

A DESCRIPTIVE STUDY OF RURAL WOMEN'S
HEALTH LITERACY ABOUT VITAMIN D

by

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A thesis submitted in partial fulfillment
of the requirements for the degree

of

Master

of

Nursing

MONTANA STATE UNIVERSITY
Bozeman, Montana

April 2011

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ACKNOWLEDGMENTS

I could not have survived two years of graduate school without the encouragement of my family. Therefore I gratefully acknowledge Cary, Seth and Chaucer, for their love and support these past two years. I am also grateful to my mother who has always been my biggest fan. I must include Leda Werrell in my acknowledgements as she has stood by me through thick and thin these past two years. Thank you Leda! I also could not have finished this thesis without the support of my friends, Dr. Ann Szalda-Petre and Dr. Stacey Sherwin. I am truly grateful for the unconditional, wise advice they offered.

I wish to acknowledge Dr. Jean Shreffler-Grant for her expert guidance, thoughtful insight, and patience throughout my research process. I also wish to thank the additional members of my thesis committee, Brett Hollis and Steven Glow, for their support and attentive input regarding my study.

I would also like to gratefully acknowledge the financial assistance granted by the Harold C. and Jessie M. Hudson Trust, and the Dr. Helen Jacobsen Lee Endowment for Rural Nursing Research. This funding was invaluable to the completion of my thesis.

Lastly, and most sincerely, I wish to thank the rural women who took the time to participate in my survey about their vitamin D and health care experiences, which allowed me to complete my thesis. I greatly appreciate their invaluable contributions to nursing research and practice that concerns rural women.

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ABSTRACT

The purpose of this study was to determine women's health literacy about vitamin D. Few studies address rural women's health literacy. As major health decision makers for their families, rural women have influence over the health of rural populations. Vitamin D deficiency is suggested to be associated with chronic diseases such as rickets, cancer, diabetes, cardiovascular disease, and multiple sclerosis. Therefore, this study was designed to highlight the unique rural women's circumstance surrounding health literacy about vitamin D.

Nola Pender's revised Health Promotion Model (HPM) framed this descriptive survey. The survey included a quiz about vitamin D facts, as well as information about vitamin D practices and selected factors outlined by the HPM. In this study, relationships were explored between vitamin D health literacy and rural women's perceived access to health care services, as well as, the HPM selected factors. A sample of 400 women was randomly selected for the mailed survey, yielding a response rate of 41.2% (n = 126).

The results showed that the majority of the participants had (a) marginal health literacy about vitamin D, (b) took widely varying amounts of vitamin D, (c) and got their information about vitamin D from their primary care provider, their most trusted source, and (d) reported access to health care services as easy. No significant relationship between access to services and vitamin D health literacy was found. The relationship between vitamin D health literacy and self-efficacy for health promotion was the only factor that showed significance.

The study has implications for additional research about the relationship between self-efficacy for health promotion and health literacy of rural women. Additionally, research into rural women's relationships with their primary health care providers, may, in turn, improve rural women's health literacy.

Implications for nurses include the importance of (a) obtaining histories about vitamin supplement dosages, (b) providing education about vitamin D; (c) addressing vitamin D and cardiovascular health, (d) and addressing rural women's health literacy needs verbally and through appropriately written material.

CHAPTER 1

INTRODUCTION

Statement of Problem

Health literacy is a concept that categorizes an individual's interpretation and expression of acquired health information in the context of a wide variety of influences. The World Health Organization (WHO) defines health literacy as "the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health" (WHO, 2010, 7th Global Conference on Health Promotion: Track Themes section, para. 1). Pender, Murdaugh, and Parsons (2002) describe health for individuals as a holistic experience that becomes fragmented into narrow segments of disease by health professionals. This fragmentation of holistic health into disease entities can be a source of confusion when translating health issues to individuals in any setting. Socioeconomic status, educational level, cultural differences, ethnic background, environmental, political, and spiritual influences further disperse the context for an individual's health experience and understanding (Pender et al., 2002).

Pender et al. recognized socioeconomic status to be a strong determinant of health. The National Rural Health Association (NRHA) documented lower incomes and decreased health status for rural as compared to urban Americans (2010). The unique socioeconomic and decreased health status of rural communities suggests the importance of studying rural individuals to gain a better understanding of their health literacy.

Health care in rural culture draws from group identity and long-term connections that promote familiar, informal, less time conscious, communication patterns and problem solving (Singleton & Krause, 2009). Conversely, health care in urban cultures is characterized by more streamlined, superficial relationships and communication patterns promoting more time conscious, specific, problem-solving patterns (Singleton & Krause, 2009). The strong interpersonal connections in rural cultures promote strong boundaries that lend to medical outsiders struggling to gain trust within a rural community (Winters & Sullivan, 2010). Neighbors and friends are often contacted first for medical and health advice (Bushy, 2004).

Bales (2010) found rural women to be the dominant medical decision makers for their families, however, “relatively little has been written about the health perspectives of rural women” (Bales, 2010). A rural woman’s perspective of health influences how she chooses to use the health care system for herself and her family (Bales, 2010). The unique rural experience of distance, isolation, and limited access to health services combined with the rural traits of independence and self-reliance highlight the importance of discovering how rural women interpret health information (Bales, 2010; Bushy, 2004; Henson, Sadler, & Walton, 1998; Lee, Hollis, & McClain, 1998; Long, 1993). As the major health decision makers for their families, rural women carry a significant influence over the health of rural populations.

Multiple studies document the consequences of vitamin D deficiency and inadequacy of vitamin D guidelines prior to the recent changes made by the Institute of Medicine (IOM) (Bodnar, Krohn, & Simhan, 2009; Hathcock et al., 2007; IOM, 2010;

Munch & Shapiro, 2006; NIH, 2009; Pinn, 2008; Prentice, 2008; Vieth, 2006;). Vitamin D deficiency is associated with the onset and morbidity of many chronic diseases such as rickets, cancer, Type I and II diabetes, cardiovascular disease, osteoporosis, parathyroid disorders, and multiple sclerosis (NIH, 2009; Vieth, 2006).

The IOM (2010) has recently revised the methods and benchmarks for assessing vitamin D levels. In 2010, the IOM (2010) released standardized vitamin D testing methods to eliminate the wide variability that presently exists in laboratories in the United States (US). Recommendations for maintaining adequate levels of vitamin D were also standardized by the IOM, and adjusted upward (IOM, 2010; NIH, 2011).

Few studies have been conducted that address the unique circumstances surrounding rural women's health literacy. Therefore in order to further illuminate the unique rural women's circumstance surrounding health literacy, this study explored rural women's health literacy about vitamin D (Speros, 2005).

Purpose of the Study

The purpose of this study was to determine rural women's health literacy about vitamin D. Rural women face unique challenges based on where they live that can affect their health care decisions, including decisions about supplements such as vitamin D. Emerging information about vitamin D makes vitamin D a good marker for measuring health literacy among rural women. The information obtained from this study will provide a better understanding of vitamin D health literacy and may contribute to a better understanding of health information delivery strategies for rural women.

Research Questions

The following research questions guided this descriptive study about rural women's health literacy about vitamin D:

1. What is the level of vitamin D health literacy among rural women?
2. Where do rural women obtain information about vitamin D?
3. Is there a relationship between rural women's health literacy about vitamin D and rural women's perceived access to health care services?
4. Is there a relationship between rural women's health literacy about vitamin D and selected factors such as race/ethnicity, age, income, education, self-efficacy for health promotion, presence of significant health issues, perceived vitamin D benefits and barriers?

Background and Significance of the Study

Health Literacy

The National Assessment of Adult Literacy (NAAL) examined health literacy as the ability to read and understand health related information with wide implications for how that information is interpreted (2003). Improvements in health literacy may lead to "improved self-reported health status, lower health care costs, increased health knowledge, shorter hospitalizations, and less frequent use of health care services" (Speros, 2005, p.633). Overall, improvement in levels of health literacy leads to improved health outcomes (IOM, 2004; USDE, 2008; Speros, 2005; WHO, 2010).

Health literacy was measured at the national level for the first time in the NAAL in 2003 (NAAL, 2006). Results of the survey showed that 36 percent of the adults in the U.S. had health literacy levels that were basic or below basic (Vernon, Trujillo, Rosenbaum, & DeBuono, 2007). Low health literacy levels cost the US economy an estimated 106 billion to 238 billion dollars annually (Vernon et al., 2007). When costs were extrapolated to future effects of present low health literacy, the estimate was closer to 1.6 trillion to 3.6 trillion dollars (Vernon et al., 2007).

Historically, health literacy has been addressed by using “plain language to avoid miscommunication in all oral and written communication and confirming understanding with all patients by having them repeat back their understanding of their diagnosis and treatment plan” (Baker, 2006, p. 878). The predominance of low health literacy noted among US adults in the 2003 NAAL assessment of health literacy indicated deficiencies in the historical use of plain language to improve health literacy.

While the importance of health literacy has been recognized in the literature, translating the assessment of, and making clinical practice accommodations for, health literacy have been difficult (Baker, 2006). Available health literacy measures are imprecise as well as impractical in the clinical setting due to time constraints (Baker, 2006; Wallace, Rogers, Roskos, Holiday, & Weiss, 2006). Conducting an established health literacy test may place undue burden on the participant or cause embarrassment (Baker, 2010; Wallace et al., 2006). To address issues of health literacy, policy changes to encourage the development of evidence-based interventions for low health literacy are called for in the literature (Vernon et al., 2007).

Vitamin D

Vitamin D is a critical nutrient for health. The National Institutes of Health (2009) reviewed the ways in which vitamin D plays a vital role in “modulating neuromuscular and immune function and reducing inflammation at the cellular level” (NIH, Introduction section, para. 3). Vitamin D “modulates many proteins responsible for cell proliferation, differentiation, and apoptosis” (NIH, 2009, para. 3). Vitamin D deficiency is associated with the onset and morbidity of many chronic diseases and Heaney (2003) suggested that these disease outcomes be considered “long-latency deficiency diseases” as they evolve over the course of many years before they become evident (Abstract section, para. 1). Insufficient levels of vitamin D have also been associated with mortality from “all-causes” (Dobnig et al., 2008, p. 1340). A lower incidence of influenza A and asthma in school children has been associated with Vitamin D supplementation over the winter months (Barclay, 2010).

Osteoporosis occurs more often in women than men after menopause due to decreased estrogen (Crowther & McCance, 2006). Estrogen deficiencies are associated with a faster rate of bone resorption than formation (Crowther & McCance, 2006). The Center for Disease Control (CDC) reports that breast cancer is the second most common form of cancer affecting women (2006). Pinn (2008) reported an association between elevated 25(OH)D3 serum concentrations and reduced susceptibility to breast cancer. A recent study reported by the American Heart Association (AHA) showed that low levels of vitamin D in young women give them an increased risk for high blood pressure at mid-life, therefore increasing their risk for stroke and cardiovascular disease (2009).

Cardiovascular disease is the leading cause of death for all women in the United States (CDC, 2010b). Bacterial vaginosis, a common cause of preterm birth and increased infant mortality, is associated with vitamin D deficiency (Bodnar et al., 2009). Certain populations of pregnant women with vitamin D deficiency in the United States have contributed to the recent unexpected expression of rickets in the pediatric population (Prentice, 2008).

Vitamin D is readily available from exposure to sunshine, as a food additive, and as a supplement (NIH, 2009). In spite of this, vitamin D deficiency is common worldwide, affecting as many as one billion people (Nemerouski et al., 2009). Sun avoidance, aging, and obesity have contributed to a growing percentage of people who are vitamin D deficient (Moyad, 2009). Current guidelines for therapeutic levels and replacement of vitamin D remain in question, and may be another contributing factor to the widespread deficiency of vitamin D (NIH, 2009; Vieth, 2006). Additionally, women experience the adverse effects of vitamin D deficiency because of their gender-influenced morbidities that include osteoporosis and breast cancer (Munch & Shapiro, 2006; Pinn, 2008).

Rural Women

Rural women are recognized as the health care decision makers for the family (Bales, 2010; Shreffler-Grant, Hill, Weinert, Nichols, & Ide, 2007). Rural women are also more likely than men to use complementary alternative medicines (CAM) such as vitamin D supplements (Shreffler-Grant et al., 2007). Rural women are more likely to experience socioeconomic disadvantages such as poverty, lack of health insurance, and

fewer years of education (United States Census, 2000, 2006). These disadvantages translate to poor health outcomes compared to more affluent urban populations (NRHA, 2010). Distance, isolation and limited access to health care services may contribute to delays in rural women seeking treatment for health issues (Bushy, 2004; Henson, Sadler, & Walton, 1998; Lee, Hollis, & McClain, 1998; Long, 1993).

Common rural traits of self-reliance and independence may contribute to delays in seeking health care (Long, 1993). Delay in seeking health care may also be influenced by a rural tendency to rely on family or neighbors prior to seeking allopathic health services (Long, 1993). This delay in seeking care may place rural individuals at increased risk for “chronic illness, disability, and premature death” (Bushy, 2004; Henson et al., 1998; Lee et al., 1998; Long, 1993, p. 125).

Due to the pivotal role women play in the healthcare of their families, ensuring that rural women receive adequate levels of vitamin D for themselves can have far reaching health benefits. Reducing the morbidity and mortality from chronic diseases influenced by inadequate levels of vitamin D can also contribute to significant individual and national health care cost savings (Center for Disease Control, 2009). Self-reliance, combined with limited access to health care services, places added significance on affordable health promotion strategies, such as vitamin D supplementation, for rural women and their families. The probability of participation in health promotion behaviors that concern vitamin D depends on rural women’s health literacy about vitamin D.

Growing Awareness About Vitamin D

Until recently, guidelines for testing and treatment of vitamin D deficiency were variable (Kellel et al., 2010; NIH, 2009; NIH 2011). Assays for measuring vitamin D in the blood have differed according to laboratory, increasing chances of falsely high or low values (NIH, 2009). To correct this variability, updated standards for laboratory testing of vitamin D became available in July of 2009 (NIH, 2011).

