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THE EFFECT OF AN OSTEOPOROSIS PREVENTION PROGRAM ON KNOWLEDGE AND SELF-EFFICACY

By

Kathryn Hayter

A THESIS

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ABSTRACT

THE EFFECT OF AN OSTEOPOROSIS PREVENTION PROGRAM ON KNOWLEDGE AND SELF-EFFICACY

By

Kathryn Hayter

The purpose of this study was to examine the effects of an Osteoporosis Prevention Program on knowledge and self-efficacy for exercise and calcium intake. Bandura's Self-Efficacy Model was used which describes efficacy expectations and outcome expectations as predictors of behavior.

A quasi-experimental design with pre-test and post-test was used with 32 women, age 40-62, at an urban outpatient center. The experimental group attended an Osteoporosis Prevention Program.

There were significant post-test differences between groups for osteoporosis knowledge and osteoporosis self-efficacy for calcium intake but not for osteoporosis self-efficacy for exercise. Additionally, paired t-tests found a significant improvement in scores pretest to post-test in the experimental group for all three tests. This demonstrated that the Osteoporosis Prevention Program had a significant effect on osteoporosis knowledge and self-efficacy for calcium intake and exercise.

Based on the assumptions of Bandura's Self-Efficacy Model, this Osteoporosis Prevention Program should positively influence Osteoporosis prevention behaviors.

Dedication

To my husband, David, and son, Erik, for their constant love, encouragement and support. The guidance and insight from my life partner enabled me to encompass my new knowledge and ascend to a higher level of understanding.

To my Women associates and patients whose courage and strength under adversity inspired me to take on new challenges and work toward greater goals benefiting others.

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CHAPTER ONE

Introduction

One of the major health risks to menopausal women is the development of osteoporosis. Approximately 25 million Americans are afflicted with this disorder. Significant morbidity and mortality are attributed to osteoporosis-related fractures in women, with approximately 1.5 million of these fractures reported each year in the United States (National Osteoporosis Foundation, 1997). It is estimated that the cost of osteoporosis in the United States is $13.8 billion annually in direct and indirect costs (Ray, Chan, & Thamer, 1997). It is projected that with escalating medical costs and increasing numbers of women at risk, the costs will reach $240 billion by the year 2040 in the United States (Lindsay, 1995).

Most osteoporosis related fractures occur in postmenopausal women. Fractures of the proximal femur (hip), vertebral body, and the distal forearm are the most common. Hip fractures are associated with a 10-20% mortality within the first year, and a 25% chance of long-term institutionalization. Fractures cause pain, disability and lead to loss of independence, and loss of quality of life. The incidence of osteoporotic fractures is projected to increase four-fold worldwide over the next 50 years, leading to a global epidemic which could threaten the viability of healthcare systems of many countries (Riggs & Melton, 1995).

Osteoporosis is defined as a decrease in the quantity of structural bony material from both trabecular and cortical bone. Trabecular bone has an open meshwork structure and is present in plates that form the internal structures of the skeleton, such as the vertebral bodies. Cortical bone has a compact structure and forms the external portion of the skeleton. Cortical bone is the primary type of bone found in the proximal femur, although some trabecular bone is also present. The two types of bone respond differently to metabolic processes and their susceptibility to fracture also differs. Two classifications of osteoporosis have been identified. Type 1 osteoporosis affects the trabecular bone and is believed to be influenced by the loss of estrogen in menopausal women. Fractures of the vertebrae occur most often in postmenopausal women with accelerated loss of trabecular bone. Type 2 osteoporosis occurs as a result of age-related changes. Hip fractures occur most frequently in older men and women who have gradually lost both cortical and trabecular bone mass (Manolnagas & Jilka, 1995).

Bone undergoes continuous remodeling. Osteoclasts resorb bone in microscopic cavities, osteoblasts then reform the bone surfaces by filling in the cavities. Bone mass declines over time because of an imbalance in resorption versus reformation. Loss of estrogen, seen in menopausal women, affects bone resorption, deters reformation, resulting in a net bone loss, and risk of osteoporosis and fractures. Bone loss is the greatest in the first five to seven years after menopause (Samsioe, 1997).

Risk factors for developing osteoporosis include female gender, genetic predisposition, Caucasian and Asian race, and early menopause (surgical or natural). Also significant are a lack of postmenopausal estrogen therapy, small body frame, inactivity, inadequate dietary calcium and vitamin D, cigarette smoking, and caffeine use (Kiel, 1994). In addition, a family history of osteoporosis, and a history of steroid therapy, and hyperthyroidism could predispose women to develop osteoporosis in their lifetimes (Ribot, Tremollieres, & Pouilles, 1995). Low bone mass densities found in women in the perimenopausal period have been predictive of future fractures (Cummings & Black, 1995).

Prevention is the most effective method of decreasing the morbidity and mortality of osteoporosis. By increasing bone mass and decreasing the rate of subsequent bone loss, the risk of developing osteoporosis can be reduced. Strategies such as weight-bearing exercise, maintaining adequate intake of calcium (1000-1500mg per day), and vitamin D (800 U per day) have been shown to decrease bone loss, and increase bone mass. Estrogen replacement therapy at the time of menopause has also been found to be a significant deterrent to the development of osteoporosis (Riggs & Melton, 1992).

Nurses can have a major impact on educating women about the risks for osteoporosis and behaviors for the prevention of osteoporosis. Traditional approaches to health promotion have focused on increasing understanding of disease processes, and listed helpful behaviors. Increase in knowledge of these risks and strategies for deterring osteoporosis may not always result in life-style changes by women. Nurses in advanced practice, with the emphasis on primary prevention in their practices, can serve a vital role in addressing these risks and providing on-going education and motivation to clients to initiate health promotion behaviors throughout a woman's life span. Other factors influencing women to initiate health behaviors need to be explored. Advanced practice nurses, with a holistic approach to health assessment and promotion, can provide a unique service to women by examining stresses and supports in their lives, by working with clients to maximize strengths, and assisting in developing strategies that are realistic to implement in women's lifestyles.

Social cognitive theory, developed by Bandura (1977), asserts that behavior is determined by expectancies and incentives. A major component of this theory is the concept of self-efficacy. For behavioral change to succeed, people must have an incentive to take action, feel threatened by their current behavioral patterns, and believe that change of a specific kind will be beneficial by resulting in a valued outcome. However, they must also feel themselves competent (self-efficacious) to implement that change. Both efficacy expectations (judgment of one's capacity to perform a behavior successfully) and outcome expectations (the perception that the behavior will lead to a positive change) are important for behavioral change to take place (Rosenstock, Strecher, & Becker, 1988).

Self-efficacy can be enhanced through four methods: performance accomplishments (learning through personal experience), verbal persuasion (information from health provider about client's ability), vicarious experiences (seeing others perform challenging activities successfully), and emotional arousal (information from health provider about consequences of health risks and benefits of change) (Rosenstock et al., 1988).

In a 1998 study of older adults and exercise, Conn found that self-efficacy perceptions were significant predictors of exercise in older adults. Lifelong leisure exercise practiced by these older adults influenced their self-efficacy beliefs positively.

The results of a study of self-efficacy and health behavior among older adults reported by Grembowski et al. (1993) suggest that interventions for older adults should concentrate on how to change behavior, and to give support for increasing their perception of their ability to make changes (efficacy expectations), rather than concentrating on the positive results of those changes (outcome expectations). Interventions aimed at improving efficacy expectations were found to motivate older adults to increase health behaviors and thereby improve health status.

In evaluating Healthcare Policy, members of the Executive Committee of Health Project analyzed three healthcare reform models to improve health and reduce costs. They identified 32 programs with documented effectiveness and determined that the features of chronic disease self-management, risk reduction and increased self-efficacy were the most effective (Fries, Koop, Sokolov, Beadle & Wright, 1998).

Purpose

The purpose of this study is to evaluate the effect of an osteoporosis prevention program on women's knowledge of osteoporosis and their perceptions of their ability to make behavioral changes to prevent osteoporosis.

CHAPTER TWO

Theoretical Framework and Literature Review

Theoretical Framework

Bandura's (1977) Social Learning Theory describes a method to predict and explain behavior using several concepts. Of primary importance to changing behaviors are the incentives as described in his theory: outcome expectations and self-efficacy expectations. Behavior change and maintenance of change are a function of 1) expectations about the outcomes that will result from one's engaging in a behavior; and 2) expectations about one's ability to engage in or execute the behavior. Outcome expectations consist of beliefs about whether a given behavior will lead to given outcomes (i.e., prevention of osteoporosis). Efficacy expectations consist of beliefs about how capable one is of performing the behaviors (i.e., calcium intake and exercise) that leads to those outcomes (Bandura, 1977). The importance of the person's beliefs is paramount to the concept of self-efficacy. By giving credence to these beliefs, nurses can more significantly help people to change behavior which leads to positive outcomes.

For purposes of this study, the focus will be on increasing efficacy expectations and outcome expectations. A model of the self-efficacy construct is presented in Figure 1.

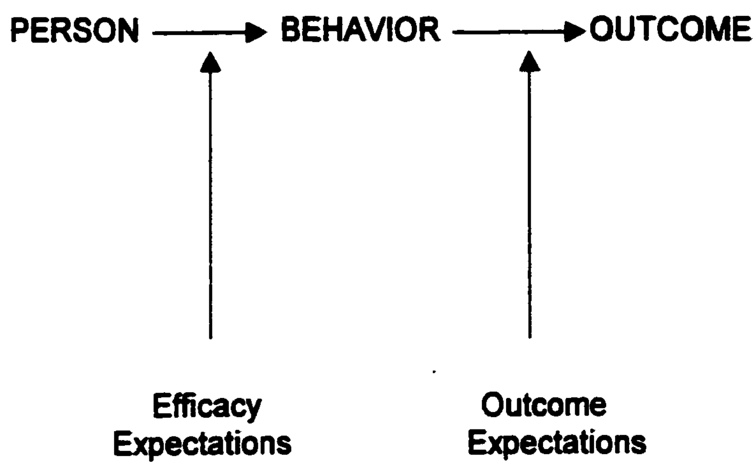

Figure 1. Bandura's Social Learning Theory, Self-efficacy construct

A prevention program should not only provide information about positive outcomes of changing health behaviors, but also should integrate methods to improve efficacy expectations. As discussed in Chapter 1, four methods described by Bandura (1977) to enhance self-efficacy are1) performance accomplishments (learning through personal experience); 2) verbal persuasion (information from health provider about client's ability); 3) vicarious experiences (seeing others perform challenging activities successfully, i.e. modeling); and 4) emotional arousal (information from health provider about consequences of health risks and benefits of change).

This study addresses two foci: increasing knowledge, and thereby subjects will have accurate outcome expectations, and using specific methods to increase efficacy expectations. A model of self-efficacy for this study is presented in Figure 2.

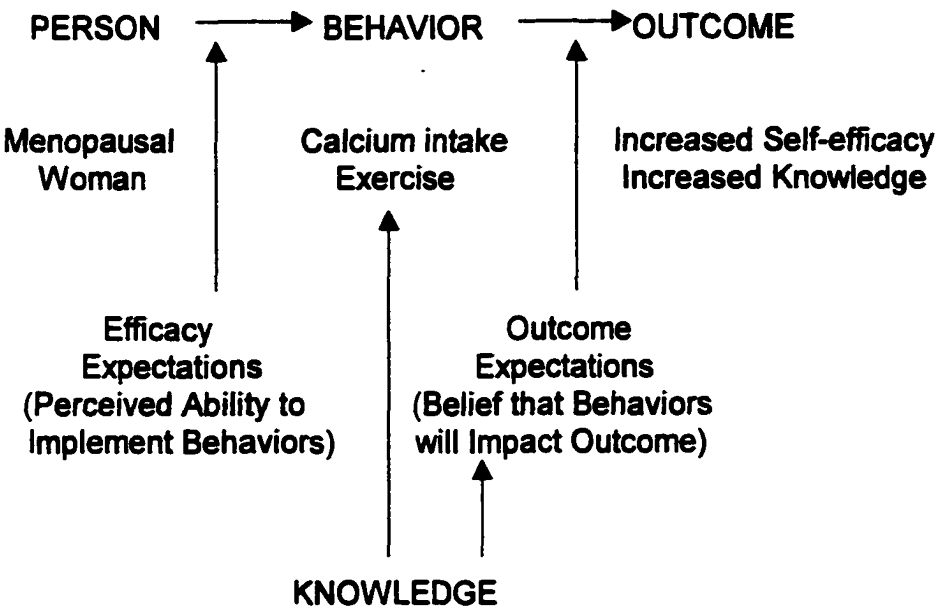

Figure 2. Model for Study of Self-Efficacy for Behaviors of Calcium Intake and Exercise.

Literature Review

Various behavioral changes have been identified that a woman can implement in her life that can influence the onset of osteoporosis. For purposes of this study, changes in diet, such as increasing calcium intake, engaging in exercise on a regular basis, and studies using self-efficacy will be explored.

