	Prob
True	45	0.67164
Don't know	14	0.20896
False	8	0.11940
Total	67	1.00000

N Missing
0
3 Levels

Having a higher peak bone mass at the end of childhood gives no protection against the development of osteoporosis in later life.

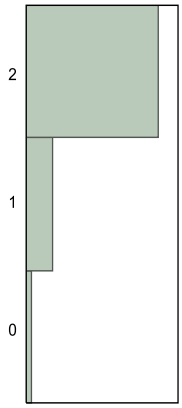


Frequencies

Level	Count	Prob
True	23	0.34328
Don't know	33	0.49254
False	11	0.16418
Total	67	1.00000

N Missing
0
3 Levels

Osteoporosis is more common in men.

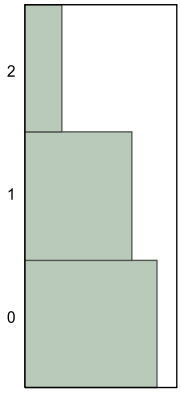


Frequencies

Level	Count	Prob
True	2	0.02985
Don't know	11	0.16418
False	54	0.80597
Total	67	1.00000

N Missing
0
3 Levels

Cigarette smoking can contribute to osteoporosis.

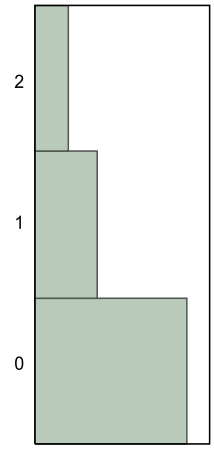


Frequencies

Level	Count	Prob
True	32	0.47761
Don't know	26	0.38806
False	9	0.13433
Total	67	1.00000

N Missing
0
3 Levels

A fall is just as important as low bone strength in causing fractures.

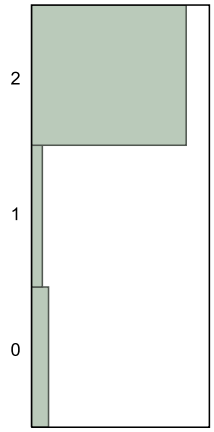


Frequencies

Level	Count	Prob
True	41	0.61194
Don't know	17	0.25373
False	9	0.13433
Total	67	1.00000

N Missing
0
3 Levels

By age 80, the majority of women have osteoporosis.

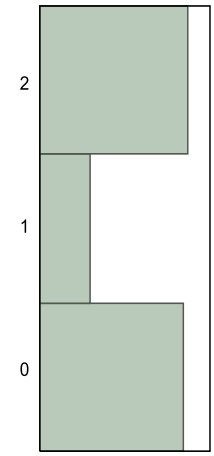


Frequencies

Level	Count	Prob
Don't know	6	0.08955
False	4	0.05970
True	57	0.85075
Total	67	1.00000

N Missing
0
3 Levels

From age 50, most women can expect at least one fracture before they die.

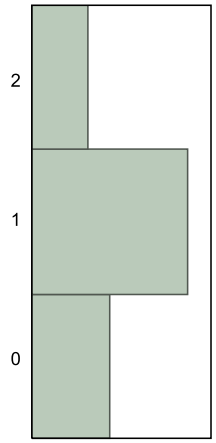


Frequencies

Level	Count	Prob
Don't know	28	0.41791
False	10	0.14925
True	29	0.43284
Total	67	1.00000

N Missing
0
3 Levels

Any type of physical activity is beneficial for osteoporosis.