Hathcock, et al. (2007) reported that newer clinical trials showed that vitamin D intake was not toxic at much higher levels than recent guidelines suggested. Vieth (2006) stated that “while safety is...an important issue, the definition of what constitutes an excessive intake of vitamin D remains so ambiguous that it may affect the ability of the public to obtain supplements with doses of vitamin D that are appropriate for health” (Abstract section, para. 2). In response to this, the IOM (2010) reviewed current research and updated dietary reference intakes in the fall 2010.

Present vitamin D serum levels considered to be adequate are between 25 and 80 ng/mL, with levels less than 30 ng/mL considered insufficient and levels less than 20 ng/mL considered deficient (Kennel, Drake, & Hurley, 2010). Present vitamin D recommended dietary allowance includes 600 International Units (IU) daily from age one to age 70 years; 600 IU for pregnant women; and 800 IU for adults 70 years and older (IOM, 2010). The upper level intake limits are 1000 IU/day for newborns to age 6 months; 1500 IU/day for infants 6 months to twelve months; 2500 IU/day for one to three year olds; 3000 IU/day for four to eight year olds; and 4000 IU/day for all other age groups (IOM, 2010).

While vitamin D is relatively available and affordable, vitamin D deficiency is recognized as being widespread (Nemerouski et al., 2009; NIH, 2011). The impact of this conundrum about appropriate vitamin D supplementation on rural women's health literacy is unknown. Since rural women are the care providers and health care decision makers for their families, the consequences of vitamin D deficiency may also apply to their spouses, children, and others in their care. The health care challenges faced by rural women also highlight the relevance of studying their health literacy about vitamin D.

Cost to Society

A review of the literature did not reveal a monetary cost to society that is specific to vitamin D deficiency. The morbidity and lost productivity from the diseases associated with vitamin D deficiency, however, can be estimated by adding the costs reported by the CDC for these individual diseases and ranges in the billions of dollars (CDC, 2010a). For example, in 2002, diabetes cost the nation 132 billion dollars in direct and indirect medical costs and half of this cost applied to women (CDC, 2010c). For 2010, the national direct and indirect cost of cardiovascular disease and stroke was estimated to be more than 503 billion dollars (CDC, 2010b).

Adequate levels of vitamin D could play a part in preventing or improving the outcome of diseases that place a tremendous cost on the health care system and society. Adequate levels of vitamin D may also prevent hardship and suffering by preventing the onset, or decreasing the morbidity of chronic diseases associated with vitamin D deficiency.

Significance

This study on rural women's health literacy about vitamin D will contribute to the gap in health literacy research from a nursing perspective. Speros (2005) noted a gap in the literature relating to "nursing generated research on health literacy, its components, and its relationship to evidence based nursing practice" (p. 638). Speros (2005) also noted that the "consequences of health literacy are improved self-reported health status, lower health care costs, increased health knowledge, shorter hospitalizations, and less frequent use of health care services" (p. 633). The results of research on rural women's health literacy about vitamin D can support evidence-based development of rural specific health promotion programs and education.

Research concerning rural women's health literacy about vitamin D may also add to a body of nursing knowledge about self-efficacy for health promotion (Timmerman, 2007, p. S40). Information derived from this study may clarify the relevance of including vitamin D in periodic health and wellness screening and the shaping of public policy regarding the significance of vitamin D in achieving public health goals (Jackson, Tucker, & Herman, 2007; Whitehead, 2006). Research on rural women's health literacy about vitamin D may contribute to the consideration of health policy for the greater good of rural women (Whitehead, 2006). Ultimately, research concerning rural women's health literacy about vitamin D may add to the body of knowledge concerning the promotion of health among rural women, and the subpopulations in their care (Bales, 2010; Whitehead, 2006).

Padula stated that concepts most predictive of health promotion are the least studied. These concepts include “self-efficacy, self-concept, social support, perceived benefits, and perceived barriers” (Pedula, 2006, p. 39). Speros (2005) and Nutbeam (2000) proposed that health literacy is an outcome of health promotion and is inclusive of these concepts. Therefore, the Health Promotion Model (HPM) developed by Pender et al. (2002) was used as the conceptual framework around which this study was designed.

This study of rural women’s health literacy about vitamin D using the HPM as the theoretical framework may contribute to the literature about health literacy. An investigation particular to rural women’s health literacy about vitamin D may shed light on the unique circumstances of rural women, where and how they obtain health information about vitamin D, and how it is interpreted. The rural context within which vitamin D information is interpreted will add to the vitamin D health education needs for rural women, with additional implications for the health of others in their care.

Theoretical Framework

Pender’s HPM “offers a guide for exploring the complex biopsychosocial processes that motivate individuals to engage in behaviors directed toward the enhancement of health” (Pender et al., 2002, p. 60). Nutbeam (2006) and Pender et al. (2002) both stressed health literacy as an outcome of health promotion in their health promotion models. The WHO (2010) and public health profession agree with Pender et al. (2002) and Nutbeam (2006) who view health literacy as an outcome of health promotion with empowering personal, social benefits (Mancuso, 2008; Speros, 2005).

The HPM framework depicts how personal history of related behaviors and experiences influenced by biological, psychological and socio-cultural factors play a role in an individual's cognitions and perceptions relating to health promoting behavior (Sakraida, 2006). Perceived barriers and benefits of health related action; perceived confidence and success for health promoting action, or self-efficacy; and activity related affect, or attitude; are grouped with the interpersonal influences of peers, family, providers, and norms; and situational influences such as options, demands, and preferences when considering commitment to a health action plan (Pender et al., 2002). The result is that health-promoting behavior results from the influential interrelationship between "individual characteristics and experiences" and "behavior-specific cognitions and affect" (Pender et al., 2002, p. 60).

Key Components of the Health Promotion Model

Sakraida (2006) provided definitions for the key components of the theoretical propositions set forth by Pender's HPM shown in Figure 1. The HPM depicts how prior related behaviors and individual "biological, psychological, and sociocultural" (p.458) factors influence behavioral outcomes through behavior specific cognitions and affect (Sakraida, 2006). Prior related behavior includes the prevalence of past comparable behavior that has immediate and secondary influence on the possibility of replicating a positive health behavior (Sakraida, 2006). Personal factors are organized within a "biological, psychological, and sociocultural" (p.458) context and include gender, aerobic capacity, age (biological factors); self-esteem, perceived health status, self-motivation (psychological factors); and race, education, and socioeconomic status (sociocultural

factors) (Sakraida, 2006). Personal factors are also predictive, and defined by the intended behavior under consideration (Sakraida, 2006).

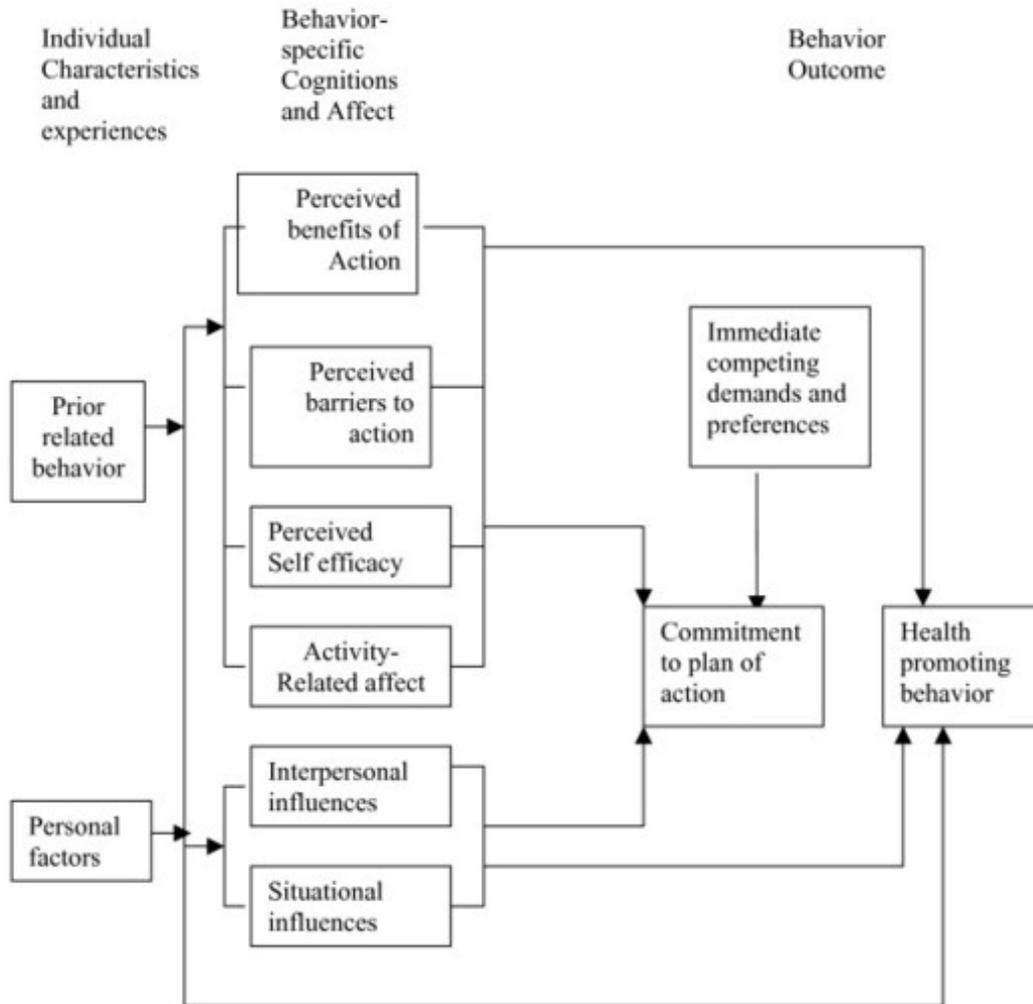


Figure 1. Pender's Revised Health Promotion Model (Google Images, n. d.)

Behavior specific cognitions and affect listed in the upper portion of the center column of Figure 1 are described as follows.

- Perceived benefits of action are anticipated positive outcomes resulting from taking action.

- Perceived barriers to action are real or imagined, anticipated, personal toll realized from taking action.
- Perceived self-efficacy: confidence and competence to organize and execute a behavior.
- Activity-related affect: positive or negative feelings stimulated by a behavior that influence one's perception of self-efficacy (Sakraida, 2006).

Interpersonal and situational influences, grouped in the lower portion of the center column in Figure 1, combine with behavior specific cognitions to influence a commitment to a plan of action that leads to health promoting behavior (Sakraida, 2006). Immediate competing demands and preferences, such as work or family, positively or negatively influence actuating a health promoting behavior (Sakraida, 2006). Interpersonal influences include families, peers, health care providers, and others who model healthful behavior, shape attitudes and beliefs, and provide support (Sakraida, 2006). Situational influences include competing demands or preferences, personal perceptions, and environmental context that promote or impede behavior (Sakraida, 2006). Health promoting behavior is described as action taken directed toward a positive health outcome such as optimizing physical and spiritual wellness, and “personal fulfillment such as exercising regularly, managing stress, eating a healthy diet, building positive relationships, and achieving adequate rest” (Sakraida, 2006, pp. 456-457).

“Health literacy is viewed as an outcome of health promotion and health education efforts and as having both personal and social benefits” (Speros, 2005, p. 635). Speros (2005) further interpreted the WHO (1998) definition of health literacy as

incorporating “personal empowerment and action” (p. 635) in the expression of health literacy. These descriptions of health literacy agree with the use of the HPM as a guide for exploration of the complex biopsychosocial processes that motivate individuals to engage in behaviors directed toward the enhancement of health” (Pender et al., 2002, p. 60). The HPM is based on the principle of “increasing well-being and actualizing human potential” (Sakraida, 2006, pp. 459-460) and can offer an avenue for understanding how individuals express and are assessed for health literacy. As the expression of health literacy is influenced by several personal and socioeconomic factors, key components of the HPM can then be used as a framework to explore rural women’s health literacy of vitamin D (Pender et al., 2002; Speros, 2005).

Definitions

For the purposes of this study, the definitions for the following terms are provided in this section. Health literacy is defined by the WHO as:

The cognitive and social skills, which determine the motivation and ability of individuals to gain access to, understand and use information in ways which promote and maintain good health. Health Literacy means more than being able to read pamphlets and successfully make appointments. By improving people's access to health information and their capacity to use it effectively, health literacy is critical to empowerment (WHO, 2010, 7th Global Conference on Health Promotion: Track Themes section, para. 1).

Rural is defined by the United States Census Bureau (1995) as “places less than 2500 [people located] outside incorporated and census designated places and the rural portions of extended cities” (Urban and Rural section, para. 2).

Vitamin D is defined by the NIH (2009) as “a fat soluble vitamin naturally present in very few foods, added to others, and available as a dietary supplement” (Introduction section, para. 1). It is also synthesized by the action of ultraviolet rays on the skin. Hydroxylations in the liver, then kidney, produce the active form: 25(OH)D (McCance & Heuther, 2006).

Complementary and Alternative Medicines (CAM) are defined by the National Center for Alternative and Complementary Medicine (NCCAM) as:

A group of diverse medical and health care systems, practices, and products that are not generally considered part of conventional medicine. Conventional medicine (also called Western or allopathic medicine) is medicine as practiced by holders of M.D. (medical doctor) and D.O. (doctor of osteopathy) degrees and by allied health professionals, such as physical therapists, psychologists, and registered nurses. The boundaries between CAM and conventional medicine are not absolute, and specific CAM practices may, over time, become widely accepted (NIH, 2010, Defining CAM section, para. 1).

Vitamin D is listed within the Complementary Alternative Medicines section of the NIH website with information provided by the NIH Office of Dietary Supplements (NIH, 2009).

Assumptions

The researchers assumptions that impacted this study included acknowledgement that there would be variations in levels of health literacy about vitamin D among the study participants. It was also assumed that respondents would provide accurate and truthful information.