Calcium. Bone is composed primarily of calcium and phosphate, therefore calcium is important for achieving peak bone mass and maintaining that bone for the remainder of life (Cummings, Kelsey, Nevitt, & O'Dowd, 1985; Heaney, 1986). The relationship between calcium intake and bone mass is that if calcium intake from food sources or supplements is not enough to offset obligatory losses (i.e. the body is in a negative calcium balance), then the resorption of bone exceeds the amount of new bone formed and the imbalance results in a loss of bone mass (Nordin, 1997).

Middle-aged and elderly women have an average intake of only 550 mg of calcium per day and women with osteoporosis consume less than that (Dawson-Hughes, 1996). According to the 1987 National Health Interview Survey, women age 35-49 consume 660 mg of calcium per day; women age 50-64, 643 mg daily; and women age 65-79 only consume 617 mg of calcium daily (Block & Subar, 1992). Estimates of calcium intake necessary to prevent a negative calcium balance have been set from 550 mg per day (Nordin, Horsman, Marshall, Simpson, & Waterhouse, 1979), up to 1000 mg per day for premenopausal women and 1500 mg per day for postmenopausal women (Nordin, 1997).

In premenopausal women, to optimize bone loss before the onset of menopause, a calcium intake of 1,000mg per day is recommended (Report of the Council on Scientific Affairs, 1995). During menopause increasing calcium intake to 1700 mg per day can slow bone loss (Aloia, Vaswani, Yeh, Ross, Flaster, & Dilmanian, 1994). Postmenopausal women 50 to 65 years of age should consume 1,000 to 1,500mg per day to minimize bone loss (Reid, Ames, Evans, Gamble, & Sharpe, 1995).

Correlation between calcium intake and fracture rates has been studied by many groups of researchers. Matkovic et al. (1979) determined that women from a dairy region of Yugoslavia where calcium intake was high (940 mg daily) had half the femoral fracture rate compared to women in other regions where calcium intake was lower (470 mg daily). Cummings (1990) described a meta-analysis of 37 studies of calcium intake and bone mass. He found a positive correlation of less than .10 between dietary calcium intake and bone mass. The correlation was greater in studies of premenopausal women. In cross-sectional studies, correlations may be weaker because of the technical difficulty of reliably measuring calcium intake, differences in skeletal site measured, and variations in subject age and calcium intake.

In other controlled studies in early-postmenopausal women, supplementation with 1000mg to 2000mg of calcium daily retarded bone loss from the radius (Ettinger, Genant, & Cann, 1987; Polley, Nordin, Baghurst, Walker, & Chatterton, 1987; Riis, Thomsen, & Christiansen, 1987). In a 14-year prospective study, dietary calcium was found to be inversely associated with subsequent risk of hip fracture (Holbrook, Barrett-Connor, & Wingard, 1988).

Researchers have studied the amount of calcium intake needed daily to preserve bone mass. Dawson-Hughes et al. (1990) found that healthy postmenopausal women whose daily calcium intake was less than 400mg lost mineral from the spine at a greater rate than women whose intake was higher.

Subsequent studies have found that non-food calcium supplementation decreased the rate of bone loss from the spine in late-postmenopausal women with a low dietary calcium intake (Dawson-Hughes et al., 1990).

Reid, Ames, Evans, Gamble, and Sharpe (1993), in a randomized controlled clinical study, found that women who were at least 3 years postmenopausal continued to lose bone on a dietary calcium intake of 750 mg per day. However, in the group of women who were supplemented with as much as 1,750 mg per day, bone loss stopped. In a meta-analysis involving over 1300 postmenopausal women and 44 bone sites, sowed that the mean annual rate of change in bone density was –1.3% in the controls and –0.12% in subjects treated with calcium (Nordin, 1997).

Increased rates of bone loss have been reported to occur for two to five years after menopause. Women lose about 1% of their spinal bone density per year during and after menopause (Samsioe, 1997). Rapid bone loss is common in elderly individual and tends to worsen with advancing age (Rosen & Tenehouse, 1998). Normal premenopausal women given placebo lost bone from the lumbar spine at a rate of 1 percent per year, whereas those who received supplemental calcium at 1500 mg per day did not lose bone (Baran, Sorensen, & Grimes, 1990). In postmenopausal women, calcium supplementation at doses of 1000 mg per day may decrease postmenopausal bone loss by as much as 50%, and the effects are more significant when the base-line calcium level is low, in older women, and in women with osteoporosis (Cummings, 1990).

In a study of elderly nursing-home residents, researchers found that a combination of vitamin D and calcium reduced the risk of hip fracture by 27% (Chaupuy & Meunier, 1996). Researchers studying nutrition and subsequent hip fracture, found that poor nutritional status leads to an increase risk of subsequent hip fracture (Huang, Himes, & McGovern, 1996).

In summary, intake of adequate amounts of calcium, including supplements, can have a significant effect on the prevention of bone loss. It is one of two behavioral changes that women can make to control bone loss and the development of osteoporosis. In addition, regular weight-bearing exercise is a behavior that women can initiate to prevent loss of bone mass which could lead to osteoporosis.

Exercise. When adequate amounts of calcium are combined with regular weight-bearing exercise, bone-sparing effects are increased. Researchers evaluated perimenopausal women who received 1000 mg of calcium daily and participated in an exercise program for two years. Women in the experimental group, taking calcium supplements, lost less bone from the distal radius (trabecular bone) than those receiving a placebo who got the same amount of exercise (Prince, Smith, & Dick, 1991).

Several cross-sectional studies have found positive relationships between general physical activity and bone density (Cheng, Suominen, Rantanen, Parkatti, & Heikkinen, 1991; Kriska et al, 1988; and Sinaki & Offord, 1988). Bernard, Bravo and Gauthier (1997) did a meta-analysis of studies that measured the effects of physical activity on bone mass density in postmenopausal women. Eighteen studies, done between 1966-1996, of women greater than age 50 without osteoporosis were included. These studies found significant effects of physical activity (walking, running, aerobics and physical conditioning) on bone mass density of the spine at L2-4. They concluded that exercise in postmenopausal women over 50 can be effective at preventing bone loss at the spine. In another meta-analysis in 1999 of randomized control trials and non-randomized control trials, researchers examined the effects of exercise training on bone mass of the lumbar spine and femoral neck in premenopausal and postmenopausal women. They included 25 studies from 1966-1996. They found that in randomized control trials, exercise training programs prevented or reversed almost 1% of bone loss per year in the lumbar spine and femoral neck for both premenopausal and postmenopausal women (Wolff, VanCroonenburg, Kemper, Kostense & Twisk, 1999).

Jacobsen, Beaver, Grubb, Taft, and Talmage (1984) found that older athletic women had bone density values in the radius and lumbar spine similar to those of young athletic women. This reinforces the idea that exercise may be especially important in women in the postmenopausal years. In a similar study, Talmage, Stinett, Landwehr, Vincent, and McCartney (1986), found that radial bone density declined with age after 47-52 years in non-athletic women, but no decline was seen in athletic women in the same age range.

In a study of ex-athletes compared with non-athletes, researchers found that the ex-athletes had higher bone mass densities even after up to 40 years from their athlete activities. When compared to a control group of non-athletes who also started an hour or more a week of vigorous activity, the ex-athletes and not the control group showed increases in bone mass (Etherington et al., 1996). Researchers examined mature females (42-50) with a history of sports training, types of previous training and bone mass density. Types of exercise were divided into 3 groups (n=20): high impact (netball, basketball), medium-impact (running, field hockey), and non-impact (swimming) activity groups and compared them with a nonsport control group (n=20). They found that the high impact group had increased whole body bone mass density and regional leg bone mass density compared to non-impact and control groups. The women with medium impact activity history had increased whole body and regional leg bone mass density compared to the nonsport control group. Regional arm bone mass density was significantly greater in all exercise groups over the control group. They concluded that females who exercise regularly in the premenopausal years in high-impact activities have higher bone mass density than non-active controls (Dook, James, Henderson, & Price, 1997).

Michel, Block, and Fries (1989) found that women who exercised vigorously displayed relatively low bone density. The relation between weight bearing exercise and bone density was positive with up to 217 minutes of exercise per week, after which the relationship was negative. This study implies that vigorous exercise beyond 3 hours and 37 minutes per week can actually have a negative effect on maintaining bone mass.

Various types of exercise have been studied, with studies using ordinary walking alone showing little benefit. Brisk walking did not stop the loss of spinal bone density in postmenopausal women over a one-year period (Cavaanaugh & Cann, 1988). In a prospective study over a 3 year period, walking exercise demonstrated no positive effect on radial bone mass (Sandler, Caulwy, Hom, Sashin, & Kriska, 1987). However, Nelson, Fisher, Dilmanian, Dallal, and Evans (1991), found significant difference in lumbar spine density between sedentary controls and postmenopausal women in a one year walking program in which the study group wore leaded belts around their waist.

Rutherford (1999) did a meta-analysis of studies over the previous 20 years to examine whether exercise can improve bone mass density in postmenopausal women. Different exercises and their effects or selected skeletal sites were examined. He determined that exercises can have a moderate benefit on bone mass density of the wrist, spine and hip, but did not detect differences between endurance or strength training for bone mass density of the spine. Evidence suggests that high impact activities such as stepping and jumping may be more effective at increasing an osteogenic response at the hip. He concluded that although the effects of exercise on bone mass density in later life are small. Epidemiological evidence suggests being active can nearly half the incidence of hip fracture later in life.

Several studies have shown a direct relation between weight-bearing exercise and bone mass (Dalsky et al., 1988; Kelly, Eisman, & Sambrook, 1990; Pocock et al., 1986; Simkin, Ayalon, & Leichter, 1987). In one group of healthy post-menopausal women, some of whom were receiving estrogen therapy, 2 years of weight-bearing exercise increased the density of the lumbar spine by

6.1%, whereas women who did not exercise lost bone (Dalsky et al., 1988). The groups, exercise and control, were equal in the number on estrogen therapy (about 20%). The inclusion of women on estrogen therapy may have inflated the degree of bone density obtained in this study, however bone loss in women who did not exercise supports the significance of exercise in prevention of osteoporosis.

In a review of studies of the effects of progressive resistance exercises on bone mass density, Layne and Nelson (1999) found that both aerobic and resistance can provide weight-bearing stimulus to bone, yet resistance training may have more profound site-specific effects than aerobic exercises. Over the previous 10 years, 24 cross-sectional and longitudinal studies have shown direct and positive relationships between resistance training and bone mass density. High intensity resistance training can also increase strength, balance and muscle mass, factors also important for preventing falls and fractures.

Kerr, Morton, Dick, and Prince (1996) examined the effects of a 1-year progressive resistance-training program on 56 post-menopausal women. They compared strength training (3 times 8 repetitions, high load, low repetitions), with endurance training (3 times 20 repetitions, low load, high repetitions). They found that bone mass density increased with the strength group significantly at the hip, intertrochanter, words triangle and distal radius site. There was no increase bone mass density with the endurance group except at the mid-radius site. They concluded that postmenopausal women's bone mass density can be increased by strength training, but not by endurance training.

Studies utilizing weight training have found positive results on bone mass. Gleeson, Protas, Leplanc, Schneider, and Evans (1990), found that lumbar bone density of premenopausal women who performed weight lifting for 12 months increased while that of the control group decreased. However a very large increase in muscle strength was accompanied by a very small increase in bone density, leading the authors to suggest that weight lifting may not be an optimal method for postmenopausal women. In a study of premenopausal women who participated in moderate weight-lifting exercise over 3 years, muscle strength increased, but there was no significant effect on bone mass density (Sinake et.al., 1996).

The effects of two types of exercise programs on the bone mass density of older sedentary females were compared (Kovort, Ensami, & Birge, 1997). Thirty-nine women (60-74) were assigned to 3 groups: 1) exercise through ground-reaction forces (GRF) (i.e. walking, jogging, stairs); 2) exercise through joint-reaction forces (JRF) (i.e. weight lifting, rowing); and 3) a non-exercise control group. The GRF and JRF exercise groups had significantly increased bone mass density in the whole body, lumbar spine and the proximal femur after 11 months of this study. Only the GRF increased bone mass density in the femoral neck. There was no change in bone mass density in the control.

Studies have also examined the optimal time to begin an exercise program to prevent osteoporosis. In a longitudinal study, bone mass density of the lumbar spine and proximal femur was maintained in premenopause, perimenopause and postmenopausal women by regular exercise (Goto, Shigeta, Hyakutake, & Yamagata, 1996). Twenty-six women with a mean age of 47.8 were followed for 5 years. Twenty-two subjects were in volleyball or jogging clubs. The bone mass density change in the lumbar spine was –0.17% in the premenopause period and –2.6% in the perimenopause period. The bone mass density in the proximal femur increased 1.8% per year in the premenopause period and decreased 1.07% in perimenopause. The premenopausal bone mass density in the proximal femur increased in all athletes, which was a significant difference compared to non-athletes which decreased by .31% per year. Women can achieve continuous gains in bone mass density of the femur before menopause with regular intense exercise. However, continued high level of physical activity in the perimenopausal period was not able to prevent bone loss.