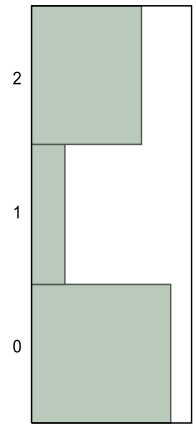


Frequencies

Level	Count	Prob
Don't know	18	0.26866
False	36	0.53731
True	13	0.19403
Total	67	1.00000

N Missing
0
3 Levels

It is easy to tell whether I am at risk of osteoporosis by my clinical risk factors

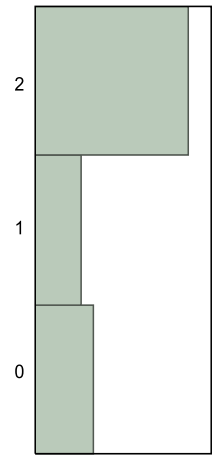


Frequencies

Level	Count	Prob
Don't know	33	0.49254
False	8	0.11940
True	26	0.38806
Total	67	1.00000

N Missing
0
3 Levels

Family history of osteoporosis strongly predisposes a person to osteoporosis.

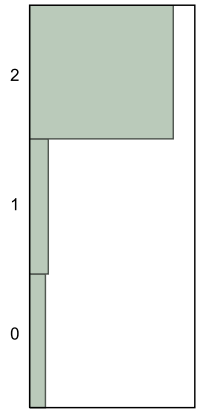


Frequencies

Level	Count	Prob
Don't know	15	0.22388
False	12	0.17910
True	40	0.59701
Total	67	1.00000

N Missing
0
3 Levels

Sun exposure is protective for osteoporosis.

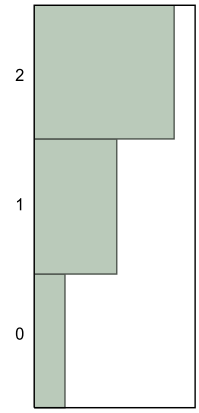


Frequencies

Level	Count	Prob
Don't know	6	0.08955
False	7	0.10448
True	54	0.80597
Total	67	1.00000

N Missing
0
3 Levels

An adequate calcium intake can be achieved from two glasses of milk a day.

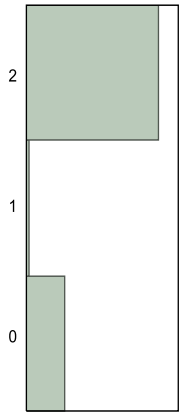


Frequencies

Level	Count	Prob
Don't know	8	0.11940
False	22	0.32836
True	37	0.55224
Total	67	1.00000

N Missing
0
3 Levels

Sardines and broccoli are good sources of calcium for people who cannot take dairy products.

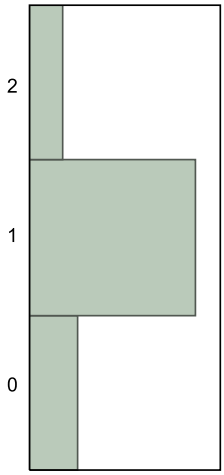


Frequencies

Level	Count	Prob
Don't know	15	0.22388
False	1	0.01493
True	51	0.76119
Total	67	1.00000

N Missing
0
3 Levels

Calcium supplements alone can prevent bone loss.

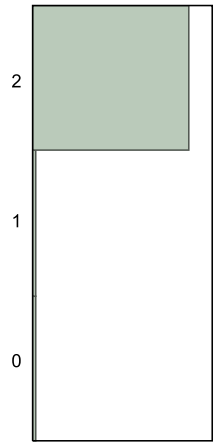


Frequencies

Level	Count	Prob
Don't know	13	0.19403
False	45	0.67164
True	9	0.13433
Total	67	1.00000

N Missing
0
3 Levels

Drinking soft drinks increases the occurrence of osteoporosis.

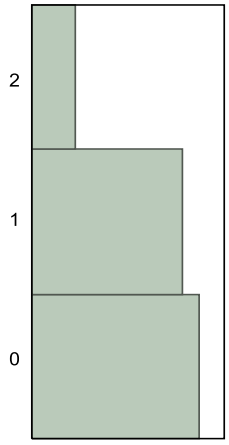


Frequencies

Level	Count	Prob
Don't know	1	0.01515
False	1	0.01515
True	64	0.96970
Total	66	1.00000

N Missing
1
3 Levels

A high salt intake is a risk factor for osteoporosis.

