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The Relationship Between Exercise Knowledge and Exercise Self-Efficacy for the Prevention of Osteoporosis

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THE RELATIONSHIP BETWEEN EXERCISE KNOWLEDGE AND EXERCISE SELF-EFFICACY FOR THE PREVENTION OF OSTEOPOROSIS

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ABSTRACT

THE RELATIONSHIP BETWEEN EXERCISE KNOWLDEGE AND EXERCISE SELF-EFFICACY FOR THE PREVENTION OF OSTEOPOROSIS

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The conceptual framework for this study was Self-efficacy (Bandura, 1977), based on Social Cognitive Theory (Bandura, 1986). The purpose of this study was to determine if there is a relationship between exercise knowledge and exercise self-efficacy for the prevention of osteoporosis in young adults. Population selection was based on clinical research findings that bone health is affected by habits early in life, such as calcium intake and establishing regular exercise, which affect bone health in later years. The study was a secondary data analysis of 353 females and males 18 to 35 years of age, primarily Caucasian (92.9%). Results from descriptive statistics demonstrated no statistically significant relationship between osteoporosis knowledge and exercise self-efficacy for the prevention of osteoporosis. ($r=0.02$). Additional findings revealed a generally low level of osteoporosis knowledge, mean OKT score was 10.81 ($SD=2.27$), and a moderately high level of exercise self-efficacy, mean OSE-Exercise score was 71.43 ($SD=20.62$).

Dedication

Special gratitude is due to my dearest friend, Nancy whose patience, support and understanding persisted throughout this endeavor. A special thanks is extended to my family and friends for their love and enthusiastic support of this project

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CHAPTER 1

INTRODUCTION

Osteoporosis is the most common bone disease, and it threatens more than 28 million Americans. It is a major cause of approximately 1.5 million bone fractures annually in the United States (National Osteoporosis Foundation, 1997; Taggart & Connor, 1995; U.S. Department of Health and Human Services Public Health Service, 2000). Although osteoporosis can affect both sexes, this disease is four times more common in women than men (Cooper, 1987; Taggart & Connor, 1995) affecting 13% to 18% of women aged 50 years and older and an estimated 3% to 6% of men over 50 years (U.S. Department of Health and Human Services Public Health Service, 2000). Men's lifetime risk of hip fractures is greater than their risk of succumbing to prostate cancer (Samside, 1997).

Intervention and management of this disease presents a major challenge that confronts healthcare professionals. The 1996 estimate for healthcare costs for osteoporosis related health issues is in excess of $13.8 billion per year or $38 million per day (National Osteoporosis Foundation, 1997). These figures only signify the direct healthcare costs. They do not identify the costs associated with human suffering and the loss of an individual's independence.

Osteoporosis is considered an age-related condition that is typified by a decrease in bone mass, characterized by low bone quality and micro-architectural deterioration of bone tissue with a consequent increase in bone fragility resulting in an increased susceptibility for fractures of the hip, spine, and wrist (Leslie & Pierre, 1999; Samside, 1997). It is estimated that one in three women and one in eight men aged 50 years and older will sustain an osteoporotic-related fracture in their lifetime (Riggs & Melton, 1995). As both men and women approach the age of 40 years they begin to experience bone loss equivalent to .3% to .5% per year (Leslie & Pierre, 1999). As women approach menopause and experience a decline in ovarian estrogen production, they may experience an additional skeletal bone loss of 3% to 5% per year for five to seven years (Leslie & Pierre, 1999). This accelerated bone loss contributes to postmenopausal osteoporosis.

Studies have demonstrated that changes in lifestyle could prevent or delay the onset or development of osteoporosis (Leslie & Pierre, 1999; McDermott, Christensen, & Lattimer, 2001). These lifestyle changes may prevent the sequelae associated with this disease such as pain, deformity, and disability that can dramatically alter a person's quality of life. An accepted exercise strategy associated with the prevention of osteoporosis is regular weight bearing exercise and muscle strengthening (Aguilar et al., 1999; Kannus, 1999; Rutherford, 1999; Ulrich, Georgiou, Gillis, & Snow, 1999).

Healthy People 2010 (U.S. Department of Health and Human Services Public Health Service, 2000) stresses the importance of research that relates to the study of osteoporosis leading to interventions for osteoporosis prevention, such as exercise. These health-promoting interventions would assist in the reduction of further bone loss subsequent to disease occurrence and the risk of fractures. Interventions identified for primary prevention, prior to the occurrence of the disease, include the promotion of routine exercise throughout the lifespan.

However, changes in exercise behaviors are difficult to initiate and maintain. Unfortunately there is limited research regarding which factors might influence individuals to adopt exercise for the prevention of osteoporosis (Taggart & Connor, 1995). In order to gain a clearer understanding of exercise behavior aimed at osteoporosis prevention, the influence of psychological variables that can affect behavior change require more investigation.

Research has supported exercise knowledge as a cognitive determinant for the promotion of exercise behavior for risk reduction and disease prevention in many chronic diseases (Ali, 1996; Dunn, Marcus, Kampert, Garcia, Kohl, & Blair, 1999; Sedlak, Doheny, & Jones, 1998; Taggart & Connor, 1995). Exercise knowledge has also been shown to be a cognitive determinant of self-efficacy for exercise (Hellman, 1997; Sedlak, Doheny, & Estok, 2000, Sedlak et al., 1998), which is an individual's judgment of his or her ability to carry out a behavior or skill (Bandura, 1986). In studies where the relationship of knowledge and self-efficacy were examined, the amount of exercise self-efficacy could be predicted by the amount of one's reported knowledge about exercise (Ali, 1996; Blalock et al., 1996; Sedlak et al., 1998; Sorensen, 1997).

Research involving different populations ranging from adolescent to elderly and healthy to symptomatic have demonstrated that exercise self-efficacy is predictive of an individual's amount of exercise adherence and compliance (Ali, 1996; Elder, Ayala, & Harris, 1999; McAuley & Blissmer, 2000; Stutts, 1997). These studies have demonstrated a linear relationship between self-efficacy and exercise behavior. When there is low self-efficacy for exercise, individuals have reported little or no exercise behavior. In contrast, as an individual's level of self-efficacy increases so does reported exercise behavior.

Considering this strong conceptual correlation, exercise self-efficacy may be considered predictive of actual exercise behavior.

Since results from studies regarding the prevention and management of other chronic diseases have demonstrated a positive relationship between exercise knowledge and exercise self-efficacy, it would be important to examine these concepts in relationship to osteoporosis. If exercise knowledge for the prevention of osteoporosis is related to one's self-efficacy for exercise, then increasing one's knowledge could increase one's self-efficacy. Since exercise self-efficacy is considered predictive of actual exercise behavior then there could be an increase in one's actual exercise behavior for the prevention of osteoporosis.

If nurses are to promote exercise for osteoporosis prevention, it is imperative to have a better understanding of the relationship between osteoporosis exercise knowledge and exercise self-efficacy. Understanding this relationship may assist nurses in developing better programs to promote osteoporosis prevention. Unfortunately, there is limited research regarding osteoporosis exercise knowledge and its relationship to exercise self-efficacy for the prevention of osteoporosis.

Purpose

In order to add to the body of science and thus provide information for nurses, the purpose of this study was to examine the relationship between osteoporosis exercise knowledge and self-efficacy for exercise for the prevention of osteoporosis. The data for the present study were from a larger osteoporosis study conducted by Gendler, Martin, Coviak, Mellon, Kim, and Rodriguez-Fisher (1998) for further psychometric analysis of the Osteoporosis Health Belief Scale (Kim, Horan, Gendler, & Patel, 1991), the

Osteoporosis Knowledge Test (Kim, Horan, & Gendler, 1991), and the Osteoporosis Self-efficacy Scale (Horan, Kim, Gendler, Froman, & Patel, 1998) on a young population.

CHAPTER 2

CONCEPTUAL FRAMEWORK AND LITERATURE REVIEW

Conceptual Framework

Bandura's (1977) Social Learning Theory elaborates upon a method to predict and explain human behavior by the use of various constructs. Self-efficacy is one of the central constructs of Bandura's Social Cognitive Theory (1986), which stemmed from Social Learning Theory, that is believed to be critical to behavior change. Self-efficacy affects the amount of effort an individual will invest in a given task and the degree of performance that the individual will attain (Ewart, Taylor, Reese, & Debusk, 1983). Self-efficacy is defined as an individual's judgment of his or her ability to carry out a behavior or skill. Individuals who have high self-efficacy for a skill are more likely to perform that skill (Bandura, 1986). Furthermore, according to Bandura's Social Cognitive Theory, a person is motivated to engage in a behavior based on two beliefs: (a) the behavior will result in a favorable outcome (outcome expectation), and (b) one considers oneself capable of executing the behavior (efficacy expectation). Self-efficacy expectation is also the conviction that one can successfully execute the behavior to produce outcomes (Bandura, 1977). Although self-efficacy expectation and outcomes expectation are both considered important, self-efficacy expectation is considered a more central determinant of subsequent behavior than the expectation of a given outcome. According to Bandura (1986), the perceptions of efficacy expectation are related to behavior in three ways: the conviction of one's ability to (a) initiate the activity, (b) maintain the activity, and (c) persist in performing the activity in the face of obstacles. A person's confidence in engaging in a positive behavior is represented by his or her level of self-efficacy.

Bandura (1977) described four sources of information that enhance self-efficacy: (1) performance accomplishments (learning from individual experience); (2) verbal persuasion (acquiring knowledge from a healthcare provider); (3) vicarious experiences (observing successful performance of others); and (4) emotional arousal (enhancing a positive mood state by providing information regarding benefits of behavior change). Reflecting upon these sources of information, it would be highly suggestive that knowledge acquired through these sources, such as verbal persuasion, would impact self-efficacy. Bandura (1986) identified knowledge as an important precondition to adopting behaviors. Bandura (1986) stated that self-efficacy may be essential in translating knowledge into behavior. Therefore, knowledge may also be related to behavior through self-efficacy. Figure 1 illustrates the relationship between knowledge, efficacy expectation, and behavior as described by Bandura (1986).