Another study evaluating exercise in premenopausal and postmenopausal women was done by Bussey, Rothwell, Littlewood, and Pye (1998). The effect of vertical jumping (50 jumps, 6 times weekly) on bone mass density of premenopausal and postmenopausal women was studied. After 5 months, the bone mass density of the femur in premenopausal women increased significantly compared to a control group. After 12 months and 18 months, there was no significant difference between postmenopausal exercise groups compared to a control group. Women in premenopause respond to high impact exercise, but not postmenopausal women.

As evident in the research reviewed, bone mass can be enhanced by exercise. Although it is not clear which type of exercise is optimal, evidence suggests that a combination of aerobic and weight-bearing exercise may be the most effective. Several studies have demonstrated that a comprehensive exercise program (aerobic and weight bearing) can halt bone loss and even increase bone mass in postmenopausal women, especially if started in the premenopausal period (Chow, Harrison, & Notarius, 1987; Rikli & McManis, 1990).

It is well documented that the behavioral changes of calcium intake and exercise can have a positive impact on preserving bone mass and thus influencing the onset of osteoporosis. Increasing a woman's knowledge about these positive outcomes of health behaviors may not necessarily lead to women implementing behavioral changes. It is also important to address women's perceived ability to make lifestyle changes to integrate new behaviors. The concept of self-efficacy addresses these perceptions of a person's ability to implement change in behavior.

Self-Efficacy. In a meta-analysis of determinants of a health-promoting lifestyle, Gillis (1993) reviewed 23 studies using Pender's Health Promotion Model as a framework. Studies using cognitive-perceptual factors and modifying factors were reviewed to help explain why individuals engage in health-promoting lifestyles. Health status and self-efficacy were noted to be significant predictors of engaging in health-promoting lifestyles in a study of Pender's Health Promotion Model with a sample of blue-collar workers (Weitzel, 1989). Waller, Crow, Sands, and Becker (1988) found that self-efficacy and better health status were the best predictors of a health-promoting lifestyle in subjects at a health fair. A significant inverse relationship between self-efficacy and barriers to a health-promotion lifestyle for disabled individuals was found (Stuifergen, Becker, & Sands, 1990). Of all the constructs evaluated, self-efficacy was the strongest predictor of a health-promoting lifestyle, but yet not the most-frequently studied determinant. Further studies incorporating self-efficacy need to be implemented.

Research of the self-efficacy concept has been applied to studies with smoking cessation, weight control, contraceptive behavior, alcohol abuse, and exercise. As noted in a meta analysis by Stretcher, DeVillis, Becker, and Rosenstock (1986), there has been a lack of research using the self-efficacy concept with behaviors related to compliance with medical regimes and dietary changes unrelated to weight control. Studies measuring the effects of a behavior change program on self-efficacy found overall increases in self-efficacy over the course of treatment, and found efficacy to be related to short and long term successes as a result of the program. Survey studies of self-efficacy reviewed suggested strong associations between self-efficacy and progress in health behavior change and maintenance.

Only a few studies have been done examining the effect of efficacy expectation on initiating exercise behaviors. In a study of men with an uncomplicated myocardial infarction, researchers found that changes in efficacy scores as a result of treadmill exercise testing predicted both the duration and intensity of subsequent self-reported home activity. Self-efficacy assessments were correlated with subsequent performance on the treadmill test, which, in turn, predicted subsequent changes in self-efficacy for exercise and physical activities at home. Those individuals who reported high self-efficacy for exercise after successfully accomplishing treadmill exercises, had higher scores for self-efficacy of performing exercise routines at home. Whereas individuals who reported low self-efficacy for performing treadmill exercises, had lower reported self-efficacy for performing exercises at home. This was a prospective descriptive study with a group of 40 persons with a mean age of 54. There was no control group. The intervention of counseling from a nurse or physician was helpful in generalizing self-efficacy effects from activities related to treadmill testing (climbing; walking; running) to less-related activities (lifting; sexual activity) (Ewart, Taylor, Reese, & Debusk, 1984). The self-efficacy enhancement techniques of performance accomplishments (achieving treadmill exercises), and verbal persuasion (counseling from health care providers) were instrumental in improving self-efficacy and generalizing this self-efficay to other physical activities. However, there was no control group to establish whether this intervention was more significant than contact that may have been received from ongoing health care post-myocardial infarction. The results of this study support the self-efficacy theory, which states that positive personal experience with activity is the most important factor in increasing self-efficacy.

In a prospective study of 198 subjects with Coronary Heart Disease who had had a cardiac catheterization, researchers found that self-efficacy scales significantly predicted physical function, social function, and family function. They concluded that self-efficacy to maintain physical, social and family function and to control symptoms helps predict physical function and role function (Sullivan, LaCroix, Russo, & Katon, 1998).

In 1992, Robertson and Keeler looked at compliance with exercise programs in 51 patients, mostly men ages 37-84, after coronary artery bypass graft surgery or angioplasty surgery. This was a correlational study which evaluated the relationships of concepts of the Health Belief Model that explained adherence to a recommended exercise regimen. Barriers to exercise, the type of surgery, and self-efficacy for exercise explained 31% of the variance of exercise adherence. The study suggests the importance of self-efficacy and health beliefs in explaining exercise adherence.

In another study of self-efficacy and activity level following cardiac surgery, Gortner and Jenkins (1990) developed an experimental study with 156 patients, aged 30-75, randomized to control or experimental groups. Both groups viewed a video program about post-operative recovery in cardiac patients. The experimental group also received a slide/tape program about family coping and conflict resolution followed by a counseling session with a nurse discussing coping techniques. The experimental group was followed by phone calls on a weekly or biweekly basis for 24 weeks, which included recovery monitoring and persuasive information about activity performed, and reassurance and support to spouse as well as the patient. Self-efficacy was defined as the belief in one's ability to exercise control over actions and over environmental demands. Self-efficacy expectations were found to be significantly increased in the experimental group. Self-efficacy expectations were found to be a significant predictor of self-reported activity, with subjects in the experimental group reporting higher levels of exercise and general activity throughout the 24 weeks of the study. This was an excellent study which demonstrated the strength of interventions which increase self-efficacy, such as verbal persuasion, performance accomplishments, and emotional arousal, and this increased self-efficacy can have an effect on increasing health behaviors.

Researchers, working with a group of patients with chronic obstructive pulmonary disease, assigned subjects to one of five experimental groups, including three exercise treatment groups (to increase walking), and two control groups. Subjects in each of the three treatment groups increased their walking activity in comparison to those in the control groups. This increase was associated with increase in perceived efficacy for walking. The sample included 60 men and women with moderate to severe COPD with a mean age of 65 (Kaplan, Atkins, & Reinsch, 1984). The self-efficacy enhancement technique of performance accomplishment was helpful in effecting an increase in self-efficacy. Efficacy expectations specific to the target behavior, walking, were most predictive of successful accomplishment for that behavior.

In studies with rheumatoid arthritis patients, assessment of health problems, difficulty adhering to health recommendations, and the relationships of these problems with self-efficacy and social support were explored. A group of 86 patients, 71% female, with a mean age of 60 were included in this correlational study. Self-efficacy was described as a person's conviction that he or she can successfully execute the behavior required to produce a certain desired outcome. Initial interviews were done assessing the subjects' perception of their health problems, and whether they thought these problems to be problematic. Subjects were also asked about health recommendations they received from their health care providers, and if they had problems adhering to these recommendations. Social support, perceived emotional support, and perceived instrumental support were measured. Self-efficacy expectations were also measured. Results indicate that subjects with high self-efficacy judge their health status higher, and this level of perception is not related to the severity of illness determined by their provider. Self-efficacy was found to be a significant determinant of performance that operates partially independently of skill level. Instrumental social support was also found to be positively related to perceived health status. Researchers concluded that problems in adherence are not primarily caused by functional incapacity but by the subjects' subjective estimates of their own capabilities in coping with the consequences of arthritis. Recommendations stated that patient education should be aimed at strengthening self-efficacy expectations in which social emotional support might be an enhancing factor (Taal, Rasker, Seydel, & Wiegman, 1993).

The impact of a rheumatoid arthritis patient education program on knowledge and self-efficacy was performed by Davis, Busch, Lowe, Taniguchi, and Djkowich (1994). They defined self-efficacy as the perception or confidence to cope with the consequences of chronic arthritis in three areas: physical function, control of pain, and control of other arthritis symptoms. The sample included 41 subjects with an average age of 52. A pretest measurement of knowledge and self-efficacy was done on all subjects prior to initiating the education program, in which 37 hours of instruction was given over a two-week period. A multi-modality program was presented by Nurses, Physicians, Physical Therapists, Occupational Therapists, Pharmacists, Social Workers, Psychologists, and Dieticians, and consisted of practical sessions, exercise classes, demonstration, home study and individual treatment. No specific interventions aimed to enhance self-efficacy were defined in the program outline. The results showed that both knowledge and self-efficacy significantly improved over baseline scores, and were maintained at follow-up. This study found that knowledge and self-efficacy could improve with a patient education program. However there was no control group, so how much increase in knowledge and self-efficacy came from contact with health care providers in the course of receiving standard care alone is unknown.

In a study of efficacy beliefs in geriatric rehabilitation, 77 participants were randomly assigned to the usual care control group or a treatment group who received three efficacy-enhancing interventions: role modeling, verbal persuasion, and physiological feedback. The treatment group had stronger efficacy beliefs regarding participation, higher participation at discharge, and less pain than the control group. Efficacy beliefs, both self-efficacy and outcome expectations, were related to participation, functional performance and length of stay (Resnick, 1998). This study demonstrated that Bandura's methods of enhancing self-efficacy (Bandura, 1977) were effective at increasing efficacy expectations in the experimental group. The subjects in the experimental group had higher participation, improved functional ability, and were able to be discharged from in-patient rehabilitation sooner compared to control group subjects. This significant finding that increasing self-efficacy can lead to improved health and decrease healthcare costs can be utilized in many types of health promotion and disease prevention.

Researchers evaluating self-efficacy in older adults (Grebowski et al., 1993) conducted an experimental study with 2,524 Medicare enrollees in an urban/suburban northwestern health center. Efficacy expectations were defined operationally by a subject's perceived ability and likelihood to control a specific health behavior. Efficacy expectations, outcome expectations, and baseline health risk assessments were done on five health behaviors: exercise, dietary fat intake, weight control, alcohol intake, and smoking. Functional health status, perceived general health status, and socioeconomic status were also measured. Participants in the experimental group received a preventive services package based on their health risk status which could have been selected from 15 major interventions (exercise, nutrition, planning, mental health, hearing, medications awareness, incontinence, hypertension, physical exam and laboratory, immunizations, injury prevention, alcohol use, smoking, vision, and breast cancer screening). These interventions were provided by a nurse or physician at health promotion and disease prevention visits and group sessions in each year of the two-year intervention. Control group methods are not discussed in this study, and there is no mention of their post-test results in the study. The researchers evaluated the relationships among preventive self-efficacy, health behavior, socioeconomic status, and health status among participants in the trial. In studying self-efficacy and older adults, they concluded that older adults with high efficacy expectations for exercise, dietary fat, and weight control are more likely to perform those behaviors and have better functional, mental health, and self-rated health than older adults with low efficacy expectations for those behaviors. The implications for changing health behaviors is that it is important to design interventions aimed at improving efficacy expectations. In so doing, older adults may be more likely to increase health behaviors and thereby improve health status.

In conclusion, self-efficacy has been found to be a significant determinant of integrating health behaviors into a person's lifestyle. Based on research, in order to assist persons to implement behavioral changes, methods designed to increase self-efficacy for health behaviors can be instrumental in achieving long lasting changes in performing health behaviors. Further research in this area is warranted. Studies designed to enhance behavioral changes to prevent osteoporosis using self-efficacy-enhancing techniques have not been found in the literature. Enhancing self-efficacy in premenopausal and menopausal women could result in positive changes for the health behaviors of calcium intake and regular exercise, which could be a substantial part of a program to prevent osteoporosis.

Hypothesis

For this study, evaluating the effect of an osteoporosis prevention program on knowledge of osteoporosis and self-efficacy for health behaviors of exercise and calcium intake, the following research hypotheses were presented:

H(R)1: Middle-aged women who participate in an osteoporosis prevention program will have more knowledge of osteoporosis than nonparticipants.

H(R)2: Middle-aged women who participate in an osteoporosis prevention program will have more self-efficacy for the behavior of exercise compared to nonparticipants.

H(R)3: Middle-aged women who participate in an osteoporosis prevention program will have more self-efficacy for the behavior of calcium intake compared to nonparticipants.