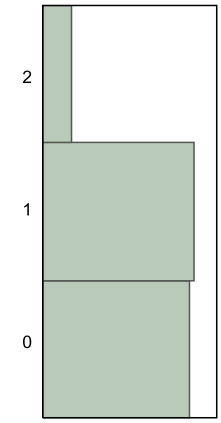


Frequencies

Level	Count	Prob
True	31	0.46269
Don't know	28	0.41791
False	8	0.11940
Total	67	1.00000

N Missing
0
3 Levels

There is a small amount of bone loss in the ten years following the onset of menopause.

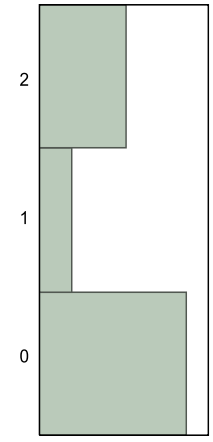


Frequencies

Level	Count	Prob
True	30	0.44776
Don't know	31	0.46269
False	6	0.08955
Total	67	1.00000

N Missing
0
3 Levels

Hormone therapy prevents further bone loss at any age after menopause.

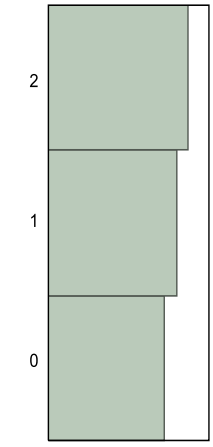


Frequencies

Level	Count	Prob
Don't know	37	0.55224
False	8	0.11940
True	22	0.32836
Total	67	1.00000

N Missing
0
3 Levels

There are no effective treatments for osteoporosis available.

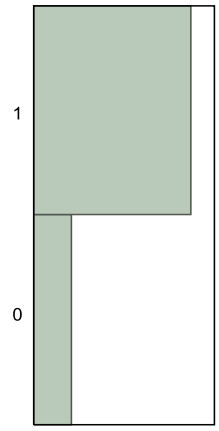


Frequencies

Level	Count	Prob
Don't know	20	0.30303
False	22	0.33333
True	24	0.36364
Total	66	1.00000

N Missing
1
3 Levels

Female gender.

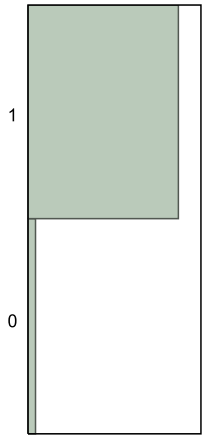


Frequencies

Level	Count	Prob
False	13	0.19403
True	54	0.80597
Total	67	1.00000

N Missing
0
2 Levels

Older age.

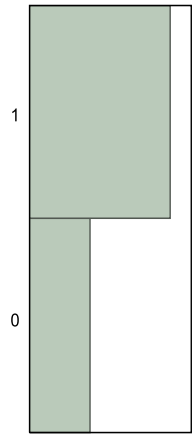


Frequencies

Level	Count	Prob
False	3	0.04478
True	64	0.95522
Total	67	1.00000

N Missing
0
2 Levels

Low weight/thin bone.

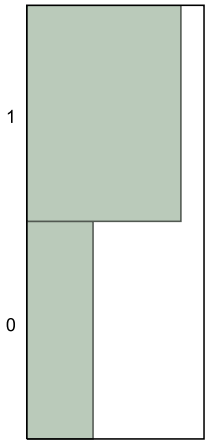


Frequencies

Level	Count	Prob
False	20	0.29851
True	47	0.70149
Total	67	1.00000

N Missing
0
2 Levels

Early onset of menopause (before the age of 45).

