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The Relationship of Osteoporosis Health Beliefs and Knowledge to Calcium Intake

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THE RELATIONSHIP OF OSTEOPOROSIS HEALTH BELIEFS AND KNOWLEDGE TO CALCIUM INTAKE

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ABSTRACT

THE RELATIONSHIP OF OSTEOPOROSIS HEALTH BELIEFS AND KNOWLEDGE TO CALCIUM INTAKE

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The purpose of this study was to examine the relationship between health beliefs (susceptibility, severity, benefits, barriers, health motivation and self-efficacy) and knowledge, to calcium intake. The study used a descriptive correlational design and a convenience sample of 201 women was selected. Data collection took place in a metropolitan area of west Michigan.and a structured interview method was used. The subjects ranged in age from 35 to 95. Ninety-six and one half percent of the sample was white. The hypothesis--"knowledge and the health beliefs account for a significant amount of variance in calcium intake" was partially supported. Self-efficacy and knowledge were found to account for a small amount of variance in calcium intake (7.8%). Bivariate correlations for five of the seven independent variables provided some support for the relevancy of the Health Belief Model (HBM) to osteoporosis preventive behavior. Applicability of the HBM to osteoporosis prevention should be further explored.

Dedication

This thesis is dedicated to my husband, Steve, my daughter, Nicole, and my son, Anson, for their patience and understanding during this project, and to my mother, Valerie, who gave me the inspiration to pursue a career in nursing.

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CHAPTER 1

INTRODUCTION

Osteoporosis is a major public health problem affecting as many as 15 to 20 million individuals in the United States (National Institute of Health [NIH], 1984). While both sexes are affected, osteoporosis is more prevalent in women. By age 65, approximately 25 percent of all white women have had one or more fractures. Seventy percent of these fractures are caused by osteoporosis (Crilly, Horsman, Marshall, & Nordin, 1978). There are over 1.3 million fractures, including 247,000 hip fractures in the United States, every year (Bowen, 1989). Hip fractures have a high mortality rate because of complications that result from the fractures (Resnick & Greenspan, 1989). Of the patients who experience hip fractures, 20 percent die within the first year, 20 percent become totally dependent, 25 percent partially dependent, and only 30-35 percent recover independence after that first year (Cummings, Kelsey, Nevitt, & O'Dowd, 1984).

The cost of osteoporosis in the United States is estimated to be 10 billion dollars a year (Special Committee of Aging [SCA], 1989). While osteoporosis is indeed financially costly to society, the human costs must also be measured in suffering, and in loss of an older person's independence. More attention to prevention is needed to sustain the quality of life and well-being of individuals in later life. Because the elderly are the fastest growing segment of our population (by the year 2000, the number of persons over 65 is expected to represent 13 percent of the population, climbing to 21.8 percent by 2030 [Fowles, 1989]), and because they are at the greatest

risk for developing osteoporosis, the need to address the health problem osteoporosis represents is further underscored.

Osteoporosis is manifested by a decrease in skeletal mass and density. Bone is living tissue that undergoes active remodeling throughout life with new bone continually being formed and old bone resorbed. The rate of formation exceeds resorption until peak bone mass is achieved at about age 35. Osteoporosis is caused by a decreased rate of bone formation, and an increased rate of bone resorption, or a combination of both factors (Coralli, Raisz, & Wood, 1986).

The skeleton consists of two types of bone: (a) trabecular bone, which has an open meshwork structure; and (b) cortical bone, which has a compact structure. Evidence suggests that there are two distinct types of osteoporosis. Type 1 occurs during the first few years after natural or surgically induced menopause, when women experience a brief period of accelerated bone loss affecting mainly the trabecular bone. This type of osteoporosis occurs due to the postmenopausal deficiency of estrogen, a hormone that helps the body convert calcium to bone. Five to ten percent of the female population suffers from Type 1 osteoporosis (Bowen, 1989). Clinical manifestations include vertebral crush fractures and Colle's fractures of the wrist (Persky & Alexander, 1989). Type 2 osteoporosis occurs in both men and women over 75 years old (SCA, vol. 2, 1989) and is thought to be a consequence of age-related changes. Ninety percent of women, and 25 percent of men greater than age 75 are afflicted by type 2 osteoporosis. Both the cortical and trabecular bone are affected, resulting primarily in fractures of the hip and wedge deformities of the spine (Persky & Alexander, 1989).

Nutrition and exercise prevention measures are effective for both types of osteoporosis. Recent studies indicate that vitamin D, calcitonin, sodium fluoride and etidronate are effective in increasing bone mineral density (MacLennan, 1990; Watt et al., 1990). Estrogen replacement therapy however, is the most important factor in the prevention of Type 1 osteoporosis according to Horsman, Gallagher, Simpson, and Nordin (1977).

Osteoporosis is a complex, multifactorial disorder. Inadequate calcium intake is only one of a number of factors that contribute to it's development. Other important contributing factors are age, sex, race, family history, menopause, and sedentary life style (Aloia et al., 1983; Spencer, 1982). Calcium intake and sedentary life style are two risk factors that can be controlled by the individual. A change in dietary habits and exercise could ultimately prevent, or at least retard, the rate of bone loss. Researchers (Coralli et al., 1986; Grisso, Baum, & Turner, 1990; Nordin, 1983; White, 1986) generally agree that the pathological effects of osteoporosis can be lessened by regular exercise and by maintaining an adequate dietary calcium intake throughout life

The sequelae of chronic calcium deficiency are greatest in the elderly. It has been well documented that calcium is one of the nutrients most often deficient in the diet of elderly in the United States, especially among women. The average daily calcium intake of elderly men and women in the United States is about 600 mg. and 480 mg. respectively (Heaney et al., 1982). This is far less than the suggested minimum calcium intake of 1,000 mg. daily for men and premenopausal women, and 1,500 mg. daily for postmenopausal women recommended by the National Institutes of Health Consensus Development Conference Statement of April 1984.

Research suggests that careful assessment of health beliefs facilitates implementing appropriate interventions to foster positive self-care practices related to treatment of chronic illness, as well as early detection and prevention of illness and health problems (Redeker, 1988; Janz & Becker, 1984). Since the prevention of osteoporosis is much more effective than attempting to reverse it's consequences, teaching preventive behaviors can be valuable in addressing this health problem. Nurses are in a position to fill an important role in educating the public about health behaviors that can slow down or prevent the process of osteoporosis. The nurse has the opportunity to influence an awareness in women of the relationship between health behaviors and the risk of developing osteoporosis. Therefore, the nurse has an opportunity to increase longevity and improve the health of women through teaching and counselling about calcium intake and regular exercise activities.

Changes in dietary habits are difficult to initiate and maintain. Knowledge gained from health education does not always translate into subsequent health behaviors. This suggests that more detailed knowledge of the mediators of these behavioral changes is needed. Therefore, in order to gain a deeper understanding of health behaviors aimed at osteoporosis prevention, it is important for nurses to consider the influence of psychological variables that can effect behavior change. Identification of such variables could enhance the individualization of health promotion strategies.

The Health Belief Model (HBM) is used in this study as the theoretical framework for assessing psychological variables. Although the original variables of the model included susceptibility, seriousness, barriers and benefits, the model has been refined. Health motivation was added as a

major concept and even more recently, self-efficacy is now recommended for inclusion in the model (Rosenstock, Strecher, & Becker, 1988). Self-efficacy is a concept that is central to Social Cognitive Theory. The HBM was derived from Social Cognitive Theory. This theory, and the concept of self-efficacy, are discussed in the conceptual framework section (page 23). Since it's introduction in 1950, the Health Belief Model (HBM), has been used in a variety of studies of health behavior, including disease detection and prevention (Becker, Kabeck, Rosenstock, & Ruth, 1975; Brailey, 1986; Champion, 1984, 1985, 1987; Hallal, 1982; Janz & Becker, 1984; Kim, Horan, Gendler, & Patel, 1991; Rutledge, 1987; Trotta, 1980). The results of these studies varied, but suggest that certain health beliefs are useful in predicting specific behaviors. This study built on a previous study by Kim et al. (1991) who, incorporating the theoretical dimensions of the HBM to measure health beliefs related to osteoporosis, developed the Osteoporosis Health Belief Scale (OHBS). This study was part of a larger one which examined the relationship of the health beliefs to both calcium intake and exercise.

Purpose

The purpose of this study was to examine relationships of health beliefs (susceptibility, seriousness, benefits, barriers, health motivation and self-efficacy) and knowledge to calcium intake.

CHAPTER 2

REVIEW OF THE LITERATURE AND CONCEPTUAL FRAMEWORK

Review of the Literature

Research utilizing the Health Belief Model (HBM) is extensive. It's use with the elderly however, is limited and only one study was found that utilized the HBM to examine osteoporosis preventive behaviors (Kim et al., 1991). The recommendation to include self-efficacy into the HBM is so recent, that no studies that used the HBM as a framework and that also incorporated the self-efficacy concept, were found. The literature review for this study includes the application of the HBM in previous studies of preventive health behaviors and early disease detection. The review also includes (a) prior research on the relationship of calcium intake and osteoporosis; (b) previous research that examined the self-efficacy concept in relationship to various health behaviors; and (c) prior studies that explicated knowledge within the HBM framework, or that looked at knowledge in relationship to nutrition behavior.

Health Belief Model Related Studies

The HBM has generated prolific research regarding behaviors related to disease detection and prevention of disease in asymptomatic subjects (Janz & Becker, 1984). Examples of disease detection studies utilizing the HBM include the following: Brailey, 1986; Burack & Liang, 1989; Champion, 1987; Hallal, 1982; Kegeles, 1963; Macrae, 1984; Stillman, 1977; and Trotta, 1980.

Janz and Becker (1984) reviewed 29 HBM-related studies that were designed to investigate preventive health behavior and disease detection behaviors. These studies used the "traditional" health beliefs of susceptibility, seriousness, benefits, and barriers. Most of the research supported a statistically significant association between the health beliefs and behaviors. Barriers were found to account for the largest percent of variance, followed closely by susceptibility, benefits and seriousness. Janz and Becker (1984) concluded that substantial empirical evidence supports the importance of the HBM dimensions in explaining and predicting a person's health behaviors. However, it was noted that, for the most part, studies using the HBM as the conceptual framework, have lacked consistent operationalization and measurement of the variables. The variability in measures was noted to make interpretation and comparison of findings across studies difficult. Refinement and standardization of tools directed toward the measurement of condition-specific beliefs.was recommended for future studies.

Champion (1984), who was concerned with the inconsistency in application of the model and the lack of valid and reliable instruments for measuring the constructs, developed and tested an instrument designed specifically for the study of the HBM variables as they related to self breast examination (BSE). In addition to the four traditional HBM variables, health motivation was included. The five variables representing the health beliefs accounted for a statistically significant amount of the variance (26 percent) in BSE practice. Barriers accounted for the largest portion of variance (23 percent) for a single HBM construct, and health motivation accounted for 2 percent of the variance in BSE practice. Women perceiving multiple barriers tended to examine their breasts less frequently.

Champion's subsequent research of 1985 and 1986, also revealed a correlation between the HBM constructs and BSE practice. A more recent study included knowledge as a variable and results revealed that, along with knowledge, barriers and susceptibility were correlated with the frequency of BSE (Champion, 1987).

Research regarding the influence of the HBM variables in disease prevention behavior also supports the conceptualization of the model (Aho, 1979; Allard, 1989; Becker, 1985; Kim et al., 1991; Knight & Hay, 1989; Maiman, Becker, Kirscht, Haefner, & Drachman., 1977; Tirrell & Hart, 1980). Allard's study (1989) adapted Champion's (1984) scale to investigate disease preventive practices and beliefs about AIDS. The HBM was found to be a good theoretical approach to obtain data on AIDS related behaviors. Perceived susceptibility to AIDS and perceived severity of the disease were found to be significantly correlated with AIDS prevention practices. Using the HBM was also found to be useful for development of health education programs to promote behavior change to reduce risk of contracting AIDS.