Conceptual Definitions

Dependent Variables

1. Knowledge of Osteoporosis

A state of conceptual awareness about the risk factors that can lead to development of osteoporosis. Knowledge of the appropriate type, intensity and frequency of exercise recommended to prevent bone loss is also part of this awareness. The knowledge of the daily requirements of calcium for adults, and food sources of calcium as well as the type of calcium supplements needed to prevent bone loss is important.

2. Self-efficacy for health behaviors for exercise.

   A woman's perception about how capable she is of implementing behaviors to increase exercise to prevent bone loss.

3. Self-efficacy for the health behavior for calcium intake.

   A woman's perception about how capable she is of implementing behaviors to increase calcium intake to prevent bone loss.

Independent Variable

1. Osteoporosis Prevention Program

   A program designed to impart knowledge regarding osteoporosis risk factors, development, and prevention behaviors as well as specific guidelines to help participants increase their perception of their ability to implement health behaviors of exercise and calcium intake.

CHAPTER THREE

Methods and Procedures

Research Design

A quasi-experimental design with pretest and post-test was used for this study. A convenience sample was used. Women meeting the criteria were invited to attend an Osteoporosis Prevention Program. Those who attended the program became the experimental group. Those women that did not attend the program became the control group. Two pretests were given to each group. The first pretest was the Osteoporosis Knowledge Test (OKT) (Kim, Horan, & Gendler, 1991) (Appendix A), and the second pretest was the Osteoporosis Self-Efficacy Scale (OSES) (Horan, Kim, Gendler, Froman, & Patel, 1998) (Appendix B) to test the dependent variables of knowledge of osteoporosis and self-efficacy for exercise and calcium intake. The experimental group participated in an Osteoporosis Prevention Program, consisting of a multimodality presentation (verbal, visual, and written interactive modalities) about osteoporosis development, risk factors, and prevention strategies as well as specific information and guidelines on how to implement health behaviors related to exercise and calcium intake. The control group received written material about menopause usually received at an office visit with their health care provider. Two post-tests (OKT and OSES) were given to each group. This type of research design was selected for this study due to the strength of analysis which results from comparing experimental and control group results. A diagram of the research design is presented in Figure 3.

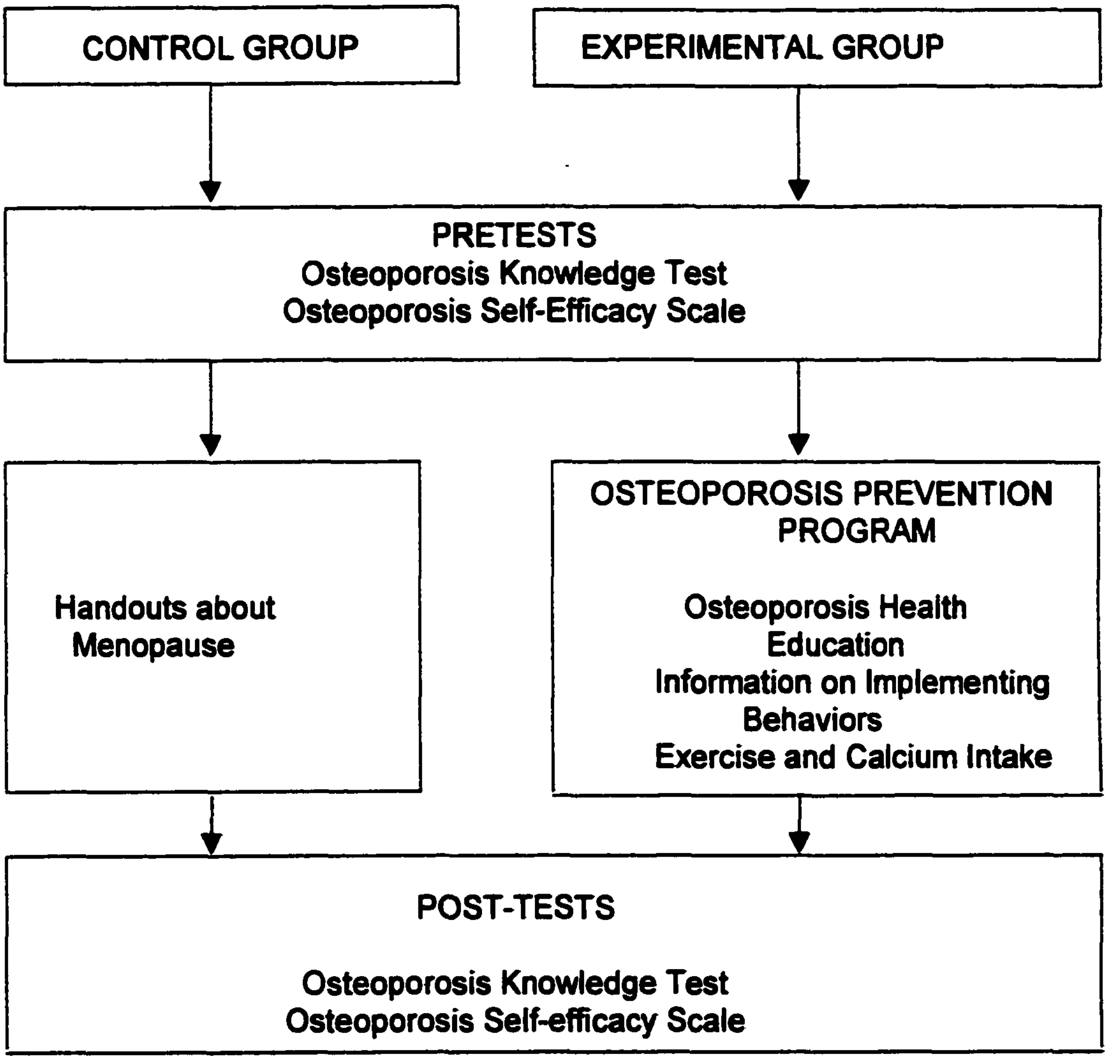

Figure 3. Research Design

Setting and Sample

Participants were selected from enrollees who received care in the Obstetrical/Gynecology Clinic in a midwestern metropolitan Health Maintenance Organization (HMO). This facility serves women from the urban and surrounding suburban locations. The clientele came from diverse socioeconomic backgrounds from low socioeconomic through lower-upper socioeconomic levels. Clients had private health insurance through the HMO, or Medicaid and Medicare sponsored membership in the HMO.

The convenience sample included 32 women aged 40-62. This age group was selected as they are in a stage of their lives in which they are becoming aware of the physical and health changes of their upcoming or recent menopause, and were likely to be receptive to osteoporosis knowledge and interventions. Sample selection criteria included having at least a 5th grade education, and being physically capable of completing the study such as ability to see, hear, and write and be fluent in reading, writing, and speaking English.

Exclusion criteria included those factors that impact the ability to exercise or increase calcium. Such exclusion criteria included women who had a history of kidney disease, parathyroid disease or cancer, due to possible restrictions of calcium intake. Women with a current diagnosis of osteoporosis or pregnancy were excluded.

Using the American College of Sports Medicine (ACSM) exercise criteria, women with coronary heart disease or hypertension were excluded if they could not exercise at least three times weekly for 20 to 30 minutes without symptoms (American College of Sports Medicine, 1995). Women with severe arthritis, low back stabilization program within the last three months, or major surgery within the last three months were excluded due to their potential inability to implement an exercise program. A description of the candidate's past and current exercise patterns was also collected.

Women who had a surgical menopause (oophorectomy), or who were currently on hormone replacement therapy were not excluded, as their ability and motivation to implement osteoporosis prevention behaviors would not be affected by their health status, and they could benefit from the prevention behaviors of exercise and calcium intake.

The medical and social history of each candidate was reviewed at the initial meeting by the use of a questionnaire to establish whether they qualified for the study (Appendix C).

Demographic information was gathered to describe the sample and evaluate the equivalency of groups. Characteristics included age, education, employment, number of family members in the household, ethnicity, marital status, exercise history, menopausal status, and the use of hormone replacement therapy (Appendix C). Frequency distribution of these variables and other descriptive data are presented in tabular form in the results section.

Instrumentation

Demographic Data and Medical History Sheet. The Demographic Data and Medical History Sheet was a two-paged questionnaire that subjects either filled in the blank with the appropriate answer or checked the appropriate line reflecting their answer. Subjects completed this sheet in private at end of their office visit to the OB/GYN department (Appendix C).

The Osteoporosis Knowledge Test (OKT) (Kim, Horan, & Gendler, 1991) and the Osteoporosis Self-Efficacy Scale (OSES) (Horan et al., 1998) were used in both the control and experimental group as pretests and post-tests. Both tools have been developed as part of an ongoing body of research at Grand Valley State University, Allendale, Michigan, with 201 women 35 years and older, related to osteoporosis prevention. Permission to use these scales was secured from the authors (Appendix D).

Osteoporosis Knowledge Test. The Osteoporosis Knowledge Test (OKT) (Kim, Horan, & Gendler, 1991) was used to measure the degree of knowledge about osteoporosis risks and prevention behaviors. The Osteoporosis Knowledge Test is a 24 item multiple-choice test about risk factors for osteoporosis, calcium intake and exercise interventions and their effects on osteoporosis. The total possible score was 24. There are two subscales: Exercise and Calcium intake (Appendix A). In this study, the total score rather than the two subscale scores was used.

Cronbach's alpha for the two subscales of the OKT, OKT Calcium and OKT Exercise, were .72 and .69, respectively. Validity of the OKT was evaluated by factor analysis and discriminant function analysis (Kim, Horan, & Gendler, 1991). In the current study, reliability based on Cronbach's alpha for the entire knowledge test was .86.

Osteoporosis Self-Efficacy Scale. The Osteoporosis Self-Efficacy Scale (OSES) (Horan et al., 1998) was used to measure the participants perception of their ability to implement the health behaviors of exercise and calcium intake. The Osteoporosis Self-Efficacy Scale is a twenty-one item scale that evaluates a participant's confidence in her ability to implement health behavior changes related to exercise and calcium intake. Subjects responded to questions on a visual analog scale by putting an "x" along the line with anchors of "Not at all confident" on the lower end to "Very confident" at the higher end. A visual analog scale was used to score the test. The line from "Not at all confident" to "Very confident" measures 10 cm. The subject's score was measured to the nearest millimeter. The range for each item is 0-100. The OSES has two subscales, one for exercise (OSES01-OSES10), and one for calcium (OSES11-OSES21). The scores for the items from each subscale were totaled. The total possible score for each subscale ranges from 0 to 1000 for exercise or 0 to 1100 for calcium (Appendix B).

Reliability coefficients for the two OSES subscales for internal consistency (Cronbach's alpha) were .94 (exercise) and .93 (calcium intake). Validity of the OSES was evaluated by factor analysis and hierarchical regression (Horan et al., 1998). In the current study, the reliability coefficients based on Cronbach's alpha were .97 for exercise and .97 for calcium.

Intervention

Osteoporosis Prevention Program. An Osteoporosis Prevention Program was given to participants in the experimental group. A group program was given to all participants at one evening session by the primary investigator. The location was a conference room in the same building as the HMO Clinic. The participants were seated at tables in rows facing the presenter. Information related to bone physiology, osteoporosis risks, development, and prevention strategies of exercise and calcium intake was included. Additional information related to increasing self-efficacy for health behaviors of exercise and calcium was also presented, based on Bandura's methods (Bandura, 1977). The prevention program consisted of an hour and a half multimodality presentation. The first half of the program included slides with text describing hormonal influences throughout women's lifespans, definitions of osteoporosis, risks to develop osteoporosis, epidemiology, and bone physiology. Also included were slides of text describing osteoporosis prevention strategies for exercise and calcium intake.

Recommendations for exercise to prevent osteoporosis were 20 to 30 minutes of aerobic load-bearing exercise at least three times per week. A portion of this time was recommended to be devoted to resistance training such as weight-lifting to help strengthen bone mass. Examples of aerobic exercise included jogging, walking with weighted vests or belts, low-impact aerobic classes, bicycling, and least preferable, swimming (Kleerekoper, 1995). Intensity of aerobic exercise was described by the "talk-sing" method. This method describes aerobic exercise intensity as that where the subject is able to carry on a conversation during exercise, but not able to sing during the activity (Harsha, Mikesky, Picard, Crowell, & Lubitz, 1997).

The recommendation for calcium intake was a total of dietary and supplemental intake of 1000 mg per day for women age 25-50, or for menopausal women on hormone replacement therapy. Menopausal women not on hormone replacement therapy or women with oophorectomy or premature ovarian failure were recommended to have a total of dietary and supplemental intake of 1200 mg calcium per day. Women over 65 were advised to have 1500 mg of total calcium intake per day (Consensus Development Conference Statement, 1994).

Subjects were encouraged to ask questions throughout the session. A break was taken after the first session, and calcium-rich foods were served and the calcium content of these foods were discussed. Foods served included calcium-fortified orange juice, cheese, figs, and spinach dip.