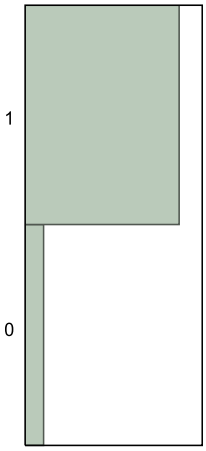


Frequencies

Level	Count	Prob
False	20	0.29851
True	47	0.70149
Total	67	1.00000

N Missing
0
2 Levels

An inactive lifestyle, with little daily exercise.

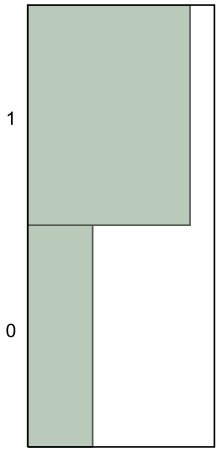


Frequencies

Level	Count	Prob
False	7	0.10448
True	60	0.89552
Total	67	1.00000

N Missing
0
2 Levels

Family history (parent, sibling, or child) who has had osteoporosis.

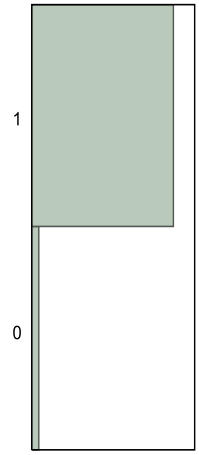


Frequencies

Level	Count	Prob
False	19	0.28358
True	48	0.71642
Total	67	1.00000

N Missing
0
2 Levels

Limit the amount of sun exposure.

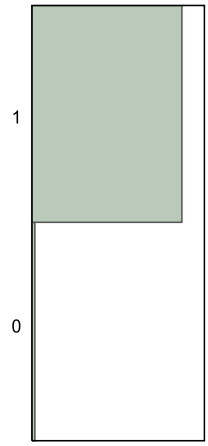


Frequencies

Level	Count	Prob
False	3	0.04478
True	64	0.95522
Total	67	1.00000

N Missing
0
2 Levels

A diet with little calcium intake and vitamin D.

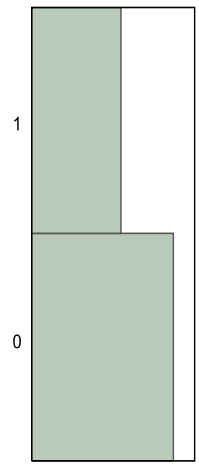


Frequencies

Level	Count	Prob
False	1	0.01493
True	66	0.98507
Total	67	1.00000

N Missing
0
2 Levels

Past bone fractures

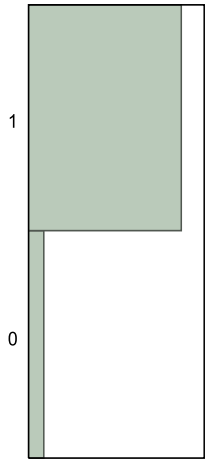


Frequencies

Level	Count	Prob
False	41	0.61194
True	26	0.38806
Total	67	1.00000

N Missing
0
2 Levels

Drink more than two soft drinks per day.

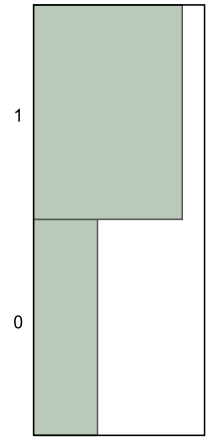


Frequencies

Level	Count	Prob
False	6	0.08955
True	61	0.91045
Total	67	1.00000

N Missing
0
2 Levels

Drink caffeine-containing drinks regularly or in significant amounts (more than two daily).

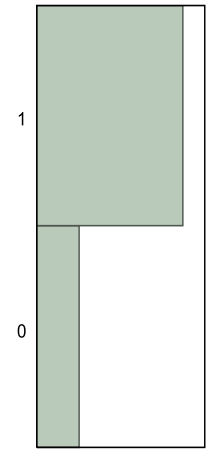


Frequencies

Level	Count	Prob
False	20	0.29851
True	47	0.70149
Total	67	1.00000

N Missing
0
2 Levels

Cigarettes smoking.