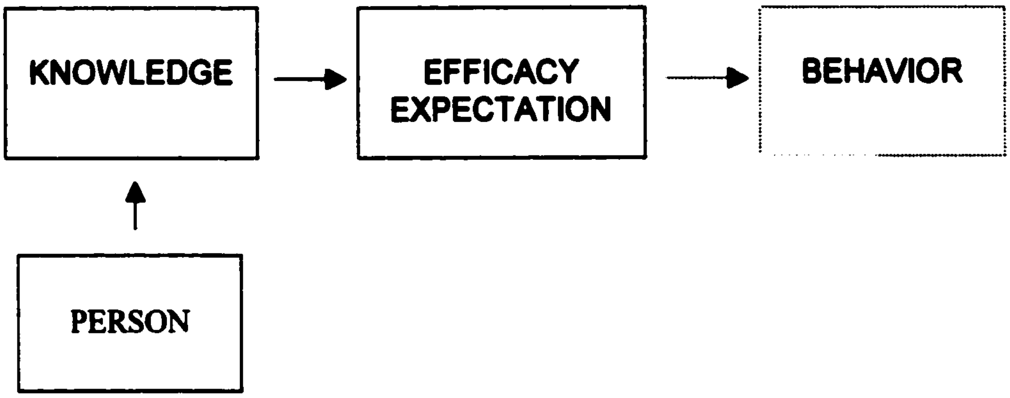
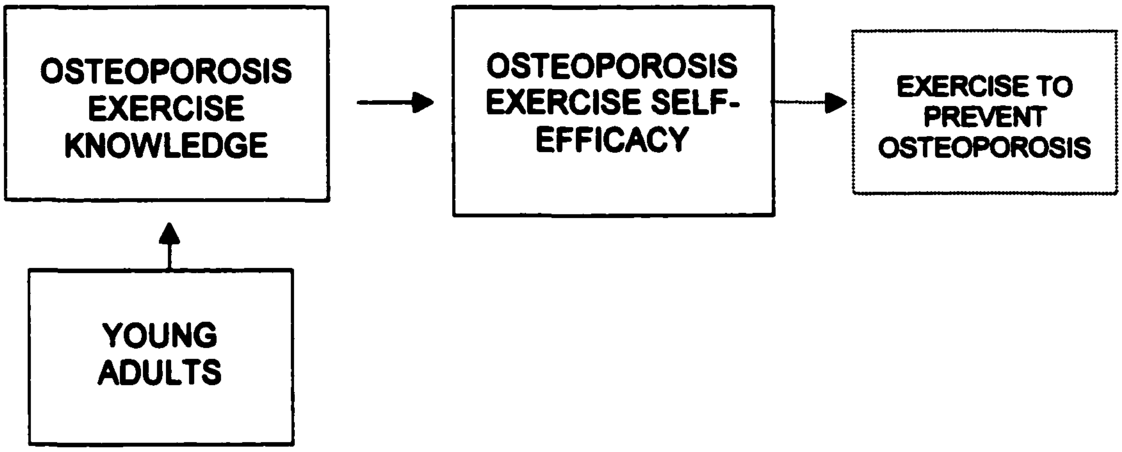


Figure 1. Self-efficacy model illustrates the relationship between knowledge, efficacy expectation, and behavior.

Bandura, A. (1986). Social foundation of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

In order to examine these concepts in osteoporosis prevention, the present study examined two concepts: osteoporosis exercise knowledge and self-efficacy for exercise in osteoporosis prevention. Studies have demonstrated that the amount of exercise self-efficacy could be predicted by the amount of one's reported knowledge about exercise (Hellman, 1997; Sedlak et al., 1998; Sorensen, 1997; Sedlak, Doheny, & Estok, 2000). Furthermore, research conducted by Conn (1998), Oman and King (1998), and Sorensen (1997) identified that self-efficacy perceptions were significant predictors of exercise. A person's confidence in engaging in a positive behavior, such as exercise for osteoporosis prevention across a wide range of specific, salient situations, may be represented by his or her level of self-efficacy. Therefore, self-efficacy expectations, assuming to be influenced by knowledge, were the cognitive determinants of exercise behavior primarily studied in this research.

Bandura (1986) argued that the measurement of self-efficacy must be specific to the target behavior. As a result of the need for this specificity, the purpose of this study was to examine osteoporosis exercise "knowledge" and its relationship to "self-efficacy" for exercise for the prevention of osteoporosis. The following model showing the relationship between osteoporosis knowledge and osteoporosis exercise self-efficacy, depicted in Figure 2, was used for this study.



Note that the concepts measured in this study are identified by bold lines.

Figure 2. Model for Study of Young Adults' Osteoporosis Exercise Knowledge and Osteoporosis Exercise Self-Efficacy Influence on Exercise Behavior. This model illustrates how osteoporosis self-efficacy, influenced by osteoporosis exercise knowledge, is theoretically assumed to be the cognitive determinant of exercise behavior for the prevention of osteoporosis.

Bandura, A. (1986). Social foundation of thought and action: A social cognitive theory. Englewood Cliffs, NJ: Prentice-Hall.

Review of Literature

The young adult population, 18 to 35 years of age, represents the age group in which optimal bone development is likely to occur and lifestyle behaviors are either initiated or reinforced. For purposes of this study, factors for osteoporosis prevention that were especially relevant to the young adult population, the application of self-efficacy concept in relationship to osteoporosis exercise behavior and osteoporosis knowledge of exercise for the prevention of osteoporosis, were explored. Relevant studies with this population were reviewed, followed with a brief summary regarding the results and applicability for the current study of osteoporosis exercise knowledge and exercise self-efficacy for osteoporosis prevention.

Overview of Osteoporosis Disease Process and Risk Factors

Osteoporosis is identified as the most common metabolic bone disease in the United States. This disease is characterized by poor bone quality and micro-architectural deterioration of bone tissue. This deterioration leads to increased bone fragility and increased susceptibility to fracture (Leslie & Pierre, 1999). The physiological changes in the bone architecture are influenced by lifestyle factors established during young adulthood. Fortunately bone is a dynamic organ that is in a continual state of remodeling throughout one's lifetime. During the complex process of bone remodeling, a number of cellular functions directed toward resorption and formation of new bone are accomplished. However there are certain factors, such as weight-bearing, that influence this process (Canalis, 1996).

A major factor in the prevention of osteoporosis is the attainment of peak bone mass, which is the maximum amount of bone that one attains in one's lifetime. Both men and women achieve peak bone mass between the ages of 25 and 35 years of age (Bilezikian, 1996) or within three years after linear growth stops (Hightower, 2000). Osteoporosis incidence is lower in individuals who have attained high peak bone mass. Factors that influence the development of bone mass must be addressed prior to one's attainment of peak bone mass.

Selected risk factors for osteoporosis fall in a variety of categories: medications (use of birth control pills, Depo-Provera, tobacco, alcohol and steroids), nutrition (inadequate calcium and vitamin D intake and high protein diets), and lifestyle (physical inactivity or excessive exercise) (Leslie & Pierre, 1999; Sedlak et al., 1998).

Habitual physical activity by adolescents and young adults is reflected in their increased bone acquisition. Researchers have documented the importance of weight-bearing exercise on the development and maintenance of bone mass (Feicht, 1990; Marcus, 1996). Conversely, the loss of bone was linked with disuse in research conducted by various authors (Feicht, 1990; Marcus, 1996; National Institutes of Arthritis and Musculoskeletal and Skin Diseases, 1997). A national survey of college students was conducted in 1995 by the Centers for Disease Control regarding youth risk behaviors. This study revealed that only 30% of college women and 37% of college men, aged 18 to 24, participated in strengthening exercises. This study also reported that women participated less in team sports than males and were more likely than male students to report exercising for less than 20 minutes during their physical education classes.

In a prospective cohort study conducted by Valimaki et al., (1994), the contribution of lifestyle factors such as exercise, smoking, and calcium intake to peak bone mass in adolescents and young adults was evaluated after 11 years' follow-up. The purpose of the study was to investigate the role of these lifestyle factors as determinants of peak bone mass. A total of 264 subjects, (153 females and 111 males) aged 9 to 18 years, were included at the beginning of the study. At the time of measurement of bone mineral density, performed by dual energy x-ray absorptiometry (DEXA), at the end of the study, the participants ranged in age from 20 to 29 years. In groups with the lowest and highest levels of exercise behaviors, there were significant differences in the femoral bone mineral densities (adjusted for age and weight) (low exercisers 0.918 g/cm^2) and (high exercisers 0.988 g/cm^2) for women ($p<0.015$) and 0.943 g/cm^2 for low exercisers and 1.042 g/cm^2 for high exercisers for men ($p<.005$). In men the femoral bone mineral densities (adjusted for age, weight, and exercise) were 1.022 g/cm^2 and 0.923 g/cm^2 for the groups with the lowest and highest values of smoking index ($p=0.054$, analysis of covariance). In women the femoral bone mineral density (adjusted for age, weight, and exercise) increased to 0.962 g/cm^2 ($p=0.099$) (percentage difference of 4.7%) for those with a calcium intake of 800 to 1,200 mg but did not increase any further at higher calcium intakes ($p=0.089$) during the study. To evaluate the effect of weight, age, exercise, and smoking on bone mineral density, multiple regression analysis on bone mineral density for the femoral neck was performed. Weight, exercise, age, and smoking were independent predictors for bone mineral density in men. However, on multiple regression analysis on bone mineral density for the femoral neck for women, the independent predictors were weight, exercise, and age. The combination of these predictors explained 38% of the variance in bone mineral density in women and 46% in men. This study suggests that regular exercise, weight, calcium intake, and avoidance of smoking are important variables in achieving maximal peak bone mass in adolescents and young adults.

The effect of physical activity and calcium supplementation on bone mineral density (BMD) in young women was explored in a two-year, randomized, intervention trial (Friedlander, Genant, Sadowsky, Byl, & Glur, 1995). One hundred and twenty-seven subjects (ages 20-35 years) were randomly assigned either to an exercise program, containing both aerobics and weight training components, or to a stretching program. In addition to the exercise portion of the study, a double-blinded study that measured the effect of calcium intake on all subjects (exercise and stretching programs) was also performed. The total calcium intake for the calcium intervention group was 1500 mg/day including calcium supplementation and dietary intake. A placebo was given to the calcium control group without mention of dietary monitoring for calcium intake. Spinal trabecular BMD was determined using quantitative computed tomography (QCT). Spinal cortical, femoral neck, and trochanteric BMD were measured by dual energy x-ray absorptiometry (DEXA) and calcaneal BMD by single photon absorptiometry (SPA). Fitness variables included maximal aerobic capacity (VO2max) and isokinetic muscle performance of the trunk and thigh. Measurements were made at baseline, one-year, and two-years. Sixty-three subjects (32 exercise, 31 stretching) completed the study, and all the measured bone parameters indicated a positive influence of the exercise intervention. There were significant increases in BMD in the exercise versus the stretching group. The exercise group demonstrated a significant gain in BMD for spinal cortical (1.3 +/- 2.8%, $p < 0.02$), femoral trochanteric (2.6 +/- 6.1%, $p < 0.05$), and calcaneal (5.6 +/- 5.1, $p < 0.01$) measurements. In contrast to exercise, the calcium intervention had no effect on any of the bone parameters. However, a limitation to the calcium intervention portion of the study is a lack of documentation of dietary calcium intake for the control group. In regard to fitness parameters, the exercise group completed the study with significant gains in VO2max and isokinetic (peak torque) values for the knee flexion and extension and trunk extension. This study indicates that over a two-year period, a combined regimen of aerobics and weight training has beneficial effects on BMD and fitness parameters in young women. However, the addition of daily calcium supplementation did not add significant benefit to the intervention group.

In summary, these studies suggest that regular exercise is important in achieving maximal peak bone mass in adolescents and young adults. Although the benefits of exercise for strengthening bones extend beyond early adulthood, the opportunities for true osteoporosis prevention are limited to this period due to the development of peak bone mass by age 30 to 35 years. Therefore a primary goal of osteoporosis prevention in this population is to increase peak bone mass in early adulthood through lifestyle changes. A strategy for increasing peak bone mass is through participation in physical activity, specifically weight-bearing exercises. Consequently, interventions that encourage and support lifestyle changes, as exercise for the prevention of osteoporosis, need to be identified.

Knowledge and Changes in Health Behaviors

Based on Bandura's Social Cognitive Theory (1986), when individuals are given knowledge and evidence, they will change their health behaviors in ways conducive to health promotion or risk reduction. These assumptions have been supported by research studies that hypothesize that knowledge has resulted in changes in health behaviors

(Biddle & Ashford, 1988; Blalock et al., 2000). The relationship between exercise knowledge and exercise behavior will be explored in the following literature review.