In the second half of the Osteoporosis Prevention Program, Bandura's techniques to enhance self-efficacy (1977) were used to discuss osteoporosis prevention behaviors of exercise and calcium intake. Participants were shown an overhead projection of a questionnaire entitled "Making Lifestyle Changes" and wrote their responses on their copy of the questionnaire. Participants were encouraged to share their responses.

The first section addressed Bandura's technique to increase self-efficacy by reviewing past accomplishments. They were asked to write down 3 previous goals they had accomplished. Examples were given such as weight loss, an exercise program, completing college or technical training, taking a leadership role in their child's school or sports activity, or being involved in a church or community program. They were then asked to set a goal to include exercise in their weekly routine, and to schedule a time to do their exercises. They were also asked to list 2 ways in which they could increase calcium intake in their diet, and to then calculate the amount of calcium they would have per day.

The next method used to enhance self-efficacy from Bandura's techniques was verbal persuasion. The participants were asked to write down what their health care provider would say to them about their ability to make lifestyle changes. This presenter also encouraged them about their ability to integrate new behaviors by having them reflect on their past accomplishments. They were then asked to write down what their family and significant others would say to them when the participants discussed their goals with them, specifically what encouragement family would offer.

The next method used was Bandura's vicarious experience technique. Participants were asked to reflect upon whom they knew that they admired for setting a goal and accomplishing it, and list two such people. They were also asked to list two characteristics these persons had that helped them accomplish their goal, such as discipline or persistence.

The last of Bandura's techniques used was emotional arousal. This presenter reminded the participants of the information from the knowledge portion of the Osteoporosis Prevention Program, and that the evidence was very strong that these prevention behaviors of exercise and calcium intake could substantially decrease their risk of developing osteoporosis. They were then reminded that as women and primary caretakers of their family and community members, they had supported many others in pursuit of school and other activities. And as primary caregivers, they had the right and responsibility to ask others for support toward their own goals. In so doing, they could potentially be in much better health, and able to continue giving support to others for many years. They were asked to list two people that they could ask for support, and list two support groups or classes they could attend to help them meet their goals.

An outline of the Osteoporosis Prevention Program is included in Appendix E. The control group received a brochure about menopause entitled "Coping with Menopause" (Organon Inc., 1994) which is typical of what would be received at a gynecological visit with their health care provider. The brochure describes changes women experience before and during menopause, reviews the normal menstrual cycle and hormonal controls and how these change prior to and during menopause. It detailed the effect of menopause on body systems including muscle, skin, reproductive organs, hair, teeth and bones. The "classic" menopause symptoms and body changes are addressed and some techniques to cope with and prevent problems are given.

Data Collection Procedures

Women age 40 to 62 were given a letter of introduction about the study and an invitation to join the study when they presented to the OB/GYN clinic for care (Appendix I). Letters were displayed at the sign-in desk and in the waiting room. Clinic staff (RN's and medical assistants) and other providers as well as the primary investigator discussed the study with potential subjects and were invited to join. Inclusion and exclusion criteria were reviewed by the researcher collected on the questionnaire. Those women who met the criteria were given the consent form (Appendix F), and the OKT and the OSES pretests by the researcher. These forms were completed at the end of the subjects' office visit in a private office. It took 20 to 30 minutes for the completion of the consent and the tools.

Voluntary consent was obtained, and women who chose not to participate were respected, and there was no change in access to or quality of care rendered to them. Participants had the right to withdraw from the study at any time without question, with no resulting change to their health care.

Confidentiality and anonymity as to the participant's identity was maintained, and all records were kept under code numbers, and accessible only to the researcher. The letter of invitation and consent form had the subject's name and code numbers on them, and the instruments were identified only with the code numbers. The study was explained to each potential participant, and a signed informed consent was obtained (Appendix F).

Every effort was taken to prevent any physical or emotional harm to subjects. There were no known risks, and there were potential benefits from the Osteoporosis Prevention Program. The research followed all procedures for, and was submitted to the Human Systems Review Board at Henry Ford Medical Center, and Grand Valley State University and received approval prior to initiation of the study (Appendix G & H).

All subjects who agreed to be in the study were invited to attend the Osteoporosis Prevention Program. Sixteen women attended the program, and post-tests were completed immediately after the completion of the program. The post-tests were done all at the same time, individually, when the group stayed after the Osteoporosis Prevention Program. There was no discussion about the test answers until all participants completed and handed in the tests. The time frame from the completion of the pretests to completion of the post-tests ranged from 3 months to a few days.

Women who were interested in the study, who did not attend the Osteoporosis Prevention Program, were mailed a letter asking them to read an enclosed brochure about menopause and complete the post-tests when finished. Sixteen women completed the post-tests and returned them in a pre-addressed stamped envelope.

The recruitment, presentation of the Osteoporosis Prevention Program, and the mailing and return of the menopausal brochure and post-tests were completed over a three month period from the initiation of the study. All subject selection, interventions, and data collection were performed by the primary investigator.

CHAPTER FOUR

Data Analysis

The purpose of this study was to evaluate the effect of an osteoporosis prevention program on women's knowledge of osteoporosis and their perceptions of their ability to make health behavioral changes to prevent osteoporosis, or self-efficacy. The hypotheses were that women who participated in an osteoporosis prevention program would have more knowledge of osteoporosis and have more self-efficacy for the behaviors of exercise and calcium intake compared to nonparticipants. All statistical analyses were performed utilizing the Statistical Package for the Social Sciences (SPSS for MS Windows, Release 6.1). All hypotheses were tested with one-tailed t-tests using a .05 level of significance.

Demographic Data

Demographic data were collected on all participants for age, educational level, marital status, ethnicity, number of persons in the household, employment, exercise history, use of hormonal replacement therapy, and menopausal status. Subjects ranged in from 40-62 with a mean of 49.12 years (SD = 6.82). The educational level of subjects ranged from 12 years to 20 years of education with a mean of 15.53 years (SD = 2.60).

Seventy-five percent of all the subjects had some college education. Eighty-four percent of all subjects were employed (27 subjects working and 5 subjects not employed). Nineteen subjects, or 60%, had one or fewer family members beside themselves in their household. Thirteen subjects, or 40%, had 2 or more family members beside themselves in their households, with a range of 2 to 5 members. The majority of subjects were married at 65.6%, or 21 subjects. Eleven subjects, or 34.4% were not married (2 single, 1 separated, 5 divorced, and 3 widowed). Exercise history showed that 12 members, or 37.5%, were currently exercising at least 3 times per week for thirty minutes. Twelve members, or 37.5%, had exercised in the past 3 times weekly for thirty minutes, and 8 subjects, or 25%, had not exercised in the past nor were they exercising regularly now. Seventeen members, or 53.1%, were menopausal. Only 9 subjects of the 17 menopausal women were taking hormone replacement therapy.

Demographic data were analyzed to compare the equivalence of the experimental and control groups. A t-test was performed on age and educational level (Table 1). A chi-square with Yates continuity correction was done on ethnicity, number of family members in the household, employment, exercise history, use of hormone replacement therapy and menopausal status (Table 2). The categories for employment status were collapsed into two groups only, working or not working outside the home, as only one person worked part-time. The categories for the number of family members in the home were also collapsed into two categories. There were a total of 19 subjects from both groups who had one or less family members at home, and a total of 12 subjects who had 2 to 5 family members at home.

Table 1

Group Comparison of Demographics by t-tests

Variable	Control		Experimental		t-tests	
	Mean	SD	Mean	SD	t	Significance
Age	48.69	6.87	49.75	6.97	.67	NS
Education	15.63	2.34	15.43	2.92	.84	NS

Table 2

Group Comparison of Demographics by chi-square tests

Variable	Control		Experimental		Values	
	n	%	n	%	chi-square	Significance
Family Members In Household 0 – 1	13	81.3	6	37.5	4.66	.03
> 2	3	18.8	10	62.5		
Employment 0 Hours	0	0	5	31.3	3.79	.05
>30 Hours	16	100	11	68.8		
Ethnicity African American	7	43.8	12	75	2.07	NS
Caucasian	9	56.3	4	25		
Exercise 3 x wk, 30'	5	31.3	7	43.8	.66	NS
Past not now	7	43.8	5	31.3		
Never	4	25.0	4	25		
Menopause Yes	7	43.8	10	62.5	.50	NS
No	9	56.3	6	37.5		
Hormone Replacement Therapy Yes	4	25	5	31.3	.00	NS
No	12	75	11	68.8		

There was no difference between groups in the categories of age, educational level, ethnicity, exercise history, use of hormone replacement, or menopausal status. There was a statistically significant difference between groups in the number of persons in the household. The women in the experimental group had 10 subjects with more than 2 members in their household beside themselves. The control group had 13 subjects with 1 or less members in the household beside themselves (chi-square = 3.79, df = 1, p= .03) (Table 2).

There was also a statistically significant difference between groups in employment status. All members of the control group were employed outside the home. The experimental group had 5 members that were not employed outside the home, with 11 members that were employed (chi-square = 4.66, df = 1, p = .03) (Table 2).

Hypotheses Testing

All hypotheses were tested using inferential statistical techniques. The appropriate statistical analysis to use to test these hypotheses was an analysis of covariance (ANCOVA) between the experimental and control groups pretest and post-test scores, using the pretest scores from the Osteoporosis Knowledge Test (OKT) and the Osteoporosis Self-Efficacy Scale (OSES) as the covariates. One of the assumptions of an ANCOVA is that there is homogeneity of regression across groups (Munro & Page, 1993). However, there was found to be a significant interaction effect between the independent variable (the osteoporosis prevention program) and all 3 covariates (the 3 pretests), which violated the above assumption, therefore an ANCOVA could not be used. Thus, independent t-tests were used on the pretest and post-test scores of the OKT and the OSES for exercise and calcium intake for the experimental and the control groups. Paired t-tests were also done within each group to test the change in scores between pretest and post-test.

Hypothesis One. The first null hypothesis postulated that there would be no difference between experimental and control groups for the post-test scores on the OKT. The pretest scores showed no significant difference between groups with the mean of the experimental group at 15.19 and the mean of the control group at 17.88 (t = 1.55, df = 30, p = .13). The post-test scores showed a statistically significant difference between groups with the experimental group showing higher mean scores. The mean score on the post-test for the experimental group was 22.00, and the control group was 17.63 (t =3.84, df = 21.02, p = .001) (Table 3). Thus the null hypothesis was rejected and the first hypothesis that women who participated in an osteoporosis prevention program would have more knowledge of osteoporosis than non-participants was supported.

Table 3

Group Comparison of Osteoporosis Knowledge Pretests and Post-tests

Osteoporosis Knowledge Test	n	Mean	SD	t	df	p
Pretests						
Experimental	16	15.19	5.30	1.55	30	NS
Control	16	17.88	4.50			
Post-tests						
Experimental	16	22.00	1.90	3.84	21	.001
Control	16	17.63	4.15			

Table 4

Group Improvement with Osteoporosis Knowledge Test from Pretest to Post-test

Osteoporosis Knowledge Test		n	Mean	Paired Difference Mean	SD	t	df	p
Experimental Group	Pretest	16	15.19	6.81	4.55	5.99	15	.00
	Post-test	16	22.00					
Control Group	Pretest	16	17.86	.25	2.11	.47	15	NS
	Post-test	16	17.63					

Paired t-tests were done between the Osteoporosis Knowledge Test pretest and post-test scores of the experimental group as well as the control group. The experimental group scores showed a statistically significant improvement (t = 5.99, df = 15, p = .00). In contrast, the control group did not show a statistically significant improvement in scores. This further supported the first hypothesis that women who participated in an osteoporosis prevention program would have more knowledge of osteoporosis than nonparticipants (Table 4).

Hypothesis Two. The second null hypothesis postulated that there would be no difference between the experimental and control groups for the scores on the OSES for exercise behaviors. The pretest mean scores of the experimental and control groups showed no significant difference with the mean of the experimental group at 594.93 (SD = 243.25), and the mean of the control group of 702.06 (SD = 184.43) (t = 1.24, df = 25.26, p = .23). The post-test mean scores from the independent t-tests between groups also did not show a statistically significant difference. The experimental group's mean score was 803.50 (SD = 135), and the control group's mean score was 733.63 (SD = 178) (t = 1.25, df = 30, p = .22) (Table 5).

However, when the paired t-tests were performed, there was a statistically significant improvement between the Osteoporosis Self-efficacy Scale for exercise pretest (m = 594) and post-test mean scores (m = 803) with the experimental group (t = 3.43, df = 15, p = .004), but not for the control group (pretest m = 702, post-test m = 733) (Table 6).