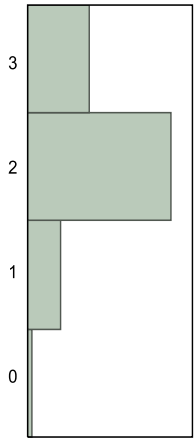


Frequencies

Level	Count	Prob
False	15	0.22388
True	52	0.77612
Total	67	1.00000

N Missing
0
2 Levels

Regular exercise prevents problems that would happen from osteoporosis.

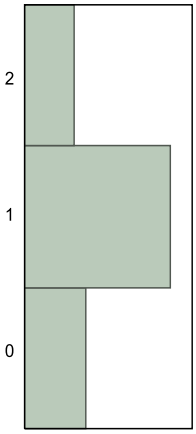


Frequencies

Level	Count	Prob
disagree	1	0.01493
neutral	9	0.13433
agree	40	0.59701
strongly agree	17	0.25373
Total	67	1.00000

N Missing
0
4 Levels

You feel better when you exercise to prevent osteoporosis.

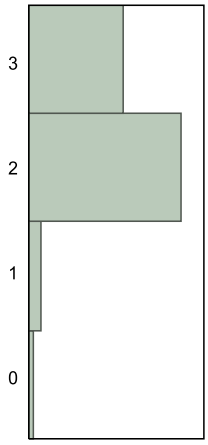


Frequencies

Level	Count	Prob
neutral	16	0.23881
agree	38	0.56716
strongly agree	13	0.19403
Total	67	1.00000

N Missing
0
3 Levels

Regular exercise helps to build strong bones.

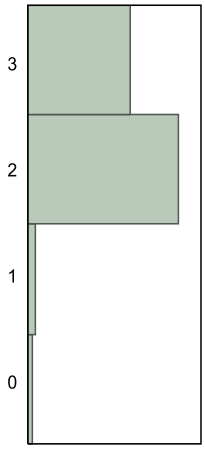


Frequencies

Level	Count	Prob
disagree	1	0.01493
neutral	3	0.04478
agree	39	0.58209
strongly agree	24	0.35821
Total	67	1.00000

N Missing
0
4 Levels

Exercising to prevent osteoporosis also improves the way your body looks.

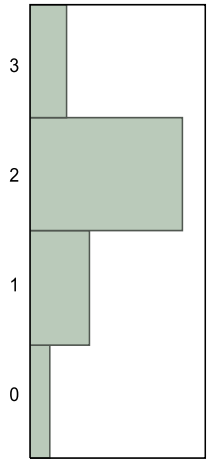


Frequencies

Level	Count	Prob
strongly disagree	1	0.01493
neutral	2	0.02985
agree	38	0.56716
strongly agree	26	0.38806
Total	67	1.00000

N Missing
0
4 Levels

Regular exercise cuts down the chances of broken bones.

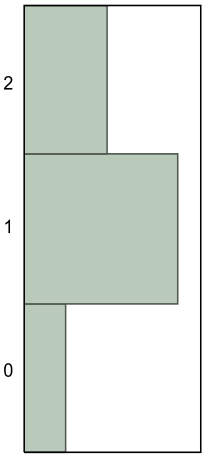


Frequencies

Level	Count	Prob
disagree	5	0.07463
neutral	15	0.22388
agree	38	0.56716
strongly agree	9	0.13433
Total	67	1.00000

N Missing
0
4 Levels

You feel good about yourself when you exercise to prevent osteoporosis.

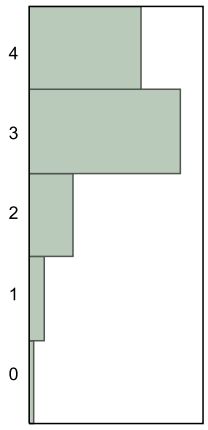


Frequencies

Level	Count	Prob
neutral	10	0.14925
agree	37	0.55224
strongly agree	20	0.29851
Total	67	1.00000

N Missing
0
3 Levels

Taking in enough calcium prevents problems from osteoporosis. Note: "taking in enough calcium" means taking enough calcium by eating calcium rich foods and/or taking calcium supplements.