CHAPTER 2

LITERATURE REVIEW

This chapter contains a review and summary of recent research literature and documents about health literacy. Relevant research literature pertaining to rural women and health literacy in rural settings is also reviewed. Research about vitamin D is summarized with attention to its relevance to women.

Health Literacy

The concept of health literacy surfaced in health education literature in the early 1970's as a social policy issue affecting the realms of education, health care, and mass communication (Parker, Ratzan, & Lurie, 2003). Today, health literacy has emerged as a significant indicator of health outcomes and is being addressed by leaders in the health care fields around the globe (Agency for Health Care Research and Quality [AHCQRQ], 2010; American Medical Association [AMA], 2010; Institute of Medicine [IOM], 2004; NAAL, 2003; WHO, 2010). Low or limited health literacy has been found to be "a stronger predictor of a person's health than age, income, employment status, education level, and race" (Ad Hoc Committee on Health Literacy for the Council on Scientific Affairs, AMA, 1999).

Limited health literacy has been found to be associated with adverse health outcomes and disparities, increased use of health services, and medication errors costing the nation an estimated 106-236 billion dollars a year (National Patient Safety

Foundation, [NPSF] 2007; USDHHS, 2009). Vernon et al. (2007) found that in a national survey of adult health literacy in 2003, 36% of adults were found to have basic or below basic health literacy levels. Vernon et al. also found that individuals with low or limited health literacy skills were more likely to say they are in poor health, have more hospitalizations, spend more on inpatient medical care, make medication and treatment errors, and experience mortality. Individuals with low or limited health literacy skills were less likely to follow provider and prescription directions, and to use preventive care (Vernon et al., 2007).

Cutilli (2007) conducted an integrative review of health literacy research and found that older individuals, especially those older than 85 are more likely to have lower health literacy. Cutilli also found research that indicated that Blacks and Hispanics were more likely than Whites to have limited health literacy.

Health literacy level does not correlate directly with years of education completed when the TOHFLA or REALM health literacy tests were used to determine health literacy level (Cutilli, 2007). Research shows, however, that higher education does increase the odds for having adequate health literacy. When only elderly participants were evaluated, more years of education became an influencing factor for having adequate health literacy (Cutilli, 2007). Cutilli found that the use of socioeconomic markers such as car ownership, food assistance, and blue-collar work were more useful determinants of socioeconomic status than income alone and may be more appropriate measures to gauge relationships between health literacy and socioeconomic status.

Cutilli (2007) reviewed research showing that the condition of poor health was more likely in those with limited health literacy and that those with limited health literacy were less likely to participate in preventive health strategies. Cutilli concluded that the relationship between adequate health literacy and a person's ability to successfully care for themselves has a significant impact on increased costs to society related to caring for individuals with limited health literacy (2007).

The importance of health literacy in determining health outcomes was emphasized by Mancuso, (2008; 2009), Nielson-Bohlman, Panzer and Kindig (2004), Nutbeam (2000), Ratzan (2001), Parker et al. (2003), Speros (2005), and the WHO (1998; 2010). Health literacy was initially considered to be literacy skills, numeracy skills, and the comprehension of health information provided in the medical setting; presently, the expression of health literacy has been recognized as including the complex interplay of culture, society, health, and education systems (American Association of Family and Consumer Science [AFCS], 2010; Baker, 2006; Chang & Kelly, 2007; Gamm, et al., 2003; Mancuso, 2008; Nielson-Bohlman, Panzer, & Kindig, 2004; Nutbeam, 2000; Speros, 2005, WHO, 2010).

Definitions of health literacy have evolved to include the broader context of health literacy that encompasses individual capacity, language, culture, and environment (Ratzan & Parker, 2000). The AMA definition of health literacy is “a constellation of skills, including the ability to perform basic reading and numerical tasks required to function in the health care environment” (American Medical Association, 1999, p. 553). The IOM, National Library of Medicine (NLM), and Healthy People 2010, define health

literacy as: “the degree to which individuals have the capacity to obtain, process, and understand basic health information and services needed to make appropriate health decisions” (Mancuso, 2008, p. 252). The NAAL added a health literacy component to their 2003 national survey using the following definition, “the ability to understand and use health-related printed information in daily activities at home, at work, and in the community to achieve one's goals and to develop one's knowledge and potential” (United States Department of Education [USDE], 2006, What is health literacy section, para. 1).

The WHO (2010) expanded the concept of health literacy by stating: “Health literacy represents the cognitive and social skills which determine the motivation and ability of individuals to gain access to, understand, and use the information in ways which promote and maintain good health.” (para. 1). The WHO further described health literacy as a process of “developing skills, knowledge and self-efficacy to act on health knowledge, and requires more than the effective transmission of information” (WHO, 2010, para 4). According to WHO, health literacy is an outcome of health promotion and health education, resulting in personal and community empowerment with personal and social benefits; and public health views health literacy as an outcome of health promotion which also implies empowerment (Mancuso, 2008 p. 253; Nutbeam, 2000; Speros, 2005).

Zarcadoolas, Pleasant, and Greer (2005) expanded on the concept of health literacy, defining it as “the wide range of skills, and competencies that people develop to seek out, comprehend, evaluate and use health information and concepts to make informed choices, reduce health risks and increase quality of life” (p. 196). Nutbeam (2000) included health literacy in his framework for health promotion stating “health literacy

refers to the personal, cognitive and social skills, which determine the ability of individuals to gain access to, understand and use information to promote and maintain good health. These include such outcomes as improved knowledge and understanding of health determinants, changed attitudes and motivations in relation to health behavior, as well as improved self-efficacy in relation to defined tasks” (pp. 261, 263).

The most common measures of health literacy are not comprehensive, but are designed as markers, indicative of an individual’s overall health literacy capacity (Baker, 2006; Mancuso, 2009). The most used, and the most valid and reliable tests of health literacy include the Rapid Estimate of Adult Literacy in Medicine (REALM), and the Test of Functional Health Literacy in Adults (TOFHLA) (Baker, 2006; Mancuso, 2009). Both have shortened forms allowing for faster administration as well as versions in Spanish. The REALM and TOFHLA have some disadvantages that include the possibility of being intimidating for the participant to complete (Mancuso, 2009). Baker (2006) and Mancuso (2009) stated that the shortened REALM does not measure comprehension of medical terms, only word recognition. Confusion also resulted when research referred to the S-TOFHLA measure of health literacy, as there are two abbreviated TOFHLA measures that are identified by this label: the brief-TOFHLA and the short-TOFHLA (Mancuso, 2009). The brief-TOFHLA is recognized as a measure of health literacy and the short-TOFHLA measures reading comprehension (Mancuso, 2009). The terms low, limited, moderate, high, adequate, inadequate, basic, or below basic health literacy are used broadly to indicate the range of health literacy based on the scores on the original health literacy instruments (Shieh & Halstead, 2009).

A newer health literacy measure, The Health Activities Literacy Scale (HALS), has been found to be time consuming to complete and needs further development to improve its relevancy (Baker, 2006). The more recent Newest Vital Sign (NVS) measure of health literacy is thought to be less intimidating and is quick to complete but has lower specificity, which lowers its reliability and validity as a health literacy test (Mancuso, 2009). Another measure of health literacy called the Medical Achievement Reading Test (MART) proved reliable and quick to administer but has not been reported in the literature since its publication (Mancuso, 2009). Additional disease specific measures of health literacy have been developed, and research has shown that higher health literacy scores are obtained when using a measure that is relevant to the patient's medical condition (Mancuso, 2009).

Additional tools for measuring health literacy are being studied for their ability to detect low or marginal health literacy with as few questions as possible, which would improve accessibility to testing in clinical or research settings by reducing the amount of time it takes to administer the test (Baker, 2009; Mancuso, 2009). Wallace et al. (2006) showed that, when compared to the REALM test of health literacy, one question proved useful as a marker for low health literacy: "How confident are you filling out forms by yourself?" (Results section, para, 2). Chew et al. (2008) found similar results when comparing short screening questions to detect inadequate health literacy with the results obtained from using the short-TOFHLA and the REALM measurements for health literacy.

Additional concerns regarding measurement of health literacy include the use of health terms and material common to clinical settings but not common to the health information found outside of clinical settings (Mancuso, 2009). Health literacy screening tests do not account for skill sets that make use of “language, context, culture, communication, or technology” (Nielsen-Bohlman, Panzer, & Kindig 2004; Mancuso, 2009, p. 87). Anxiety, stress due to illness, and language other than English or Spanish can confound health literacy test results (Mancuso, 2009). Mancuso (2009) also noted that further research is needed to discover if the current tests of basic reading, comprehension, and numeracy testing are adequate for general health literacy testing.

Rural Women

Many researchers mention the lack of research literature about rural women’s behaviors, attitudes, perceptions, and needs regarding their health (Bales, 2010; Bushy, 2004; Leipert & George, 2008; Thurston & Meadows, 2003, Centre of Excellence for Women’s Health [CEWH], 2004). In response to the absence of information about rural women in Canada’s rural health policy and research data, a national study conducted from 2003-2004, resulted in a summary report outlining the unique health disparities and needs of rural women (CEWH, 2004). Research by Thurston and Meadows (2003) found that mid-life women believed living in a rural setting to be of great import to their health. Leipert and George (2008) reported several key determinants to rural women’s health: “employment, gender, health services, social environments, rural change, rural culture, and rural pride”(abstract section, para. 1). Research about the context of rural women’s

unique experience with health is relevant to this descriptive study of rural women's health literacy about vitamin D and is summarized in this section.

Rural women tended to value independence, self-reliance, and privacy, but were very supportive of neighbors in need of assistance with health care (Bales, 2010; Pierce, 2001). Issues regarding access to health care were less about distance to services, and more about choosing a community provider rural women knew and trusted (Pierce, 2001). Often, a trusted health care provider was one whom had attained community connections to the land and place that span many years (Pierce, 2001).

Rural women tended to pay more attention to health than men (Pierce, 2001, Shreffler-Grant et al., 2007). Rural women more often allocated their time and resources to health promotion activities and the prevention of disease than do men (Shreffler-Grant et al., 2007). Rural women were likely to manage the health care of their families (Bales, 2010; Shreffler-Grant et al., 2007). Rural women often faced deficits in educational opportunities, and had less access to quality day care, were more likely to have low paying jobs, and more likely to have inadequate health insurance than women in urban or suburban areas (Bales, 2010; Bales, Winters, & Lee, 2010).

Jesse, Dolbier, and Blanchard (2008), found that barriers for pregnant or recently pregnant rural women with depression included lack of trust, feeling judged, discontent with the health care services, and not wanting to be helped. Research results supported the need for development of women centered, culturally sensitive, depression interventions for rural women (Jesse et al., 2008).

Rural women with breast cancer were found to be more likely to get chemotherapy and mastectomies and less likely than urban women to have had radiation therapy and lumpectomies for breast cancer treatment (Bettencourt, Schlegel, Talley, & Molix, 2007). Further research is needed to determine if distance between the cancer treatment center and the rural women's home is a determining factor in the treatment they received (Bettencourt et al., 2007). Bettencourt found that rural women had more misconceptions about breast cancer, had less general knowledge about cancer and cancer treatment, and were more likely to not know what stage of breast cancer they had than their urban counterparts. According to Bettencourt et al.'s research, rural women also reported problems with finding out about travel and accommodations when initiating their cancer treatment. These investigators found that traveling to distant treatment facilities disrupted family life, employment, contributed to feelings of isolation, and displacement. Support systems gained at the cancer treatment facility were then lost when rural women returned home, further contributing to emotional isolation (Bettencourt et al., 2007).

Another study found that rural women with chronic illness benefited from obtaining health education specific to their disease through use of the internet in a support group format (Winters & Sullivan, 2010). Rural women in communities with limited health care resources, and an absence of women with similar chronic illnesses in the same rural community reported a decreased sense of emotional isolation while participating in the program (Winters & Sullivan, 2010).

Cudney, Sullivan, Winters, Paul, and Oriet (2005) reported that rural women with varying chronic illnesses participated in a computer based education and support group that eliminated the emotional isolation often experienced by rural women, and helped to empower women to advocate for themselves (Bettencourt et al., 2007; Cudney et al., 2005; Winters & Sullivan, 2010). The internet based format allowed rural women to share their fears, feelings, interpersonal problems, and frustrations with the medical system (Bettencourt et al., 2007; Cudney et al., 2005; Winters & Sullivan, 2010). Designed to foster self-management, the computer based education and support group facilitated women to develop solutions to shared problems (Cudney et al., 2005).

Rural women who have one or more chronic diseases were more likely to use CAM than rural women without chronic conditions (Shreffler-Grant, Nichols, Weinert, & Eide, B., 2010). Shreffler-Grant et al. found that CAM was often self prescribed; and learned about from friends or relatives, reading, and marketing, rather than from health professionals (2010). The study also found that rural women were more likely than men to use CAM (Shreffler-Grant et al., 2010).

Folta et al. (2009) studied a community-based program to reduce cardiovascular (CVD) risk in rural sedentary, overweight, and obese women. Study results demonstrated that nutrition counseling, dietary changes, and exercise were found to be effective for improving self-efficacy, and decreasing waist circumference and body weight (Folta et al., 2009). Another study found improvements in facilitating dietary changes to reduce CVD risk in rural women through the use of a computer-based,

interactive nutrition education program (Tessaro, Rye, Parker, Mangone, & McCrone, 2007).

Women and Health Literacy

“A woman’s health literacy is an important element in her ability to engage in health promotion and prevention activities both for herself and her children. Without an adequate understanding of health care information, it is difficult if not impossible for a woman to make informed decisions that will lead to satisfactory health care outcomes for herself and her family” (Shieh & Halstead, 2009, p. 601). Research addressing the effects of women’s health literacy level will be reviewed in this section.