Biddle and Ashford (1988) conducted two exploratory, community-based, cross-sectional retrospective studies. They examined the cognitions of aerobic exercisers and nonexercisers regarding health beliefs, exercise cognitions, exercise knowledge, and attributions of exercisers having a more positive cognitive profile. Exercisers were classified as those who participated at least twice a week in an aerobic-type physical exercise and non-exercisers were those who participated occasionally, less than once per month, or never. Analysis looked specifically at the differences between exercisers and nonexercisers, between males and females, and between those under 40 and those over 40 years of age. The study took place in England.

In Study 1, the sample was comprised of 433 (199 women; 234 men) with 263 under the age of 40. The 14-item (true-false) questionnaire that assessed beliefs about general and cardiovascular health, intention to attend a screening clinic, health attributions (locus of causality of CHD), and knowledge of health was administered. Subjects were also asked about participation in aerobic physical activity. Results revealed that exercisers and nonexercisers were significantly different in their health cognition (beliefs and attributions concerning health and exercise) ($P < 0.0001$). Exercisers were higher in exercise knowledge, health motivation, and perceptions of control, and had done more in the past to maintain their cardiovascular health. Nonexercisers had more perceptions of vulnerability to general and cardiac ill health and perceived more barriers to attending a hypothetical cardiac screening clinic. There was also a significant effect for gender ($p < .001$). Women were significantly higher in perception of general health vulnerability and health concern. Men scored higher in health motivation and perception of heart vulnerability and were more likely to have done something about cardiovascular health in the past. Age had a significant effect ($p < 0.0001$) on ten variables. Participants under 40 years of age were higher on knowledge, health motivation, and perceived benefits of action. Those over 40 years of age had higher perceptions of general health and heart vulnerability, heart concern, and health saliency. They were more likely to have had a recent cardiovascular check-up and were more likely to have suffered recent cardiovascular health problems or had close family members who had (Biddle & Ashford, 1988). This study supports the relationship between exercise knowledge, health beliefs, age, gender, and exercise behavior for cardiac risk reduction and health promotion.

In Study 2, Biddle and Ashford (1988) replicated their first study with another sample in order to extend their previous study. They added two more aims: (1) to ascertain the nature of differences, if any, between exercisers and nonexercisers in health and exercise beliefs, and health knowledge and attributions and (2) to ascertain the nature of gender and age differences if any, on the same variables. The sample consisted of 468 participants (238 men; 230 women). MANOVA revealed that exercisers and nonexercisers were significantly different ($p < 0.0001$). Exercisers were higher in their perceptions regarding their intention to exercise, identified greater importance and benefits for exercise, and had higher health motivation and health saliency. They also had higher beliefs in exercise control and were more likely to have exercised and modified other health habits in the past. Nonexercisers had higher perceptions of general health vulnerability. The two age groups (under and over 40 years) were significantly different

($p < .0001$). The older group had higher perceptions of health saliency. The younger group had better knowledge, felt exercise was safer and had the highest intention to exercise. Also, other health behaviors were less likely to be adopted by those over 40 years of age who were non-exercisers. It also showed that older people had less exercise knowledge and more negative beliefs and worries about exercise than younger people. This study indicates that beliefs are different between groups of exercisers and nonexercisers, and between gender and age groups. Perceptions of vulnerability to ill health were associated with sedentary behavior.

In an experimental design research conducted by Blalock et al. (2000), the effects of abbreviated educational materials on osteoporosis-related knowledge, beliefs, and behaviors were studied. Five hundred thirty six participants were randomly assigned to one of four groups and given packets on either general information of osteoporosis, instructions on how to increase one's level of exercise, both packets, or no packets. Measures of osteoporosis knowledge and health beliefs were used as independent variables to predict exercise behavior in the sample of 307 women, aged 35 to 43 years. The instrument developed to assess health beliefs consisted of 17 health belief questions (five calcium intake, five exercise behavior specific, one exercise self-efficacy, one calcium intake self-efficacy, four osteoporosis specific, and one question regarding health salience). All 17 questions on the health belief instrument were assessed using multiple item responses, and scale scores were computed as the unweighted average of item responses. The health belief total scale alpha was not reported. However, the Cronbach alpha exceeded .70 for the exercise specific questions and the exercise self-efficacy question. Osteoporosis knowledge was measured by 20 true/false questions. The KR-20 for the osteoporosis knowledge instrument was .80 at the first assessment, pre-intervention. Exercise behavior was defined as weight bearing exercise at least three days per week. Exercise level was assessed by a self-report response to a series of questions asking participants how often they performed 11 weight-bearing physical activities, and the length of the workout. The number of questions and scale of possible scores were not reported. Logistic regression analyses revealed that increased knowledge of the effectiveness of exercise in reducing osteoporosis risk was associated with a greater likelihood of meeting the recommended exercise guidelines for osteoporosis prevention. This analysis also implied a correlation between increase knowledge about exercise and increase exercise behavior.

Women's knowledge and practices regarding the prevention and treatment of osteoporosis were explored in a descriptive/exploratory study conducted by Ribeiro et al. (2000) based on a convenience sample of 185 women, ages 25 to 84 years. The data were obtained through a questionnaire that was specifically designed for the purposes of this study and included a mixture of structured and open-ended questions. The method of analysis for quantitative data was not identified in this article; however, the researchers reviewed responses to the open-ended questions, and the most frequent comments and concerns were noted. The data revealed that 94% of the women in the study had read or heard something about osteoporosis from various sources. However, only 55% had found the information useful. Most of the women in the study were aware that women's bones got thinner and more brittle with age; however, only 59% realized that the same process occurred in elderly men; and 88% of women did not know that bone demineralization begins before menopause. Knowledge of risk factors for osteoporosis was generally deficient. Thirty three percent were able to identify only one risk factor correctly and 27% gave vague or incorrect responses. Only 15% of the respondents identified sedentary life style as a significant behavioral risk factor. Additional data revealed that a considerable portion of the respondents either did not exercise at all (16%) or exercised only once or twice a week (19%). Only 29% of the respondents knowingly used exercise for osteoporosis prevention. The results also indicated that women's knowledge about osteoporosis was generally deficient even among those who were reasonably well educated. They were unaware that the onset of bone demineralization starts before menopause thus conceivably resulting in thoughts that preventative measures, such as exercise, are unnecessary until after menopause. The findings of this study suggest that women possess limited knowledge about osteoporosis. Additionally, they were not taking adequate measures, such as exercise, to prevent or treat osteoporosis as they age.

In a recent descriptive correlational study by Taggart and Connor (1995), the Health Belief Model (HBM) was used as a framework to investigate the relationship of exercise habits to knowledge about osteoporosis and health beliefs. The convenience sample consisted of 113 female college students, aged 18 to 53 (M = 25). It was hypothesized that the perception of susceptibility to osteoporosis and the benefits of exercise in preventing it, in contrast to recognition of barriers to exercise, would be positively related to the frequency of an individual's exercise. Participants assessed their exercise habits utilizing a self-report of weekly exercises listed according to type and frequency. The Osteoporosis Health Belief Scale (Kim et al., 1991), a closed-ended questionnaire, consisting of five subscales (susceptibility, seriousness, exercise barriers, exercise benefits, and health motivation) was used to collect the data. Cronbach alphas for internal consistency ranged from .61 to .80 for each of the five subscales (Kim et al., 1991). The reliability for this questionnaire was not reported for this study. The Osteoporosis Knowledge Test (Kim et al., 1991), was used to measure participants' knowledge of risk factors for osteoporosis, its potential consequences, and the benefits of exercise for the prevention of osteoporosis. Reliability coefficient for internal consistency (KR 20) for the exercise subscale of the Osteoporosis Knowledge Test was .69 (Kim et al., 1991). The results varied for the relationship between specific health beliefs, knowledge, and exercise. Data analysis using Pearson correlation coefficients showed no statistically significant relationships between frequency of exercise and either osteoporosis knowledge or perceived susceptibility. However, results demonstrated that students who were most knowledgeable about osteoporosis perceived more benefits of exercise ($r = .25$, $p < .01$). Students who had higher scores on perceived seriousness of osteoporosis had higher perceived susceptibility to osteoporosis ($r = .24$, $p < .05$). Also, there was a positive relationship between age and perception of barriers to exercise ($r = .94$, $p < .001$). Significant positive relationships were also shown between age and knowledge scores ($r = .19$, $p < .04$) and age and health motivation ($r = .19$, $< .05$). Thus, the older the student, the greater the knowledge of osteoporosis and the higher health motivation.

Although older students had greater knowledge of osteoporosis, they also identified more barriers ($r = .94$, $p < .01$) to exercise than did the younger students. Results from the participants' self-report of exercise habits revealed that those who exercised more did so for reasons other than osteoporosis prevention (increased muscle strength, weight control, improved appearance, and enhanced cardiovascular function).

This study did find significant relationships between knowledge and perceived benefits of exercise; however, it did not identify any statistically significant relationship between exercise habits and osteoporosis knowledge (Taggart & Connor, 1995).

It is evident in the studies reviewed that the relationship between exercise knowledge and exercise behavior is inconclusive due to conflicting results. Generally, individuals possessed limited knowledge of osteoporosis. None-the-less, in some studies individuals who were more prone to exercise had more knowledge of either the general benefits or osteoporosis risk preventative benefits of exercise. The literature also supports the proposition that knowledge alone is not the only variable related to exercise behavior. Although a person may be knowledgeable about the benefits of exercise, factors such as feelings of vulnerability or perceived barriers to exercise may inhibit a person from initiating exercise behavior. It is therefore important to address other factors associated with exercise for example, a person's perceived efficacy to initiate and maintain exercise as a health promoting behavior. The concept of self-efficacy addresses the perceptions that individuals have regarding their ability to implement behavior change, maintain the behavior, and persist in performing the behavior in the face of obstacles (Bandura, 1986).

Self-efficacy

One recent study (Chen, Neufeld, & Skinner, 1999) utilized the HBM along with two other models (Model of Human Occupation and Health Locus of Control) to investigate factors influencing compliance with a home exercise program. The sample consisted of 62 participants (39 women and 23 men) in an upper extremity rehabilitation program. Ages ranged from 23 to 88 years (M = 47.8). Questionnaires consisted of: a 19-item 6-point Likert scale Health Belief Survey, developed by the researcher, designed to assess perceived severity of health condition (seven-items), perceived benefits (two-items), perceived barriers (eight-items), and self-efficacy for performing a prescribed home exercise program (two-items); an 18-item 6-point Likert Multidimensional Health Locus of Control Scale (Wallston & Wallston, 1978) that measured perception of internal control; Modified Activity Profile, based on Baum's (1995) Activity Card Sort to determine perceived capacities and extent of enjoyable activities by persons with upper-extremity orthopedic conditions; and a home exercise self-report diary. Data analyses were performed using Spearman rank order correlation, *t*-test, chi-square, and multiple linear regressions. Results of stepwise regression revealed that only one variable, perceived self-efficacy, was significantly related to exercise compliance behavior ($p < .01$). Exercise compliance was determined by comparing the participant's self-report of performed exercise to the therapist's recommendations. Participants with higher perceived self-efficacy about the home exercises were more compliant with therapists' recommendations.