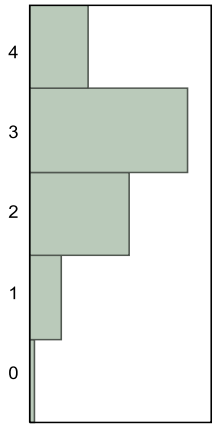


Frequencies

Level	Count	Prob
strongly disagree	1	0.01493
disagree	3	0.04478
neutral	9	0.13433
agree	31	0.46269
strongly agree	23	0.34328
Total	67	1.00000

N Missing
0
5 Level

You have lots to gain from taking in enough calcium to prevent osteoporosis.

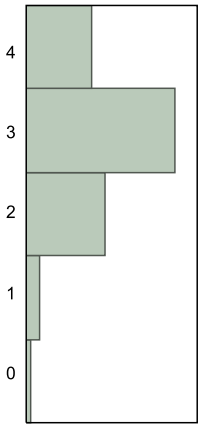


Frequencies

Level	Count	Prob
strongly disagree	1	0.01493
disagree	6	0.08955
neutral	19	0.28358
agree	30	0.44776
strongly agree	11	0.16418
Total	67	1.00000

N Missing
0
5 Levels

Taking in enough calcium prevents painful osteoporosis.

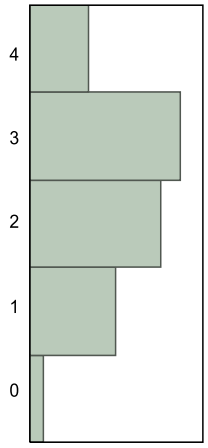


Frequencies

Level	Count	Prob
strongly disagree	1	0.01493
disagree	3	0.04478
neutral	17	0.25373
agree	32	0.47761
strongly agree	14	0.20896
Total	67	1.00000

N Missing
0
5 Levels

You would not worry as much about osteoporosis if you took in enough calcium.

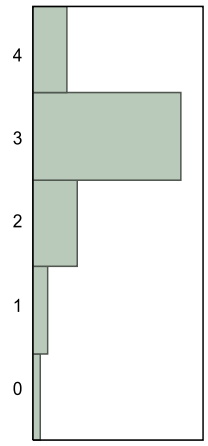


Frequencies

Level	Count	Prob
strongly disagree	2	0.02985
disagree	13	0.19403
neutral	20	0.29851
agree	23	0.34328
strongly agree	9	0.13433
Total	67	1.00000

N Missing
0
5 Levels

Taking in enough calcium cuts down on your chances of broken bones.

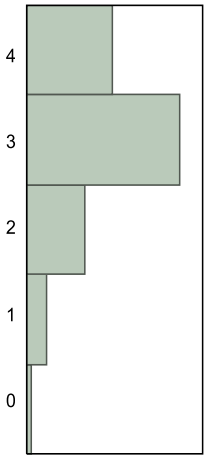


Frequencies

Level	Count	Prob
strongly disagree	2	0.02985
disagree	4	0.05970
neutral	12	0.17910
agree	40	0.59701
strongly agree	9	0.13433
Total	67	1.00000

N Missing
0
5 Levels

You feel good about yourself when you take in enough calcium to prevent osteoporosis.

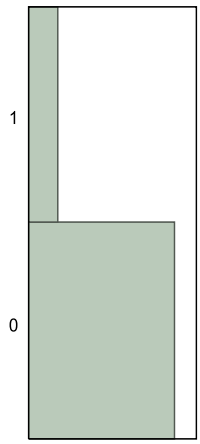


Frequencies

Level	Count	Prob
strongly disagree	1	0.01493
disagree	4	0.05970
neutral	12	0.17910
agree	32	0.47761
strongly agree	18	0.26866
Total	67	1.00000

N Missing
0
5 Levels

Have you ever received/attended any formal public health educational program about osteoporosis?