Roter (as cited in Shieh & Halstead, 2009) found medical communication patterns of women with low health literacy to include difficulty describing their illness history, having inadequate assessment of information abilities, and difficulty asking questions of their care providers. Brewer et al (as cited in Shieh & Halstead, 2009) found that women breast cancer survivors with low health literacy had an inaccurate perception of their recurrent breast cancer risk compared to those survivors with higher health literacy. Guerra, Krumholz, and Shea (as cited in Shieh & Halstead, 2009) reported a low incidence of having had mammograms among Latino women with low health literacy. Low health literacy was a better predictor of decreased cervical cancer screening knowledge than ethnicity or education according to a study by Lindau et al. (2002). Lindau et al (2002) also found that physicians correctly identified low literacy among the female study participants only 20% of the time when no screening tests for health literacy

were used.

The adverse effects of smoking on pregnant women and fetuses were less likely to be known among women assessed to have low reading level, than those with higher reading level, as measured by the REALM test (Arnold et al., 2001). Improving pregnant women's health literacy level benefited from health education materials written at a third grade level as opposed to a 10th grade level when discussing alcohol use and its avoidance during pregnancy (Calabro, Taylor, & Kapadia, 1996). Doak, Doak, and Root (as cited in Sheih & Halstead, 2009) found that health education materials were better comprehended when written at a sixth-eighth grade level, and less so at the tenth grade level.

Vitamin D

Vitamin D is relatively inexpensive and prevalent through a combination of diet, sun exposure, and supplements (NIH, 2011). Research and position statements about vitamin D as well as its ramifications for the health of women will be reviewed in this section.

Kennel et al. (2010) estimated that the prevalence of adequate levels of vitamin D in the U. S. population in 2010 was 30% for Caucasians and 5% for African Americans. The factors affecting the amount of vitamin D metabolism initiated by sunlight were reported by Kennel et al. to include "time of day, season, latitude, altitude, clothing, sunscreen use, pigmentation, and age" (p. 752). Kennel et al. supported vitamin D testing

for those with clinical risk factors such as malabsorption, malnutrition or renal insufficiency; and empiric treatment with supplements for those with inadequate sun exposure or dietary sources of vitamin D. Under detection and under treatment of vitamin D deficiency persists in spite of the low cost and safety of treatment (Kennel et al., 2010).

Bodnar et al., (2009), Hathcock et al. (2007), Munch & Shapiro (2006), NIH (2009), Pinn (2008), Prentice (2008), and Vieth (2006) reported on the consequences of vitamin D deficiency, and the inadequacy of previously recommended vitamin D guidelines. Vitamin D deficiency is associated with the onset and morbidity of many chronic diseases such as rickets, cancer, Type I and II diabetes, cardiovascular disease, osteoporosis, parathyroid disorders, and multiple sclerosis (NIH, 2011; Vieth, 2006). Current benchmarks for assessing vitamin D levels have recently been revised by the IOM (NIH, 2011). Standardized laboratory reference material for testing 25(OH)D became available in July of 2009 and may improve the variability of results related to different analysis methods used by laboratories in the US (NIH, 2011).

Dawson-Hughes et al. (2010) reported that vitamin D deficiency is associated with increased risk of falls and osteoporotic fractures. According to Dawson-Hughes et al., vitamin D supplementation reduces fracture risk by improving lower limb strength, thereby decreasing risk of falling. Vitamin D supplementation also reduces fracture risk through its effect on improving bone metabolism (Dawson-Hughes et al., 2010).

The International Osteoporosis Foundation (IOF) position statement about vitamin D, includes the following recommendations regarding vitamin D supplementation in the older adult (Dawson-Hughes et al, 2010):

- The estimated average vitamin D requirement for older adults to reach a serum 25(OH)D level of 30ng/ml is 20 to 25 mcg/day (800 to 1000 IU/day).
- For individuals who are obese, have osteoporosis, limited sun exposure, or malabsorption, vitamin D supplementation may need to increase to as much as 50 mcg (2000 IU) per day.
- Due to the variability in individual response, it is recommended that high-risk individuals have their serum 25(OH)D levels measured and treated if found to be insufficient or deficient.
- A “mean serum 25(OH)D level of at least 60 nmol/L (24 ng/ml) is needed for optimal fall risk reduction” (Dawson-Hughes et al., 2010, Falls section, para. 1).
- “The mean serum 25(OH)D level associated with reduction in non-vertebral fracture risk was 66 nmol/L (26.4 ng/ml) (Dawson-Hughes et al., 2010, Fracture section, para. 1).
- “Hip fracture risk reduction was observed at a mean 25(OH)D level of 74 nmol/L (29.6 ng/ml) and higher” (Dawson-Hughes et al., 2010, Fractures section, para.1).
- “The estimate of 75 nmol/l (30ng/ml) is a closer estimate of 25(OH)D levels associated with maximal [parathyroid hormone] suppression and is supported as

the appropriate target level of serum 25(OH)D for older individuals” (Dawson-Hughes et al., 2010, Fractures section, para. 1).

- “The required dose to reach 75 nmol/L can be estimated from the measured level [of 25(OH)D]. Each 2.5 mcg (100 IU) of added vitamin D will increase the serum 25(OH)D level by about 2.5 nmol/L...or 1.0 ng/ml... Because of the variability in individual 25(OH)D responses to supplemental vitamin D in high-risk individuals, the serum 25OHD levels should be retested after about 3 months of supplementation to confirm that the target 25(OH)D level has been reached” (Dawson Hughes et al., 2010, Recommendation section, para. 2).

Sun protection and avoidance can decrease risk for skin cancer, but increase risk for vitamin D deficiency (Lucas, Repacholi, & McMichael, 2006). “Dark skin pigmentation, staying indoors, older age, sun avoidance, and clothing habits limit skin exposure necessary for metabolism of vitamin D” (Lucas et al., 2006, p. 485).

Moyad, (2009) reported that sun avoidance, aging, and obesity have contributed to a growing percentage of people who are vitamin D deficient.

Busko (2009) reported that adolescents with low levels of vitamin D were more likely to have hypertension, hyperglycemia, and metabolic syndrome, suggesting an increased risk for CVD. Adults with vitamin D deficiency were at greater risk for hypertension, diabetes, and CVD (Busko, 2009).

Pinn (2008) reported an association between elevated 25(OH)D₃ serum concentrations and reduced susceptibility to breast cancer. Higher than average vitamin

D intake and serum metabolite concentrations were associated with significantly reduced incidence of colorectal cancer according to a study by Grant and Garland (2004).

Lappe, Davies, Travers-Gustafson and Heaney (2006) conducted a four-year clinical trial in rural Nebraska with cancer-free postmenopausal white women and found that “seasonally adjusted serum 25(OH)D concentration was positively correlated with the size of daily vitamin D supplement dose, and negatively with age, weight, and body mass index ($P < 0.01$ for all)” (Results section, para. 1). “Approximately two-thirds of this rural population fell below 80 nmol/L, a value considered to be the lower end of the optimal range. Based on the slope of 25(OH)D on supplement dose observed in these women, it would require an additional vitamin D input of nearly 2000 IU per day to reach the goal of an RDA for vitamin D, i.e., to bring 97.5% of the cohort to levels of 80 nmol/L or higher” (Lappe et al., 2006, Conclusions section, para. 1). Using the same postmenopausal female study participants from rural Nebraska reported by Lappe et al. (2006), Lappe Travers-Gustafson, Davies, Recker, and Heaney (2007) found during the four-year, population-based, double-blind, randomized placebo-controlled trial, that improving calcium and vitamin D nutritional status substantially reduced all-cancer risk (Lappe et al., 2007).

Dobnig et al. (2008) conducted a prospective cohort study of male and female participants with a mean age of 62 and found that low 25(OH)D levels were significantly correlated with the inflammatory markers: “C-reactive protein and interleukin 6 levels; oxidative burden [markers:] serum phospholipid and glutathione levels; and cell adhesion [markers:] vascular cell adhesion molecule 1 and intercellular adhesion molecule 1 levels

(Results section, para.1). The study also concluded that low 25(OH)D and 1,25(OH)D “levels are independently associated with all-cause and cardiovascular mortality” (Dobnig et al., 2008).

Barclay (2010) found that children given vitamin D supplements over the winter months had a decreased incidence of influenza A. The protective effect of vitamin D was greater in children with asthma, and in children age 3 and older attending nursery school (Barclay, 2010).

Williamson & Greene (2007) reported that in spite of the longstanding recommendation for vitamin D supplementation in infants, cases of rickets were occurring in populations in the US that did not receive supplementation. Ethnic minorities with darker skin, and those with limited sun exposure were especially at risk for rickets (Williamson & Greene, 2007).

Gloth and Greenough, (2004) found that morphine dosages used to treat chronic pain were nearly double for the 26% of the sample participants with serum tested vitamin D insufficiency. These investigators found that 26% of the study participants with vitamin D insufficiency also used morphine to treat their chronic pain for an average of 71.1 months compared to 43.8 months for the remaining 74% with vitamin D sufficiency. Lower levels of physical functioning and negative outlook of their overall health were also noted to be peculiar to the participants with vitamin D deficiency (Gloth & Greenough, 2004).

Milaneschi et al. (2010) found a significant relationship between the development of depression in older women and deficient levels of vitamin D. This correlation was part of a six-year population based cohort study.

A study of postmenopausal women by Lappe et al. (2007) reported a 60% to 75% decrease in all cancer risks after starting vitamin D supplementation. Scragg (2008) reported an association between type 1 and type 2 diabetes mellitus and vitamin D deficiency. Scragg, Sowers, and Bell (2004) reported in the National Health and Nutrition Examination Survey (NHANES), that individuals who had no diagnostic history of type 1 or 2 diabetes mellitus were more likely to have high fasting and post glucose challenge serum glucose levels when they had vitamin D insufficiency. Researchers from Finland, Hyppönen, Läärä, Reunanen, Järvelin, & Virtanen, (2001), reported that vitamin D given in doses of 2000 IU/day during the first year of life was associated with an 80% reduction in the risk for acquiring type 1 diabetes mellitus as an adult.

In a 4-year prospective study, Forman et al. (2007), found an increased relative risk for incident hypertension in participants who's 25(OH)D levels were less than 15 ng/mL as compared to those with 25(OH)D levels greater than or equal to 30 ng/mL. The Framingham Offspring Study with a 5.4-year follow up reported that serum 25(OH)D levels less than 10 ng/mL were 80% more likely, and those with serum 25(OH)D levels less than 15 ng/mL were 53% more likely to experience a cardiovascular event than those with higher levels (Forman et al., 2007; Wang et al., 2008). An analysis of findings from the Framingham Heart Study by Wang et al. (2008) found that the risk

for myocardial infarction, stroke, and heart disease doubles when one is vitamin D insufficient.

Summary

The field of health literacy is in flux, and more research is needed to move health literacy toward translational research applied to general populations in community and clinical settings (Mancuso, 2009). “Accurately assessing health literacy will assist to improve health outcomes, decrease health disparity, and increase health status, leading to enhanced quality of life” (Mancuso, 2009, p. 88).

Rural women face disadvantages to health care access that lead to poor health outcomes (Sheigh & Halstead, 2009). Few studies have been done about the context of rural women and health literacy (Speros, 2005). Vitamin D is acknowledged to have positive health benefits in the literature with added significance for reducing risk for female related health conditions such as osteoporosis and breast cancer (AHA, 2009; NIH, 2009; Munch & Shapiro, 2006; Pinn, 2008; Vieth, 2006).

Health literacy improves empowerment through health interaction and participation, which raises awareness and potential for modification of health factors and their determinants (Bettencourt et al., 2007; Cudney, 2005; Nutbeam, 2000; WHO, 2010). Rural women are a population group about which relatively little is known (Bales, 2010). A descriptive study of rural women’s health literacy about vitamin D can add to the literature about rural women as well as health literacy, with implications for improving rural women’s health interactions, health education, and health outcomes.

CHAPTER 3

METHODS

Chapter three describes the methods used to address the research questions in this study of rural women's health literacy about vitamin D. The chapter is organized into six sections: (a) study design, (b) population and sample, (c) procedures for data collection, (d) instrumentation; (e) discussion of rights of human subjects; and (f) analysis.

Study Design

A descriptive cross sectional design was used for this study. A mail survey was used to collect data on participant's knowledge and use of vitamin D, as well as their sources of vitamin D information. Socioeconomic and demographic data were collected to describe the sample and for use in analysis of associations between variables and rural women's health literacy about vitamin D. Pender's revised HPM provided a theoretical framework for this study. The content and construction of survey questions were based on the literature review and Pender's theoretical framework.

Population and Sample

The target population for this study was rural women ages 18 and older living in a specific rural community in a northwestern state in the United States. The study included women living in the specific town as well as women living in the area

surrounding the town who considered that town their hometown. As vitamin D is considered a complimentary and alternative medicine (CAM), women were chosen for this study due to research showing that rural women are more likely than rural men to use CAM (Schreffler-Grant, Weinert, Nichols, & Ide, 2005). Women also tended to pay more attention to health than men; often allocated their time and resources to health promotion activities and the prevention of disease; and were likely to manage the health care of their families (Bales, 2010; Pierce, 2001; Schreffler-Grant et al., 2007).

As of 2000, 363 women ages 18 or older lived in the town located at the center of this rural community (United States Census, 2009). The researcher accounted for the possibility that more women aged 18 and older may currently live in that town as the census was conducted ten years ago and the study also included the area surrounding that town. Therefore, surveys were sent to women in a total of 400 randomly selected households. A response rate of 25% was anticipated, yielding 100 women in the final sample.

Random sampling was used to select a representative sample of the target population. A blindfolded volunteer pointed to 400 individual listings in the local rural community phone directory. If a non-residential listing was chosen, it was not counted, and another selection was made by the blind-folded volunteer. These listings were used as the sample population. Residents of this rural community received their mail in post office (PO) boxes at the local post office or in rural route PO boxes. The phone book did not list PO boxes, therefore, surveys were sent using name, town, state, and zip code only on the mailing envelopes. Each cover letter sent with the survey designated an adult

female as the intended recipient, with instructions to disregard if no adult female was available to complete the survey. The investigator called the post-master prior to the mailing to request assistance with getting the mailed surveys into the appropriate post office boxes by using only the names of addressees. The post-master indicated she would ensure delivery of the surveys as addressed.