Laffrey (2000) conducted a study on physical activity among 71 older Mexican American women ages 60 to 87 years. Theories of stage of readiness for change and self-efficacy were used to guide this research that focused on relationships of age, stage of readiness for exercise, and exercise self-efficacy on performance of physical activity and preference for leisure physical activities. Physical activity data were collected by use of a Seven-Day Physical Activity Recall Questionnaire (PAR) (Blair, 1984). In this sample, 56 women reported performing a minimum of one leisure activity, predominantly walking. Self-efficacy for exercise was measured with a self-sfficacy questionnaire developed by Marcus and Owen (1992), which consisted of a five-item measure of confidence about one's ability to persist with exercise in a variety of situations. Stage of readiness for change (precontemplation, contemplation, preparation, action, and maintenance stages) was measured by the Stage of Readiness for Change for Exercise Questionnaire (SOR). Marcus, Selby, Niaura, and Rossi (1992) adapted the SOR from Prochaska and DiClemente's (1984) Stage of Readiness for Smoking Cessation Questionnaire. Comparing scores with scores on the PAR established concurrent validity of the SOR. The revised SOR showed a κ index (coefficient of alienation that measures the lack of relationship between two variables) of reliability of .78 over a two-week period. Results from a Pearson's correlation analysis demonstrated that decreased age was significantly and inversely related to an increase in daily activity, leisure/sport activity, and total habitual activity, but was not significantly related to stage of readiness or exercise self-efficacy. Stage of increased readiness and exercise self-efficacy was significantly and positively related to increases in leisure/sport activity and total habitual activity, but only self-efficacy was significantly positively related to daily activity. Stage of readiness and exercise self-efficacy also demonstrated a positive linear relationship. A one-way analysis of variance was used to examine exercise self-efficacy scores among the stage of exercise readiness groups. Self-efficacy was found to differ significantly by stage of readiness ($F(4,59) = 7.06$, $p < .01$). Three hierarchical multiple regression analyses were used to determine the extent that age, self-efficacy, and stage of readiness predicted total habitual activity, daily activity, and leisure/sport activity. Age, self-efficacy, and stage of readiness accounted for 27% of the variance in daily activity and 32% of the variance in leisure/sport activity. Age accounted for 17% of the variance in daily activity. Self-efficacy and stage of readiness contributed an additional 10% to the variance in daily activity. Age was significantly and negatively related to both daily and leisure/sport activities. When the three variables of age, stage of readiness, and self-efficacy were examined together, stage of readiness did not significantly predict daily activity after accounting for age and self-efficacy, which were both significant at ($p < .01$). Following an examination of the other variables, self-efficacy was the only significant predictor of leisure/sport activity ($p < .01$) in the presence of age and stage of readiness. This study supports the relationship between self-efficacy and exercise behavior.

Knowledge and Self-efficacy

The relationship between knowledge of osteoporosis-preventive behaviors (calcium intake and exercise participation) and predictor variables of self-efficacy to perform life activities, knowledge of healthy behaviors and benefits and barriers to calcium intake and exercise were explored by a descriptive study of 233 college women, aged 17 to 42 years, mean age of 20.68 years (SD 4.30) (Ali, 1996). This study was conducted utilizing the Health Promotion Model (Pender, 1987). Exercise behavior was assessed by a self-report of physical activities during the course of an average week. Participants were asked if they exercised or not. Those who exercised were asked to identify which weight bearing exercises they performed, including the total number of minutes and number of days per week that the activity was performed. A total exercise score was expressed in minutes per week. This measurement of exercise behavior was previously tested in a population of postmenopausal women and had a test-retest reliability coefficient of 0.910 over a two-week period. Only 3% of this population reported performing regular exercise, 62% reported exercising irregularly, and 35%

reported exercising when they consumed a high caloric intake. The mean total exercise minutes/week was 233.58. Self-efficacy was measured by Sherer and Adam's (1983) General Self-Efficacy Scale. In this study, the 17-item scale had a Cronbach's alpha of 0.899. Knowledge of healthy osteoporosis-preventive behaviors was measured by a six-item modified knowledge test that addressed calcium, exercise, smoking and alcohol consumption (Ali & Bennett, 1992). Forward stepwise multiple regression was used to predict exercise behaviors. The women who perceived themselves as having a higher level of general self-efficacy were more knowledgeable of osteoporosis-preventive behaviors and perceived greater benefits to exercise participation. Their higher general level of self-efficacy was also predictive of increased exercise performance. Study results support a positive relationship between exercise knowledge and general self-efficacy. Unfortunately exercise self-efficacy for the prevention of osteoporosis was not specifically examined in this study. An additional significant finding of this study identified weaknesses of this population regarding knowledge of exercise related to osteoporosis prevention. None of the participants had knowledge about exercise and how it strengthens bones and increases bone mass to avert brittle bones associated with old age.

In a cross-sectional study conducted by Blalock et al. (1996) of 452 premenopausal women, predictors of osteoporosis exercise behaviors were examined. A mailed questionnaire assessed stage in the precaution adoption process and 12 knowledge and attitudinal variables of which eight were associated with participation in weight-bearing exercise. Exercise state was measured by an instrument adopted from the Minnesota Leisure Time Physical Activity Questionnaire (Taylor et al., 1978). Women were asked whether they had participated in any of 10 different exercise activities on a regular basis during the preceding month. Osteoporosis knowledge was assessed by a 60-item true/false questionnaire. Exercise Self-efficacy was assessed by three items from the Osteoporosis Self-Efficacy Scale (Horan, Kim, Gendler, & Patel, 1994). Measures of health motivation, perceived severity of osteoporosis, barriers and concerns related to calcium intake and exercise behavior were either from or adopted from the Osteoporosis Health Belief Scale (Kim, Horan, Gendler, & Patel, 1991). Women were classified into one of seven stages of exercise, dependent upon exercise behavior. Stage 1 consisted of individuals who never seriously thought about increasing exercise currently performed, to Stage 7 consisting of currently doing things to increase the amount of exercise performed. Chi-square analyses were used to determine if women in different stages differed with respect to their interest in acquiring knowledge about osteoporosis. Women in Stage 1 had less knowledge of osteoporosis than did women in Stage 2 ($t(24) = -2.87$, $p < .01$). Women in Stage 4 perceived exercise as more inconvenient (barrier) than did women in Stage 5 ($t(177) = 3.69$, $p < .001$). Women in Stage 6 perceived exercise as more inconvenient than did women in Stage 7 ($t(209) = 2.94$, $p < .01$). A stepwise discriminant analysis to test for interactions between selected variables revealed that education (years of school) and self-efficacy predicted exercise stage. Post hoc comparisons between exercise stages revealed that never-engaged women (Stages 1 & 2) had less knowledge about osteoporosis than women in any of the later stages. Currently engaged women (Stages 4 & 5) reported more exercise benefits and higher self-efficacy. Compared with women in any of the earlier stages, women in the acting stage (Stages 6 & 7) reported more health motivation and greater self-efficacy, stronger beliefs in the effectiveness or benefits of exercise in relation to osteoporosis risk reduction, and fewer exercise barriers. Finally women in Stage 1 reported lower self-efficacy, more exercise inconvenience and fewer exercise benefits than women in higher stages of exercise. A stepwise discriminant analysis revealed four significant independent predicators of exercise stage: exercise inconvenience, ($F(3, 429) = 10.70$, $p < .0001$); self-efficacy ($F(3, 429) = 5.85$, $p < .001$); exercise benefits, ($F(3,429) = 4.50$, $p < .01$); and health motivation, ($F, (3,429) = 4.38$, $p < .01$). These exercise stage predictors were associated with reporting more exercise benefits and higher self-efficacy. The variable most strongly associated with exercise behavior was self-efficacy. However, knowledge and perceived benefits of exercise were identified as important discriminating factors between women who were thinking about changing their exercise behavior and those who were not.

The impact of an osteoporosis prevention program, based on the HBM (Rosenstock, 1966) and Self-Efficacy Model (Bandura, 1977), was assessed in a study of 31 college women by Sedlak et al. (1998). The study represented a classic experimental design with one control group and one treatment group. The sample included women enrolled in a freshman level pre-nursing course. Three instruments were utilized to assess osteoporosis knowledge, osteoporosis health beliefs, and self-efficacy for calcium intake and exercise for the prevention of osteoporosis. Osteoporosis knowledge was assessed utilizing a 24-item multiple-choice instrument that measured knowledge of osteoporosis (Kim et al., 1991). The test items addressed general osteoporosis knowledge and the relationship of activity levels, as well as appropriate exercise and dietary intake of calcium to prevent osteoporosis. The Osteoporosis Health Belief Scale (Kim et al., 1991), a 42 item self-report questionnaire based on the HBM, was used to measure health beliefs related to osteoporosis. The Health Belief Scale consists of seven subscales (perceived susceptibility and seriousness of developing osteoporosis, benefits of exercise, benefits of calcium intake, barriers to exercise and barriers to calcium intake for preventing the development of osteoporosis, and general health motivation). The reliability for the entire scale was .74 at pretest and .84 at posttest. Confidence to conduct activities related to osteoporosis prevention was measured by the Osteoporosis Self-Efficacy Scale (Horan et al., 1998). This measurement consists of a 12-item visual analogue scale that measures confidence in conducting activities related to osteoporosis prevention with an emphasis on exercise and dietary intake of calcium. The intervention group (n=18) participated in an educational program for three weeks, consisting of receipt of instructional materials, didactic instruction, and group discussions. The control group (n=13) met with researchers twice to complete the three tools, at pretest and posttest, as did the intervention group, but did not receive any osteoporosis information. Interestingly, at pretest and posttest subjects the control group had higher exercise self-efficacy than the experimental group (460.53 versus 427.94) and (496.46 versus 425.16) respectively out of a possible range of 0 to 600, although this was not reported as statistically significant by the authors. A repeated measures of analysis of variance was used to compare the effect of intervention on subjects' knowledge and health beliefs about osteoporosis. The intervention group had a significantly greater increase in knowledge than the control group (F-ratio = 15.08, $p < .001$). There was no statistically significant correlation found between self-efficacy and knowledge.

This study supported the use of osteoporosis education programs to improve osteoporosis knowledge and health beliefs. Findings on self-efficacy were statistically non-significant for pre and posttests in both control and intervention groups, however exercise self-efficacy scores were higher in the control group at both pretest and posttest compared to the experimental group. No relationship was identified between increased knowledge of osteoporosis and self-efficacy in the experimental group. This study presented two significant limitations, specifically, the fact that all the subjects in this study previously participated in a study on osteoporosis risk factors and a high drop out rate (49%) resulting in a small study population. Additionally, the impact of students' participation in a previous osteoporosis study may have affected their knowledge level and thus may not reflect the general college students' knowledge level of osteoporosis. This study stressed the importance of further research regarding various learning experiences to increase subjects' knowledge, self-efficacy and confidence to perform osteoporosis prevention strategies.