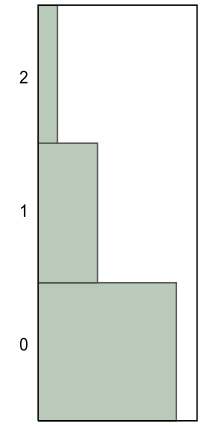


Frequencies

Level	Count	Prob
No	56	0.83582
Yes	11	0.16418
Total	67	1.00000

N Missing
0
2 Levels

If yes, A) how long was the formal public health educational program about osteoporosis?

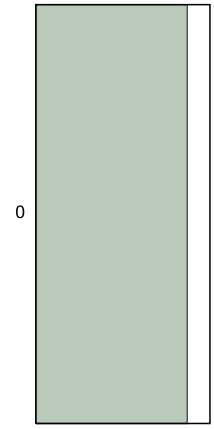


Frequencies

Level	Count	Prob
one session	7	0.63636
one week	3	0.27273
other	1	0.09091
Total	11	1.00000

N Missing
56
3 Levels

Other 3

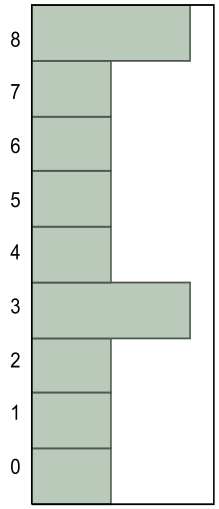


Frequencies

Level	Count	Prob
Don't know	1	1.00000
Total	1	1.00000

N Missing
66
1 Levels

B) Where did you receive the formal public health educational program about osteoporosis?

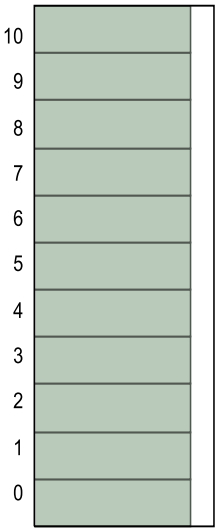


Frequencies

Level	Count	Prob
A	1	0.09091
By attending medical seminars discussing this subject	1	0.09091
Course from the internet	1	0.09091
Internet	2	0.18182
Nursing course	1	0.09091
Qatif Central Hospital	1	0.09091
School	1	0.09091
School health department	1	0.09091
university	2	0.18182
Total	11	1.00000

N Missing
56
9 Levels

***C)* Who did give you the formal public health educational program about osteoporosis?**

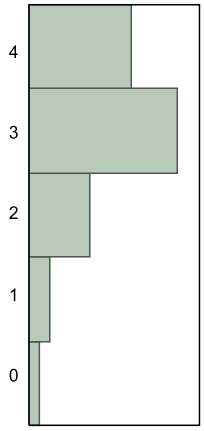


Frequencies

Level	Count	Prob
A	1	0.09091
Free Lectures	1	0.09091
Physiotherapists	1	0.09091
Professor	1	0.09091
Responsible for the school health department	1	0.09091
Special doctor in the treatment of osteoporosis and osteoporosis	1	0.09091
Specialists in this field	1	0.09091
Teacher	1	0.09091
Teacher at the university	1	0.09091
Through social media	1	0.09091
University	1	0.09091
Total	11	1.00000

N Missing
56
11 Levels

Osteoporosis education programs are effective to increase general knowledge about osteoporosis.

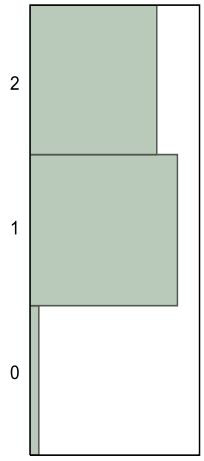


Frequencies

Level	Count	Prob
strongly disagree	2	0.02985
disagree	4	0.05970
neutral	12	0.17910
agree	29	0.43284
strongly agree	20	0.29851
Total	67	1.00000

N Missing
0
5 Levels

Attending education program about osteoporosis can play important roles to shift your health belief.