Kim et al. (1991) developed an Osteoporosis Health Belief Scale (OHBS) based on Champion's scale (1984), to measure health beliefs related to osteoporosis. The study is a pioneer study both in application of the HBM to the elderly population and in developing a HBM scale specifically designed to assess beliefs related to exercise behavior and calcium intake. The OHBS is in it's initial stages of development. The results of the study by Kim et al. (1991) found barriers and health motivation to be statistically significant constructs in explaining both calcium intake and exercise behaviors. Further use and revisions of the scale have been suggested to gather additional information about health beliefs and to facilitate the

development of individual programs to decrease specific barriers and to promote health motivation for those at risk for developing osteoporosis.

The results of research using the HBM with disease detection and preventive behaviors have been varied, but suggest that certain HBM variables are useful in predicting specific behaviors. Much of the support for the HBM has come from studies in which data on beliefs and behaviors were collected at the same time. These studies have shown strong correlations between beliefs and behavior, but it is difficult to judge if beliefs produce behavior or vice versa. A problem with a retrospective design is that causality can not be implied as there is evidence to show that individuals sometimes rationalize their beliefs and feelings to fit their behavior (McKinlay, 1972).

Another problem with many HBM studies relates to self-administration of the questionnaire and self-report of the behavior. Also, problems with inconsistency regarding measurement of the health belief variables limits interpretation of many of the studies. Jette, Cummings, Brock, Phelps, and Naessens (1981) reported that scales comprised of items that refer to a specific health problem have higher reliability than scales comprised of items that fail to mention the disease of interest. The development of consistent, reliable and valid measures has been recommended. Ideally, separate scales should be constructed as the HBM is applied to each new health problem (Champion, 1984; Given, Given, Gallin, & Condon, 1983; Janz & Becker, 1984; Jette et al., 1981; Maiman, Becker, Kirscht, Haefner, & Drachman, 1977). Champion (1984) suggests, if the HBM is found to be theoretically sound and if reliable instruments are available, the study results can be used to structure individualized health promotion nursing strategies.

Self-Efficacy Related Research

Numerous studies have examined the self-efficacy concept in relationship to diverse health behaviors (Champion, 1989; Diclemente, Prochaska, & Gibertini, 1985; Ewart et al., 1984; Glynn & Ruderman, 1986; Godding & Glasgow, 1985; Jeffery, 1984; Kaplan, Atkins, & Reinsch, 1984; Nicki, Remington, & MacDonald, 1984;). These studies indicate self-efficacy is a consistent predictor of health behavior and that interventions can enhance self-efficacy. Many of the studies of self-efficacy and health behavior dealt with smoking behaviors (Strecher, McEvoy, DeVellis, Becker, & Rosenstock, 1986). Other health behavior studies utilizing the self-efficacy concept include investigations of; weight control, contraceptive behavior, alcohol abuse, exercise, phobias, and breast self-exam. No studies were found that examined the relationship between self-efficacy and osteoporosis preventive behaviors.

Some of the research that examined self-efficacy investigated the concept alone, while other studies included behavioral influencers in addition to self-efficacy. Of the studies that examined other variables in addition to self-efficacy, some focused on representations of outcome expectations as differentiated from efficacy expectations. These studies (Chambliss & Murray, 1979; Godding & Glasgow, 1985; Kaplan et al., 1984) demonstrated an interaction between outcome expectation and self-efficacy as it relates to action. Because Social Cognitive Theory theorizes that a combination of both outcome expectations and efficacy expectations are necessary to explain behavior (Rosenstock, Strecher, & Becker, 1988), it is of interest to review research that examines both perceptions regarding capability of performing the behavior (self-efficacy) and perceptions related to the likelihood that a given behavior will lead to certain outcomes

(outcome expectations). However, caution must be used in interpreting these studies, since conceptualization and operationalization of the outcome expectations lack consistency and clarity.

Strecher et al. (1986) reviewed several studies that examined the concept of self-efficacy and health behaviors. To provide an overview of self-efficacy research, Strecher's review will be summarized. Following the overview, three studies will be described in greater detail to exemplify how the concept has been utilized, and to provide the necessary background information to demonstrate how the present study builds on previous studies.

Strecher et al. (1986) reported that experimental and descriptive research investigating the relationship between self-efficacy and smoking provides considerable evidence that perceived capability influences cessation of smoking and relapse behavior (Blittner, Goldberg, & Merbaum, 1978; Brod & Hall, 1984; Chambliss & Murray, 1979; Coelho, 1984; Condiotte & Lichtenstein, 1981; DiClemente, 1981; Godding & Glasgow, 1985; McIntyre, Lichtenstein, & Mermelstein, 1983; Nicki, Remington, & MacDonald, 1985; Pechacek & Dunaher, 1979; Prochaska & DiClemente, 1984; Strecher, Becker, Kirscht, Eraker, & Graham-Tomasi, 1985). Self-efficacy correlated with both initial and long-term weight loss in a study by Jeffery et al. (1984). Glynn and Ruderman (1986) reported weight loss, in conjunction with a treatment program, was significantly correlated with increases in self-efficacy scores. Researchers examining contraceptive behavior reported women's confidence in their ability to use contraception was related to more effective contraceptive behavior (Strecher et al., 1986). Results of studies involving compliance with exercise regimens

(Ewart et al., 1984; Kaplan et al., 1984) indicated that increased perceptions of self-efficacy toward exercise resulted in increased physical activity.

Using a quasi- experimental design, Kaplan et al. (1984) tested the relevance of self-efficacy to a medically recommended regimen for walking exercise behavior among subjects with chronic obstructive pulmonary disease. Self-Efficacy Theory was supported as exemplified by the following three findings: (a) compliance with the exercise program resulted in increases in subjects' expectations of their ability to accomplish the behavior in the future; (b) these expectations, in turn, were associated with increased performance on a treadmill exercise test three months later; and (c) significant correlations between self-efficacy and behavior were found when self-efficacy represented the specific behavior (walking) versus progressively dissimilar behaviors such as general exertion, moving things and lifting. The researchers also reported an interaction between what they characterized as an outcome expectation and self-efficacy.

Godding and Glasgow (1985) investigated self-efficacy and smoking behavior. The purpose of their research was to develop and evaluate measures of both self-efficacy and outcome expectations. The treatment consisted of small group meetings in which self-efficacy enhancement was taught. The researchers found high correlations between self-efficacy and both present and future smoking behavior. The combination of outcome expectations with self-efficacy scores did not increase predictability of smoking behavior, as Social Cognitive Theory predicts. Limitations of the study include a very small convenience sample, and questionable validity of the Outcome Expectation Scale.

Gonzalez's (1990) descriptive study reported a strong relationship between self-efficacy and the frequency of breast self-examination. The researcher used a convenience sample of 106 spanish-speaking Mexican American females. Social support, barriers, and English proficiency were additional variables that were examined. The effects of English proficiency on frequency of BSE were reported to be mediated by self-efficacy. This study suggests that self-efficacy might have relevance with diverse populations. Limitations to the study include reliability concerns with the self-efficacy tool and measurement of the dependent variable. The self-efficacy scale included items related to access to health care, physician-patient communication and other more generalized expectations about compliance, in addition to items specific to perceived capability with BSE. Although Cronbach Alpha for the scale was reported to be .82, conceptually, self-efficacy was not distinguished from other behavioral determinants such as barriers. Socially desirable responses to the questionnaires and the fact that BSE was measured via self-report are additional reasons to view the results of this study cautiously.

In summary, the literature review of self-efficacy research provides considerable evidence for the relevance of the concept to diverse health behaviors. As a cognitive mediator of behavior it does not influence behavior alone, as demonstrated by the interaction with outcome expectations. Few studies however, measure both self-efficacy and outcome expectations. The interaction between outcome expectations and self-efficacy that some studies reported points to the possible significance of considering both of these behavioral dimensions for better explanation of behavior. Since , according to Rosenstock et al. (1988), the susceptibility and benefits variables of the HBM relate to outcome expectation, adding the

self-efficacy variable to the HBM would ensure inclusion of these two key behavioral influencers.

Further research of self-efficacy will also help refine measurement of the concept. Although most of the studies reviewed reported reliability and validity properties for the instruments used to measure self-efficacy, there is some inconsistency regarding operationalization of the concept. For example, there was considerable difference in the level of specificity in items that represented target behaviors. Although self-efficacy is conceptualized as situation-specific, scales to measure generalized self-efficacy expectations have been developed (Sherer et al., 1982; Sherer & Adams, 1983; Tipton & Worthington, 1984). Other problems with measurement of the concept involve uncertainty about the components of the concept that should be measured, and uncertainty about how the concept is differentiated from other similar concepts. Self-efficacy may have some over-lapping or similar attributes to the concepts of motivation and barriers. Additional research, especially with other similar, but apparently distinct concepts, such as those conceptualized in the HBM, should help clarify these differences and increase the precision with which the concepts are measured.

Calcium-intake Related Research.

The literature pertaining to osteoporosis indicates that involutional bone loss is a multifactorial disorder. Bone health can be thought of as a chain whose links collectively determine it's overall strength. Calcium, as well as gonadal hormones, exercise, age, sex, and genetics are important links in the chain. Two of these links, calcium intake and exercise, are influenced by behavioral factors. This review focuses on the evidence related to only one of the links in the chain of bone health--calcium intake.

Examination of the effect of calcium modification in the human diet and its effect on bone mineral density was the purpose of the first three studies in this review (Riis, Thomsen, and Christiansen, 1977; Baran et al., 1990; Nordin, Horsman, Crilly, Marshall, & Simpson, 1980). The remainder of the review consists of studies involving investigation of calcium modification along with preventive treatment modalities such as estrogen replacement therapy, and the use of certain vitamins and minerals.

Riis et al. (1977) in a two-year double-blind study, examined the effects of calcium supplementation on postmenopausal bone loss in 43 women in the early menopause period. The bone mineral content in the forearm was measured by single photon absoprtiometry, and the entire body and spine was measured by dual photon absorptiometry every three months. The group that was treated with 2,000 milligrams of calcium showed a tendency toward slowed loss of compact bone in the proximal forearm and total skeleton as compared with the placebo group. The results of the study revealed that calcium supplementation had a minor effect on the loss of cortical bone.

Baran et al. (1990) researched the effect of calcium intake on bone density in younger women. In a randomized study the effect of dietary modification in the form of dairy products on vertebral bone mass in 30 to 42 year old premenopausal women over a 3 year period was investigated. Twenty women increased their dietary calcium intake by an average of 610 mg. of calcium per day, while 17 age and weight- matched women served as controls. Mean dietary calcium intake (mg./day) of the treatment group was 962 mg. (SD = 375), while the control group was 892 mg. (SD = 514). Calcium intake was monitored by 3 day diet histories and 24-hour urinary calcium excretion. The vertebral bone density in the women consuming

increased calcium did not change over the 3 year period. In contrast, bone density in the control group was lower (-2.9% plus or minus 0.8%, $P < .001$) than the supplemented intervention group. The results of the study suggest that increased calcium intake in the premenopausal woman may prevent age-related bone loss.

Nordin et al. (1980) investigated bone loss in a population of women with osteoporosis. Forty-one of the patients serving as controls did not receive a calcium supplement in addition to their regular diet, while the 20 women in the treatment group received a 1,200 mg. calcium supplement every day for one year. The treatment group was not significantly different from the untreated group. However, when the treatment group was treated with estrogen, vitamin and calcium supplements, bone loss was effectively slowed.