Table 5

Group Comparison for Osteoporosis Self-Efficacy Scale Exercise Pretest and Post-test

Osteoporosis Self-efficacy Scale Exercise	n	Mean	SD	t	df	p
Pretests						
Experimental	16	594.94	243.25	1.24	25	NS
Control	16	702.06	184.43			
Post-tests						
Experimental	16	803.50	135.06	1.25	30	NS
Control	16	733.63	178.40			

Table 6

Group Improvement Osteoporosis Self-Efficacy Scale for Exercise Pretest to Post-test

Osteoporosis Self-efficacy Scale Exercise		n	Mean	Paired Difference Mean	SD	t	df	p
Experimental Group	Pretest	16	594.94	208.56	243.21	3.43	15	.004
	Post-test	16	803.50					
Control Group	Pretest	16	702.06	31.56	76.28	1.66	15	NS
	Post-test	16	733.63					

The second null hypothesis was not rejected and the hypothesis that women who participated in an osteoporosis prevention program would have more self-efficacy for the behavior of exercise compared to nonparticipants was not supported. However, the statistically significant improvement in scores from pretest to post-test in the experimental group, and not in the control group, demonstrated that the Osteoporosis Prevention Program had a definite positive effect on self-efficacy for exercise.

Hypothesis Three. The third null hypothesis postulated that there would be no difference between the experimental and control groups for the scores on the OSES for calcium intake behaviors. The pretest scores between groups showed no significant difference with the mean score of the experimental group at 828.81 (SD = 247), and the control group mean score at 780.06 (SD = 218). Post-test scores did show a statistically significant difference with the experimental group having a higher mean score of 961.06 (SD = 160) compared to the control group's mean score at 813.06 (SD = 230) (t = 2.11, df = 30, p = .04) (Table 7).

The paired t-tests for the OSES for calcium intake behaviors pretest to post-test also showed a statistically significant improvement in scores for the experimental group (pretest m = 828, post-test m = 961) (t = 2.39, df = 15, p = .03) whereas the change in scores pretest (m = 780) to post-test (m = 813) for the control group was not significant (Table 8).

Table 7

Group Comparison Osteoporosis Self-Efficacy Scale for Calcium Pretest to Post-test

Osteoporosis Self-efficacy scale Calcium	n	Mean	SD	t	df	p
Pretests						
Experimental	16	828.81	247.46	.59	30	NS
Control	16	780.06	218.46			
Post-tests						
Experimental	16	961.06	160.74	2.11	30	.04
Control	16	813.06	178.40			

Table 8

Group Improvement Osteoporosis Self-Efficacy Scale for Calcium Pretest to Post-test

Osteoporosis Self-efficacy Calcium		n	Mean	Paired Difference Mean	SD	t	df	p
Experimental Group	Pretest	16	828.81	132.25	132.5	2.39	15	.03
	Post-test	16	961.06					
Control Group	Pretest	16	780.06	33.00	112.41	1.17	15	NS
	Post-test	16	813.06					

The null hypothesis was rejected and the hypothesis that women who participated in an osteoporosis prevention program would have more self-efficacy for the behavior of calcium-intake compared to nonparticipants was supported.

Summary

In summary, two out of three null hypotheses were rejected using independent t-tests. Paired t-tests done to examine the difference between pretest and post-test results within groups showed that the experimental group improved significantly in knowledge, and for self-efficacy for exercise and calcium. The first hypothesis that women who participated in an osteoporosis prevention program would have more knowledge of osteoporosis than nonpartipants was supported. The second hypothesis that women who participated in an osteoporosis prevention program would have more self-efficacy for the behavior of exercise was not supported. However the experimental group did show improvement in scores pretest to post-test, whereas the control did not. The experimental group was lower on the pretest compared to the control group and the experimental group did show a mean score that was higher than the control group on the post-test results. The mean Osteoporosis Self-Efficacy Scale for exercise scores on the post-tests, however were not statistically different. If differences between pretest scores could have been controlled by using an ANCOVA, the results might have been different. The third hypothesis that women who participated in an osteoporosis prevention program would have more self-efficacy for the behavior of calcium intake was supported.

In conclusion, the first and third hypotheses were supported, and all three post-tests showed significant improvements in scores for the experimental group, while the control group remained unchanged. These results indicated that an osteoporosis prevention program can make a significant difference in knowledge of osteoporosis and self-efficacy for exercise and calcium intake.

CHAPTER FIVE

Discussion and Implications

Discussion

The purpose of this study was to evaluate the effectiveness of an Osteoporosis Prevention Program on women's knowledge of osteoporosis and their perceptions of their ability to make health behavior changes to prevent osteoporosis. The framework for this study was Bandura's Social Learning Theory which describes a method to predict and explain behavior using several concepts. Change in behavior and maintenance of that change are a function of 1) expectations about the outcomes that will result from engaging in a behavior, and 2) expectations about one's ability to engage in or execute the behavior (Bandura, 1977).

Outcome expectations consist of beliefs about whether a given behavior will lead to given outcomes. Providing knowledge about risk factors for developing osteoporosis and prevention behaviors was an important component in the self-efficacy model. The knowledge of osteoporosis prevention behaviors such as the types and duration of exercise, as well as specific calcium requirements, food and supplement sources, were included in the Osteoporosis Prevention Program to provide realistic outcome expectations.

Efficacy expectations are beliefs about how capable one is of performing the behaviors (i.e. exercise and calcium intake) that lead to the desired outcomes (i.e. prevention of osteoporosis). The portion of the Osteoporosis

Prevention Program that focused on enhancing self-efficacy was developed using Bandura's methods to increase self-efficacy: 1) performance accomplishments (learning through personal experience), 2) verbal persuasion (information from health care providers about the client's ability to change), 3) vicarious experiences (modeling other's activities who performed challenging activities successfully), and 4) emotional arousal (information about consequences of health risks and benefits of change).

Based on Bandura's Social Learning Theory and his construct of self-efficacy, it was hypothesized in this study that participants of an Osteoporosis Prevention Program would have 1) more knowledge about osteoporosis, 2) more self-efficacy for the behavior of exercise and, 3) more self-efficacy for the behavior of calcium intake on the post-test compared to non-participants.

In testing the first hypothesis, it was found that women in the experimental group demonstrated more knowledge of osteoporosis than the control group on the post-tests. There was also a greater improvement in scores pretest to post-test for the experimental group compared to the control group. This demonstrated that general information typically given to women about menopause by their health care provider (control group intervention) is not specific to knowledge of or prevention of osteoporosis. A more individualized, tailored osteoporosis prevention program can yield significant insights for women into risk factors that lead to development of osteoporosis and those behaviors that can best prevent the disease.

The second hypothesis, that participants of the Osteoporosis Prevention Program would have more self-efficacy for the behavior of exercise than nonparticipants, was not supported by the data. The post-tests scores were not significantly different between groups. If an ANCOVA procedure was possible, by controlling this pretest difference between 2 groups, the results might have been different. However, when the improvement in scores pretest to post-test within groups was evaluated, the experimental group posted a significantly greater improvement in scores compared to the control group. In examining the scores of the pretests for self-efficacy for exercise, the experimental group scores were lower than the control group scores. In the post-test scores for exercise self-efficacy, the control group scores rose only slightly, whereas the experimental group scores increased substantially. This demonstrated that the Osteoporosis Prevention Program had a definite beneficial effect on the participant's belief that they could change their exercise behaviors to those that could help prevent osteoporosis.

The third hypothesis, that participants of the Osteoporosis Prevention Program would have more self-efficacy for the behavior of calcium intake, was supported by the data. Post-test scores for participants were significantly higher than the control group. In examining the change in scores pretest to post-test, the experimental group also showed a significantly greater improvement in scores compared to the control group. This also demonstrated that the Osteoporosis Prevention Program had a significant effect on improving self-efficacy for calcium intake behaviors.

The impact of the Osteoporosis Prevention Program in this study was two-fold: 1) knowledge of osteoporosis increased, which addressed the outcome expectations in Bandura's self-efficacy construct, and 2) self-efficacy for the behaviors of exercise and calcium intake also increased substantially, and this demonstrated a positive effect on efficacy expectations in Bandura's self-efficacy construct. This was the first study done to attempt to improve self-efficacy for osteoporosis prevention behaviors of exercise and calcium intake. As it was successful at improving self-efficacy for exercise and calcium intake, this makes it a valuable contribution to the body of research for osteoporosis prevention.

According to Rosenstock et al. (1988) both efficacy expectations and outcome expectations are important for behavioral change to take place. There have been many educational programs done to increase knowledge of health risks and prevention behaviors, although an increase in knowledge alone has not consistently led to a change in health behaviors over time to help prevent health problems.

Studies which measured the effects of behavior change programs on self-efficacy found overall increases in efficacy over the course of treatment, according to a meta-analysis of self-efficacy research (Stretcher et al., 1986). These survey studies of self-efficacy reviewed suggested strong associations between self-efficacy and progress in health behavior change and maintenance of that change.

Gortner and Jenkins (1990) in a study of self-efficacy and activity level after cardiac surgery, found that self-efficacy expectations were a significant predictor of self-reported exercise and activity which was maintained over 24 weeks of the study. In a study evaluating self-efficacy in 2524 older adults over a 2-year period, researchers found that adults with higher efficacy expectations for exercise, dietary fat, and weight control were more likely to perform those behaviors, and had better functional, mental and self-rated health than older adults with low efficacy for those behaviors (Grebowski et al., 1993).

Improving knowledge of osteoporosis and self-efficacy for behaviors of exercise and calcium intake through this comprehensive Osteoporosis Prevention Program, can have a synergistic effect on preventing osteoporosis. Knowledge of risk factors for the disease and the specific behaviors that can help prevent osteoporosis, as well as working to increase self-efficacy, is a very potent combination which could lead to long-term integration of health promotion behaviors into a woman's lifestyle. This approach to osteoporosis prevention education has a great potential to prevent osteoporosis from occurring in women's lifetimes.

Even though a convenience sample was used, the experimental and control groups were equivalent in the categories of age, education, marital status, ethnicity, exercise history, use of hormone replacement therapy, and menopausal status. A difference was found between groups in the categories of number of persons in the household and employment status.

Women in the experimental group had more participants (10/16) with greater than 2 other members in the household, whereas the control group had more subjects (13/16) with one or less other members in the household. In including this demographic category, it was anticipated that women with more family members at home would have less self-efficacy for exercise and calcium intake. The rationale for this anticipation was that women with more family and household responsibilities would have less time for themselves and thus less likely to be able to change their lifestyles. Reflecting back to the mean scores for the pretest of the osteoporosis self-efficacy score for exercise, the experimental group did have lower scores then the control group. However on the post-test scores, the experimental group (most with more family members at home) posted a greater improvement in scores pretest to post-test compared to the control group (most with less family members at home).

This could be partially explained by methods used in the self-efficacy-enhancing portion of the Osteoporosis Prevention Program. One of the strongest techniques to enhance self-efficacy is performance accomplishments. In the program, participants were asked to write down 3 accomplishments that they had achieved in their lives. Examples were given such as weight loss, following an exercise program, completing education such a college or technical degree or certification. Also included in these examples was management of a household and raising children. Women have traditionally been the primary caretakers of children and household managers. To do this well takes strong household and time management skills. Having accomplished management of a large family and household could have been seen by the participants as a significant performance accomplishment.

Additionally, in the section of the program addressing emotional arousal, the issue of women as caretakers of their family and society was discussed. Participants were asked to consider how much time they had devoted to caring for others. Examples were given such as scheduling for children's school activities, or children's participation in sports or clubs, as well as their own social commitments such as church activities or fund-raising events. They were then asked how much time they had scheduled to take care of themselves. They were given the rationale that by taking care of themselves, they could be in better health with more energy and thus care for others and to continue that support for many more years.

In the portion of the Osteoporosis Prevention Program addressing Bandura's verbal persuasion, participants were asked to reflect upon what their health care provider would tell them about their ability to change health behaviors. The women were also asked to consider what family members or significant others would say to them if they discussed their goals for health behaviors with them. They were asked to write down who in their lives with whom they could discuss their goals. These persons could also help support them in working toward their goals, or even join them in an exercise program, or work together at home to increase calcium intake.

In light of these interpretations of performance accomplishments, emotional arousal, and verbal persuasion, a larger family could be potentially seen as a benefit. Participants could have realized that they accomplished complex management of a large family, had dedicated alot of time to help the family and they, too, deserved time and could accomplish a schedule also devoted to taking care of themselves. Considering the aspect of verbal persuasion, by having participants elicit support from their health care provider and from their family, a large family could have been viewed as having more social support. Having a large family could be a greater source of support to accomplish their personal goals to integrate health promotion behaviors into their lifestyles.

The other demographic category in which the experimental and control group differed was employment status. All members in the control group worked greater then 30 hours per week outside the home. Of women in the experimental group, 5 of 16 of them did not work at all outside the home, whereas 11 of 16 participants in the Osteoporosis Prevention Program did work more than 30 hours per week. It is possible that this could have affected the experimental group's post-test scores for self-efficacy for exercise and calcium intake. These women may have believed they could integrate these health promotion behaviors into their lifestyle as they had more time in which to add an exercise routine, or more time to plan meals to increase calcium intake. However, participants of the Osteoporosis Prevention Program showed lower scores on pretests for self-efficacy for exercise. Never the less, on the post-tests, the mean score for all members of the experimental group (working and not working) improved over pretest scores. Even though statistically significant, this researcher is not convinced that the difference in employment status between groups contributed to the improvement in post-test scores of self-efficacy for exercise or calcium intake. More women in the experimental group worked outside the home than did not. What may be a more plausible explanation, is that women who did not work outside the home had more time to attend the Osteoporosis Prevention Program compared to women in the control group, all of whom did work more than 30 hours per week outside the home.