Procedures for Data Collection

A mailed survey with a cover letter explaining the study and informed consent information was sent to the random sample of potential participants. A copy of the survey is found in Appendix A and a copy of the cover letter is found in Appendix B. For visibility purposes, flyers identifying the study and university affiliation were emailed to local businesses, with a request that they be posted in high traffic areas. A copy of the flyer can be found in Appendix C. Local businesses included the grocery store, a central gas station restaurant/bar, and the hospital.

An interview with the local newspaper was conducted prior to mailing the surveys to increase study validity and generate enthusiasm for participation in the study. The article introduced the researcher as a nursing graduate student of Montana State University and briefly described how the sample was chosen, the topic of the study, and emphasized rural women as having influence over the health of rural populations.

After the data collection, a vitamin D fact sheet was mailed to each of the establishments used for posting of the flyers with a request to post the fact sheet for

community residents to see. A copy of the vitamin D fact sheet is included in Appendix D. If requested by participants, the researcher mailed, or emailed participants a link to the study results, and included a note of thanks for their participation in the study.

Instrumentation

The researcher developed a survey questionnaire designed to assess rural women's health literacy about vitamin D (See Appendix A). The survey was a newly developed instrument; therefore, reliability and validity had not been established. The survey questions were developed from literature about vitamin D and health literacy, rural health influences, and Pender's HPM (NAAL, 2006; NIH, 2009; Nurss, Parker, & Baker, 2008; Nutbeam, 2006; Pender et al., 2002; Shieh & Halstead, 2009; Wallace et al., 2006). The questionnaire for this study was adapted from the data collection tool developed by O'Neill (2007) for her thesis titled "An Assessment of Health Literacy about Complementary and Alternative Medicine in Adult Residents of Flathead County, Montana."

The 46 question survey consisted of Likert type, multiple choice, and short answer questions designed to gather information to answer the research questions. The Federal Plain Language Guide (FPLG) and an online women's health quiz aided wording of the survey questions for optimal understanding (FPLG, 2009; HealthForums.com, 2001). The previous survey mentioned above was used as a guide for layout, content, as well as the construction of the survey instrument questions for this study (O'Neill, 2007).

Part one of the survey contained 11 questions pertaining to prior experience with vitamin D, self-motivation to use vitamin D; perceived benefits and barriers to the participant's sense of getting enough vitamin D; and perceptions about vitamin D shaped from past experience likely to influence self-motivation to become familiar with vitamin D. Questions 1- 11 addressed behavior-specific cognitions and affect outlined by Pender (2002) as well as questions that explored interpersonal influences on getting information about vitamin D. Questions in this section of the survey contributed to answering research questions two and four.

Part two of the survey contained 12 true false questions numbered 12 through 23 that assessed health literacy about vitamin D. This section was scored on a 0-12 scale in order to classify participants as having limited, marginal or adequate health literacy about vitamin D. Limited health literacy scores included from 0 to 4 correct responses. Marginal health literacy included from 5 to 8 correct responses. Adequate health literacy included from 9 to 12 correct responses. These questions addressed research question number one. Correct answers to questions 13, 15, 18, 21, and 23 of the true-false portion of the survey were false.

Part three included 9 questions, numbered 24 through 32, that related to behavior-specific cognitions and affect identified by the HPM as influencing health promotion behavior (Pender et al., 2002). Question number 24 assessed self-efficacy for health promotion by asking participants to choose declaratory statements that described their behavior and feelings of empowerment about their health. These declaratory statements were labeled alphabetically and were scored according to statements chosen. High self-

efficacy for health promotion was signified by choosing statements a, c, d, or h. Choosing statements b, e, or j signified moderate self-efficacy for health promotion. Low self-efficacy for health promotion was signified by choosing f, g, i, or k. These questions addressed research question number four.

Question numbers 31 and 32 asked participants to rate and describe how easy or hard it is to see a health care provider. The answers to these questions served as the measure of perceived access to care and was used to address research question number three.

Part four of the survey contained 13 questions numbered 33-46. Question number 33 was drawn from studies by Wallace et al. (2004) and Chew et al. (2004) to screen for limited health literacy. Those who answered somewhat, a little bit or not at all were determined to have limited health literacy in general (Wallace et al. 2004). The answer to this question will add to the discussion of health literacy. Question numbers 34-45 were demographic questions considered to be influencing biological and socio-cultural factors identified by the HPM (Sakraida, 2006). These questions contributed to addressing research question number four. Question 46 asked for mailing information if the participant wanted a copy of the results of the survey.

Rights of Human Subjects

The rights of human subjects were maintained through adherence to the regulations outlined by the United States Department of Health and Human Services (USDHHS) (2009). Approval for this study by the Montana State University-Bozeman

Institutional Review Board was obtained in December, 2010, prior to onset of data collection (USDHHS, 2009).

A cover letter including the necessary components for informed consent was included with each mailing. The cover letter is included in Appendix B. This included the goals of the study; type of data to be collected; who was involved in the development of the study; the sampling process; a confidentiality pledge; potential benefits and risks associated with participation, freedom to withdraw at any time; and freedom to not answer any questions participants didn't want to answer.

The cover letter explained that all results would be confidential and that no names or other identifying information would be used for reporting of the results. The cover letter encouraged participants to contact the researcher or the committee chair if they had any questions or concerns regarding the study. Participants could provide an email or home address directly to the researcher for receiving results of the study if they chose. The cover letter explained that consent to participate in the study was implied when the participant returned the completed survey (See Appendix B).

The survey questions were intended to be low risk and non-threatening and some involved demographic information. All questions were structured in a familiar format and words from a plain language guide were substituted where appropriate (Federal Plain Language Guidelines, 2009).

Potential benefits included the opportunity to supply new information about rural women's health literacy about vitamin D. The results of the study may help guide patient education efforts by nurse practitioners as the guidelines for vitamin D evolve.

Potential risks involved in participation in the study were minimal and included invasion of privacy and the inconvenience of time taken to complete the survey. These risks were mentioned in the cover letter along with the information that the survey would take fifteen minutes to complete. The coded list of potential participants were kept in a locked file and destroyed when the study was completed.

Analysis

Quantitative data generated in this study were analyzed with SPSS 19 statistical software, using a combination of descriptive and Chi Square Statistics to answer the research questions. Once cleaned and coded, the data were entered into SPSS 19. Identification of possible data entry errors was done through descriptive statistics, frequencies, and cross-tab tables. Irregular or suspicious data was compared to the original survey and corrections made.

Some survey questions required short answer qualitative responses. When possible, qualitative responses were coded according to content and entered as quantitative variables in SPSS. Results were summarized using descriptive statistics.

Descriptive statistics were used to summarize and present all data collected. Responses to survey questions 12 through 23 were scored and summarized for a vitamin D health literacy score to answer research question number one, concerning the level of vitamin D health literacy among rural women. Responses to survey question number 9, was summarized using descriptive statistics to answer research question number 2, where do rural women obtain information about vitamin D? To answer research question

number 3, concerning the relationship between rural women's health literacy about vitamin D and rural women's perceived access to health care services, Pearson Chi Square statistics were used to identify a significant association between level of vitamin D health literacy score and responses to survey question number 31.

Lastly, Pearson Chi Square statistics were used to answer research question number 4, which measured the relationship between rural women's health literacy about vitamin D and selected factors such as race/ethnicity, age, income, education, self-efficacy for health promotion, presence of significant health issues, and perceived vitamin D benefits and perceived vitamin D barriers. Scores for level of health literacy about vitamin D were compared to responses to demographic questions numbered 35 through 46 as well as cognitive behavioral factors indicated by question numbers 2, 11, 24 through 35, 36, 39, and 44.

A specific breakdown for questions assessing the concepts outlined as modifying factors in the HPM were as follows:

Table 1. HPM and Corresponding Survey Questions

HPM Modifying Factors:	Corresponding Survey Questions:
Prior Related Behavior	3, 4 and 10
Personal Biological Factors	26, 27, 34, 35, and 36
Personal Psychological Factors	11, and 25
Perceived Benefits of Action	5, 8, 9 and 11
Perceived Barriers to Action	3, 11
Perceived Self-Efficacy	24
Activity Related Affect	1, 2, 8, and 11
Interpersonal Influences.	5, 6, 9, 28, 29, 30, 31 and 32
Socio-Cultural and Situational Influences and Immediate Competing Demands	37 through 45

CHAPTER 4

RESULTS

A mailed survey was utilized to provided data concerning health literacy about vitamin D among rural women in order to answer the research questions. Chapter 4 contains a description of survey respondents and a summary of the results. Descriptive statistics were used to obtain a summary of demographic data obtained from to the survey. Descriptive statistics and Chi Square associations were used to answer the research questions.

Sample

Study participants were women from one rural community in a Northwestern state. To acquire the sample, 400 female residents were contacted by mail and asked to return a completed survey. There was a 41.2% (N = 126) response rate. To calculate the response rate, the numerator was found by adding the number of returned blank surveys (13), and the number of completed returned surveys (126), which equals 139. The denominator for the response rate was found by subtracting the total number of undeliverable surveys (63), from the total number of surveys mailed out (400), which equaled 337. Of the 400 surveys mailed, 63 surveys were returned undeliverable due to change of address, wrong address, unknown address, no mail receptacle, or deceased addressee.

There were 126 rural female participants in this study, ranging in age from 26 to 93 (mean age = 56.5 ± 12.133). The majority of the participants were married (81.6%, $n = 102$) with two people in their household (56.0%, $n = 70$). Most participants identified themselves as Caucasian/White (97.6%, $n = 121$). Most participants (30.6%, $n = 38$), had high school diplomas or had completed undergraduate college degrees, (30.6%, $n = 38$). See Table 2 for a complete summary of demographic data collected about the participants in this study.

Total yearly income before taxes was reported to be \$40,000 to \$49,000 by 7.7% ($n = 9$) of the participants, with 33.3% ($n = 39$) reporting making more than that and 41% ($n = 48$) making less. Twelve participants (10.3%) reported a yearly income of less than \$20,000. Full-time employment was listed by 33.1% ($n = 41$) of the participants, and 13.8% ($n = 17$) reported working more than one job. The number of participants reporting they were not employed was 34.4% ($n = 43$). Participants listed self-pay (38.7%, $n = 124$) and insurance provided by employer (35.5%, $n = 124$) as the most prevalent method of paying medical bills.

The majority of the participants (62.4%, $n = 78$) reported living in the local community and the remainder reported living in several surrounding towns. Participants reported living in the rural area involved in this study for a range of 1 to 75 years with an average of 23.22 ± 18.291 years.

Table 2. Socio-Demographic Information about the Sample

Survey Question/Category	Frequency	Valid Percent
Female	126	100%
Age:		
18-30	2	1.6%
31-50	32	25.6%
51-65	59	46.8%
66-75	29	23.2%
> 75	2	1.6%
> 90	1	0.8%
Marital status:		
Single	7	5.6%
Married	102	81.6%
Widowed	5	4.0%
Separated/Divorced	9	7.2%
Widowed and Separated/Divorced	2	1.6%
Number In Household:		
1	16	12.8%
2	70	56%
3	14	11.2%
4	11	8.8%
5	10	8.0%
6	2	1.6%
7	1	0.8%
>7	1	0.8%
Race/Ethnicity:		
Caucasian/White	121	97.6%
AI*	1	0.8%
White + AI	1	0.8%
White + HL*	1	0.8%
Employment Status**:		
Not Employed	43	34.4%
Part-Time	31	25.0%
Full Time	41	33.1%
More than One Job	17	13.8%:
Education:		
< High School	1	0.8%
GED	5	4.0%
High School	38	30.6%
Associate Degree	30	24.2%
Bachelor Degree	38	30.6%
Graduate Degree	11	8.9%
Doctorate	1	0.8%

Table 2 Continued

Income:		
< \$10,000	5	4.3%
\$10,000 - \$19,000	7	6.0%
\$20,000 - \$29,000	17	14.5%
\$30,000 - \$39,000	19	16.2%
\$40,000 - \$49,000	9	7.7%
\$50,000 - \$59,000	9	7.7%
> \$60,000	30	25.6%
Do Not Wish to Disclose	21	17.9%
Income:		
< \$10,000	5	4.3%
\$10,000 - \$19,000	7	6.0%
\$20,000 - \$29,000	17	14.5%
\$30,000 - \$39,000	19	16.2%
\$40,000 - \$49,000	9	7.7%
\$50,000 - \$59,000	9	7.7%
> \$60,000	30	25.6%
Do Not Wish to Disclose	21	17.9%
Who Pays Medical Bills**		
Self-Pay	48	38.7%
Medicare	34	27.4%
Medicaid	3	2.4%
Other Government/V*/IH*	4	3.2%
Employer Provided Health Insurance	44	35.5%
Private HCI	36	28.8%

Note: not all questions were answered by participants.

*AI = American Indian; HL = Hispanic/Latino, V = Veterans, IH = Indian Health

** Respondents circled all that apply

Health and Health Care About the Sample

Table 3 summarizes data obtained from the mailed concerning health and health care about the participants. The most frequently seen health care provider was a doctor (59.5%, n = 75), followed by a nurse practitioner (37.3%, n = 47). The most frequent sources of health information were health care provider (73%, n = 92) and then internet (47.2%, n = 59) second, and newspaper/magazine (46%, n = 58) a close third. The most

trusted source of health information was health care provider (34.9%, n = 44). A majority of the participants rated their health as very good (31% , n = 50) or good (31%, n = 39). Forty-eight participants (34.4%) reported the presence of significant health problems. The most commonly listed first significant health problem was cardiovascular disease (26.4%, n = 14).