Multiple studies have revealed that calcium supplements, in combination with estrogen replacement therapy, have a positive effect on bone mineral density. Among these studies is research done by acknowledged experts in the field (Heaney et al., 1982; Heaney, Recker, & Saville, 1978; Horsman, Gallagher, Simpson, & Nordin, 1977; Recker, Saville, & Heaney, 1977).

Yano, Heilbrun, Wasnich, Hankin, and Vogel (1985) evaluated the relationship of dietary intake of nutrients and supplemented vitamins and minerals among elderly Japanese-American men and women living in Hawaii. The researchers reported that dietary intakes of milk, calcium supplements, and vitamin D were significantly and positively associated with increased bone mineral content in both sexes after adjusting for age, weight, height, strenuous exercise (men), history of nonviolent fracture, thiazide use, and estrogen use (women).

Spencer, Menczel, Lewin, and Samachson (1964) concluded that elderly persons have a decreased ability to absorb calcium from the intestine. Therefore, greater calcium intake is necessary to achieve a comparable calcium balance in the elderly as compared with younger subjects.

The relationship of calcium intake and vitamin D to bone mass changes was examined by several researchers (Aloia et al., 1983; Riggs, Jowsey, Kely, Hoffman, & Arnaud, 1976). The results of the studies indicated that calcium modification in combination with vitamin D was effective in decreasing bone turnover in patients with osteoporosis. The researchers concluded that increased intake of calcium should be encouraged in the perimenopausal years, and adequate calcium absorption should be ensured by provision of an adequate amount of vitamin D through diet or sunlight.

In summary, results of several studies have shown a positive correlation of calcium intake to bone density (Aloia et al., 1983; Horsman et al., 1977; Nordin et al., 1980; Recker et al., 1977; Riggs et al., 1982; Riis et al., 1987; Yano et al., 1985). Many of the studies designed to investigate a relationship between calcium intake and osteoporosis are difficult to interpret because either the studies did not take place over a long enough period of time to reveal long term bone changes, (Aloia et al., 1983; Nordin et al., 1980; Riggs et al., 1977; Yano et al., 1985) or the studies were conducted on women soon after menopause when estrogen deficiency induces a transient bone loss (Heaney et al., 1978; Riis et al., 1987). Most of the relevant long-term studies have revealed that, although calcium supplementation retarded bone loss, the therapeutic effect was less effective than estrogen replacement (Horsman et al., 1977; Recker et al., 1977; Riggs et al., 1982; Riis et al., 1987).

Knowledge Related Research

Although nursing interventions often focus heavily on teaching, it is becoming increasingly evident that knowledge alone is not a predictor of health related behaviors. Luker and Caress note that recent research shows ". . . . situational or personality factors often play a more significant role in determining compliance than education" (1988, p. 714). Nevertheless, there is considerable literature support to indicate that knowledge has a significant impact in determining actions that affect health.

The HBM conceptualizes knowledge as a modifying variable and thus is characterized as having an indirect effect upon behavior by mediating the major health beliefs. Studies using the HBM as a framework often also examine knowledge. No studies were found that used the HBM as a framework to examine knowledge and osteoporosis preventive behaviors. This review includes (a) studies in which knowledge, along with the HBM, were examined and (b) studies in which the relationship between nutritional knowledge and dietary behavior was examined.

Barnes and Thomas (1990) investigated knowledge within the framework of the HBM, to test the effect of a modified cancer education program for the elderly. These researchers found that although knowledge scale scores increased in each of the two groups who received cancer education, (one modified for the elderly and one that was "conventional") there was not a significant difference between these two groups nor between an additional control group which received education about nutrition. The researches also reported that perceived benefits were positively correlated with level of education.

Champion (1987) reports a study in which she tested the relationship between concepts of the HBM, (including knowledge) and breast self exam.

The investigator hypothesized that a combination of the health beliefs of susceptibility, severity, benefits, barriers, and motivation, together with concepts of control and knowledge, would be significantly correlated with frequency of breast self exam (BSE). Knowledge was found to account for 4 percent of the variance of frequency of BSE when a stepwise multiple regression analysis was done. The barriers concept was found to account for 22 percent of the variance, leaving the other concepts adding only insignificant amounts to the total variance. As a result, Champion concluded that knowledge and barriers can predict breast self-exam without the additional variables posited by the HBM.

Stillman (1977) utilized the HBM as a framework to examine health beliefs and knowledge in relation to breast cancer and breast self-exam. Statistical analysis was not done, but she suggests that knowledge may play a significant role with BSE. Stillman reported multiple misconceptions (knowledge deficits) regarding breast cancer among a group of women whose mean BSE practice rate was moderately low. The results of the study are limited because of the lack of statistical analysis, however, it was assumed that lack of knowledge had an impact on the relatively low percentage of BSE practicers.

Grokowski and Sims (1978), found a positive association between nutrition knowledge and desirable nutrition attitudes. They examined the relationship among attitudes, knowledge and dietary behaviors of non-institutionalized elderly. The researchers found nutrition knowledge to be significantly related to three of the four nutrition attitude measures. The authors concluded that improving knowledge about nutrition should result in positive attitudes toward nutrition and subsequently result in improved dietary behavior.

Sutterer, Carey, Silver, and Nash (1989) conducted a large study, that used the HBM to examine factors which might be related to participation in a screening program for early identification and prevention of cardiovascular disease and diabetes. The researchers hypothesized that knowledge of disease and risk status are important factors in self-initiated behavioral change. The researchers found that the recruited participants displayed a moderate level of knowledge about risk factors, but that level of knowledge was not related to initial risk status or to subsequent self-initiated change in risk over time. There was, however, a 15.2 percent reduction of serum cholesterol at the end of 1.5 years among those individuals who were considered in the high risk category at the initial screening. The researchers speculated that knowledge of risk "... might be associated with perceived susceptibility and hence their risk status" (Sutterer et al., 1989, p. 145). Although there were multiple design problems, this study provides a rationale for undertaking additional studies that examine knowledge in relationship to preventive health behaviors, along with other key variables such as those explicated by the HBM.

The studies in this section require caution with interpretation of the findings. Limitations of these studies include conceptualization, sampling and measurement problems. An underlying assumption of studies that look at knowledge in relationship to the HBM, is that once people have adequate information, they will form desirable attitudes and beliefs, and subsequently perform the desired behavior. However, although attitudes and beliefs are closely linked to knowledge, obtaining adequate knowledge may not lead to immediate change in beliefs. Research has also shown that knowledge and skills gained from intervention programs do not always translate into subsequent behavior.

A review of the literature in relation to knowledge and health behavior indicates that although knowledge plays a significant role in behavior, it's effect is probably indirect. Studies in which the role of knowledge is examined as an influencer of the health beliefs seem to hold the most promise for additional research utilizing the variable. The HBM, which conceptualizes knowledge as a mediating variable, provides an appropriate framework for examining it's effect upon one or more of the health beliefs. Perhaps knowledge mediates certain health beliefs more than others, and with certain kinds of behaviors. Because it appears that there is a lack of research that examines knowledge and osteoporosis prevention nutrition behaviors in conjunction with health beliefs and attitudes, this study helps fulfill a need for additional exploration in this area.

Conceptual Framework

Rates of adherence to recommended medical treatment plans and healthy lifestyle practices tends to be quite low (Gerber & Nehemkis, 1986). Behavior is the result of a complex interaction of interpersonal, familial, cultural and situational factors. More difficult types of behaviors involve an even more complex interplay of a myriad of behavioral determinants. Several models and theories have been developed to explain and predict behavior. The models encompass various combinations of certain factors that are felt to influence behavior. Models that emphasize cognitive-behavioral aspects and that are grounded in Social Cognitive Theory, are popular frameworks for examining health behavior. These models focus on knowledge and skills, beliefs, motivation and decision-making regarding what action to take, as well as feedback relative to the action taken. Models based on Social Cognitive Theory (SCT) also assume that people are capable of rational decision-making.

. The Health Belief Model (HBM), developed in the 1950s by a group of social psychologists, is based on SCT and provides the conceptual framework for this study. This model is probably the most widely utilized one in health behavior research, and has " . . . very substantial empirical evidence supporting HBM dimensions as important contributors to the explanation and prediction of individuals' health-related behaviors" (Janz & Becker, 1984, p. 41). The HBM was originally developed to explain and predict behaviors that related to preventive health, but has since been utilized with illness and sick role behaviors. The following discussion will include an overview of the HBM, definition of the terms specific to this study, and a description of how the HBM relates to this study.

The HBM provides a framework for understanding why people may not avail themselves of opportunities to detect illness early or to follow through with recommended preventive practices. The model is most applicable with voluntary, health-related actions that involve an element of uncertainty. Because it is a psychosocial model, it is applicable only to behavior that can be explained by a person's attitudes and beliefs. The HBM encompasses a "value-expectancy" approach which attributes behavior to the value an individual places on an expected outcome of the action and also to the perception by the individual that the specific behavior will result in the expected outcome.

The HBM hypothesizes that health-related behavior occurs as a result of the interactive and combined effects of (a) readiness to comply with recommended action/s and (b) modifying and enabling factors. The factors that influence readiness to act include those dimensions known as the health beliefs: (a) Perception of a threat to health, which is conceptualized as a combination of how susceptible the individual perceives

him/herself to be to an illness and how severe of an effect he/she believes the illness would have on his/her life; (b) belief that the action will result in the expected outcome; (c) belief that there are not insurmountable barriers which preclude goal attainment; and (d) health motivation, defined as a concern about health, a health consciousness and a high saliency of health in one's value system.

The HBM is described as an evolving model. The next evolutionary development on the horizon for the HBM includes the concept of self efficacy. Rosenstock, Strecher, and Becker (1988) recommend that self-efficacy be added to the other "traditional" health beliefs and claim the addition will provide a model that better accounts for those factors responsible for determining health-related behavior.

Bandura (1977) developed the self-efficacy concept, which is one of the major dimensions of Social Cognitive Theory (SCT). SCT, like the HBM, seeks to predict and explain behavior and also encompasses a value-expectancy approach. SCT posits that behavior depends on both outcome expectations and efficacy expectations. Outcome expectations are defined as " . . . a person's estimate that a given behavior will lead to certain outcomes" (Bandura, 1977, p. 193), and efficacy expectations (synonymous to self-efficacy) are defined as " . . . the conviction that one can successfully execute the behavior required to produce the outcomes" (Bandura, 1977, p. 193), or beliefs about how capable one is of performing (Strecher et al., 1986, p. 74). Proponents of SCT believe behavior is best explained when both outcome expectations and self-efficacy are considered. By incorporating self-efficacy into the HBM, as this study does, the dimension of efficacy expectation would be added along with outcome

expectations, which, according to Rosenstock et al. (1988) are represented by the benefit and susceptibility beliefs .

Self-efficacy has been hypothesized to be a paramount concern with health care behaviors that require difficult life-style changes or with behavior that is characterized as habitual. The osteoporosis preventive behavior of adequate calcium intake, the behavior of interest in this study, is not a simple behavior. Altering one's nutritional intake involves changing behavior that may be partially habitual, and subsequently would be viewed as a challenging undertaking. Merritt (1989) relates the significance of patient education and knowledge acquisition to self-efficacy. She contends that people will be more likely to engage in behavior required to learn something new if they perceive they are capable of the behavior. Inclusion of self-efficacy within the HBM could add a significant dimension to the model and contribute to knowledge about osteoporosis preventive behaviors.