Limitations

The use of a convenience sample with voluntary assignment to experimental and control groups, was a limitation of this study. The results of this study would have been stronger had randomization of subjects to groups been possible. It had been proposed that subjects be randomized into experimental or control groups, and that ongoing sessions be held once monthly for each group. However, due to time constraints and recruitment problems, all subjects who met the criteria were invited to attend a one-time Osteoporosis Prevention Program. Those who attended the Osteoporosis Prevention Program became the experimental group. Those who did not attend were mailed the menopause pamphlet to read and then asked to complete the post-tests and return them by mail. Sixteen women attended the Osteoporosis Prevention Program, and once 16 women had returned the post-tests by mail, the study was closed. Although subjects were not randomly assigned, the control group and the experimental group were equivalent in categories of age, education, ethnicity, exercise history, menopausal status, and use of hormone replacement therapy. Differences were found only in number of family members at home and employment, which were addressed earlier. The equivalence of groups does strengthen this quasi-experimental design.

It is possible that women who attended the Osteoporosis Prevention Program were more motivated to learn about osteoporosis, and this may have impacted the positive results in the experimental group. A random assignment of groups would be recommended in further studies of osteoporosis knowledge and self-efficacy to confirm findings from this Osteoporosis Prevention Program. Women in this study for both groups had a mean education of 15 years. This limitation could impact the generalizability of results to a wide population with varying education. The geographic area for this study was limited to an urban and suburban location. This also could be a limitation as results may not be able to be generalized to a wider population.

The sample size was also a limitation of this study. There were only 16 subjects in each group. A power analysis was done prior to the study to evaluate the appropriateness of the sample size. Power tables developed by Kraemer and Thiemann (1987) were used to determine the effect size of the projected sample size. Effect is the extent to which the null hypothesis is false, or that the presence of the phenomena is being measured accurately in the study. Since there was limited research data available on knowledge and self-efficacy for osteoporosis, the power tables, rather than research findings, were used to calculate the smallest effect size that would be sufficiently large to have clinical or theoretical value. A large effect size would be about .8, a medium effect size, .5, and a small effect size, .2. Power is the capacity of the study to detect differences or relationships that actually exist in the population, or the capacity to correctly reject the null hypothesis. The minimum acceptable level of power is .8, this results in a 20% chance of a Type II error in which a study fails to detect existing effects. Three out of four dimensions of the power equation are needed to use the power tables: level of significance, which was set at 0.05; sample size which was 16 per group; power, which was set at the minimally acceptable level of .8, then the effect size could be estimated. Initially, a sample size of 30 in each group was projected, and a large effect was estimated.

Due to the control in a quasi-experimental study, the sample size could decrease and still approximate the population (Burns & Grove, 1993). Sample size, however, must be sufficient to achieve an acceptable level of power to correctly reject a null hypothesis.

In re-evaluating the sample size and level of power according to the statistical power tables, with a one-tailed, .05 level of significance, with n = 16 in each group, and power level set at .8, the effect size would be .55. This is considered a medium-large effect size. Tools with strong reliability and validity, such as the OKT and the OSES, tend to measure more precisely than tools that are less well developed, and thus the effect size is larger.

With an n of 16 in each group, .05 level of significance, a large effect size projected at .8, a sample size of 15 would have a power of 99 according to the power tables. Even if the effect size was .70, with the other parameters being the same, the power would be 90. With a medium effect size of .55, which is probably an underestimation for the OKT and the OSES, the power is 80, which is the minimal acceptable level to correctly reject a null hypothesis.

Therefore, even though an n of 30 in each group was proposed, at an n of 16 with highly reliable instruments, the power was strong enough to correctly reject the null hypothesis. Thus, the sample size was acceptable to give credence to the results. With a small sample size, there is more likelihood of not finding significant differences between groups. This was not true in this study. With the use of the t-test, equal group size, as in this study, also increases the power because the effect size is maximized (Burns & Grove, 1993). The inability to us an ANCOVA due to the presence of an interaction effect between the independent variable (osteoporosis prevention program) and all 3 covariates (pretests) was a limitation in this study. If the pretest scores could have been covaried out with an ANCOVA, there may have been more significant results between posttest scores between the experimental and control groups.

The use of the quasi-experimental untreated control group with pretest and post-test design has uncontrolled threats to internal validity which would include selection-maturation, instrumentation, differential statistical regression, and interaction of selection and history (Burns & Grove, 1993).

The threat of selection maturation is not significant in this study as it was time-limited, under 3 months. Subjects were not likely to change or mature substantially over that limited time. However, the short time period used in this study is a limitation as evidence of a prolonged change in knowledge and self-efficacy over time cannot be generalized. However, other studies with self-efficacy noted earlier in this chapter have identified that when self-efficacy increased, it has led to sustained changes in health promotion behaviors.

The threat from instrumentation which can be present in this type of study design is not present in the current study as the exact tests were used pretest and post-test. Differential statistical regression could have been a threat to validity in this type of research design. The tendency of scores to regress toward the mean could have been identified as an improvement of scores as some experimental pretest scores were lower than the control group scores. However most scores started above the statistical mean and progressed higher, thus not showing evidence of statistical regression.

The threats to validity due to history could have been a limitation in this study. Historical events such as discussion in the media and advertisements about osteoporosis risks and prevention could have had an effect on post-test results. However, this effect would likely have impacted both experimental and control group members.

The pretests could have had an effect of increasing knowledge of osteoporosis or self-efficacy for exercise or calcium intake. But again, this effect would have been seen in the experimenttal and control group members

Implications

This study demonstrated that an Osteoporosis Prevention Program could improve knowledge of osteoporosis and self-efficacy for osteoporosis prevention behaviors compared to information that is typically received from health care providers about menopause. Increasing knowledge, which addresses Bandura's outcome expectations, and increasing self-efficacy for the behaviors of exercise and calcium intake, which strengthen efficacy expectations, could lead to changes and maintenance of these lifestyle changes over time. This could result in substantially decreasing a woman's risk of developing osteoporosis in her lifetime.

Bandura's model of self-efficacy (1977) could be used to develop prevention programs for many types of health problems, such as heart disease, obesity, and tobacco and alcohol dependence. Knowledge has been historically addressed in prevention programs. Integrating methods to increase self-efficacy into prevention programs could lead to substantial improvements in health promotion behaviors and prevention of health problems.

Recommendations

Recommendations for further research to reinforce the findings of this study, would include the use of this Osteoporosis Prevention Program with a larger sample size with randomized groups, and another post-test at a longer interval to test for self-efficacy changes over time.

The integration of Social Support Theory (House, Kahn, McLeod & Williams, 1985) with the framework of Bandura's Social Learning Theory could be beneficial. Enhancing self-efficacy through the methods of performance accomplishments, verbal persuasion, vicarious experiences, and emotional arousal could be even stronger if support from an individual's family, friends, and/or community were added within those methods to strengthen self-efficacy. That may help assure that health behavioral changes that are made are maintained over a longer period of time as individuals would not be isolated in beginning or continuing their prevention behaviors.

In conclusion, a significant effect on knowledge of osteoporosis, and self-efficacy for osteoporosis prevention behaviors was found with the Osteoporosis Prevention Program. Implementation of a program such as this could make a significant impact on prevention of osteoporosis for many women. When started in the perimenopausal period, it could impact a change in women's lifestyles at a time when significant positive health effects could begin and continue through their lifetimes.

APPENDIX A

OSTEOPOROSIS KNOWLEDGE TEST

APPENDIX A

ID NO: ____________

OSTEOPOROSIS KNOWLEDGE TEST

(Interviewer: Read the following instruction SLOWLY)

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

I am going to read a list of things which may or may not affect a person's chance of getting osteoporosis. After I read each one, tell me if you think the person is:

MORE LIKELY TO GET OSTEOPOROSIS, or

LESS LIKELY TO GET OSTEOPOROSIS, or

IT HAS NOTHING TO DO WITH GETTING OSTEOPOROSIS.

I am going to show you a card with these 3 choices. When I read each statement, tell me which one of the 3 will be your best answer. (Test administrator. Do not read "don't know" choice. If the participants say "don't know", circle this option.)

CODE		MORE LIKELY	LESS LIKELY	NEUTRAL	DON'T KNOW
0 1	1. Eating a diet LOW in milk products	ML	LL	NT	DK
0 1	2. Being menopausal; "change of life"	ML	LL	NT	DK
0 1	3. Having big bones	ML	LL	NT	DK
0 1	4. Eating a diet high in dark green leafy vegetables	ML	LL	NT	DK
0 1	5. Having a mother or grandmother who has osteoporosis	ML	LL	NT	DK
0 1	6. Being a white woman with fair skin	ML	LL	NT	DK
0 1	7. Having ovaries surgically removed	ML	LL	NT	DK
0 1	8. Taking cortisone (steroids e.g. Prednisone) for long time	ML	LL	NT	DK
0 1	9. Exercising on a regular basis	ML	LL	NT	DK

10/90

(Interviewer: Read the following instruction SLOWLY)

For the next group of questions, you will be asked to choose one answer from several choices. Be sure to choose only one answer. If you think there is more than one answer, choose the best answer. If you are not sure, just say "I don't know."

CODE

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

0 1

A. Swimming
B. Walking briskly
C. Doing kitchen chores, such as washing dishes or cooking
D. DK

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

0 1

A. Bicycling
B. Yoga
C. Housecleaning
D. DK

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

0 1

A. 1 day a week
B. 2 days a week
C. 3 or more days a week
D. DK

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

0 1

A. Less than 15 minutes
B. 20 to 30 minutes
C. More than 45 minutes
D. DK

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

0 1

A. Just a little faster
B. So fast that talking is not possible
C. Much faster, but talking is possible
D. DK

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

0 1

A. Jogging or running for exercise
B. Golfing using golf cart
C. Gardening
D. DK

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

0 1

A. Bowling
B. Doing laundry
C. Aerobic dancing
D. DK

(Interviewer: Read the following statement SLOWLY)

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

CODE

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

0 1
- A. Apple
- B. Cheese
- C. Cucumber
- D. DK

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

0 1
- A. Watermelon
- B. Corn
- C. Canned Sardines
- D. DK

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

0 1
- A. Chicken
- B. Broccoli
- C. Grapes
- D. DK

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

0 1
- A. Yogurt
- B. Strawberries
- C. Cabbage
- D. DK

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

0 1
- A. Ice cream
- B. Grape fruit
- C. Radishes
- D. DK

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

0 1
- A. 100 mg - 300 mg daily
- B. 400 mg - 600 mg daily
- C. 800 mg or more daily
- D. DK

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

0 1
- A. 1/2 glass daily
- B. 1 glass daily
- C. 2 or more glasses daily
- D. DK

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

0 1
- 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. DK

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APPENDIX B

OSTEOPOROSIS SELF-EFFICACY SCALE

APPENDIX B

ID NO: ____________

OSTEOPOROSIS S-E SCALE

We are interested in learning how confident you feel about doing the following activities. Everyone has different experiences which will make them 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.