Table 3. Health and Health Care Information

Survey Question/Category	Frequency	Valid Percent
How Do You Rate Your Health		
Poor	1	0.8%
Fair	14	11.1%
Good	39	31.0%
Very Good	50	39.7%
Excellent	22	17.5%
Where Do You Get Health Information *		
Health Care Provider	92	73%
Family	38	30.2%
Friend	25	19.8%
Radio/TV	41	32.5%
Newspaper/Magazine	58	46%
Books	47	37.3%
Pamphlets	36	28.6%
Internet	59	47.2%
Health Care Provider Seen Most Frequently *		
Nurse Practitioner	47	37.3%
Physician Assistant	28	22.2%
Doctor	75	59.5%
Chiropractor	16	12.7%
Naturopath	12	9.5%
Do you Have Any Significant Health Problems?		
Yes	48	34.4%
No	77	61.6%

Table 3 Continued

First Listed Significant Health Problem:		
Cardiovascular disease	14	14
Breast Cancer	1	1.9%
Osteoarthritis	1	1.9%
Degenerative Bone Disease	2	3.8%
Osteoporosis	3	5.7%
Musculoskeletal Pain	2	3.8%
Hypothyroidism	3	5.7%
Skin Condition	3	5.7%
Gastrointestinal Disease	1	1.9%
Autoimmune disease	4	7.5%
Hyperthyroidism	1	1.9%
Cancer	2	3.8%
Type I Diabetes	1	1.9%
Multiple Sclerosis	2	3.8%
Fibromyalgia/Chronic Fatigue	1	3.8%
Lupus	1	1.9%
Type II Diabetes	2	1.9%
Over Weight/Obesity	3	3.8%
Hemiplegia	1	1.9%
Peripheral Neuropathy	2	3.8%
Asthma	1	1.9%
Second Listed Significant Health Problem:		
Cardiovascular Disease	6	17.6%
Depression	2	5.9%
Osteoarthritis	5	14.7%
Degenerative Bone Disease	2	5.9%
Musculoskeletal Pain	2	5.9%
Hypothyroidism	1	2.9%
Autoimmune Disease	1	2.9%
Sleep apnea	2	5.9%
Lyme Disease	1	2.9%
Rheumatoid Arthritis	1	2.9%
Type II Diabetes	2	5.9%
Over Weight/Obesity	1	2.9%
Eye Disease	2	5.9%
Hearing Loss	1	2.9%
Bronchitis	1	2.9%
COPD	1	2.9%
Menopause	1	2.9%
Poor Leg Circulation	1	2.9%
Respiratory Disease	1	2.9%

Table 3 Continued

Third Listed Significant Health Problem:		
Cardiovascular Disease	1	7.7%
Osteoarthritis	1	7.7%
Degenerative bone Disease	1	7.7%
Osteoporosis	1	7.7%
Musculoskeletal Pain	1	7.7%
Skin condition	1	7.7%
Fibromyalgia/Chronic Fatigue	2	15.4%
Over Weight/Obesity	1	7.7%
Eye Disease	2	15.4%
Allergies	1	7.7%
Parkinson's Disease	1	7.7%
Most Trusted Source of Health Information:		
Doctor	40	33.3%
Nurse Practitioner	3	2.5%
Physician Assistant	3	2.5%
Family	1	0.8%
Friend	2	1.7%
Internet	10	8.3%
Naturopath	4	3.3%
Radio/TV	3	2.5%
Newspapers/Magazines	3	2.5%
Medical Journals	1	0.8%
Books	2	1.7%
Health care Provider	44	36.7%
Pamphlets	3	2.5%
Vitamin Supplement Distributor	1	0.8%
How Easy or Hard to Get In to See a Health Care Provider?		
Impossible	1	0.8%
Very Hard	4	3.3%
Hard	15	12.2%
Easy	69	56.1%
Very Easy	34	27.6%

*Respondents circled all that apply

Vitamin D

As can be seen in Table 4, the majority of the participants reported taking vitamin D (71.4%, n = 90), that they get enough vitamin D (71.1%, n = 81), and that they decided on their own to take vitamin D (68.5%, n = 89). A majority of participants reported eating foods with vitamin D (83.6%, n = 63), and that it was very important (50.0%, n = 63) or extremely important (22.2%, n = 28) to have vitamin D in their bodies.

Most participants reported taking vitamin D to promote health (75.0%, n = 60). Specific health reasons for taking vitamin D included bone and joint health (48.1%, n = 13), depression (11.1%, n = 3), gastrointestinal disease (11.1%, n = 3), and low serum vitamin D level (7.4%, n = 3). Reported vitamin D supplement dosages ranged from less than 400 IU to 50,000 IU twice weekly, with the most frequently reported dosages including 1000 IU to < 2000 IU (18.9%, n = 17), 2000 IU (17.8%, n = 16), and 1000 IU (15.6%, n = 14). The majority of the participants reported their HCP as a main source of vitamin D information (60%, n = 47.6), with newspaper/magazine second (46%, n = 58). Most participants also felt that not taking a vitamin D supplement kept them from getting enough vitamin D.

Table 4. Participant's Vitamin D Responses

Survey Question/Category	Frequency	Valid Percent
Yes, take Vitamin D.	90	71.4%
Yes, Get Enough Vitamin D	81	71.1%
Yes, Eat Foods with D	97	83.6%
Why take Vitamin D?		
Prevent Disease	8	10.0%
Promote Health	60	75.0%
To treat a Health Problem	8	10%
Other	4	5.0%
Decide on own to Take D or Told by Health Care Provider:		
On my own	61	68.5%
Health care Provider	23	18.3%
How Much Vitamin D Do You Take?		
<400 IU	7	7.8%
400 IU	11	12.2%
500 IU	2	2.2%
600 IU	2	2.2%
800 IU	4	4.4%
900 IU	1	1.1%
1000 IU	14	15.6%
1000 - < 2000 IU	17	18.9%
2000	16	17.8%
>2000 - < 5000 IU	3	3.3%
4000 IU	2	2.2%
5000 IU	6	6.7%
> 5000 - < 10,000 IU	2	2.2%
20,000 IU	1	1.1%
50,000 IU Twice Weekly	1	1.1%
Not Sure	1	1.1%
Specific Health Reasons for Taking Vitamin D:		
Bone and Joint Health	13	48.1%
Depression	3	11.1%
Gastrointestinal Disease	3	11.1%
History of Breast cancer	1	11.1%
Multiple sclerosis	1	3.7%
Improves Migraines	1	3.7%
Low Serum Vitamin D Level	2	7.4%
Osteoporosis	1	7.4%
Pregnant	1	3.7%
Fall Prevention	1	3.7%

Level of Health Literacy About Vitamin D

The first research question in this study concerned the level of vitamin D health literacy was among rural women. A 12-question true-false quiz, created by the researcher, was used to determine participant's health literacy level about vitamin D. Reliability and validity have not been established for this new tool. The quiz consisted of 12 true or false statements about vitamin D, (12 through 23 of the survey in Appendix A). The quiz was scored on a zero to 12 scale and identified participants as having limited, marginal or adequate health literacy about vitamin D. Limited health literacy scores ranged from zero to four correct responses. Marginal health literacy ranged from five to eight correct responses. Adequate health literacy ranged from nine to twelve correct responses. If a participant left a question blank, it was considered incorrect. The respondents scores ranged from zero to 11 correct responses, with a mean of 7.55. The majority of the participants fell into the marginal health literacy category (52.4%, n = 66), followed by 38.9% (n = 49) in the adequate health literacy category. See Table 5 for the distribution of health literacy levels about vitamin D.

Table 5. Health Literacy Levels About Vitamin D

Vitamin D Health Literacy Level	Frequency	Valid Percent
Limited Health Literacy (0 – 4 correct)	11	8.7%
Marginal Health Literacy (5 – 8 correct)	66	52.4%
Adequate Health Literacy (9 – 12 correct)	49	38.9%

Sources of Vitamin D Information

Research question number two was where rural women obtain information about vitamin D. Question number nine of the survey asked the participant to designate where they had learned about vitamin D by circling all the choices that were applicable. The most common sources of vitamin D information reported by the participants included health care provider (47.6%, n = 60), newspaper/magazine (46%, n = 58), and radio/TV (28.6%, n = 36). Table 6 summarizes the results for research question number two.

Table 6. Sources of Vitamin D Information *

Survey Question/Category	Frequency	Valid Percent
Sources of Vitamin D Information:		
Health Care Provider	60	47.6%
Radio/TV	36	28.6%
Newspaper/Magazine	58	46%
Family	31	24.6%
Friend	22	17.5%
Book	34	27%
Pamphlet	21	16.7%
Internet	24	19.0%

*Respondents were asked to circle all that apply

Vitamin D Health Literacy and Perceived Access to Health Care Services

Research question three was, is there was a relationship between rural women's health literacy about vitamin D and rural women's perceived access to health care services? In question 31, participants were asked for their perceptions of how easy or hard is it to get in to see a health care provider, which was used as the indicator of perceived access to health care services. The relationship between vitamin D health

literacy and perceived access to care was analyzed using Pearson Chi Square. For this analysis, responses to “very easy” and easy were combined (83.7%, n = 20), and responses to “impossible”, “very hard”, and “hard”, were combined (12.2%, n = 20). The relationship between vitamin D health literacy and perceived access to health care services was not found to be statistically significant and is presented in Table 7.

Table 7. Relationship between Vitamin D Health Literacy and Perceived Access to Health Care Services

Vitamin D Health Literacy By:	Number of Valid Cases	df	p Value
How “Easy” or “Hard” to See a Health Care Provider	126	2	.963

Vitamin D Health Literacy and Selected Factors

Research question number four was, is there is a relationship between vitamin D health literacy and the following selected factors: race/ethnicity, age, income, education, self-efficacy for health promotion, presence of significant health issues, perceived vitamin D benefits, and perceived vitamin D barriers. All but one of the selected factors showed no significant relationships with vitamin D health literacy when examined using Pearson’s Chi Square. A significant association was found between vitamin D health literacy level and level of self-efficacy for health promotion. A presentation of the results of research question number four is followed by Table 9 which contains a summary of the Chi Square results.

Relationship Between Vitamin D Health Literacy and Race/Ethnicity

All but three respondents reported that they were Caucasian/White in question number 35 of the survey. The categories were then condensed into “Caucasian/White” and “Other” for purposes of analysis. The association between Race/Ethnicity and health literacy about vitamin D for this population was not significant.

Relationship Between Vitamin D Health Literacy and Age

Question number 36 of the survey asked respondents to list their age on their last birthday. These answers were grouped into three age ranges for the purposes of the analysis. The association between age and health literacy about vitamin D was not significant.

Relationship Between Vitamin D Health Literacy and Income

Participants were asked in question number eleven of the survey to circle a range of income that best described their yearly total income before taxes. The categories of income were merged from seven into three, for this analysis. The relationship between vitamin D health literacy and income was not significant.

Relationship Between Vitamin D Health Literacy and Education

Number 39 of the survey asked participants to disclose their highest level of education. For this analysis, the number of categories for educational attainment was reduced from seven to three. The association between vitamin D health literacy and level of education was not significant.

Relationship Between Vitamin D Health Literacy and Self-Efficacy for Health Promotion

Question number 24 of the survey was used as the measure self-efficacy by asking that participants circle declaratory statements that best described their feelings of empowerment about their health. Participants were asked to circle all that apply. The participants' responses were quantified by self-efficacy level, and regrouped into corresponding categories of low, medium, and high self-efficacy for health promotion. These declaratory statements were labeled alphabetically and were scored according to statements chosen. High self-efficacy for health promotion was signified by choosing statements a, c, d, or h. Choosing statements b, e, or j signified moderate self-efficacy for health promotion. Low self-efficacy for health promotion was signified by choosing f, g, i, or k. The relationship between vitamin D health literacy and self-efficacy for health promotion was found to be significant at the 0.05 level for a 2-tailed test using Pearson Chi Square.

Relationship Between Vitamin D Health Literacy and Presence of Significant Health Problem

In item 26, respondents were asked, "Do you have any significant health issues?" Using Pearson Chi Square, the association between vitamin D health literacy and the presence of a significant health problem, was not significant.

Relationship Between Vitamin D Health Literacy and Perceived Vitamin D Benefits

The benefit of vitamin D was evaluated in survey question number 11 in which participants indicated how important it was to have enough vitamin D in the body. The

response was measured on a Likert scale. Data were then regrouped into three categories: (a) don't know/not important, (b) somewhat important, and (c) very or extremely important. The relationship between vitamin D benefits and vitamin D health literacy was examined using Pearson Chi Square and the results were not significant.

Relationship Between Vitamin D Health Literacy and Perceived Vitamin D Barriers

Question number two of the survey asked that participants indicate what keeps them from getting enough vitamin D. The responses fell into five categories: (a) lack of sun, (b) no dietary vitamin D, (c) no vitamin D supplement, (d) no knowledge about vitamin D; and (e) presence of chronic illness, or health problem. Pearson Chi Square analyses were not used to examine associations between the barriers and vitamin D health literacy due to small numbers of responses in the cross-tabulation cells. Descriptive results are reported below in Table 9.

Table 8 lists the results for the Chi Square analyses between level of vitamin D health literacy and the selected factors listed in research question number four as presented above.

Table 8. Pearson Chi Square Analyses between Vitamin D Health Literacy and Selected Factors

Health Literacy about Vitamin D By:	Number of Valid Cases	df	p Value
Race Ethnicity	124	2	.188
Age	125	4	.453
Income	96	4	.342
Education	124	4	.234

Table 8 Continued

Self-Efficacy for Health Promotion *	118	4	.010 *
Presence of Significant Health Issues	125	2	.670

* Association is significant at the 0.05 level for a 2-tailed test

Table 9. Perceived Vitamin D Barriers

Survey Question/Category	Frequency	Valid Percent
What Keeps you from getting Vitamin D?		
Lack of Sun	7	20.6%
No Dietary Vitamin D	4	11.8%
No Vitamin D Supplement	13	38.2%
No Knowledge about Vitamin D	5	14.7%
Presence of Chronic Illness/Health Problem	5	14.7%

CHAPTER 5

DISCUSSION

This study regarding rural women's health literacy about vitamin D used a mailed survey. The conceptual framework used to guide the study was developed by the HPM developed by Pender et al. (2002). The purpose of the study was to determine rural women's health literacy about vitamin D. Answers to four research questions were sought:

1. What is the level of vitamin D health literacy among rural women?
2. Where do rural women obtain information about vitamin D?
3. Is there a relationship between rural women's health literacy about vitamin D and rural women's perceived access to health care services?
4. Is there a relationship between rural women's health literacy about vitamin D and selected factors such as race/ethnicity, age, income, education, self- efficacy for health promotion, presence of significant health issues, perceived vitamin D benefits and barriers?