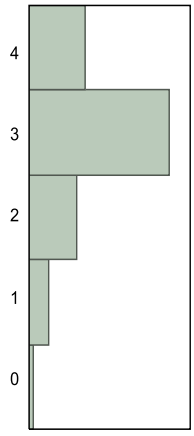


Frequencies

Level	Count	Prob
neutral	2	0.02985
agree	35	0.52239
strongly agree	30	0.44776
Total	67	1.00000

N Missing
0
3 Levels

One-day education session is effective to learn various methods to prevent osteoporosis.

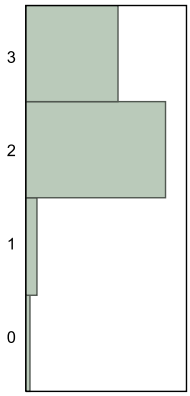


Frequencies

Level	Count	Prob
strongly disagree	1	0.01493
disagree	5	0.07463
neutral	12	0.17910
agree	35	0.52239
strongly agree	14	0.20896
Total	67	1.00000

N Missing
0
5 Levels

Public health educational program about osteoporosis reduces unhealthy lifestyles and increases the understanding of preventing osteoporosis.

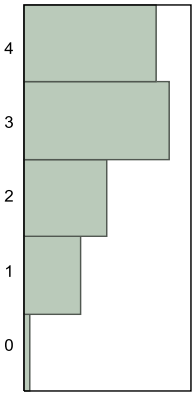


Frequencies

Level	Count	Prob
disagree	1	0.01493
neutral	3	0.04478
agree	38	0.56716
strongly agree	25	0.37313
Total	67	1.00000

N Missing
0
4 Levels

A longer than one-day educational program is more sufficient than short session to increase the awareness and enhance healthy habits.

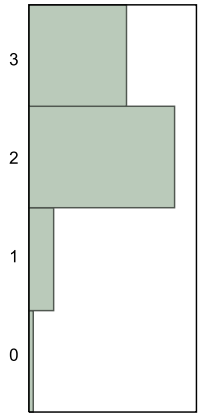


Frequencies

Level	Count	Prob
strongly disagree	1	0.01493
disagree	9	0.13433
neutral	13	0.19403
agree	23	0.34328
strongly agree	21	0.31343
Total	67	1.00000

N Missing
0
5 Levels

Osteoporosis education programs can have a positive impact on physical activity, risk factors of osteoporosis and fractures, and consumption of caffeine and calcium intake.



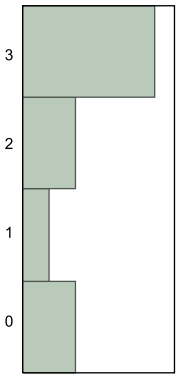
Frequencies

Level	Count	Prob
strongly disagree	1	0.01493
neutral	6	0.08955
agree	36	0.53731
strongly agree	24	0.35821
Total	67	1.00000

N Missing
0
4 Levels

Additional data was analyzed

B) Where did you receive the formal public health educational program about osteoporosis?

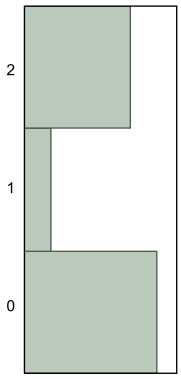


Frequencies

Level	Count	Prob
Course	2	0.20000
Hospital	1	0.10000
Internet	2	0.20000
School	5	0.50000
Total	10	1.00000

N Missing
0
4 Levels

3) *Who did give you the formal public health educational program about osteoporosis?*



Frequencies

Level	Count	Prob
Medical professional	5	0.50000
Social Media	1	0.10000
Teacher	4	0.40000
Total	10	1.00000

N Missing
0
3 Levels