In an additional study conducted by Sedlak et al. (2000), the HBM was utilized to study interventions related to increasing osteoporosis knowledge, health beliefs and health behaviors in a community-based convenience sample of 138 men, aged 65 years and older. In this theory based descriptive study, four instruments were utilized consisting of the Osteoporosis Knowledge Test (OKT) (Kim et al., 1991), Osteoporosis Health Belief Scale (OHBS) (Kim et al., 1991), Osteoporosis Self-efficacy Scale (OSE-Exercise) (Horan et al., 1998), and the Osteoporosis Preventing Behaviors Survey (Doheny & Sedlak, 1995). Osteoporosis Knowledge Test is a 24-item multiple-choice instrument that measures knowledge of osteoporosis (Kim et al., 1991). The test items addressed general osteoporosis knowledge, exercise, and dietary intake of calcium to osteoporosis prevention. The percent knowledge scores on 24 questions ranged from 5 to 91 with a mean percent score of 50 (SD = 18.83). The Cronbach's alpha for the total knowledge score was .80. Utilizing a standard school grading scale of A = 90%, B = 80%, C = 70%, and D = 60%, a majority of the men (71%) failed the knowledge test. These scores indicated that men have a low level of osteoporosis knowledge. The Osteoporosis Self-Efficacy Scale, a 12-item visual analogue scale, asked subjects to rate their confidence about doing osteoporosis preventing activities (0 = least confident to 10 = most confident). This scale measured their perceived level of confidence related to performing osteoporosis prevention behaviors that addressed exercise and calcium intake. The score obtained on the Self-Efficacy Exercise subscale (items 1-6) of the Self-Efficacy Scale specifically assessed confidence in conducting exercise activities related to osteoporosis prevention. Responses on the six exercise items were summed, multiplied by 10, divided by six (six-items) and converted to percent scores for "Exercise." The Cronbach's alpha for the Exercise scale was .96, and the mean exercise score was 66.93 % (SD = 25.13). The 95% confidence interval for the mean of 66.93 % indicated that the population mean was likely to fall within the range of 64.79 % to 69.07 %. Thus men reported a moderately high (70%) level of confidence to perform exercise for the prevention of osteoporosis. Unfortunately only one third of the men in this study reported performing weight-bearing exercise a minimum of twice a week, and only 10% reported doing these exercises six or more times per week. This study identified an inverse relationship between self-efficacy for exercise and exercise performance.

In conclusion, based on the review of the literature, the variable most strongly associated with exercise behavior was self-efficacy. However, osteoporosis knowledge and perceived benefits of exercise were identified as important discriminating factors between individuals who were thinking about changing their exercise behavior and those who were not. College women who perceived themselves as having a higher level of general self-efficacy were more knowledgeable of osteoporosis-preventive behaviors and perceived greater benefits to exercise participation. Their higher general level of self-efficacy was also predictive of increased exercise performance. Study results supported a positive relationship between exercise knowledge and general self-efficacy. Premenopausal women identified four significant independent predicators of exercise stage: exercise inconvenience, self-efficacy, exercise benefits, and health motivation. These exercise stage predictors were associated with reporting more exercise benefits and higher self-efficacy. Elderly men demonstrated a low level of osteoporosis knowledge, moderately high exercise self-efficacy and low exercise performance, thus demonstrating an inverse relationship between exercise self-efficacy and exercise performance.

The literature suggests that people have limited knowledge of osteoporosis preventative behaviors. Although studies have addressed techniques to increase osteoporosis knowledge, studies examining its relationship to exercise self-efficacy have been scant or inconclusive. Therefore, the relationship between the variables of osteoporosis knowledge and exercise self-efficacy is important to understand in order to promote exercise for the prevention of osteoporosis.

Research Hypothesis

For this study, evaluating the relationship between exercise knowledge and exercise self-efficacy for the prevention of osteoporosis was explored by presenting the following research hypothesis:

H(R) 1. There is a positive relationship between osteoporosis exercise knowledge and exercise osteoporosis preventative self-efficacy in young adults.

Conceptual Definitions

For the purpose of this study, the following are the definitions of concepts:

Osteoporosis exercise knowledge. General knowledge about osteoporosis risks and the appropriate type and frequency of exercise recommended for osteoporosis prevention.

Exercise osteoporosis self-efficacy. One's perception regarding how capable one is of initiating or maintaining exercise for the prevention of osteoporosis.

Young adults. Includes those individuals who are 18 to 35 years of age.

CHAPTER 3

METHODS

Research Design

This study was conducted using a descriptive, correlational design that described relationships between variables and did not infer cause-and-effect relationships. This study was a secondary data analysis of a larger study performed for the purpose of analysis of psychometric properties of osteoporosis instruments (Gendler, Martin, Coviak, Mellon, Kim, & Rodrigues-Fisher, 1998). There was no experimental manipulation or random assignment to groups. Therefore, the aim of this study was to describe the relationship between the variables of osteoporosis exercise knowledge and exercise self-efficacy for the prevention of osteoporosis.

Setting and Sample

The convenience sample of 353 young adults, age 18 to 35 years, was extrapolated from the main study of 425 subjects. This population was selected because there is limited information regarding this age group and osteoporosis exercise knowledge and exercise self-efficacy for the prevention of osteoporosis. Bone health can be affected by habits early in life. Peak bone mass occurs around age 30. Risk for developing osteoporosis is dependent on establishing regular exercise patterns early in life that affect bone health in later years. Permission to use these data was secured from the authors (Appendix G).

Instrumentation

The Osteoporosis Knowledge Test (Kim et al., 1991) was used to measure general knowledge of osteoporosis and exercise. The Osteoporosis Exercise Self-efficacy scale (Horan et al., 1998) was used to measure perceptions about the capability of doing exercise for the prevention of osteoporosis. The Osteoporosis Knowledge Test and Self-Efficacy Scale were developed as part of ongoing research at Grand Valley State University, Allendale, Michigan, related to osteoporosis prevention with a population of 201 women 35 years and older. These instruments have been used in a variety of studies and specifically with college age students (Sedlak & Doheny, 1996; Sedlak et al., 1998). Demographic data of the sample were also described.

Demographic data. For the present study, the sample was described according to age, gender and ethnicity.

Osteoporosis knowledge test. The Osteoporosis Knowledge Test (OKT) was developed by Kim et al., (1991) and used to measure the degree of knowledge about osteoporosis risks and preventive behaviors. The OKT is a 24 item multiple-choice test regarding knowledge about risk factors for osteoporosis, exercise behaviors and calcium intake and their effects on osteoporosis. The OKT (Appendix C) consists of two subscales: Osteoporosis Knowledge Test Calcium Scale (items 1-9 and 17-24) and Osteoporosis Knowledge Test Exercise Scale (items 1-16). The OKT Calcium and OKT Exercise subscales both share nine common items (1-9). Reliability coefficients for internal consistency (KR 20) for OKT Exercise subscale is .69 (Kim et al., 1991). Validity of the OKT was evaluated by content validity and item analysis. For this study a total of 16 of the 24 OKT items were used, nine items regarding general osteoporosis knowledge (items 1–9) and the Exercise subscale (OKTE) (items 10-16). For this study, the KR-20 for OKT instrument, items 1-16, was .5361.

Osteoporosis self-efficacy exercise scale. The Osteoporosis Self-Efficacy Exercise Scale (OSE-Exercise) is a subscale of the Osteoporosis Self-Efficacy Scale (Horan et al., 1998) that measures perceptions about confidence that the subject feels about doing exercise related activities, such as walking, swimming, golfing, biking, or aerobic dancing. The OSE-Exercise (See Appendix D) consists of a ten-item instrument, comprised of a visual analog 100 millimeters long for each item. Subjects completed the questionnaire with instruction and guidance from the interviewer. Subjects were instructed to place and "X" on the line that represents their own perceptions on a continuum between "not at all confident" and "very confident." Scores range from 0 to 100.

The reliability coefficient for internal consistency (Cronbach alpha) of the OSE-Exercise Scale is .94 (Horan et al., 1998). Validity of the Osteoporosis Self-Efficacy Scale was evaluated by factor analysis and hierarchical regression analysis (Horan et al., 1998). The coefficient alpha for internal consistency on the OSE-Exercise for this study was .967.

Data Collection Procedures

The research data were originally collected from several sites at two Midwest universities: freshman health classes; students; faculty; staff; and community at Better Bones Tour; student center; wellness events; and selected physical therapy and nursing classes. The total number of subjects in this primary study totaled 425.

Human subject review procedures. The procedures as they apply to human subjects were followed. Prior to data collection, permission to conduct the study was obtained from the Human Research Review Committee of Grand Valley State University (GVSU) in 1998 and potential participants at the time of their participation. At one institution, the investigators and data collectors came to the various classes following faculty agreement and distributed the questionnaires to their classes. The questionnaires were collected from the participants upon completion. At the remaining institutions, the protocol for data collection consisted of participants completing the questionnaires at their convenience on their own time. The questionnaires were either returned to a faculty or the participants placed the questionnaires in a box outside the researcher's office. Prior to participation in the study, either a research assistant or the researchers read the following sample script to each potential participant:

> Hello, I am __________, a graduate assistant in the Kirkhof School of Nursing working with the Osteoporosis Research Project. Professors in the School of Nursing are conducting this study to better understand people's knowledge and health beliefs about osteoporosis. We would like your participation in the study. It means you would fill out some questionnaires. It will take approximately 20 minutes. We ask you to do this on your own time so that class time will not be interrupted. We would also like to contact you in the future for a follow-up to the research. Your participation is voluntary and you may withdraw from the study at any time. The information will be confidential and will not be

associated with your name. When you complete your questionnaires, please separate your consent sheet from the packet (which contains your name) and place it in the envelope outside Professor Gendler's office (230 Henry). A box will also be placed at the same location for you to place your questionnaires in.

Periodically during the data collection months, questionnaires were available at campus wellness events. Student Services were requested to have questionnaires available for distribution. Potential subjects who verbally agreed were given the written questionnaires. The length of time for a subject's participation in the study consisted of approximately 20 minutes on a single occasion to complete four self-administered questionnaires. Completion of the osteoporosis questionnaires was considered consent to participate. All subjects were invited to participate in future studies. They were asked if they were willing to be contacted by the investigators as potential participants in future studies on osteoporosis risks and prevention. Individuals were asked to complete a consent form agreeing to be contacted regarding future studies (Appendix A). This consent form was returned separately from the questionnaires. The subjects were informed that their participation was voluntary and that they were free to withdraw from the study at any time. They were informed that precautions would be taken to maintain confidentiality. Participants were asked to complete a demographic sheet (Appendix B). All demographic data were kept in a secured area accessible only to the investigators and future graduate research assistants who were trained in maintaining confidentiality. A code was constructed that maintained confidentiality and made demographic data available to investigators.

The subject population characteristics (e.g., state of health, age, sex, ethnic background) were obtained. The identified goal of this study was to collect sufficient data during a two-year period from a variety of age, gender, and ethnic groups for the purpose of psychometric analysis of osteoporosis instruments. The criteria for completing the questionnaires included age 18 years or older. The cost to the subject consisted of time and energy spent on completion of the questionnaires, which was approximately 20 minutes or less. There was no monitary remuneration given to the subjects. There were no potential risks to the subjects. Permission to perform a secondary data analysis was obtained from the Human Research Review Committee at Grand Valley State University.

CHAPTER 4

DATA ANALYSIS

The purpose of this study was to determine if there is a relationship between exercise knowledge and exercise self-efficacy for the prevention of osteoporosis in young adults aged 18 to 35 years. The hypothesis was that young adults who possessed greater osteoporosis exercise knowledge would have greater exercise self-efficacy for the prevention of osteoporosis. Product moment correlation statistics were utilized to examine the relationship between osteoporosis knowledge and exercise self-efficacy. The independent variable was exercise knowledge as measured by the Osteoporosis Knowledge Test (OKT) (questions 1-16) (Kim et al., 1991). The dependent variable was the level of exercise self-efficacy as measured by the Osteoporosis Self-efficacy Exercise Scale (OSE-Exercise) (Horan et al., 1998). The sample was described on gender, age and ethnicity, and the relationship of gender and age to osteoporosis knowledge and exercise self-efficacy. The standard Statistical Package for the Social Sciences (SPSS 10.0) was used to analyze the data. The level of significance was defined as an alpha of .05.