The sample of participants was drawn from a random selection of women's names in a rural community's telephone directory. Data was analyzed using descriptive and Pearson Chi Square statistics.

This chapter presents a discussion of the results of this study, including a review of the findings in relation to the findings in the literature review. The findings of this study showed that the majority of the participants had marginal vitamin D health literacy

based on the vitamin D health literacy questionnaire used in this study. The results also revealed that participants in this study found vitamin D information from several sources, the majority of which were health care providers, followed closely by newspapers/magazines, and then books. The study did not find a significant relationship between vitamin D health literacy and rural women's perceived access to health care services. Lastly, the study results indicated that none of the selected factors examined in research question number four showed a relationship with vitamin D health literacy except self-efficacy for health promotion, which was significantly associated with vitamin D health literacy.

There is currently no valid and reliable tool to assess health literacy about vitamin D. The instruments used for vitamin D health literacy assessment and the assessment of self-efficacy for health promotion, were developed by the researcher, based on the literature, but had never been used before. The survey has also not been normed, so the appropriate population for the survey is unknown. This limitation and its implications regarding the study results are discussed in the limitations of the study section. Implications for further research and advanced practice nursing are also discussed.

Evaluation of Results:

Demographic and Socio-Demographic Measures

Rural women were chosen as study participants based on research by Pierce (2001) and Shreffler-Grant et al. (2007), showing that women paid more attention to health than men, and allocate time and resources to the promotion of health and

prevention of disease. Bales (2010) and Bales et al. (2010) found that rural women were more likely to have deficits in education, and an increased likelihood to have low paying jobs, and inadequate health insurance. The participants in this study showed differences and similarities from the research results of Bales (2010) and Bales et al. (2010).

In contrast to the results of Bales (2010) and Bales et al. (2010), a majority of the participants in this study were well educated. Thirty-eight (36.6%) of this study's participants reported having a high school diploma and 50 (39.5%) of this study's participants had a bachelors degree or higher. Another difference was that 33.3% (n = 39) of the participants in this study made greater than \$50,000 annual income before taxes, compared to 18.3% (n = 75) of the population of this rural town who made more than \$50,000. This is also in contrast to This suggests a more affluent sample for this study compared to the population of this rural town, as well as in the studies by Bales (2010) and Bales et al. (2010).

One similarity between this study and the findings by Bales (2010) and Bales et al. (2010) was that a significant number of participants reported self-pay for how they paid their medical bills (38.7%, n = 48). This suggests a significant number of respondents were uninsured or underinsured and is consistent with the findings about rural women by Bales (2010) and Bales et al. (2010).

The socio-demographics of this study population varied slightly from the demographic statistics for the same rural town compiled by the US Census Bureau (2009a) and the 2005-2009 American Community 5-Year Estimates (US Census, 2009b). Study participants age and race/ethnicity were comparable to statistics compiled for this

rural town by the US Census Bureau (2009a). The majority of the study participants were Caucasian (97.6, n = 121), closely resembling statistics for this rural town (95.1%, n = 869) (US Census, 2009a). Average household size of the study participants (2.55) was also comparable to statistics for this rural town(2.19).

The average age of the study participants was higher than the average reported for this rural town by the US Census Bureau (2009a). The average age of the study participants (56.5), was higher than the average age of females in this rural town (49.9) (US Census, 2009a).

Some respondents in this study reported living in other surrounding communities. The participants living in these particular communities were included in this study as these communities border large expanses of ranch land or mountainous terrain in the vicinity of the rural town that has a population of 930 (US Census, 2009a). The US Census Bureau (2009a) had no population report for two of the communities listed, and the population of the third was reported to be 322.

Health and Health Care Measures

Shreffler-Grant, et al. (2010) found that rural women who have one or more chronic diseases were more likely to use CAM. Even though a large majority of the respondents rated their health as “good”, “very good”, or “excellent”, more than a third reported that they had at least one significant health problem.

Cardiovascular disease was the most common significant health issue reported by the participants. Of the participants who reported a significant health problem, 51.7% (n

= 21) reported cardiovascular disease as the health issue. This information follows national statistics stating that cardiovascular disease is the leading cause of death for all women in the United States (CDC, 2010b).

Health Literacy about Vitamin D: The results of the true-false measure of health literacy about vitamin D developed in this study indicated that a majority of the participants (52%, n = 66) were classified as having marginal health literacy about vitamin D. Participants with adequate health literacy about vitamin D (38.9%, n = 49) were the next largest group, and those with limited health literacy (8.7%, n = 11) were the smallest group. These results show that the participants had some prior knowledge about vitamin D.

Most participants (99.2%, n = 119) answered correctly that vitamin D deficiency is increasing in the United States. A majority of the participants correctly identified that vitamin D is associated with building strong bones, preventing heart disease, breast cancer and colon cancer, and needs sunlight for synthesis in the body. A higher number of incorrect responses were given for the following true-false questions: breast fed infants are at risk for low vitamin D that can cause rickets, the new recommended daily requirements for vitamin D, and the safe upper limits of vitamin D dosing. The incorrect answers about vitamin D may have implications for under or over treatment with vitamin D that may translate to adverse health consequences.

The relationship between low health literacy and poor health outcomes for women is documented in the literature (Arnold et al., 2001; Lindau et al., 2002; Shieh &

Halstead, 2009). Available health literacy instruments, such as the TOFHLA and REALM, originally defined health literacy by categories or means of scores (Shieh & Halstead, 2009). The terms low, limited, moderate, high, adequate, inadequate, basic or below basic health literacy, are used broadly throughout the literature to indicate a range of health literacy. There is no recognized standard for a quick convenient, reliable, and valid health literacy test for use in the clinical setting (Baker, 2006). Health literacy tests specific to health conditions relevant to the test taker are also varied and prevalent and tend to yield higher health literacy scores (Baker, 2006). Due to these inconsistencies in health literacy testing, a better instrument is needed to determine health literacy levels.

The measurement tool for health literacy about vitamin D used in this study was developed by the researcher and was based on literature about health literacy testing and vitamin D facts (Baker, 2006; NIH, 2011; Shieh & Halstead, 2009). As this measurement tool had never been used before, caution must be used when considering implications of the results of the health literacy about vitamin D classifications identified by this study.

Resources Used to Get Vitamin D Information: This study found that participants most frequently reported health care providers as their source for vitamin D information (47.6%, n =60). Newspapers and magazines were listed second most frequently (46%, n = 58). Participants also listed health care providers (36.7%, n = 44) and doctor (33.3%, n = 40), as their most trusted source of health information, with the internet (8.3%, n = 10) listed next as the most trusted source of health information. Many participants

qualified their responses for magazines as professional medical journals, and listed Medscape and MayoClinic.com as trusted internet sources.

The United States Department of Health and Human Services (USDHHS) conducted a study about sources of health care information most trusted by American's over ten years ago and did not specifically designate findings for rural populations (2000). This study reported that health information was sought from friends, family, co-workers, or health care professionals they knew, and few consulted, or trusted the internet for health related information (USDHH, 2000). However, Nichols, Sullivan, Ide, Shreffler-Grant, & Weinert (2005) found that physicians and nurse practitioners were the sources of health information most often used by older rural people which is consistent with this study.

Relationship Between Health Literacy about Vitamin

D and Perceived Access to Health Care Services: The relationship between

vitamin D health literacy and access to health care services was not found to be significant. Most of the respondents reported that it was easy to get in to see their health care provider (81.7%, n = 103). Many respondents who commented that it was easy, also reported they can be seen the same day they call for an appointment. There is a hospital and clinic located in the local community so proximity was also listed as why it was easy to access health care services. Some additional comments by participants included "specialists in [closest larger towns] are nearby"; "Emergencies to [closest city] are easy"; and "I can afford it, and have a reliable vehicle I can drive to [closest larger towns]".

Those respondents who indicated it was hard to get in to see a health care provider listed reasons including: long wait for annual /specialist appointments; no health insurance; rapid turnover of health care providers, “so can’t build a relationship with them”; hard to get to town with 2 small children; “I don’t drive and my doctor is 45 minutes away”, “weather and road conditions make travel and access to medical care difficult”.

The findings about why rural women find it easy or hard to access health care services are similar to the findings of Bushy (2004) who found that distance, isolation and access to health care services for rural people are a matter of perception and individualized. These results are also consistent with previous findings that distance, isolation and limited access to health care services may contribute to delays in rural women seeking treatment for health issues (Bushy, 2004; Henson, Sadler, & Walton, 1998; Lee, Hollis, & McClain, 1998; Long, 1993).

Relationship Between Vitamin D Health Literacy and Selected Factors

The relationship between health literacy about vitamin D and each of the following selected factors: race/ethnicity, age, income, education, and presence of significant health issues, was examined. There were no significant findings for these factors. The findings of no significance support Cutilli’s review (2007) who found that health literacy level does not correlate directly with years of education completed when the TOHFLA or REALM health literacy tests were used to determine health literacy

level. However, research shows that higher education does increase the odds of having adequate health literacy when only elderly participants were evaluated (Cutilli, 2007).

The NAAL health literacy study reported that adults that did not graduate from high school were more likely to score in the below basic health literacy range as compared to 15% in the general population (NAAL, 2006). This finding suggests that lack of a high school education may be a useful determinant of low health literacy level but was not supported by the findings in this study. Respondents who scored in the low vitamin D health literacy range had education levels that included all education selections included on in the survey, except doctorate.

This study used yearly total income as an indicator for economic status. The use of socioeconomic markers such as car ownership, food assistance, and blue-collar work, however, may have been more useful determinants of socioeconomic status than income alone when measuring relationships between health literacy and socioeconomic status according to research reviewed by Cutilli (2007).

Relationship Between Vitamin D Health

Literacy and Self-Efficacy for Health Promotion: The relationship between health literacy about vitamin D and self-efficacy for health promotion was found to be significant. This finding is consistent with the WHO (2010) definition of health literacy as meaning more than being able to read pamphlets and successfully make appointments.

Health literacy is enhanced by improving people's access to health information and their capacity to use it effectively (WHO, 2010). In this way, empowerment and

action are critical for the expression of health literacy (Speros, 2005; WHO, 2010).

Empowerment and action for the expression of health literacy can be influenced by self-efficacy for health promotion (Speros, 2005; Pedula, 2006).

According to Padula (2006), self-efficacy is one of the concepts that is most predictive of health promotion. Folta et al. (2009) found that strategies for improving self-efficacy were successful at reducing CVD risk in rural sedentary, overweight, and obese women. The relationship between the concept of self-efficacy for health promotion and empowerment for the expression of health literacy may contribute to an explanation of the significant finding between health literacy about vitamin D and self-efficacy for health promotion.

Relationship Between Vitamin D Health

Literacy and Perceived Vitamin D Benefits: There were no significant

association found between health literacy about vitamin D and benefits to vitamin D.

This relationship was based on the participant's responses to survey question number 11,

“How important is it to have enough vitamin D in your body?”

Though the relationship between health literacy about vitamin D and perceived benefits to vitamin D, it is noteworthy that many respondents wrote in health reasons for taking vitamin D. This indicates that some respondents felt it was of benefit to them to take vitamin D for treatment of specific health conditions. These conditions included bone and joint health, history of breast cancer, multiple sclerosis, osteoporosis, gastrointestinal disease, pregnancy, low vitamin D blood level, fall prevention, and

depression. These written responses show that some participants in this study had prior knowledge about vitamin D, and perceived that vitamin D was beneficial for health promotion, disease prevention, and treatment of a health problem. The literature documenting the evidence based, and suggested but unsubstantiated research benefits of having adequate levels of vitamin D, supports the perceived benefits expressed by the participants.

Relationship Between Vitamin D Health

Literacy and Perceived Vitamin D Barriers: There were not enough responses to adequately measure associations between level of vitamin D health literacy and the selected factor vitamin D barriers. The response categories for barriers to vitamin D included (a) lack of sun, (b) no dietary vitamin D, (c) no vitamin D supplement, (d) no knowledge about vitamin D; and (e) presence of chronic illness, or health problem. These responses indicate that the rural women in this study had prior knowledge about barriers to vitamin D and support this study's result showing greater than 50% of the rural women participants had a moderate level of health literacy about vitamin D.

Study Limitations

Limitations for this study include the following: First, the study involved women in a northwestern rural setting of the United States, so the results may not pertain to women in other settings of the United States. Second, the results may not be applicable to rural men and rural children as only rural women respondents were included. Third, the number of

participants was limited. Fourth, self-administered surveys can be skewed by response bias. All of the limitations above may result in reduced validity of results and reduced potential to generalize the results to other populations.

Additional limitations include the lack of validity and reliability of the survey instrument used to derive the research results. The researcher, based on the literature, developed the vitamin D health literacy tool and self-efficacy for health promotion tool contained within the survey.

Implications for Research

Based on a small sample of 126 rural women in a northwestern region of the U.S., the relationship between vitamin D health literacy and self-efficacy for health promotion, was the only statistically significant finding in this study. Repeating all or parts of this study, using different population groups, a larger rural sample, and a larger geographic distribution, may yield results that would confirm or refute the result of the survey. Repeating this study with a contrasting urban educated female population may also yield interesting data for comparison.

Further research concerning self-efficacy for health promotion may add to a body of knowledge about health literacy. This study touched on the relationship between self-efficacy and health literacy for rural women, which supports the need for further research in this area.