The modifying and enabling factors of the HBM include demographic, socio-psychological and structural variables. Some of these factors may function as a cue to action, also characterized as a "triggering" mechanism. These factors are considered to have an indirect influence on health behavior by their effect on an individual's health motivation and perceptions. Examples of the modifying and enabling factors include a) demographic characteristics such as age, sex, race, and income; b) socio-psychological variables such as personality, social class, type of health care practitioner-patient relationship and social support; and c) structural variables which, according to Redeker, include knowledge (1988, p. 31). The only modifying/enabling factor this study examined is knowledge.

Knowledge is a variable that is frequently explicated for specific measurement in health behavior research. Studies in which breast self-

examination behaviors are examined, are examples (Trotta, 1980; Stillman, 1977; Champion, 1987). The HBM was originally conceived with knowledge recognized as a significant determinant of health related behaviors (Becker et al.,1977) and as having the potential to influence an individual's readiness to undertake a specific action. According to Rosenstock (1974, p. 330), both perceived susceptibility and severity have a strong cognitive component and are at least partly dependent on knowledge. Because of it's potential significance as a modifier of the health beliefs and because it is an area that nursing can impact, knowledge of osteoporosis preventive behaviors is one of the variables examined in this study.

The HBM can be applied to osteoporosis preventive behaviors as indicated by the following examples relative to each of the HBM variables. If a woman's responses to the Osteoporosis Health Belief Scale (OHBS) indicate she perceives herself as susceptible, she will see herself as being likely to get osteoporosis. The perception of severity is a combination of an emotional arousal created by the thought of osteoporosis, and perceptions of the kinds of difficulties that having osteoporosis represent to the woman. For example, a woman might perceive that having osteoporosis would result in physical disability, causing an inability to continue to work or function as a wife and/or mother. In regard to the benefits variable, if sufficient calcium intake is perceived as beneficial, a woman will believe that ingesting a sufficient amount of calcium will decrease her susceptibility to osteoporosis. She may also believe that adequate calcium intake would decrease the severity of osteoporosis, if, at some point in time, she should get the illness. Examples of barriers that might be perceived by a woman with regard to calcium intake to prevent osteoporosis include (a) viewing calcium supplements or foods high in

calcium to be too expensive, (b) being concerned that recommended calcium supplements will result in stomach irritation, or (c) believing it is too inconvenient to keep track of calcium intake to ensure adequate inclusion in the diet. If a woman is motivated towards health, she will be more likely to eat a well balanced diet, obtain regular exercise and obtain regular medical "check-ups". A self efficacious woman, will feel confident that she possesses the skills to ingest adequate dietary calcium, or that she has the skills to administer calcium supplements.

The HBM provides a logical framework from which to explore osteoporosis preventive health behaviors. The model includes variables that are not necessarily immutable and that are amenable to nursing interventions. If significant correlations between the health beliefs of the HBM and calcium intake are found, then those beliefs that are below a level necessary for appropriate behavior can be identified and nursing interventions tailored to alter beliefs and modify behavior. The HBM is a model that is limited to explaining and predicting behaviors that are due to attitudes and beliefs (Janz & Becker, 1984, p. 44). Although dietary intake of calcium might have a habitual component, as is often the case with dietary behaviors, attitudes and beliefs are probably also significant. The amount of calcium included in a woman's meal, or whether or not she takes a calcium supplement, is likely a function of the health beliefs she holds and the subsequent formulation of attitudes about calcium intake and osteoporosis. The intake of calcium also represents a behavior that is under voluntary control, and thus is contingent upon a woman's decision to act or not to act, according to the beliefs and attitudes she holds.

Exploring the self-efficacy concept in relationship to osteoporosis preventive behavior builds on previous studies by increasing the diversity

of health behaviors for which the concept has relevance. Incorporating self-efficacy with the HBM as a major health belief should strengthen the model by including more of the variables that probably are determinants of osteoporosis preventive behaviors. If the determinants of osteoporosis preventive behavior are better understood, nursing interventions can more appropriately be tailored to promote health and prevent disease.

Hypotheses

The four hypotheses that were explored in this study are: (1) There is a negative relationship between the strength of health beliefs related to barriers and calcium intake; (2) There is a positive relationship between the accuracy of knowledge and calcium intake; (3) There is a positive relationship between the strength of the health beliefs related to susceptibility, severity, benefits, health motivation and self-efficacy and the level of calcium intake; and (4) Knowledge and the health beliefs account for a significant amount of variance in calcium intake.

Definition of terms

This study utilized an adapted version of the HBM (Appendix A). Collectively, health beliefs refers to attitudinal components of health behaviors and include: susceptibility, seriousness, benefits, barriers, health motivation, and self-efficacy.

Susceptibility refers to the perceived risks of developing osteoporosis. Seriousness is concerned with perceived degree of personal threat related to developing osteoporosis. Threat is defined as perceived harmful consequences of osteoporosis. Benefits refer to perceptions regarding the effectiveness of osteoporosis preventive behaviors. Barriers are perceptions of negative components of osteoporosis preventive behaviors, which would be undertaken to prevent osteoporosis. Health motivation

relates to a state of concern about general health matters, which results in positive health activities and willingness to seek and comply with recommendations that are believed to decrease disease. Self-efficacy is defined as perceptions regarding the capability of ingesting recommended amounts of calcium. Knowledge refers to factual material possessed in regard to osteoporosis risk factors with an emphasis on exercise and nutrition. Calcium intake refers to the amount of calcium ingested either by eating foods that include calcium or by taking a calcium supplement.

CHAPTER 3

METHODOLOGY

Research Design

This study was conducted using a descriptive, correlational research design. The purpose of the study was to examine relationships of osteoporosis health beliefs and knowledge to calcium intake of women.

Sample and Setting

A convenience sample of 201 women was selected for the study. Data collection took place in a metropolitan area of Western Michigan. Subjects were recruited from senior centers, apartment complexes which house senior citizens, an outpatient mammography clinic, and a university and public school system. The variety of interviewing sites were selected in order to obtain a representative sample from social, economic and employment groups. Criteria for inclusion into the study was (a) female, age 35 and older; (b) English speaking; (c) no prior diagnosis of osteoporosis; and (d) oriented to person, place and time.

Characteristics of Subjects

The ethnicity of the sample was predominantly white (96.5 percent). The remainder of the sample was comprised of three percent black and .5 percent "other". The ages of the subjects ranged from 35 to 95. The sample was categorized into four groups according to an age range and three groups according to years of education. Sample characteristics are depicted in Table 1. Thirty-six percent of the subjects (73) reported they had friends or relatives who had osteoporosis.

Table 1

Sample Characteristics

Characteristics	Frequency	Percent
Age		
35-44	58	28.9
45-54	45	22.4
55-64	39	19.4
65 +	54	29.3
Years of Education		
6-12	88	43.7
13-18	90	44.7
20-27	23	11.4
Race		
Black	6	3.0
White	194	96.5
Other	1	5.0
Friend/Rel. has Osteoporosis		
Yes	73	36.3
No	128	63.7

Instruments

This study used the following instruments: (a) the Osteoporosis Health Belief Calcium Scale (OHBCS) to measure health beliefs about osteoporosis, (b) the 24-hour dietary recall method to measure dietary calcium intake, (c) the Osteoporosis Calcium Self-Efficacy Scale to measure perceptions about the capability of ingesting recommended amounts of calcium, and (d) the Osteoporosis Calcium Knowledge Test to measure the subject's knowledge about osteoporosis risk factors. A calcium supplement data sheet was used to assess calcium intake from supplements and medications which contain calcium. The instruments were piloted and procedural problems identified and rectified.

Osteoporosis Health Belief Calcium Scale (OHBCS)

The OHBCS is part of a revised version of the 35 item Osteoporosis Health Belief Scale (OHBS) developed by Kim et al. (1991) (Appendix B). The current OHBS consists of 42 items. The OHBS was based on Champion's Breast Self-Examination HBM instrument, and includes subscales which address both nutrition and exercise behaviors. There are a total of 30 items on the OHBCS, and it includes only those subscales of the OHBS that address nutrition behavior. The items are reflective of each of the five original theoretical dimensions of the HBM (susceptibility, seriousness, barriers, benefits, and health motivation). Each subscale is comprised of six items. Perceived seriousness was determined by scores on the seriousness subscale, perceived benefits was determined by scores on the benefits subscale, perceived barriers was determined by scores on the barriers subscale and health motivation was determined by scores on the health motivation subscale. The OHBCS questionnaire uses a Likert format with responses from 1 to 5; "strongly disagree" was scored as 1 and "strongly

agree" as 5. The total possible score for each subscale ranges from 6 to 30. Questions are worded at a fifth grade readability level.

Internal consistency of the OHBCS was evaluated by using Cronbach alpha. Reliability coefficients ranged from .71 (seriousness) to .82 (Susceptibility) (Table 2). Stability of the OHBCS was examined using a subsample of 51 women who were tested at a 3 week interval. Reliability coefficients ranged from .52 (benefits) to .84 (susceptibility) (Table 2). A review of the literature and input from nursing faculty and nurses in practice established content validity for the items. Construct validity of the OHBCS was determined by factor analysis.and resulted in a five factor solution: Susceptibility, seriousness, health notivation, barriers and benefits. That is, all items related to a specific concept loaded under the respective subscale.

Table 2

Reliability Coefficients of OHBCS

Subscales	Total Items	Cronbach Alpha	Test-Retest r
Susceptibility	6	.82	.84
Seriousness	6	.71	.79
Benefits Calcium	6	.80	.52
Barriers Calcium	6	.74	.68
Health Motivation	6	.73	.67

24-Hour Dietary Recall Method

Dietary calcium intake was measured using the 24-hour dietary recall method (Appendix C). The 24-hour recall was developed by Burke (1947); McHenry (1939); and Kruse, Palmer, Schmidt, and Wiehl (1940). Several large dietary studies have successfully used the 24-hour dietary recall as a means for individual dietary assessment (Witschi, 1990). The subjects in this study were asked to recall all food and drink consumed the previous day--from morning until bedtime. The success of 24-hour dietary recall depends on the subjects motivation, awareness of food intake, memory, cooperation, and communication skills.

Gersovitz, Madden, and Smiciklas-Wright, (1978) and Witschi, (1990) reported that the 24-hour dietary recall provides an accurate estimate of mean intake over a 24 hour period. Hankin and Hunemann (1967) recommend that three repeated 24-hour recalls be obtained of individual's nutrient intake to increase reliability. In this study, only one 24-hour dietary recall was obtained on each subject. Considering the purpose of this study (examining relationships of the health beliefs and an individual's typical daily calcium intake) one 24-hour dietary recall was judged to be an adequate method for collecting dietary information as a small variation in calcium intake estimation should not seriously affect the outcome. Researchers Young, Hagan, Tucker, and Foster, (1952) and Chalmers et al. (1952) found a one day 24-hour recall was adequate for obtaining the mean of a group when large numbers of subjects were used. Young et al. (1952) reported 50 subjects were the minimum number required to secure accurate means. The 24-hour dietary recall method was chosen for this study because (a) it is a simple and rapid means of obtaining information, (b) it can accommodate today's lifestyle where many people eat at least one meal

outside the home, and (c) a higher percentage of participation can be achieved as compared to a dietary assessment method that requires precise measurement by weighing each serving.

To overcome the potential threats to validity and reliability that can occur with administration of the 24-hour dietary recall method, food models, sample measuring spoons, cups and other frequently used food containers were used to help subjects accurately estimate amounts of food consumed. Food intake was assessed only if it represented "typical foods" consumed in a 24 hour period. A calcium supplement data sheet was used to assess calcium intake from supplements and medications which contain calcium (Appendix D).