Demographic Data

There was a total of 353 subjects with 226 (64%) females and 96 (27.2%) males. There were 31 subjects (8.8%) with missing gender data. The subjects ranged in age from 18 to 35 years, with a mean of 20.13 years (SD = 3.03). The mean age for females was 20 years (SD = 3.07). The mean age for males was 19.71 (SD = 2.64). The subjects were primarily Caucasian (n=328, 92.9%), followed by Asian (n=6, 1.7%), Black (n=6, 1.7%), Latino (n=3, 0.9%), Native American (n=1, 0.3%), Biracial (n=7, 2%). Race was not identified for (n=2, 0.6%) participants (See Table 1).

Table 1

Description of Sample by Age, Gender, and Ethnicity

Variable	n	%
Age (n=353)		
18-22	305	86.4
23-27	33	9.4
28-35	15	4.2
Gender (n=353)		
Females	226	64.0
Males	96	27.2
Not Identified	31	8.8
Ethnicity (n=353)		
Asian	6	1.7
Black	6	1.7
Caucasian	328	92.9
Latino	3	.8
Native American	1	.3
Biracial	7	2.0
Missing Data	2	.6
Total	353	100.0

Osteoporosis Knowledge Test

The OKT (Kim et al., 1991) was used to measure osteoporosis knowledge. It is a 24 item multiple-choice test regarding knowledge about risk factors for osteoporosis, exercise behaviors and calcium intake and their effects on osteoporosis. The portions of the OKT used for this study, comprised 16 of the original 24 questions, and pertained to general osteoporosis knowledge and exercise specific questions and their effects on osteoporosis. The level of measurement as obtained by the OKT for osteoporosis knowledge represents two levels. Each individual question has a dichotomous answer of either right or wrong and is therefore nominal. The total score of all questions on the Osteoporosis Knowledge Test (1-16) regarding a subject is considered interval.

Questions 1-9 of the OKT pertain to general osteoporosis knowledge of risk factors. Questions 10–16 on the OKT relate to knowledge of exercise for the prevention of osteoporosis. Therefore, KR-20 was used to measure reliability coefficients for internal consistency for the total scale and separately on items 1-9 and items 10-16 of the OKT. The KR-20 for the entire OKT instrument was .5361. The KR-20 for OKT questions 1-9 was .5157 and for questions 10-16 was .4238, thus indicating only a moderate degree of reliability for each concept: general osteoporosis risks and exercise. The KR-20 performed on the entire instrument demonstrated a moderate degree of reliability.

The possible range of scores on the OKT was 0 – 16. For this sample, the range was 4 – 16 (See Table 2). The mean on the OKT was 10.81 (SD=2.27); therefore the subjects only answered 10 out of 16 questions correctly or 63%. Table 3 lists each question with number and then percent of subjects who answered it correctly. Four out of the nine questions (questions 3, 6, 7, 8) that pertained to generalized osteoporosis knowledge were correctly answered less than 50% of the time (See Table 3), whereas one out of seven questions (question 10) that pertained to osteoporosis exercise specific

Table 2

Distribution of Scores on the OKT (N=352)

Correct answers Number and %	n	%
4 (25%)	1	.3
5 (31%)	4	1.1
6 (38%)	7	2.0
7 (44%)	21	6.0
8 (50%)	22	6.3
9 (56%)	38	10.8
10 (63%)	59	16.8
11 (69%)	57	16.2
12 (75%)	57	16.2
13 (81%)	48	13.6
14 (88%)	24	6.8
15 (94%)	11	3.1
16 (100%)	3	.9

questions was answered correctly less than 50% of the time. An analysis of scores showed that 0.9 % of the subjects (n=3) answered 100 % of the questions correctly. Twenty four percent (n=83) of the subjects answered 81% to 94% of the questions correctly. Sixteen percent (n=57) of the subjects answered 75% of the questions correctly

Table 3

Questions Answered Correctly by Percentage of Subjects

OKT Question	% Correct	OKT Questions
1.	91	Diet low in milk products
2.	70	Being menopausal
3.	27	Having big bones
4.	73	Diet high in dark green leafy vegetables
5.	89	Mother or grandmother who has osteoporosis
6.	27	White woman with fair skin
7.	30	Ovaries surgically removed
8.	48	Taking cortisone for a long time
9.	94	Exercising on a regular basis
10.	45	Exercise to reduce chance of getting osteoporosis
11.	68	Exercise to reduce chance of getting osteoporosis
12.	92	Days a week one should exercise to strengthen bones
13.	89	Time one should exercise on each occasion to strengthen bones
14.	58	Types of exercise that makes bones strong
15.	90	Exercises to reduce one's chance of getting osteoporosis
16.	93	Exercises to reduce one's chance of getting osteoporosis

and the remaining subjects (n=209) answered less than 70% of the questions correctly when utilizing a scoring scale of 0 to 100% (See Table 2).This demonstrated that individuals had less knowledge of generalized osteoporosis preventative measures than exercise specific preventative measures.

Osteoporosis Self-Efficacy Exercise Scale

The OSE-Exercise is a visual analog scale with 10 items ranging from 0–100 with 0 being not at all confident to 100 being very confident. The level of measurement for the scale is ratio level. In order to calculate the scores for the OSE-Exercise, the scores on each of the 10 items were first added, and then the total score was divided by the total number of items (10) to obtain the individual's score. The mean OSE-Exercise score for this young adult sample was 71.43 (SD=20.62). Reliability was established for the OSE-Exercise using Cronbach's alpha. The coefficient alpha for internal consistency on the OSE-Exercise was .967. The coefficient alpha was high indicating that the OSE-Exercise scale was reliable for internal consistency.

Hypothesis

For this study, evaluating the relationship of osteoporosis exercise knowledge and osteoporosis exercise self-efficacy was explored by presenting the following research hypothesis:

Hypothesis. Young adults who possessed greater osteoporosis exercise knowledge would have greater exercise osteoporosis preventive self-efficacy.

Product-moment correlation coefficient (*Pearson's r)* was used to measure the relationship between the variables of osteoporosis knowledge and osteoporosis exercise self-efficacy. The data demonstrated that there was no significant relationship between OKT and OSE-Exercise (r=0.02) (See Table 4), thus the hypothesis was rejected.

Table 4

Pearson Correlations by OKT, OSE-Exercise, and Age for Young Adults (N=352)

	OKT Score	OSE-Exercise Score	Age
OKT	1.00		
OSE-Exercise	0.02	1.00	
Age	0.30**	-.13*	1.00

Note. **(p<0.01), *(p<0.05)

Differences between females and males on OKT and OSE-Exercise were also evaluated. Pearson correlations were performed separately on OKT and OSE-Exercise according to gender (See Table 5 and 6). There was no significant relationship between OKT and OSE-Exercise demonstrated separately for females (r=-.00) or males (r = .03).

Table 5

Pearson Correlations by OKT, OSE-Exercise, and Age for Females (N=226)

	OKT Score	OSE-Exercise Score	Age
OKT	1.00		
OSE-Exercise	-.00	1.00	
Age	.35**	*-.10	1.00

Note. ** (p< 0.01), * (p<0.05)

Table 6

Pearson Correlations by OKT, OSE-Exercise, and Age for Males (N=96)

	OKT Score	OSE-Exercise Score	Age
OKT	1.00		
OSE-Exercise	0.03	1.00	
Age	0.21*	-.30**	1.00

Note. . ** ($p < 0.01$)
* ($p < 0.05$)

Additional Findings

In order to evaluate if there were differences between females and males on knowledge, a t-test was done to compare female with male scores on the OKT. The female mean score on the OKT was 10.98 (SD = 2.11); the male score was 10.33 (SD = 2.59) (See Table 7). Independent sample t-tests and Levene's Test for Equality of Means revealed significant differences in mean scores between females and males ($t = 2.17$, $df = 148.84$, $p = .032$) (See Table 7). These results demonstrated that females had a greater knowledge of osteoporosis than males.

Table 7

Comparison of Osteoporosis Knowledge Tests by Gender

Gender	Mean	SD	t	df	p
Female (n=226)	10.98	2.11	2.17	148.84	.032*
Male (n=96)	10.33	2.59			

* Note. ($p < 0.05$)

As previously presented, differences between gender on OSE-Exercise were also explored. The mean OSE-Exercise score for this young adult sample was 71.43 (SD = 20.62). When compared by gender, the mean score for females on the OSE-Exercise was 70.30 (SD = 18.88); the mean sores for males was 75.75 (SD = 22.88) (See Table 8). Independent sample t-tests and Levene's Test for Equality of Means revealed significant differences in mean scores between females and males (t = -2.05, df = 152.79, p = .042) (See Table 8). These results demonstrated that males had greater exercise self-efficacy for osteoporosis prevention than females.

Table 8

Comparison of Osteoporosis Exercise Self-efficacy Scores by Gender

Gender	Mean	SD	t	df	p
Female (n=226)	70.30	18.88	-2.05	152.79	.042*
Male (n=96)	75.75	22.88			

*. P < 0.05 level

Age was also examined to study its relationship to OKT and OSE-Exercise. Data analysis using the Pearson's r showed that there was a positive relationship between age and OKT (r = .30, p < 0.01). As age increased, so did OKT scores. There was a statistically significant inverse relationship between age and OSE-Exercise scores (r = -.13, p <0.05) (Table 4). Thus, as an individual's age increased, OSE-Exercise scores decreased.

Summary

In summary, there was no relationship between osteoporosis knowledge and exercise self-efficacy in young adults, thus the hypothesis was rejected using product-moment correlation coefficient (*Pearson's r*). The results also demonstrated no statistically significant relationship between osteoporosis knowledge and exercise self-efficacy for the prevention of osteoporosis when separated by gender. There was a statistically significant positive relationship between osteoporosis knowledge and age for the young adult population. Exercise self-efficacy and age demonstrated a statistically significant inverse relationship.

The mean scores on the OKT were low for this population (10.81), representing a score of 63% out of 100%. More specifically, the young adults population had low knowledge of general osteoporosis preventative measures (questions 1-9) and more knowledge of exercise related osteoporosis preventative measures (questions 10-16). OKT and gender demonstrated a statistically significant relationship. Independent sample t-tests and Levene's Test for Equality of Means revealed significant differences in mean scores for females versus males. Females had more knowledge than males; however overall osteoporosis knowledge was low for both genders.

The OSE-Exercise mean score for this young adult sample was high (71.43) on a scale of 0-100. Independent sample t-tests and Levene's Test for Equality of Means revealed significant differences in mean scores for females versus males. Males had higher OSE-Exercise scores than females. There was a statistically significant inverse relationship between age and OSE-Exercise scores; OSE-Exercise scores decreased with increasing age.

The KR-20 for the OKT instrument used to measure reliability coefficients for internal consistency was in the moderate range. The Coefficient alpha (Cronbach's alpha) for internal consistency on the OSE-Exercise was high.

In conclusion, the results indicated that there was no relationship between osteoporosis knowledge and exercise self-efficacy in the young adult population as a whole or separately for either gender.

CHAPTER 5

DISCUSSION AND IMPLICATIONS

Discussion

The purpose of this study was to evaluate the relationship between osteoporosis exercise knowledge and exercise osteoporosis preventive self-efficacy in young adults. This study did not support a relationship. The study population had poor knowledge of osteoporosis and had a moderately high level of exercise self-efficacy. One can only speculate that there may be other factors that have a relationship to exercise self-efficacy in this population. Possible explanations for these results will be explored.