<u>If it was recommended that you do any of the following THIS WEEK, how confident or certain would you be that you could:</u>

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

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

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

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

11. begin to eat more calcium rich foods

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

12. increase your calcium intake

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

13. consume adequate amounts of calcium rich 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

2

APPENDIX C

DEMOGRAPHIC DATA AND MEDICAL HISTORY

APPENDIX C

DEMOGRAPHIC DATA SHEET

ID# ____________

Date ____________

1. How old are you? (in years) ____________
2. How many years of school have you completed? (in years) ________
3. Are you employed outside the home?
   - No ________
   - Yes, less than 30 hours per week ________
   - Yes, more than 30 hours per week ________
4. Number of family members living in your home (besides yourself) ______
5. Ethnic Background (check one)
   - African American ____
   - Caucasian ____
   - Asian ____
   - Middle-Eastern ____
   - Hispanic ____
   - American Indian ____
   - Other ____
6. Martial Status
   - Single ____
   - Married ____
   - Separated ____
   - Divorced ____
   - Widowed ____
7. Exercise History (Check one)
   - ____ I exercise at least 3 times a week for 30 minutes.
   - ____ I have exercised regularly in the past (3 times weekly for 30 minutes), but I do not exercise regulary now.
   - ____ I have not exercised regularly in the past nor do I exercise regularly now.
8. Have you been through your menopause? (no periods for more than 1 year)
   - ____ Yes
   - ____ No
9. Do you currently take Estrogen or Hormone Replacement medication? (Premarin, Prempro, Premphase, Estraderm patch, or others)
   - ____ Yes
   - ____ No

10. Do you have or have you ever had any of the following?

	No	Yes
1. Osteoporosis	____	____
2. Kidney Disease	____	____
3. Parathyroid Disease	____	____
4. Cancer	____	____
5. Diabetic on Insulin	____	____
6. Back Injury or Back Therapy in the last 3 three months?	____	____
7. Major Surgery in the last 3 months?	____	____
8. Heart Disease (Angina, Heart attack)	____	____
If yes, would you now be able to do moderate exercise 3 times a week without chest pain, shortness of breath or dizziness?	____	____
9. High Blood Pressure	____	____
If yes, would you now be able to do moderate exercise 3 times a week without headaches, dizziness, chest pain or shortness of breath?	____	____
10. Arthritis	____	____
If yes, would you now be able to do moderate exercise 3 times a week without joint pain or other arthritis symptoms?	____	____

	No	Yes
11. Are you currently pregnant?	____	____

12. Primary Language ______________

13. Are you able to read, speak, and write english? Yes ____ No ____

APPENDIX D

PERMISSION TO USE INSTRUMENTS

APPENDIX D

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

Kathryn Hayter
42391 Little Road
Clinton Township, MI 48036

January 2, 1996

Dear Kathryn Hayter:

Thank you for your interest in the Osteoporosis Health Belief Scale (OHBS), Osteoporosis Knowledge Test (OKT), and the Osteoporosis Self-efficacy Scale (OSES). You have my permission to use these scales. Please keep us informed of any results you obtain using these scales. In that way I hope to continue to serve as a clearing house for information about the scales.

I wish you much success with your study.

Sincerely,

[redacted]

Katherine K. Kim RN, Ph.D.
Professor
Kirkhof School of Nursing
Grand Valley State University

APPENDIX E

OSTEOPOROSIS PREVENTION PROGRAM OUTLINE

APPENDIX E

Osteoporosis Prevention Program Outline

I. Introduction
  A. Women's Life Expectancy
  B. Stages of Reproductive Development
  C. Hormone changes throughout woman's lifespan
  D. Effects of loss of estrogen on body systems

II. Osteoporosis
  A. Definition
  B. Incidence of Osteoporosis
  C. Incidence of Osteoporosis fractures
  D. Lifetime fracture risk
  E. Fracture projections worldwide
  F. Percentage of women with Osteoporosis by age.
  G. Epidemiology
  H. Cost of Osteoporosis fractures
    1. Hospitalization
    2. Long term care
  I. Consequences of Osteoporosis
    1. Decreased quality of life
    2. Morbidity/mortality
  J. Risk factors
    1. Family history
    2. Estrogen effects
    3. Lifestyle risks
    4. Diseases
    5. Body stature
    6. Steroid-induced
  K. Progression of bone growth/loss in women's lifespan
  L. Effect of early intervention with postmenopausal bone loss

III. Bone physiology
  A. Ability to alter structure with stress/activity
  B. Remodeling
  C. Turnover
    1. Trabecular bone
    2. Cortical bone
  D. Continuous process

IV. Osteoporosis prevention
  A. Overview
  B. Combination of treatment modalities

V. Exercise
- A. Bone loss with lack of muscle use
- B. Muscle strength loss over lifespan
- C. Effectiveness of combined exercise types, decreasing order
  1. Weight training and aerobic activity
  2. Weight training alone
  3. Aerobic exercise alone
- D. Types of exercise
  1. Weight bearing, aerobic exercise/ preserving bone
  2. Weight training/ building bone
- E. Specificity of exercise on bone
  1. Spine
  2. Study of muscle loading and bone mass density
  3. Back exercises, prevent wedge and compression fractures
- F. Principles of exercise for bone benefit
  1. Site specific
  2. Weight bearing or resistance
  3. Dynamic and varied
  4. Exceed normal daily usage
  5. Excessive loading leads to fatigue, damage
- G. Exercises for established Osteoporosis
  1. Spinal extension
  2. Isometric abdominal
  3. Walking
  4. Free weights
  5. Water resistance exercises
- H. Summary
  1. Type
  2. Frequency and duration

VI. Calcium
- A. Requirements over lifespan
- B. Normal daily intake with diet
- C. Calcium content in foods
- D. Calcium supplements
  1. Types
  2. Percent of elemental calcium
  3. Brand names, available calcium, cost
- E. Calcium Absorption

VII. Summary of Osteoporosis
A. Age to start prevention
B. Menopause and bone loss
C. Psychosocial impact
D. Osteoporosis is preventable
E. Osteoporosis is treatable

VIII Banduras techniques for promotion of self-efficacy
A. Performance accomplishments
1. Review previous accomplishments
2. Goal setting
3. Scheduling
B. Verbal Persuasion
1. Encouragement from health care provider
2. Elicit support from significant other/ family members
C. Vicarious Experiences
1. Modeling behavior from others accomplishments
2. Discuss other people's accomplishments
D. Emotional Arousal
1. Positive outcomes from health behaviors
2. Peer support
3. Support groups

APPENDIX F

CONSENT FORM

APPENDIX F

Form 5405 MR Rev. 2/94

Henry Ford Hospital

CONSENT
TO PARTICIPATE IN A RESEARCH STUDY

☐ MAIN ☐ WEST BLOOMFIELD
☐ FAIRLANE ☐ OTHER ______________

DATE

MRN

NAME

Approval Stamp

PROJECT TITLE: Promotion of Osteoporosis Knowledge and Prevention

1. Purpose of the Project

You have been asked to take part in a research study because you are in an age group when changes in your hormones can affect your health. There will be 60 women in this research study at Henry Ford Hospital and Medical Centers.

2. Procedures of the Project

First you will be asked to complete a questionnaire at an outpatient visit. Then at another outpatient visit, you will be involved in an educational program which will include either written, oral or audio-visual material in a session lasting no more than 2 hours. You will be asked to complete another questionnaire at this teaching session.

3. Risks/Discomforts of the Project

The Project Director, Kathryn Hayter RNC Nurse Practitioner, does not expect you to experience any complication or discomforts from being in this study. However, there may be risks or discomforts that are not known at this time. You will be informed about any findings which might change your willingness to continue in the study. If you should become pregnant during the course of this study, you will not be able to continue with this study and you will be withdrawn from the project. You should tell the person obtaining your consent about any other medical research projects you are involved in right now.

orm 5405 MR Rev. 2/94

Henry Ford Hospital

CONSENT
TO PARTICIPATE IN A RESEARCH STUDY

☐ MAIN ☐ WEST BLOOMFIELD
☐ FAIRLANE ☐ OTHER ____________

DATE

MRN

NAME

Approval Stamp

PROJECT TITLE: Promotion of Osteoporosis Knowledge and Prevention

4. Benefits of the Project

You may benefit from participation in this study because you will receive information about menopause and health risks and disease prevention. Additionally, others may be helped by what is learned from this research.

5. Alternatives to Participation

There will be no changes made in your health care services as a result of participating or not participating in this study. You will receive the same quality gynecological care with or without the information in this study.

6. Privacy

Research data that includes your name or other identifying information will not be published, released or seen by anyone other than an authorized representative of the Henry Ford Health System unless you give permission in writing or unless there are legal requirements to disclose that information. If this information from this study is published in a medical or nursing journal, or presented at a scientific meeting, you will not be identified by name.

7. Information about the Project

Kathryn Hayter RNC, Nurse Practitioner, has explained this research project and has offered to answer any questions. If you have any additional questions about the research, you may contact her directly at (313) 653-2033. If you have questions about your rights as a research subject, you may contact Ms. Julie Washington in the Research Office at Henry Ford Hospital at (313) 876-2024, or Professor Paul Huizenga, Office of Research and Development at Grand Valley State University at (616) 895-2470.

rm 5405 MR Rev. 2/94

Henry Ford Hospital

CONSENT
TO PARTICIPATE IN A RESEARCH STUDY

☐ MAIN ☐ WEST BLOOMFIELD
☐ FAIRLANE ☐ OTHER ____________

DATE

MRN

NAME

Approval Stamp

PROJECT TITLE: Promotion of Osteoporosis Knowledge and Prevention

8. Voluntary Participation

Your participation in this research study is voluntary. You do not have to take part in the study, and if you decide to participate, you can stop at any time. If you decide not to participate, or if you enter the study, but then later decide to stop, you will receive the same health care from Henry Ford Hospital and Medical Centers that you would have without consenting to take part in the study. There will be no penalties or loss of benefits to which you would otherwise be entitled if you choose not to participate, or if you choose to stop your participation once you have started.

9. Stopping the Project

The Project Director or your Health Care Provider can end your participation in the research if you should be diagnosed with a medical condition making it physically impossible to complete the study, or a condition in which it would be inadvisable to engage in health promotion behaviors described in the study.

10. Cost to Subject
You will not have any extra health care costs because you are in this study.

orm 5405 MR Rev. 2/94

Henry Ford Hospital

CONSENT
TO PARTICIPATE IN A RESEARCH STUDY

☐ MAIN ☐ WEST BLOOMFIELD
☐ FAIRLANE ☐ OTHER ____________

DATE

MRN

NAME

Approval Stamp

PROJECT TITLE: Promotion of Osteoporosis Knowledge and Prevention

11. Consent

This consent form has been reviewed with you. You have read this consent form, or it has been read to you. All of the procedures have been explained to you. You understand what you are being asked to do. Your questions have been answered, and any technical terms you did not understand have been defined for you. If you agree to be in this study, you will be given a copy of this consent form.

Signature of Subject	Date
Printed Name of Subject	
Witness Signature	Date
Investigator's Signature	Date

APPENDIX G

HENRY FORD HUMAN RIGHTS COMMITTEE APPROVAL

APPENDIX G

Henry Ford Health System

Research Administration
CFP-1
2799 West Grand Boulevard
Detroit, MI 48202-2689
(313) 876-2024 Office
(313) 876-2018 Fax

Thomas Roth, PhD
Director of Research

Lynne M. Pecze, MHA
Administrative Director of Research

S. David Nathanson, MD
Chair, Care of Experimental Animals Committee

Ira Wollner, MD
Chair, Human Rights Committee

Leonard Lutter, PhD
Chair, Small Projects Funding Committee

December 5, 1997

TO: Kathryn Hayter, RNC
Ob/GYN

FM: Ira Wollner, M.D., Chairman
Munther Ajlouni, M.D., Vice Chairman
Human Rights Committee (Institutional Review Board)

RE: Research Proposal, "Promoting of Osteoporosis Knowledge and Prevention" ()

Period of IRB Approval: December 2, 1997 - December 1, 1998

This is to advise you that the human rights aspects of the above-referenced protocol have been reviewed and approved through the expedited review procedure. This approval is based on Title 45, Section 46.110(b) of the HHS Code of Fe Regulations. The protocol will be reviewed by the full Committee as an information item at its next meeting.

As the IRB is empowered by the 45 CFR 46.117(c), it determined that the use of a written consent form was not necessary. It is understood that oral informed consent will be obtained from each participant and documente the patient's medical record. You may use the written consent as the text for the oral consent process.

The Human Rights Committee and Federal Regulations require that your protocol be reviewed at intervals appropriate the degree of risk but not less than once per year and that a final report be submitted at the termination of the project. Therefore, either a progress or final report for this proposal should be submitted to the Committee by November 20, 1

APPENDIX H

GRAND VALLEY STATE UNIVERSITY

HUMAN RIGHTS COMMITTEE APPROVAL

APPENDIX H

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

April 15, 1997

Kathryn Hayter
42391 Little Road
Clinton Township, MI 48036

Dear Kathryn:

The Human Research Review Committee of Grand Valley State University is charged to examine proposals with respect to protection of human subjects. The Committee has considered your proposal, "***The Effect of an Osteoporosis Prevention Program on Knowledge and Self-Efficacy***", and is satisfied that you have complied with the intent of the regulations published in the Federal Register 46 (16): 8386-8392, January 26, 1981.

Sincerely,

[redacted]

Paul Huizenga, Chair
Human Research Review Committee

APPENDIX I

INTRODUCTORY LETTER

APPENDIX I

TO WOMEN CLIENTS AT HENRY FORD MEDICAL CENTER:

You are invited to participate in a study of women and how to prevent health problems after menopause. The study can help you and the results can help improve the health of other women after menopause. The study involves completion of a questionairre, attending one health seminar, and completion of a second questionairre.

If you are a woman between age 40 and 60, and are interested in joining this program, please complete the information below and return it to our staff. We will contact you to start the study very shortly. All information will be kept confidential.

Thank-you,

[redacted]

Kathryn Hayter
Nurse Practitioner
OB/GYN

Name ______________________________

Address ______________________________

____

Phone number Home ______________ Work ______________

Alternate number ______________

Best time and place to call you ______________________

Date of Birth ______________ Medical Record # ______________

FOR STUDY PURPOSES ONLY

ID# ______________ Group # ______________ Class Date ______________

LIST OF REFERENCES

LIST OF REFERENCES

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