Osteoporosis Self-Efficacy Calcium Scale (OSECS)

The OSECS is a six item instrument and is a subscale of the Osteoporosis Self-Efficacy Scale (OSES), a 12 item scale which was developed for the larger study of which this study is a component (Appendix E). The OSECS measures perceptions about ability to take in adequate amounts of calcium and utilizes a visual analog scale consisting of six items pertaining to calcium intake. Subjects completed the questionnaire with instruction and guidance from the interviewer. Subjects were instructed to place an "X" on an answer line that represents a continuum between "not at all confident" and "very confident". The responses were coded by measuring where the "X" occurs on the answer line. The score of each item ranges from 0 (not at all confident) to 100 (very confident). The reliability coefficient (Cronbach alpha) was .90. A review of the literature provided the basis for item construction, and nursing experts analyzed items for content validity. Construct validity of the OSES was evaluaed by factor analysis and resulted in a two factor solution: osteoporosis self-

efficacy calcium intake and osteoporosis self-efficacy exercise. All self-efficacy items related to calcium intake loaded under the same subscale of the OSECS.

Osteoporosis Calcium Knowledge Test

The Osteoporosis Calcium Knowledge Test (OCKT) is part of the Osteoporosis Knowledge Test which was developed, and revised for the larger study, of which this study is a component (Appendix F). The Osteoporosis Knowledge Test was developed to measure elderly subject's knowledge about osteoporosis risk factors with an emphasis on exercise and nutrition. This tool has 24 items and takes about 10 minutes to administer. This study used those portions of the instrument that address general osteoporosis risk factors (nine items) and nutrition (eight items),.for a total number of 17 items, and a total possible score of 17.

The following factors were considered in developing the Osteoporosis Knowledge Test: (a) content of the test was based on literature reviewed on osteoporosis, (b) a panel of six judges consisting of nursing and physical therapy faculty and registered dietitians determined whether the questions on the test reflected the kind of information the elderly needed to know to prevent osteoporosis, (c) a questionnaire used for one of the investigator's previous research provided items related to calcium rich foods (Kim et al., 1991), and (d) a small pilot test was done.

The format for the nine osteoporosis risk factors consists of a rating scale including the choices "more likely to get osteoporosis"; or "less likely to get osteoporosis"; or "it has nothing to do with osteoporosis". A cue card with the possible choices written in large, bold, print was given to the subject to facilitate responding to the test questions. The answers to all items were coded as 0 = incorrect and 1 = correct. Internal consistency of

the OCKT was determined with the Kuder-Richardson formula 20 (KR-20) and produced a reliability coefficient of .72.

Procedure

A structured interview method was used to collect data. Data collection took place over a three month period and was obtained by three graduate nursing students and six undergraduate nursing and physical therapy students, who participated in an extensive training program. Before the full-scale study was undertaken, a pretest of the instruments was done on a similar population to determine clarity and research adequacy.

Permission was obtained to conduct the study from the Grand Valley State University Human Subject Research Review Board. Verbal permission was obtained from the managers at the senior centers and apartment complexes. Subjects were informed about the purpose of the study, their rights regarding confidentiality and voluntary participation, and verbal consent was obtained prior to the interview (Appendix G). Since no risk to subjects was anticipated, a consent form was not obtained. Cognitive function was assessed by determining if the subject was oriented to person, place and time.

Demographic information, including age, race and education, was obtained from each subject (Appendix H). After the demographic data sheet was completed, the instruments were administered in the following order: (a) Osteoporosis Knowledge Test, (b) Osteoporosis Health Belief Scale, (c) 24-hour food recall (including calcium supplement sheet), and (d) Osteoporosis Self-Efficacy Scale. The Osteoporosis Knowledge Test was administered first to avoid possible response bias resulting from exposure to the information about osteoporosis that is included on the Osteoporosis Heath Beliefs and the Osteoporosis Self-Efficacy Scales.

CHAPTER 4

RESULTS

This chapter reports the descriptive statistics and the statistical tests of the hypotheses.

Descriptive Statistics

The mean scores and standard deviation. for each of the subscales of the OHBCS, the Osteoporosis Self-Efficacy Calcium Scale, the Osteoporosis Calcium Knowledge Test and total reported calcium intake, are presented in Table 3.

Table 3

Mean and Standard Deviation of Eight Major Variables of the Study

Measure	Mean Score	SD
Susceptibility	15.72	4.48
Severity	18.19	3.69
Barriers	13.05	3.29
Benefits	23.51	3.01
Health Motivation	23.84	2.95
Self-Efficacy	467.93	102.48
Knowledge	11.74	3.01
Calcium Intake (mg)	999.79	578.90

Tests of the Research Hypotheses

Four research hypotheses were tested: (1) There is a negative relationship between the strength of health belief related to barriers and calcium intake; (2) there is a positive relationship between the accuracy of knowledge and the level of calcium of intake; (3) there is a positive relationship between the health beliefs related to susceptibility, seriousness, benefits, health motivation and self efficacy and the level of calcium intake; and (4) knowledge and the health beliefs account for a significant amount of variance of calcium intake.

Hypothesis 1 was weakly supported with a statistically significant correlation coefficient of -.16 ($p = .012$). The fewer barriers that were perceived in relationship to ingesting adequate calcium resulted in a higher reported calcium intake. Hypothesis 2 was also weakly supported with a statistically significant correlation coefficient of .22 ($p = .001$). More accurate knowledge about osteoporosis resulted in a higher reported calcium intake. Hypothesis 3 was partially supported in that all variables examined, with the exception of susceptibility and severity, were significantly correlated with calcium intake at the .05 level.(Table 4). Stronger beliefs relative to benefits, health motivation and self-efficacy resulted in a higher reported calcium intake. The results of the analysis for hypotheses 1, 2, and 3, along with the relationships of the variables to each other, are depicted in Table 4. Relationships were considered to be significant at the 0.5 level.

Hypothesis 4 was analyzed using stepwise multiple regression. The results of the multiple regression analysis are depicted in Table 5. The only variables that were entered into the multiple regression equation were knowledge and self-efficacy. These two variables accounted for 7.8 percent

of the variance of the dependent variable--calcium intake (multiple regression coefficient of .28). Knowledge accounted for 4.8 percent of the variance and self-efficacy accounted for 3.0 percent.

Table 4

Correlations Between Health Beliefs and Knowledge and Calcium Intake

	Sus.	Sev.	Ben.	Bar.	H M.	S E.	Knowl.
Ca	.03	-.09	.14*	-.16*	.20**	.22**	.22**
Sus.		.17**	-.08	.23**	-.24**	-.23**	.05
Sev.			.01	.15*	-.06	-.13*	-.12
Ben.				-.28**	.44**	.22**	.23**
Bar.					-.33**	-.37**	-.38*
HM.						.33**	.21**
SE.							.22**

*p < .05

**p < .01

Note: Ca. = Calcium
Sev. = Severity
Ben. = Benefits
Sus. = Susceptibility
Bar. = Barriers
HM. = Health Motivation
SE. = Self-Efficacy
Knowl. = Knowledge

Table 5

Stepwise Multiple Regression of Health Beliefs and Knowledge, on Calcium Intake

Step	Variable Entered	b wt.	Mult. R	R^2	F value
1	Knowledge	34.89	.22	.048	10.08*
2	Self-Efficacy	.10	.28	.078	8.37*

*p < .01

In summary, hypotheses 1 and 2 were supported, but the correlation coefficients indicate low relationships. Hypothesis 3 was partially supported in that five of the six health beliefs correlated individually with calcium intake. Hypothesis 4 was partially supported in that, collectively, two of the seven independent variables accounted for some of the variance of calcium intake. These findings will be further analyzed and discussed in chapter 5.

CHAPTER 5
DISCUSSION AND IMPLICATIONS FOR NURSING

Discussion

This section will discuss the findings of the study, focusing on (a) the relevance of the HBM variables to osteoporosis prevention behavior and (b) methodological and research design limitations. The hypotheses will be discussed in consecutive order. The relevance of the HBM variables to the osteoporosis preventive behavior of adequate calcium intake, and a comparison of the results of this study to other HBM research, will be incorporated into the discussion of each hypothesis. The methodological limitations will be discussed at the end of this section.

Relating this study to other HBM research is hampered by differences in health behaviors and inconsistencies with application of the model. There are many different kinds of health behavior--some that relate to sick role (compliance), others to early detection (screening), and others to prevention of health problems (immunization). Champion (1987) points out that variables in the HBM may vary in importance depending on the behavior being examined. This may apply not only to the broad categories of behavior as above, but also to specific illnesses or health problems. Thus, with HBM research it might be more relevant to compare studies dealing with very similar behaviors and health problems. Because only one other study was found that dealt with osteoporosis using the HBM, comparing the results of this study with others is subsequently limited.

Although, according to the HBM, behavior should be able to be predicted by the combined effects of all the health beliefs, not all researchers using the HBM analyzed this additive effect. Some studies only used selected health beliefs. Health motivation for example, was not always included along with the other four traditional health beliefs, and no other studies were found that also included self-efficacy. Whether or not the combined effect of the beliefs is analyzed (multivariate analysis), can make a difference regarding interpretation of the study results. Pederson, Wanklin and Baskerville (1984) for example, did not find individual health beliefs contributed significantly to smoking cessation, but their combined effect, as determined by logistic regression analysis, did contribute to smoking cessation. Maiman et al. (1977) points out that the HBM postulates that the various beliefs occur in combination to induce action, and thus, multivariate analysis is necessary. Not all studies using the HBM used multivariate analysis.

Hypothesis 1

The support for hypothesis 1--"there is a negative relationship between the strength of health belief related to barriers and calcium intake", provides validity for the barriers concept, and is congruent with the HBM. It would be expected that, as hypothesized by the HBM, when the number of perceived barriers increased, calcium intake would decrease, . Perceived barriers scores were relatively low. The mean was 13.0 and scores ranged from 6 to 23 out of a total possible of 30. This would be an expected finding since calcium intake was fairly adequate. Because a multiple regression analysis does not show negative relationships, it was significant to single this variable out in a separate hypothesis. The barriers concept is a significant one to single out, since, according to Janz

and Becker (1984), in a review of HBM research from 1974 to 1984, perceived barriers was the most powerful dimension. These researchers point out that barriers was significantly associated with health behavior in all of the13 studies reviewed. Champion (1987), who used a stepwise multiple regression analysis, found barriers to account for the majority of the variance in BSE behaviors (22%) when analyzed along with the other health beliefs of susceptibility, severity, benefits and health motivation. In a previous study, (1985) Champion also found barriers accounted for the largest portion of variance (23%) on BSE. Trotta also (1980) found the concept of barriers explained the largest amount of variance in BSE. Kim et al. (1991) found that barriers (along with health motivation) discriminated high from low calcium intake and concluded barriers is an important construct in explaining calcium intake to prevent osteoporosis.

In this study, although barriers was significantly related to calcium intake, the relationship was weak. Barriers ranked fourth in strength of the correlation coefficients among the five variables that significantly correlated with calcium intake. The weak relationship could be the result of possible redundancy of the barriers measurement which could have decreased variability, or an overestimation of calcium intake. Barriers correlated relatively highly with three of the other four variables that correlated with calcium intake (barriers-health motivation, -.33; barriers-self-efficacy, -.37 and barriers-knowledge, -.38 (Table 4). The results of the factor analysis for construct validity for the OHBCS, would tend to refute a possible redundancy problem. Nevertheless, health motivation, barriers and self-efficacy seem to share similar dimensions with the potential for overlap to occur when operationalized (Janz & Becker, 1984; MuCullock, 1988).

Hypothesis 2

The subjects on the whole demonstrated a fair amount of knowledge about osteoporosis risk factors and dietary sources of calcium (mean score of almost12 out of 17). The correlation coefficient for knowledge and calcium intake was the highest among the five significant correlations, although, at .22, it is a weak relationship.