Theory

Self-efficacy is one of the central constructs of Bandura's Social Cognitive Theory (1986) that is believed to be critical to behavior change. Self-efficacy is defined as an individual's judgment of his or her ability to carry out a behavior or skill. Individuals who have high self-efficacy for a skill are more likely to perform that skill (Bandura, 1986). He also identified knowledge as an important precondition to adopting behaviors. Bandura (1986) stated that self-efficacy may be essential in translating knowledge into behavior. Therefore, knowledge may also be related to behavior through self-efficacy. Consequently, one would expect that young adults who possessed greater osteoporosis exercise knowledge would have greater exercise osteoporosis preventive self-efficacy.

The conceptual framework for this study is Self-efficacy (Bandura, 1977) based on Social Cognitive Theory (Bandura, 1986), which assumes that people are capable of rational decision-making. However, when complex behaviors are necessary to maintain health, a person's higher level of self-efficacy is needed for both initiating and maintaining a behavioral change (Bandura, 1977). An essential component of health promotion teaching involves enhancing self-efficacy of clients by performance accomplishments followed by vicarious experiences (Rosenstock et al., 1988). Enhancing self-efficacy is the best predictor for increasing health promotion activities.

According to previous studies (Ali, 1996; Biddle & Ashford, 1988; Blalock et al., 2000) supporting Bandura's theory (1986) that knowledge may be related to behavior through self-efficacy, those who had more knowledge had higher self-efficacy for health promoting behaviors as opposed to those with less knowledge. Those with higher levels of self-efficacy are expected to engage in health promoting behaviors, such as exercise, than those with low self-efficacy. Knowledge of healthy behaviors and self-efficacy were significantly correlated with osteoporosis prevention behaviors (Ali, 1996). Those women in the study who valued their health were knowledgeable about healthy behaviors, and perceived greater benefits to exercise participation. Additionally, the women who tended to perform greater exercise activities perceived themselves as more self-efficacious. Likewise, this is consistent with Bandura's (1986) theory, which hypothesizes that an individual's level of confidence to engage in a specific behavior is significantly related to actual behavior. Based upon Bandura's premise that a relationship exists between knowledge and self-efficacy, the hypothesis that osteoporosis exercise knowledge would be positively related to exercise osteoporosis preventive self-efficacy was tested, however the results did not support the model. Knowledge was too poor.

Osteoporosis Knowledge

The OKT instrument utilized in this study demonstrated a moderate level of reliability in the young adult population. It is unclear if results would have been altered had the instrument reliability for internal consistency been higher. On previous study (Sedlak, Doheny, & Jones, 1998), the reliability of the OKT scale increased following an intervention that significantly increased knowledge scores about osteoporosis. Therefore, the limitation with the OKT instrument may not rest with its reliability but with the low knowledge level of the study population.

Additionally, there were significant differences in scores of females versus males. The females scored higher on the OKT than males, while males scored higher on exercise self-efficacy. A previous study also documented that the level of knowledge held by men regarding osteoporosis was found to be low. Seventy-one percent of the men failed the knowledge test, with a 95% confidence interval for the mean score of 50%, on a scale of 0-100% (Sedlak et al., 2000).

Similar to previous research, the current study's scores on the OKT were higher in those subjects that were chronologically older (Taggart & Connor, 1995). Explanations for these findings may be related to several factors: a woman's increased interest in this disease as it is typified as an age related disease predominately in women and therefore considered a woman's health problem, advertisements for osteoporosis education and prevention targeted for women, information that women gleaned from health care providers, relatives and friends, and a woman's perception of her own susceptibility as she ages (Ribeiro, Blakeley, & Laryea, 2000; Taggart & Connor, 1995). Although many women have heard or read something about osteoporosis, research indicated that knowledge regarding risk factors and prevention continued to be limited (Ribeiro, Blakeley, & Laryea, 2000). A possible contributing factor to this limited level of osteoporosis knowledge is that the media disseminates the general benefits of exercise for every group; however information about the benefits of exercise for the prevention of osteoporosis is directed to postmenopausal and elderly women rather than across the life span. Regardless of the explanations for the current level of osteoporosis knowledge, a problem exists with the low knowledge level of this population. Evidence from the OKT scores revealed that the young adult population lacked specific knowledge of the following: having ovaries surgically removed makes one more likely to develop osteoporosis, having big bones makes one less likely to develop osteoporosis, being a white woman with fair skin makes one more likely to develop osteoporosis, taking steroids such as prednisone makes one more likely to develop osteoporosis, and walking briskly is the best way to reduce a person's chance of getting osteoporosis.

Exercise Self-Efficacy for Osteoporosis Prevention

The scores on the OSE-Exercise indicated a moderately high level of self-efficacy yet the knowledge scores were low. Perhaps obtaining data from a young population, who may intrinsically envision themselves more confident in their ability to exercise, although their knowledge of osteoporosis may be low, may not demonstrate a relationship as stipulated in the hypothesis. Young adults inherently exercise for reasons other than osteoporosis prevention, such as weight loss, self-esteem, social normative influences, stress relief, and enhanced cardiovascular function (Elder, Ayala, & Harris, 1999; Pender, 1996; Taggart & Connor, 1995). In a study conducted by Ali (1996), participants identified the general benefits of exercise for enhancing feelings of well-being, losing weight, maintaining weight, and reducing stress, however none of the participants correlated exercise with strengthening bones, contributing to achievement of peak bone mass or preventing brittle bones associated with aging.

Osteoporosis Knowledge and Exercise Self-Efficacy

One can only speculate reasons why the data from this study did not support a positive relationship between knowledge and self-efficacy. According to Bandura's theory, individuals with low knowledge would have demonstrated low self-efficacy and those with higher knowledge would have demonstrated a higher level of self-efficacy. However, this correlation was not demonstrated in this population.

Nonetheless, findings from this study were consistent with Sedlak et al. (1998). In their study, the mean knowledge scores in the control and experimental groups were low. The control group pre and posttest self-efficacy scores were higher than the experimental groups. The only explanation that these authors had given for the phenomenon was that the control group was younger (predominately 18-19 years) and subjects younger in age were considered to be more confident in the ability to exercise. These results may also be generalized to the present study in that the young adult population possessed more confidence in their ability to exercise and therefore scored higher in exercise self-efficacy

Similar to current findings, previous research (Ailinger & Emerson, 1998; Ribeiro et al., 2000; Weiss & Sankaran, 1998) also revealed that young adults had a relatively low level of osteoporosis knowledge and a high level of exercise self-efficacy. One questions that when knowledge specific to a topic such as osteoporosis is low, a basis may not exist upon which a correlation can be made with domain specific self-efficacy, such as exercise self-efficacy for the prevention of osteoporosis. One can speculate that the subjects overall high level of exercise self-efficacy was unrelated to osteoporosis knowledge but possibly related to other factors as previously mentioned, such as social acceptability or weigh loss. Because judgments of self-efficacy are task and domain specific, a problem of mismeasurement of self-efficacy may have existed. Thus, this phenomenon may have contributed to a rejection of the hypothesis, and to the data not demonstrating any significant relationship between osteoporosis knowledge and osteoporosis exercise self-efficacy.

Application to Education and Practice

The purpose of this research was to provide a basis for evaluating the relationship between factors that could potentially influence exercise behavior for the prevention of osteoporosis. Although this study did not support a relationship between osteoporosis knowledge and exercise self-efficacy for the prevention of osteoporosis, it did identify that the overall osteoporosis knowledge in this population is low, which has been consistent with other researchers (Ailinger & Emerson, 1998; Ribeiro, Blakeley, & Laryea, 1998; Sedlak, Doheny, & Jones, 1998; Weiss & Sankaran, 1998). As previously discussed, this population of young adults possesses a low knowledge level of osteoporosis; their level of exercise self-efficacy may not be dependent upon this knowledge. However, consistent with Sedlak et al.'s 1998 study, the data from the current study supported that exercise self-efficacy decreased with age. One can only speculate that if young adults had a higher level of osteoporosis knowledge, this may have a positive influence on their level of exercise self-efficacy as they age.

Limitations

There were limitations to this study. Predominately this is a secondary data analysis. There were limited data on ages 23 to 35 years; consequently, the data did not have an equal representation of information for each age category in the total age range in the target population of study. Although the target population for this study was 18 to 35, the mean age of the data population was 20.3 years (SD 3.03) thus the results may not generalize to the general population of young adults aged 18 to 30 years primarily. The population was primarily composed of young adult college students, primarily Caucasian (92.3%), and female (70.3%). There were limited numbers of ethnic minorities.

The OKT instrument utilized in this study demonstrated only a moderate level of reliability. It is unclear if these results would have been different if the OKT instrument had demonstrated a higher level of reliability in this population. However, this limitation could possibly be related to the low level of osteoporosis knowledge in this population as opposed to the reliability of the instrument.

Because of the social desirability of being viewed as being active and a young person's inherent confidence in her or his ability to exercise (Sedlak et al., 1998), a higher level of self-efficacy and over reporting one's confidence level in exercising is more likely than underreporting. Although the purpose of the questionnaire was clear, some of the young adult population may have wanted to appear desirable (i.e. being overly confident regarding their ability to exercise) in the questionnaire. Since perceived self-efficacy is subjective, self-efficacy was assessed by self-report questionnaires, as in many surveys, rather than an objective measurement. Accuracy of self-report questionnaires is often questionable due to their subjective nature.

Although the osteoporosis knowledge instrument was also self-report, it may have reflected more objective data, and thus may have generated more accurate data. The OKT presumably measured what the subjects knew as opposed to what they believed as in the OSE-Exercise. Regardless, the OKT as a self-report had the potential of producing results that were a reflection of guessing as opposed to an accurate measurement of one's knowledge base. One can speculate that an explanation for this phenomenon was that subjects not knowing the answer guessed across the spectrum of selections, some answered the questions correctly and others did not. An item analysis of questions on the OKT would have provided more information related to the topic of subjects guessing on certain questions.

Implications for Further Research

Enhancing an individual's knowledge and self-efficacy has been studied regarding its influences on behavior patterns developed in late childhood or adolescence that carries over through adulthood. Therefore, learning health-promoting skills and habits at a young age can translate to healthier adults who have assumed responsibility for health promotion. Although the population in this study did have confidence in their ability to exercise, they lacked the knowledge related to osteoporosis prevention that could be crucial to their continued health promoting behaviors across the life span versus only in young adulthood.

Nurses have an opportunity to expand individuals' knowledge of exercise and model health promoting behavior related to healthier lifestyles and the reduction of symptoms related to chronic diseases, such as osteoporosis. The results of this study have identified significant knowledge deficits in young adults regarding osteoporosis risk factors and osteoporosis prevention for both females and males. As the majority of this population has not achieved peak bone mass, it is an opportune time to promote education and enhance knowledge of osteoporosis prevention and exercise and enhance the potential for an improved quality of life in older adulthood.

There have been strides to increase knowledge of exercise for the prevention of osteoporosis in various research studies and as legislation in some states that have made a commitment to increase the public's knowledge of osteoporosis (National Osteoporosis Foundation, 1997). One of the goals of "Healthy People 2010 National Health Objectives for the Nation" (U.S. Department of Health and Human Services Public Health Service, 2000) is to prevent illness and disability related to arthritis and other rheumatic conditions, osteoporosis, and chronic back conditions. The national health objectives for the year 2010 included two objectives for osteoporosis

1. Reduce the proportion of adults with osteoporosis
2. Reduce the proportion of adults who are hospitalized for vertebral fractures associated with osteoporosis.

The importance of designing interventions to prevent osteoporosis has been cited in the health objectives. Nurses need to take advantage of opportunities for primary prevention of this disease by developing educational and exercise programs to promote health throughout clients' lifespan. Health promotion programs should become a mandatory part of the curriculum in institutions of learning. Health care providers and the media need to focus their efforts on osteoporosis prevention, target individuals across the life span and stress that osteoporosis is a preventable "disease of childhood with late adult manifestations."

Evidence from the literature review has provided encouraging results for self-efficacy as a strong predictive variable for exercise behavior. Evidence from this study has indicated that young adults have a low level of knowledge for osteoporosis prevention. Nurses are challenged to provide opportunities to enhance both a person's knowledge and self-efficacy for exercise through persuasive strategies. In addition to self-efficacy, opportunities to increase knowledge of osteoporosis have also proven effective. Nursing assessment, interventions, and education are important interactions with clients. Regardless of age, exercise assessments and osteoporosis knowledge screening should be included as part of an initial health history.

Summary and Conclusion

Nurses need to design educational programs that address knowledge deficits of the young adult population, as those identified in this young adult population. This information is valuable in developing programs that address specific knowledge deficits of at risk populations. Opportunities to educate individuals regarding osteoporosis knowledge of exercise and general osteoporosis knowledge need to be stressed throughout the lifespan to encourage health promoting and health responsive behaviors. Additionally, further study should be conducted with diverse ethnic populations to determine to what extent the results of this study generalize to other multicultural groups.

APPENCICES

APPENDIX A

APPENDIX A

Consent to Participate in the KSON Osteoporosis Prevention Research Project

I ________________________________ (name) agree to be contacted regarding future participation in osteoporosis risk and prevention studies to be conducted by the Kirkhof School of Nursing Osteoporosis Research Project at Grand Valley State University. I understand that agreement to be contacted in no way obligates me to continued participation in the study.

____

(signature)

I can be contacted at:
Name:

____

Address:

____

____

Telephone: ______________________ Best hours to contact me are:

____

e-mail address: ____________________________

Questions about the study may be directed to Professor Phyllis Gendler 616-895-3516.
Questions about your rights as a participant should be directed to Professor Paul Huizenga, Chair of Human Research Review Committee 616-895-2472

APPENDIX B

APPENDIX B
Demographic Data

DEMOGRAPHIC DATA SHEET

Date: ____________ ID # ____________

Data Collection Site: __________________

1. How old are you? _________ (in years)
2. How many years of school have you completed? _________ (in years)
3. How tall are you? _____ feet and _____ inches (CODE: in cm) _________
4. How much do you weigh? _________ (in pounds)
5. Are you:
   1. Female________
   2. Male___________

6. In order to understand osteoporosis risk factors that are different among people from different backgrounds, we are asking your help in giving us specific information about your racial and ethnic background. Please place an X by each racial or ethnic group that represents your heritage. Check all that apply.

Asian

Specify________________

Black

________ 1. African American

________ 2. Black (Not Hispanic)

Specify_______________

Caucasian

________ 1. Northern Europe

Specify________________

________ 2. Central Europe

Specify________________

________ 3. Eastern Europe

Specify_______________

________ 4.White (not Latino) ------

Latino

________1. Spain

________2. Puerto Rico

________3. Cuban American

________4. Central American

Specify________________

________5. South American

Specify________________

________6. Mexican American

Specify________________

Mediterranean

Specify________________

Middle Easterner

Specify________________

Native American

_________1. Alaskan Native

_________2. Other Specify________________

Pacific Islander

Specify_______________

Other Specify_______________

7. Do you have osteoporosis?

_____ 1. Yes

_____ 2. No

8. Do you have friends or relatives who have osteoporosis?

_____ 1. Yes

_____ 2. No

9. Are you a twin?

_____ 1. Yes

_____ Identical

_____ Fraternal

10. Are there twins in your family?

_____ 1. Yes

_____ 2. No

11. Living family members:

Grandmother	______	Age	________________	City
	______	Age	_______________	City
Mother	_____	Age	_______________	City
Daughter	______	Age	_______________	City
	_____	Age	_______________	City
	______	Age	_______________	City
Granddaughter	_____	Age	_______________	City
	_____	Age	_______________	City
	_____	Age	_______________	City
Sister	_____	Age	________________	City
	_____	Age	________________	City
	_____	Age	________________	City

Thank you very much for your assistance in our study.

APPENDIX C

APPENDIX C

ID NO: ____________

OSTEOPOROSIS KNOWLEDGE TEST

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

Below is a list of things which may or may not affect a person's chance of getting osteoporosis. After you read each statement, think about if the person is:

MORE LIKELY TO GET OSTEOPOROSIS, or

LESS LIKELY TO GET OSTEOPOROSIS, or

IT HAS NOTHING TO DO WITH (NEUTRAL) GETTING OSTEOPOROSIS, or

YOU DON'T KNOW.

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

ML = MORE LIKELY

LL = LESS LIKELY

NT = NEUTRAL

DK = DON'T KNOW

1. Eating a diet LOW in milk products	ML	LL	NT	DK
2. Being menopausal; "change of life"	ML	LL	NT	DK
3. Having big bones	ML	LL	NT	DK
4. Eating a diet high in dark green leafy vegetables	ML	LL	NT	DK
5. Having a mother or grandmother who has osteoporosis	ML	LL	NT	DK
6. Being a white woman with fair skin	ML	LL	NT	DK
7. Having ovaries surgically removed	ML	LL	NT	DK
8. Taking cortisone (steroids e.g. Prednisone) for long time	ML	LL	NT	DK
9. Exercising on a regular basis	ML	LL	NT	DK

For the next group of questions, choose one answer from the 4 choices. Be sure to choose only one answer. If you think there are more than one answer, choose the best answer. If you are not sure, circle D.

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

A. Swimming D. Don't Know
B. Walking briskly
C. Doing kitchen chores, such as washing dishes or cooking

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

A. Bicycling D. Don't Know
B. Yoga
C. Housecleaning

12. How many days a week do you think a person should exercise to strengthen the bones?

A. 1 day a week D. Don't Know
B. 2 days a week
C. 3 or more days a week

13. What is the LEAST AMOUNT OF TIME a person should exercise on each occasion to strengthen the bones?

A. Less than 15 minutes D. Don't Know
B. 20 to 30 minutes
C. More than 45 minutes

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

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

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

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

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

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

Calcium is one of the nutrients our body needs to keep bones strong.

17. Which of these is a good source of calcium?

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

18. Which of these is a good source of calcium?

A. Watermelon
B. Corn
C. Canned Sardines
D. Don't Know

19. Which of these is a good source of calcium?

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

20. Which of these is a good source of calcium?

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

21. Which of these is a good source of calcium?

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

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

A. 100 mg - 300 mg daily
B. 400 mg - 600 mg daily
C. 800 mg or more daily
D. Don't Know

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

A. 1/2 glass daily
B. 1 glass daily
C. 2 or more glasses daily
D. Don't Know

24. Which of the following is the <u>best reason</u> for taking a calcium supplement?

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

APPENDIX D

APPENDIX D

ID NO: ___________

OSTEOPOROSIS SELF-EFFICACY SCALE

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

If it were recommended that you do any of the following THIS WEEK, how confident or certain would you be that you could:

1. begin a new or different exercise program

Not at all confident |———————————————| Very confident

2. change your exercise habits

Not at all confident |———————————————| Very confident

3. put forth the effort required to exercise

Not at all confident |———————————————| Very confident

4. do exercises even if they are difficult

Not at all confident |———————————————| Very confident

5. maintain a regular exercise program

Not at all confident |———————————————| Very confident

6. exercise for the appropriate length of time

Not at all confident |———————————————| Very confident

7. do exercises even if they are tiring

Not at all confident |———————————————| Very confident

8. stick to your exercise program

Not at all confident |———————————————| Very confident

9. exercise at least three times a week

Not at all confident |———————————————| Very confident

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

Not at all confident |———————————————| Very confident

If it were recommended that you do any of the following THIS WEEK, how confident or certain would you be that you could:

11. begin to eat more calcium rich foods

Not at all confident |————————————————| Very confident

12. increase your calcium intake

Not at all confident |————————————————| Very confident

13. consume adequate amounts of calcium rich foods

Not at all confident |————————————————| Very confident

14. eat calcium rich foods on a regular basis

Not at all confident |————————————————| Very confident

15. change your diet to include more calcium rich foods

Not at all confident |————————————————| Very confident

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

Not at all confident |————————————————| Very confident

17. select appropriate foods to increase your calcium intake

Not at all confident |————————————————| Very confident

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

Not at all confident |————————————————| Very confident

19. obtain foods that give an adequate amount of calcium

Not at all confident |————————————————| Very confident

20. remember to eat calcium rich foods

Not at all confident |————————————————| Very confident

21. take calcium supplements if you don't get enough calcium from your diet

Not at all confident |————————————————| Very confident

APPENDIX E

APPENDIX E

GRAND VALLEY
STATE UNIVERSITY
401 W. FULTON STREET • GRAND RAPIDS, MICHIGAN 49504-6431

January 18, 2002

Ms Suzanne Leclaire
7017 Bonaire Court, NE
Rockford, Michigan 49341

Dear Ms Leclaire,

Thank you for your interest in the Osteoporosis Knowledge Test (OKT) and Osteoporosis Self-Efficacy Scale-21(OSES). You have my permission to use the instruments. Please keep us informed of any results you obtain using the instruments. In that way we hope to continue to serve as a clearinghouse for information about the instruments.

I wish you much success with your study.

Sincerely,

[redacted]

Phyllis Gendler, PhD, APRN, BC, NP
Professor and Dean
Kirkhof School of Nursing
Grand Valley State University
401 West Fulton Street
Grand Rapids, MI 49504-6431

Phone: 616-336-7161
Fax: 616-336-7362
E-mail: gendlerp@gvsu.edu

[illegible]
01/18/02

APPENDIX F

APPENDIX F

GRAND VALLEY
STATE UNIVERSITY
1 CAMPUS DRIVE • ALLENDALE, MICHIGAN 49401-9403 • 616/895-6611

February 15, 2002

Suzanne Leclaire
7017 Bonaire Ct.
Rockford, MI 49341

RE: Proposal #02-153-H

Dear Suzanne:

Your proposed project entitled **The Relationship Between Exercise Knowledge and Exercise Self-Efficacy for the Prevention of Osteoporosis,** has been reviewed. It has been approved as a study, which is exempt from the regulations by section 46.101 of the Federal Register 46(16):8336, January 26, 1981.

Sincerely,

[redacted]

Paul A. Huizenga, Chair
Human Research Review Committee

APPENDIX G

APPENDIX G

GRAND VALLEY
STATE UNIVERSITY

September 26, 2001

Ms. Suzanne Leclaire
7017 Bonaire Court, NE
Rockford, Michigan 49341

Dear Ms. Leclaire,

I am pleased about your interest in the Osteoporosis Research at the Kirkhof School of Nursing at Grand Valley State University. Your investigation of the relationship between exercise knowledge and exercise self-efficacy for the prevention of osteoporosis in young adults will add to the body of nursing knowledge and provide direction for nursing interventions to prevent osteoporosis and its associated problems.

You have my permission to use the data collected as part of the larger study done in 1998 by Gendler, Martin, Coviak, Mellon, Kim, and Rodriques-Fisher in order to evaluate the psychometric properties of the Osteoporosis Knowledge Test and the Osteoporosis Self-Efficacy Scale.

Best wishes for success with your thesis.

Sincerely

[redacted]

Phyllis Gendler PhD, APRN, BC, NP
Professor and Dean
Kirkhof School of Nursing

401 West Fulton Street • Grand Rapids, MI 49504-6431
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1-800-480-0406

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