Knowledge, as a modifying variable, is hypothesized to have an indirect effect on behavior by influencing one or more of the health beliefs. The moderate correlations between knowledge and some of the other independent variables that were found in this study, would tend to support this indirect effect. Other studies examining knowledge along with the HBM have reported results consistent with this indirect effect. Tirrell & Hart (1980) reported knowledge was found to operate as an enabling factor to the HBM, thus having an indirect effect on behavior. Significant correlations between knowledge and self-efficacy and knowledge and perceived benefits found in this study are consistent with Brailey's study (1986), and might be an example of the indirect influence of knowledge. Although Brailey (1986) did not find knowledge correlated with frequency of BSE, there was evidence that knowledge contributed indirectly in that educational interventions to promote self-examination increased self-efficacy, perceived susceptibility and perceived benefits. Becker (1975) explains the indirect relationship of knowledge by suggesting that knowledge is probably an influencer of an individual's readiness to undertake a specific action, and that knowledge may be a significant influencer of severity and susceptibility, both of which are recognized as having a strong cognitive component. However, as noted in the intercorrelation matrix for this study, susceptibility and severity do not

significantly correlate with knowledge, which would be expected if there was an influence.

The correlation between knowledge and barriers and knowledge and benefits found in this study are similar to correlations found between the same variables in Champion's study (1987). When knowledge about osteoporosis or breast self-examination/breast cancer increases, perceived barriers relative to calcium intake or frequency of BSE decreases and perceived benefits regarding taking in enough calcium or performing BSE increases. Champion (1987) speculates that perceptions of benefits and barriers may motivate women to acquire more knowledge about health behavior, suggesting a reciprocal effect.

The positive correlation found between knowledge and self-efficacy is consistent with the literature that indicates knowledge tends to positively affect perceptions of self efficacy (Lauver, 1987). A knowledgeable person tends to have more confidence in his/her ability to perform.

Hypothesis 3

In congruence with the HBM, it was hypothesized that positive relationships would be found between the strengths of susceptibility, severity, benefits, health motivation and self-efficacy, and the level of calcium intake. The results of this study indicate only three of the five variables explicated in hypothesis 3 are positively correlated to calcium intake. These correlations are depicted in Table 4 and although they all are low, the relationships are consistent with the HBM. Prior research with the HBM, as reported by Janz and Becker (1984), has found that the health beliefs of susceptibility, benefits and barriers are consistently associated with preventive health behavior. The results of this study reflect some consistency with previous HBM research and preventive health behavior.

Barriers and benefits were significantly correlated with calcium intake, and severity and susceptibility were not. The findings regarding susceptibility and severity will be further discussed in the following paragraphs.

The mean reported calcium intake (999.8 mg.) was found to be quite high (the suggested minimum calcium intake is 1,000 mg. daily for premenopausal women [National Institutes of Health Consensus development Conference Statement of April 1984]). If women perceive themselves to be susceptible to osteoporosis and they perceive osteoporosis to be a severe problem, then the HBM would hypothesize that they would take in adequate calcium (as it appears occurred with this sample given the reported calcium intake). However, this hypothesis was not supported in this study.

Perhaps Osteoporosis is perceived more like a natural consequence of aging, or as a "condition" as opposed to an actual disease, such as cancer. This view may result in perceptions that osteoporosis would not be a serious consequence or be associated with death. Janz and Becker (1984) point out that perhaps the reason that severity has not been found to explain preventive health behavior, is that people have difficulty conceptualizing severity when (a) they are asymptomatic, (b) when the health problem is one that is seen as long term, or (c) when the health problem is one with which they have had little personal experience. Almost 64 percent of the sample did not have friends or relatives who have osteoporosis, and because of this may have had little exposure to the problems it can cause. According to Bandura (1977), much behavior is developed through modeling, a cognitive process whereby observations are made of others and a subsequent symbolic construction serves as a guide for action or as a influencer of beliefs. Limited exposure to osteoporosis, which might be

assumed given the high percent of subjects that did not have friends or relatives with osteoporosis, may explain, to some degree, the subject's low perceptions of susceptibility.and severity.

The relationship that was found between health motivation and susceptibility may explain why perceived susceptibility was low. Susceptibility was found to negatively correlate, at a significant level, with health motivation (the more motivated a woman was to health, the less susceptible she perceived herself to be). As evidenced by the mean score for the health motivation variable, this sample represented women with a relatively high degree of concern about general health matters. Because of this motivation, the subjects may perceive they are "protected" against a myriad of health problems or diseases and perhaps not perceive themselves as particularly vulnerable to a specific problem such as osteoporosis. Also, the health motivated female's diet is probably well balanced and likely to include an adequate amount of calcium--not necessarily to prevent osteoporosis, but just because it is a positive health behavior. This may explain why perceptions of susceptibility and severity were low.

The results of the significant bivariate correlation between health motivation and calcium intake is consistent with other HBM research. Kim et al. (1991) reported health motivation (in addition to the barriers concept) discriminated between high and low calcium intake, and Champion (1985) found health motivation accounted for 2% of the variance of BSE behavior.

The finding of significant, although low, zero-order correlation between benefits and calcium intake supports the HBM and is consistent with the findings of many of the studies examining preventive health

behavior (Janz & Becker, 1984). The benefits scores were relatively high (mean of 23.5, range 12 to 30--total possible of 30), which, in view of the relatively high level of calcium intake, would be a predicted result.

Hypothesis 4

The purpose of this study was to explore the relationship of health beliefs and knowledge to osteoporosis preventive nutrition behavior. Hypothesis four, "knowledge and the health beliefs account for a significant amount of variance in calcium intake" specifically addresses this aim.

In order to analyze the additive effect of the independent variables for this study, a stepwise, multiple regression analysis was done. From a theoretical standpoint, it could be expected that the combined effects of all six health belief variables contributed to the variance of calcium intake. In reality however, and as reflected in prior research using the HBM, it's unlikely that this would occur. Behavior is complex and methodological problems inherent in behavioral research limit the ability to show definite relationships. Also, the HBM is limited to explaining and predicting behaviors that are due to attitudes and beliefs (Janz & Becker, 1984) and there might be other behavioral determinants, that would not be examined. What is realistic, however, is the ability to determine what combination of variables account for variance in the specific behavior. In this study, only two of the seven independent variables made significant contributions to the variance of calcium intake when the effects of all of them together was examined. Although the variance that they explained (7.8%) was quite small, it can be concluded that hypothesis 4 was partially supported.

Self-efficacy was the second strongest variable to correlate with calcium intake, and was only one of the two variables to enter into the multiple regression equation. As reported earlier, self-efficacy accounted

for 3% of the variance of calcium intake. The variance it explained is so small, that apparently, other unmeasured variables, contributed greater amounts. This finding is congruent with self-efficacy theory which postulates that self-efficacy combines with other variables, namely outcome expectations, to determine behavior. Although no other studies were found that included self-efficacy along with the traditional health beliefs and within the context of the HBM, the finding that self-efficacy significantly contributes to calcium intake is consistent with other studies that examined self-efficacy either alone or with other variables, some of which were conceptually similar to some of the health beliefs.

The finding that knowledge made a small, but significant contribution to calcium intake when it's effect was considered along with the health beliefs, supports prior research of knowledge and health behavior in that it influences health behavior, but cannot explain behavior by itself. Despite the significant bivariate correlations between knowledge and some of the other independent variables, indicating knowledge had an indirect effect on behavior by modifying other variables, (in congruence with the HBM), the multiple regression analysis tends to indicate a direct relationship to behavior. The finding of a direct influence of knowledge on behavior are consistent with those of Champion (1987) who found knowledge accounted for 4% of the variance in BSE behaviors when she examined knowledge along with health beliefs.

Methodological Limitations

Although hypothesis 4 was partially supported, as mentioned previously, the amount of variance explained by the independent variables that entered into the multiple regression equation was very small. Other, unmeasured variables aparently accounted for most of the variance of the

dependent variable. However, given the greater amounts of variance that HBM variables accounted for in other studies using the HBM, it seems unusual that a larger amount of variance was not found or that a greater number of independent variables did not enter the regression equation. Methodological problems of this study may have precluded determining relationships that actually exist. The following paragraphs will discuss methodological and design problems and relate how these may have prevented finding more definite support of the HBM towards explaining calcium intake to prevent osteoporosis. The methodological and design limitations include (a) validity and reliability of the OHBCS, the self-efficacy instrument and calcium intake measurement; (b) limitations inherent in a self-selected sample; and (c) the effect of a retrospective research design.

The OHBCS may not have been an accurate representation of the strength of the respondents belief. Some respondents, especially those in the older age group, may have tended to either "agree" or "disagree" even if they actually felt more strongly. Perhaps this phenomenon led to a decreased variability among the scores, resulting in failure to show a significant relationship. The results indicating that the susceptibility subscale (the first subscale administered) had the most variability (SD = 4.482) might provide evidence that respondents were less likely to respond using the full availability of responses as the test progressed and they became fatigued, or "forgot" about the other options unless verbally cued like they were when the instrument was introduced.

Although factor analysis was done with the OHBCS, with results indicating each of the subscales measured separate concepts, the literature refers to a tendency for some "overlap" of some of the variables examined

in this study. Since this study is only the second one that the scale has been used with, additional refinement is probably necessary.

An example of the potential for redundancy to be a problem with the health beliefs, could be characterized by the barriers concept. There tends to be inconsistency regarding operationalizing the barriers concept. Rosenstock et al. (1988) characterizes barriers as a "catch-all" (p. 179) and suggests inclusion of self-efficacy may de-limit the barriers concept. As mentioned previously, barriers may share some dimensions with other concepts, such as health motivation and self-efficacy. Perhaps the failure to show a combined effect upon calcium intake was due to a degree of redundancy among some of these variables. The higher the bivariate correlations are between the independent variables, the lower the multiple R (Polit & Hungler, 1987). Lack of consistent operationalization and measurement of the variables has been implicated for the varied results of HBM research.

Problems with the 24-hour food recall method of obtaining calcium intake indicates a need to interpret the results of this study cautiously. Because the code book (Table of Food Composition to Accompany Diet Analysis '90 Software) did not always have exactly the same type of food the subject reported she ate, some interpretation occurred by the coder, which might have resulted in an inaccurate representation of calcium intake--perhaps an overestimation. Limitations inherent in this method of dietary analysis as described in Chapter 3--Methodology, could have also resulted in an inaccurate estimate of calcium intake, again perhaps overestimating the amount. A three or five day diet history would provide a more accurate account of calcium intake because it would enable obtaining an average to account for atypical diet intake on a given day, which is likely

to occur. Although the 24 hour intake was supposed to be "typical" for this sample, it's likely this aspect was not adequately represented.

Evidence that some of the calcium intake was not accurately represented is demonstrated by an interesting discovery. A discrepancy was found between the amount of calcium subjects reported taking in the form of a supplement, versus the amount of calcium that was actually ingested in this supplement, as determined by calculations made by the researchers upon checking the labels of the particular brand of supplement. The difference between the total reported calcium (diet plus supplement) and the total actual calcium (diet plus calcium supplementation corrected by researcher), was 28.7 mg. (999.8 mg. and 971.1 mg. respectively). One specific example of this discrepancy was a report that the subject took 1 calcium tab, thinking she was taking 1,000 mg--the number that was included in large print on the front of the label. However, the dose for 1,000 mg., as indicated on the back label, was 3 tabs. Because this study is concerned with perceptions, data analysis dealt only with the calcium that was reported. In other words, the significant issue regarding calcium intake is what the subject <u>believes</u> she is taking.

Another limitation concerning methodology relates to the self-efficacy measurement. This concept was measured with an instrument never used previously and reliability and validity have not been well established. The high reliability coefficient (.90) indicates there might be some redundancy among the items. This aspect could limit the ability of the tool to show adequate variability of the scores. There may actually be a stronger relationship between self-efficacy and calcium intake, but weaknesses of the instrument precluded finding this.

In addition to validity and reliability of the instruments, an additional methodological limitation involves sample selection. Because the sample was self-selected, it is probable that the subjects were homogeneous with respect to many of the health beliefs. Some homogeneity was reflected in sample characteristics (well educated, almost all white ethnicity). This homogeneity could result in a decreased variability of scores and limit the ability to discern higher, or more significant correlations between the independent and dependent variables.

Additional Limitations

Despite attempts to ensure heterogeneity of the sample, it ended up being a relatively homogeneous group with respect to education and race. The sample characteristics and the fact that the sample was self-selected, limit generalizability. This sample might have had some unusual, unidentified attributes which led to their inclusion in the study. Because of this possibility, the fact that hypotheses 3 and 4 were only partially supported, does not mean they may not be better supported with a different sample, perhaps one that is more heterogeneous.

Research design was another possible limitation. Retrospective design may result in subjects responding differently to statements about threat (susceptibility and severity). They may see themselves as already doing the behavior that will prevent the health problem and subsequently are less likely to perceive the problem as a threat.

To summarize, methodological and research design problems may explain why stronger or more thorough support of the hypotheses was not found. These include validity and reliability concerns regarding the instruments, limitations relative to a self-selected sample and a retrospective research design.

In conclusion, although the amount of variance in calcium intake accounted for by the health beliefs and knowledge was small, and an additive effect of all the health beliefs was not found, this study made important contributions to the knowledge base relative to preventive health behavior and applicability of the HBM. This study can serve as a springboard for additional research related to the health beliefs and osteoporosis preventive health behavior. This study also generated some significant implications for nursing practice and education. These implications, along with recommendations for future research, will be described in the following paragraphs.

Implications for Nursing Practice

Suggestions for nursing practice based on the results of this study should be regarded as very tentative. Generalizability is limited, and the relationships of the independent variables with the dependent variable were weak. Also, the overall amount of variance of calcium intake, taking into account all independent variables was minimal. However, some of the findings from this study provide support for the relevancy of the HBM to osteoporosis preventive health behavior, and this, together with some other aspects of the study, are meaningful to nursing practice.

Even though the results of this study preclude drawing more definite conclusions about behavioral determinants for calcium intake to prevent osteoporosis, communication of the study will add to nursings' knowledge base regarding strengths and limitations of the HBM. This study may also stimulate additional exploration and experimentation into influencers of preventive health behavior to prevent calcium. Additional investigation may reveal that the HBM may not represent the best combination of

variables to predict osteoporosis preventive behavior. But this should not preclude considering other models that might better explain.

A nurse with a knowledge base in behavioral theory is equipped to facilitate behavioral change regarding health practices. As nursing practice becomes more sophisticated, there will be more emphasis on the independent function of nurses. Although medical treatment is important in prevention of osteoporosis, other factors such as calcium intake, are also important. Developing strategies to assist clients to increase calcium intake to prevent osteoporosis is an independent nursing function. Taking responsibility for this function is an example of autonomous nursing practice and can result in a more challenging, successful, and rewarding role. Nursing education should focus on teaching behavioral models, such as the HBM, to facilitate enactment of the independent role function of the nurse.

The findings of this study suggest that nurses interested in application of the HBM to the osteoporosis preventive behavior of adequate calcium intake, should focus on those variables for which significant correlations between the independent and dependent variables were found (barriers, benefits, health motivation, knowledge and self-efficacy). Additional emphasis could be placed on knowledge and self-efficacy, since these two accounted for the greatest amount of variance in calcium intake. However, because of the minimal amount of variance these variables explained and the weak bivariate correlations, unless methodological limitations precluded showing relationships that did exit, it is important to realize that other unmeasured variables probably accounted for more of the variance in calcium intake. Focusing on perceived barriers to calcium intake is suggested, since barriers may share some similar dimensions with

self-efficacy and because so many other HBM studies found the barriers concept to be a significant influencer of preventive health behavior.

Although, given methodological concerns, it cannot be ascertained that susceptibility and severity have no significance to calcium intake, this study indicates these two variables may not directly influence osteoporosis preventive behavior. The finding that neither susceptibility nor severity correlated with calcium intake indicates adequate calcium intake may be possible without feeling susceptible to osteoporosis, and without perceiving osteoporosis to be severe.

However, there could be a problem with "ignoring" the susceptibility and severity health beliefs. Previously it was pointed out that adequate calcium intake by this sample could have been a result of eating a well balanced diet as would likely occur if a person was motivated towards health. Although health motivation would tend to assure a well-balanced diet, it may not assure consistency regarding an adequate calcium intake that would be necessary for a female with an increased risk for osteoporosis. Assurrance of adequate calcium intake could be facilitated by raising a woman's beliefs about susceptibility and/or severity to osteoporosis. However, because some of the variables may interact with each other, or have similar dimensions, intervention that was designed to affect one particular variable may also affect another. For example, ensuring adequate knowledge (a variable that was found to be significantly related to calcium intake) may also increase perceptions of the threat factors of susceptibility and severity (those variables that theoretically have a strong cognitive component).

Self-efficacy is a variable that nurses may want to focus on, since it was the only health belief that explained the variance of calcium intake. By

using the principles of self-efficacy theory, strategies can be developed to increase a woman's confidence in her ability to take in adequate calcium. Experiencing the ability to take in adequate calcium will further enhance self-efficacy perceptions and more likely assure adequate calcium intake. Self efficacy is probably recognized by nurses to some extent, as a significant factor in health behavior. But many nurses probably lack the depth of knowledge about Self-Efficacy Theory to assure more successful application. Self-Efficacy Theory should be taught in nursing education programs.

Since knowledge was found to be one of the variables that was related to calcium intake, creative ways to impart knowledge and raise women's awareness of osteoporosis and it's risk factors, should be explored. Posters or public service announcements could help gain attention and stimulate women to seek additional knowledge about their risk status and preventive behaviors. Nurses in any setting can take the opportunity to teach about osteoporosis during the initial assessment phase and during subsequent contacts with clients. Although, from the results of this study, knowledge appears to have a direct effect on calcium intake, it also probably has an indirect on the health beliefs and could positively alter those which might be considered deficit.

The aspect of over-lap and interaction among the independent variables, and the suggestion to focus only on some of the variables, can result in more practical care-planning. With health care costs rising, nurses will probably be increasingly limited by time constraints. Theoretically, the HBM postulates that the variables act in a combined way to result in behavior. Thus, to use the model for assessment and intervention, all the variables would need to be carefully addressed.

However, not all the researchers who conducted HBM studies tested this additive effect, and for those who did, the results were inconsistent. Some researchers suggest certain variables are significant to some types of behavior, but not to others. Focusing on a few variables that are particularily relevant to certain behaviors, or with the expectation that they likely will impact the others, facilitates more efficient care planning, especially in the initial phases.

The results of this study indicate a vast majority of the variance of calcium intake was not explained by the HBM. However, five of the seven bivariate correlations were congruent with the relationships postulated by the model, providing some support for the relevancy of the HBM to calcium intake to prevent osteoporosis. Nurses who are interested in applying the HBM to assessing women's risk status relative to osteoporosis, or enhancing calcium intake to prevent osteoporosis, should focus on those variables that were significantly related to calcium intake--barriers, benefits, health motivation, self-efficacy and knowledge. Particular importance should be placed on self-efficacy and knowledge, the two variables that accounted for the variance in calcium intake as a result of the multivariate analysis.

Recommendations for Future Research

Janz and Becker (1988) suggest that it's time to move beyond survey research studies with the HBM. Because there is a paucity of experimental design research to evaluate interventions designed to alter health beliefs, it is recommended that additional research using the HBM should focus on examining specific intervention strategies. However, because methodological problems with this study may have prevented showing relationships that do exist, and because there is a paucity of research on osteoporosis prevention and the HBM, replication of this study, with a less

homogeneous sample, is recommended. The suggestion to replicate this study, even though numerous descriptive studies already exist regarding the HBM and health behavior, is valid in view of Champion's (1985) suggestion that certain health beliefs may be significant to certain types of behavior.

The finding that self-efficacy accounted for variance in calcium intake supports the recommendation to include this concept as a major health belief. Additional research using the HBM should incorporate self-efficacy.

Because there is a paucity of research not only with osteoporosis and the HBM, but also regarding the elderly, replication of this study with an elderly population might provide some interesting information. Another suggestion would be to examine the differences in health beliefs about osteoporosis and calcium intake, among various age groups. Osteoporosis preventive behaviors should not be limited to any one age group. Prevention of osteoporosis may even be significant in-utero. However, effective strategies to enhance preventive behaviors would probably differ depending on the age of the population. Pederson (1984) suggests that health beliefs may change with age, possibly becoming stronger.

If replication of this study were done, it would be interesting to add some different, or additional modifying variables. This might provide some information regarding other variables that might be more significant to osteoporosis preventive behavior, especially if the findings of this study are repeated. For example, to what extent did having a friend or relative with osteoporosis influence calcium intake? Or, to what extent did having a friend or relative with osteoporosis influence susceptibility and severity perceptions? Pederson (1984) notes the significance of the physician role

in influencing smoking cessation. Research examining the role of the nurse in facilitating adequate calcium intake may be fruitful.

Additional research that uses a path analysis to examine relationships among the HBM variables, relative to osteoporosis preventive behavior, may be fruitful in determining interactions between the variables. Although multiple regression analysis allows for some comparisons to be made between variables (multicorrelational matrix), it does not allow for conclusions to be made regarding interactions between them. A path analysis would probably provide additional, more meaningful patterns about the relationships among the independent variables and to the dependent variable, and can be useful in clarifying the complexities inherent in multivariate research. The HBM has undergone refinement and has been reformulated in the course of it's existence. Continued refinement and possibly additional reformulation might be necessary for more successful explanations of health behavior. Additional research will facilitate finding the "right" combination of health beliefs

Lastly, additional refinement of the tools used to measure the variables is needed and additional research with psychometric testing is recommended. As pointed out earlier, the literature indicates that lack of consistency regarding conceptualizing and operationalizing the HBM variables has probably been responsible, to a large extent, for the varying findings relative to behavioral research utilizing the model.

Conclusion

Osteoporosis is a major health problem associated with significant morbidity and mortality. Although there are numerous other variables that influence it's development, adequate calcium intake appears to be a significant factor in preventing it's occurrence and halting, or slowing it's

progression. Nurses can play a significant role in assuring women take in enough calcium via independent role functions of teaching and facilitating behavioral change. In order to do this in a cost effective and practical manner, it is important to be able to readily identify, those factors which are most relevant to the desired behavior. This study provides some guidance regarding facilitating adequate calcium intake to prevent osteoporosis. In addition, this study may also increase nurses' appreciation for the complexities of behavior, and stimulate additional explorations into the determinants of osteoporosis preventive behavior.

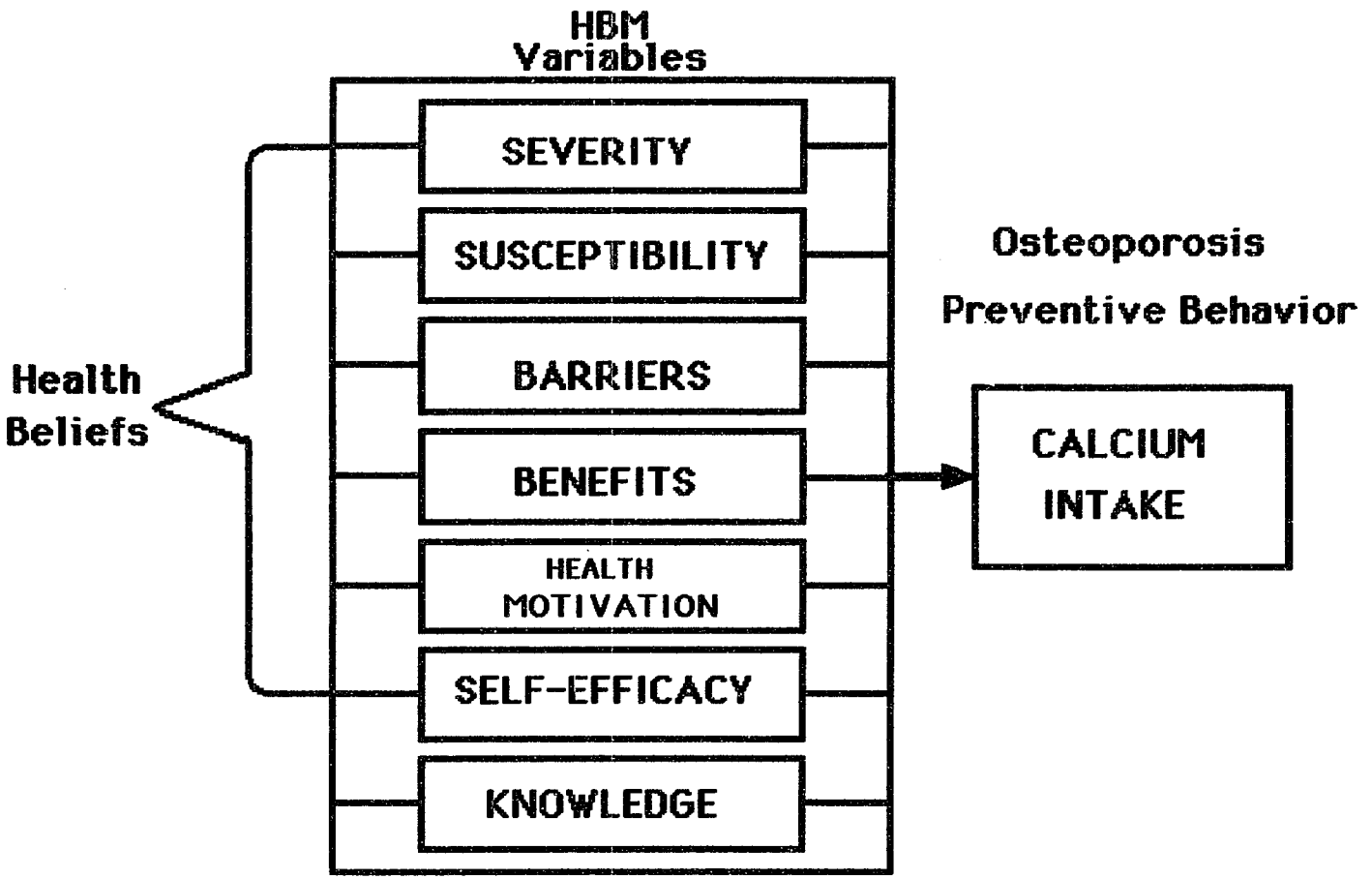
Although little variance in calcium intake was explained by the HBM, some support for the relevance of the model to calcium intake to prevent osteoporosis was found. Additional attempts to apply the HBM to osteoporosis preventive behavior should be made. Perhaps reformulations of the model may be necessary in order for the the HBM to be a better "fit" to the osteoporosis preventive behavior of calcium intake. Or, perhaps a different behavioral model may be more appropriate. Additional exploration of osteoporosis preventive behavior will result in a greater knowledge about facilitating behavioral changes and enable nurses to contribute to prevention of this serious health problem.

APPENDICES

APPENDIX A

Conceptual Framework

Influencers of Calcium Intake--Health Beliefs and Knowledge



APPENDIX B

ID NO: _____

OSTEOPOROSIS HEALTH BELIEF SCALE

(Interviewer: Read the following instruction SLOWLY)

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

I am going to ask you some questions about your beliefs about osteoporosis. There are no right or wrong answers. Everyone has different experiences which will influence how they feel. After I read each statement, tell me if you STRONGLY DISAGREE, DISAGREE, are NEUTRAL, AGREE, or STRONGLY AGREE with the statement. I am going to show you a card with these five choices. When I read each statement, tell me which one of the five is your choice.

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

(Interviewer: Before administration of the scale, check whether the participant can read the five choices on the card. If the person is unable to read them, you need to read the five choices after each statement).

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

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STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
1	2	3	4	5	
SD	D	N	A	SA	9. Your feelings about yourself would change if you got osteoporosis.
SD	D	N	A	SA	10. It would be very costly if you got osteoporosis.
SD	D	N	A	SA	11. When you think about osteoporosis you get depressed.
SD	D	N	A	SA	12. It would be very serious if you got osteoporosis.
SD	D	N	A	SA	13. Regular exercise prevents problems that would happen from osteoporosis.
SD	D	N	A	SA	14. You feel better when you exercise to prevent osteoporosis.
SD	D	N	A	SA	15. Regular exercise helps to build strong bones.
SD	D	N	A	SA	16. Exercising to prevent osteoporosis also improves the way your body looks.
SD	D	N	A	SA	17. Regular exercise cuts down the chances of broken bones.
SD	D	N	A	SA	18. You feel good about yourself when you exercise to prevent osteoporosis.

(Interviewer: Read the following instruction SLOWLY)

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

SD	D	N	A	SA	19. Taking in enough calcium prevents problems from osteoporosis.
SD	D	N	A	SA	20. You have lots to gain from taking in enough calcium to prevent osteoporosis.
SD	D	N	A	SA	21. Taking in enough calcium prevents painful osteoporosis.
SD	D	N	A	SA	22. You would not worry as much about osteoporosis if you took in enough calcium.
SD	D	N	A	SA	23. Taking in enough calcium cuts down on your chances of broken bones.

STRONGLY DISAGREE	DISAGREE	NEUTRAL	AGREE	STRONGLY AGREE	
1	2	3	4	5	
SD	D	N	A	SA	24. You feel good about yourself when you take in enough calcium to prevent osteoporosis.
SD	D	N	A	SA	25. You feel like you are not strong enough to exercise regularly.
SD	D	N	A	SA	26. You have no place where you can exercise.
SD	D	N	A	SA	27. Your spouse or family discourages you from exercising.
SD	D	N	A	SA	28. Exercising regularly would mean starting a new habit which is hard for you to do.
SD	D	N	A	SA	29. Exercising regularly makes you uncomfortable.
SD	D	N	A	SA	30. Exercising regularly upsets your every day routine.
SD	D	N	A	SA	31. Calcium rich foods cost too much.
SD	D	N	A	SA	32. Calcium rich foods do not agree with you.
SD	D	N	A	SA	33. You do not like calcium rich foods.
SD	D	N	A	SA	34. Eating calcium rich foods means changing your diet which is hard to do.
SD	D	N	A	SA	35. In order to eat more calcium rich foods you have to give up other foods that you like.
SD	D	N	A	SA	36. Calcium rich foods have too much cholesterol.
SD	D	N	A	SA	37. You eat a well-balanced diet.
SD	D	N	A	SA	38. You look for new information related to health.
SD	D	N	A	SA	39. Keeping healthy is very important for you.
SD	D	N	A	SA	40. You try to discover health problems early.
SD	D	N	A	SA	41. You have a regular health check-up even when you are not sick.
SD	D	N	A	SA	42. You follow recommendations to keep you healthy.

APPENDIX C

RECORD OF ALL FOOD EATEN (24 HOUR RECALL METHOD)

DATE: _____ ID NO: _____

CODE	QUANTITY	HOUSE MEAS.	FOOD OR BEVERAGE	TIME
				Snack
				Breakfast
				Snack
				Lunch

Is what you ate yesterday the way you usually eat? Yes _____ No _____

(Interviewer: If food intake for the previous day was NOT typical, make another appointment.

10-90

24 HOUR RECALL METHOD (CONTINUED)

CODE	QUANTITY	HOUSE MEAS.	FOOD OR BEVERAGE	TIME
				Snack
				Supper
				Snack

APPENDIX D

ID NO: _____

CALCIUM SUPPLEMENTS

TYPE	AMOUNT OF CALCIUM INTAKE PER DAY		
	Mg. per tab/Tbsp	No of tab/ Tbsp per day	Total in mg.
Calcium Carbonate			
1. Caltrate _____			
2. Calel-D _____			
3. BioCal 625 or 1250 _____			
4. Oyster Shell calcium e.g. Oscal, generics _____			
5. Titralac liquid _____			
6. Tums _____			
7. Alka-Mints _____			
8. CalSup _____			
9. Titralac tablets _____			
Calcium Phosphate			
10. Posture _____			
11. Discal-D _____			
Calcium Gluconate			
12. Neo calglucon _____			
Other: specify			
_____			
_____			
_____			

CODE

_____ Total amount per day (in mg.)

APPENDIX E

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.

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

1. begin a new or different exercise program

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

2. change your exercise habits

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

3. put forth the effort required to exercise

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

4. do exercises even if they are difficult

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

5. exercise for the appropriate length of time

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

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

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

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

7. increase your calcium intake

Not at all confident ——— Very confident

8. change your diet to include more calcium rich foods

Not at all confident ——— Very confident

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

Not at all confident ——— Very confident

10. select appropriate foods to increase your calcium intake

Not at all confident ——— Very confident

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

Not at all confident ——— Very confident

12. obtain foods that give an adequate amount of calcium

Not at all confident ——— Very confident

APPENDIX F

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
	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

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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 D. DK
B. Cheese
C. Cucumber

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

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

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

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

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

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

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

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

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

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

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

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

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

0 1 A. If a person skips breakfast D. DK
B. If a person does not get enough calcium from diet
C. If a person is over 45 years old

Appendix G

INFORMATION TO PARTICIPANTS

Hello, I am_____, a (graduate nursing student/nursing student) at Grand Valley State University. I am (conducting/helping-with) an osteoporosis study (along with/which is being conducted by) several faculty members and other graduate students at Grand Valley State University. As you may know, osteoporosis is a condition in which the bones become very brittle and weak so that they break easily. For this project, we would like to ask you some questions about osteoporosis, specifically your exercise and food intake and what you know and feel about osteoporosis.

It will take about one hour. Information you give to me will be kept confidential. You can withdraw participation at any time. Would you be willing to help us?

APPENDIX H

DEMOGRAPHIC DATA SHEET

Date: _____ ID # _____

Interviewer # _____

Data Collection Site: _____

I need to have some information about you.

1. How old are you? _____ (in years)

2. How many years of school have you completed? _____ (in years)

3. How tall are you? _____ feet and _____ inches

   (CODE: in cm) _____

4. How much do you weigh? (in pounds) _____

5. Are you (Interviewer: If race is apparent, do not ask this question)

   _____ 1. American Indian

   _____ 2. Black

   _____ 3. Pacific/Asian

   _____ 4. White

   _____ 5. Other Specify: _____

6. Do you have osteoporosis?

   _____ 1. Yes

   _____ 2. No

   (Interviewer: If the person says "yes", terminate the interview and thank the person for his/her assistance.)

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

   _____ 1. Yes

   _____ 2. No

Interviewer: If you have experienced any special problems during the interview with this person, record the nature of the problem.

_____

_____

_____

8. Orientation to three spheres
   _____ 1. Yes
   _____ 2. No

10-90

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