Additional research using the tools developed for this study on health literacy about vitamin D and self-efficacy for health promotion is needed in order to establish

reliability and validity of the tools. One way to further evaluate these tools would be to repeat their use in larger studies with other rural and urban populations in varying geographic regions. Additionally, repeating this study's vitamin D health literacy scale in these ways, and then correlating scores with a standardized scale for health literacy (REALM, TOHFLA) would help establish reliability for this tool.

More research that is dedicated to establishing health issue specific health literacy tools, such as for vitamin D health literacy, that are comprehensive and easy to conduct in clinical settings is needed. This research could advance efforts to identify those with low health issue specific health literacy, who would need extra efforts by the provider to ensure accurate safe care for the patient.

A large majority of the respondents rated their health as “good”, “very good”, or “excellent”, but more than a third reported that they had at least one significant health problem. More research is needed to discover if this is similar of different from other populations and if unique rural circumstances are an influencing factor.

This study of rural women's health literacy about vitamin D using the HPM by Pender et al. (2002) as the theoretical framework will contribute to the literature about health literacy. More research is needed about rural women's health literacy that focuses on the unique circumstances of rural women, where and how they obtain health information, and how health information is interpreted and experienced. Research about the rural context within which information is interpreted will add to the knowledge about health education needs for rural women, with additional implications for the health of rural women, and others in their care.

Lastly, this study found that most respondents got health information from their primary care provider and trusted that source the most. Therefore, further studies on how to improve women's relationships with their primary health care providers have implications for improving health literacy.

Implications for Advanced Practice Nursing

The majority of the participants had a moderate health literacy level of vitamin D. The findings in this study indicate that rural women get health information from their primary care provider or doctor whom they also trust the most. Most of the participants in this study decided on their own to take vitamin D, and the dosages ranged from less than 400 IU daily to 50,000 IU twice weekly. Implications for advanced practice nursing therefore, includes recognizing the importance of a detailed medication history that includes the dosages of vitamin supplements.

The self-prescribed, wide variations in vitamin D dosing by participants in this study has implications for over and under treatment with vitamin D that could translate to adverse health consequences. A detailed supplement history could also provide an opportunity for nurses to educate about evidence based recommended daily intakes of vitamin D, appropriate vitamin D dosing for prevention of osteoporosis and falls, and appropriate vitamin D dosing for treatment of osteoporosis.

This study shows that many participants are taking a wide range of vitamin D dosages without the advice of a health care provider in order to treat health problems. Advanced practice nurses must stay current with the literature about vitamin D and rural

women in order to provide evidence based care. Evidence based research would guide the advanced practice nurse to evaluate the need for vitamin D serum testing in health and wellness screening according to the patients history and medical diagnoses.

Evaluating the health literacy of rural women is also important to ensure health education efforts are appropriate. Development of educational materials that are written at an appropriate level and are culturally appropriate for specific rural populations is another responsibility of the advanced practice nurse. These educational materials should be readily accessible in the medical office. Educational materials should also be distributed appropriately throughout the community, as this study showed that most participants who are taking vitamin D are doing so on their own, without the advice of their primary care provider.

Second to health care provider, newspapers and magazines were the next most popular choice chosen by the participants for getting health information. Advanced practice nurses can capitalize on this information and write articles about vitamin D for publication in the local newspaper and popular magazine publications.

Staying current with research on rural women's health literacy can support a foundation for the advanced practice nurse to develop rural specific, evidence-based interventions for improving rural women's health literacy about vitamin D. This study found a significant relationship between health literacy about vitamin D and self-efficacy for health promotion; therefore, nurses may increase successful health changes by developing specific health promotion programs that encourage self-efficacy.

Other concepts and techniques supported by the significant finding in this study between vitamin D health literacy and self-efficacy for health promotion as well as this study's participants' tendency to self-prescribe vitamin D, include Motivational Interviewing (MI) and the Transtheoretical Model for Change (Change Theory) (Duran, 2003; Prochaska, Norcross, & Diclemente, 1994). Advanced practice nurses can use MI and the Change Theory to assess and address issues such as vitamin D, that patient's feel are most important to them, as well as their readiness for health promotion (Duran, 2003). Concepts inherent to these models support a patient's autonomy and freedom of choice, as they know what change process may work best for them (Duran, 2003). They offer an avenue for health education, promote empowerment, and improve self-efficacy, all of which are implicated in successful behavior change, and supported by this study's significant association between health literacy about vitamin D and self-efficacy for health promotion (Duran, 2003).

Advanced practice nurses also have a responsibility to stay politically informed and advocate for patients regarding rural women's health literacy and vitamin D needs. Public policy about rural women's public health goals can benefit from the collective voice of advanced practice nurses as well as the continued support of research about rural women's health literacy about vitamin D.

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APPENDICES

APPENDIX A

SURVEY

**A SURVEY OF RURAL WOMEN’S OVERALL KNOWLEDGE AND USE OF
VITAMIN D**

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Please circle the best answer or fill in the blank when provided.

PART ONE: QUESTIONS ABOUT VITAMIN D

1. Do you, or do you not, get enough vitamin D? (**circle one**)

I DO NOT GET ENOUGH I DO GET ENOUGH

2. What allows you to get (**or**) What keeps you from getting enough vitamin D? (**fill in the blank**)

3. Do you take vitamin D? (**circle one**)

YES NO

4. How much vitamin D do you take? (**Fill in the blank**)

5. Did you decide on your own to take vitamin D or did your health care provider tell you to take vitamin D? (**Circle one**)

ON MY OWN HEALTH CARE PROVIDER

6. If you answered health care provider, are you taking the amount of vitamin D

you were told to take by your health care provider? **(Circle one)**

YES NO

7. Do you eat any foods that have vitamin D? **(circle one)**

YES NO

8. Why are you taking vitamin D **(circle one)**

- a) To prevent disease
- b) To promote health
- c) To treat a health problem
- d) Other (please list)

9. Where have you learned about vitamin D? **(circle all that apply)**

- a) From my health care provider
- b) I heard about it on the radio/TV
- c) I read about it in a newspaper/magazine
- d) I heard about it from my family
- e) I heard about it from my friend
- f) I read about it in a book
- g) I read about it in a pamphlet
- h) I read about it on the internet

10. Do you wear sunscreen when you are out in the sun? **(circle one)**

NEVER RARELY SOMETIMES FREQUENTLY ALWAYS

11. How important to you is having enough vitamin D in your body?

DON'T KNOW NOT IMPORTANT SOMEWHAT VERY EXTREMELY

PART TWO: Vitamin D Knowledge

Read each question, and circle T for True, or F for False

12. T F Vitamin D is made when sunlight hits your skin.
13. T F Vitamin D is not important for building strong bones.
14. T F Vitamin D may prevent heart disease and diabetes.
15. T F Sunscreen does not block the body's ability to make vitamin D.
16. T F Vitamin D deficiency is increasing in the United States.
17. T F Breast fed infants are at risk for low vitamin D, which can cause Rickets.
18. T F Low vitamin D in teens and young adults has no effect on having weak bones (osteoporosis) in later years.
19. T F Vitamin D may play a role in the prevention of colon, prostate and breast cancers.
20. T F The use of vitamin D supplements is beneficial in lowering death rates from any cause.
21. T F Twenty minutes of sun exposure on the face, arms, and hands in the middle of the day without sunscreen provides enough vitamin D.
22. T F Recommended daily amounts of vitamin D was recently increased to 600 IU daily for adults 51-70 years of age; and 800 IU daily for adults > 70 years of age.
23. T F Taking 4,000 IU of vitamin D supplements over long periods of time can cause side effects.

PART THREE: QUESTIONS RELATING TO YOUR HEALTH

24. How would you describe your behavior about your health? (**circle all that apply**)

- a) Only I am responsible for my health.
- b) My health is the responsibility of other people such as my health care provider.
- c) I am healthy because of what I do to take care of myself.
- d) I can keep myself from getting sick by taking good care of myself.
- e) If I took better care of myself, I would avoid getting sick.
- f) I don't do much to take care of my health.
- g) I am unable to take care of my health because I am unable to get medical care.
- h) Because I am unable to get medical care, I try to take good care of my health.
- i) Taking care of my health is not that important to me.
- j) Many things in my life interfere with taking good care of my health.
- k) My health is all up to chance

25. How would you rate your health? (**circle one**)

Poor Fair Good Very Good Excellent

26. Do you have any significant health problems? (**circle one**)

YES NO

27. If you answered yes, please list your top three significant health problems.

- 1) _____
- 2) _____
- 3) _____

28. If you see a health care provider, whom do you see most frequently for your

health care needs? (**circle all that apply**)

- a) Nurse Practitioner
- b) Physician Assistant
- c) Doctor
- d) Chiropractor
- e) Naturopath
- f) Other (please list)

29. How do you normally get your health care information? (**circle all that**

apply)

- a) health care provider
- b) family
- c) friends
- d) radio/TV
- e) newspapers/magazines
- f) books
- g) pamphlets
- h) internet
- i) other: _____

30. Which health information source(s) do you trust the most? (**please list**

top three)

- 1) _____
- 2) _____
- 3) _____

31. How easy or hard is it to get in to see a health care provider? (**circle one**)

Impossible Very Hard Hard Easy Very Easy

32. Please tell me briefly why you answered as you did to question #31.

PART FOUR: QUESTIONS RELATING TO YOU

33. How confident are you filling out medical forms?

EXTREMELY QUITE A BIT SOMEWHAT A LITTLE BIT NOT AT ALL

34. Are you a female? (**circle one**)

YES NO

35. What is your race/Ethnicity (**circle all that apply**)

- a) Caucasian/White
- b) American Indian
- c) Alaska Native
- d) African American
- e) Asian
- f) Hispanic/Latino
- g) Other (specify) _____

36. What is your age on your last birthday (**please list**)

37. When asked where you live, what town do you mention? (**please list**)

38. How many years have you lived in this area?

39. What is the highest level of education you have completed? **(circle one)**

- a) Less than High School
- b) GED
- c) High School
- d) Associate Degree
- e) Bachelors Degree
- f) Graduate Degree
- g) Doctorate

40. What is your marital status? **(circle one)**

- a) Single
- b) Married
- c) Widowed
- d) Separated/Divorced
- e) Common Law
- f) Living Together

41. How many people are in your household? **(circle one)**

- 1 2 3 4 5 6 7 Greater than 7

42. Are you employed? **(circle all that apply)**

- No Part Time Full Time More than one job

43. If you are employed, what do you do for work?

APPENDIX B

COVER LETTER



Dear adult female resident of the household,

My name is Jenny Larson, and I am a graduate nursing student at Montana State University College of Nursing. I am writing to ask you to participate in a study that is part of my requirements for my master's degree in nursing. The purpose of this study is to explore what rural women know and are doing about vitamin D. Your name was randomly selected from your community's telephone directory. Vitamin D is of interest to me as it is a readily available supplement that is taken in many different ways for many different reasons. The results of this study will help me understand what rural women think about vitamin D. This will be important information for nurse practitioner's as they care for rural women.

Enclosed is a survey that should be completed by a woman in this household who is 18 years or older. You must be female and age 18 or older to participate in this study. The survey includes questions **about you, your health, and knowledge about vitamin D**. It should take about 15 minutes to complete the survey. By completing this survey and mailing it back to me, you are agreeing to participate in this study.

Your participation in this study is entirely voluntary and you can decide to stop at any time. You don't have to answer any question you don't want to answer. Your responses will remain strictly confidential. Results will be reported as a group and no names will be used. No one will see your responses except my thesis committee chair, Jean Shreffler-Grant Ph.D, RN and me.

The potential benefit to you, is knowing that you have helped provide information about knowledge of vitamin D that can improve how nurse practitioners inform their rural women clients about vitamin D. The potential risk is the inconvenience of time it takes to complete the questionnaire.

If you are willing to participate in this study, please complete the enclosed survey and return it to me in the enclosed self-addressed envelope **within one week**. If you have questions or concerns about this study, please contact Jean Shreffler-Grant, or me, at any time. Our contact information is provided at the end of this letter. If you do not wish to participate, please disregard this letter, or return the blank survey in the envelope provided.

Thank you very much for helping me with my research on vitamin D!

Sincerely,

Jennifer Larson APRN
Researcher

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APPENDIX C

FLYER



**DON'T MISS THIS
OPPORTUNITY TO PARTICIPATE IN
VITAMIN D STUDY**

FEMALE PARTICIPANTS NEEDED

(you must be at least 18 years of age or older to participate)

ALL RESPONSES ARE CONFIDENTIAL

**I AM A GRADUATE NURSING STUDENT AT MONTANA STATE
UNIVERSITY AND THIS STUDY IS REQUIRED FOR MY MASTERS DEGREE**

**I WILL BE MAILING A VITAMIN D SURVEY TO RANDOMLY SELECTED
WOMEN OF PHILIPSBURG**

**PLEASE HELP ME LEARN WHAT RURAL WOMEN THINK ABOUT
VITAMIN D BY COMPLETING THE SURVEY AND RETURNING IT IN THE
ENCLOSED SELF ADDRESSED STAMPED ENVELOPE!**

**THANK YOU IN ADVANCE FOR HELPING ME LEARN MORE ABOUT
RURAL WOMEN AND VITAMIN D!**

JENNIFER LARSON MSU GRADUATE NURSING STUDENT

APPENDIX D

FACT SHEET

Vitamin D Fact Sheet: Do You Get Enough? (Nichols, 2007).

More than half the US population could be deficient in vitamin D! Do *you* get enough? The research on vitamin D is fascinating. Most (if not all) the cells in our body have vitamin D receptors. Vitamin D is not only important for bone health and muscle strength, but appears to be linked to our immune system, multiple sclerosis, both type 1 and type 2 diabetes, rheumatoid arthritis, heart disease and cancer.

The sun is the primary source of vitamin D, with fortified milk as the main food source. We used to think that was enough to handle our vitamin D needs – but we need more than we previously thought and many factors impact how much we actually get from the sun. I think it is a good idea for most people to supplement with vitamin D and make sure to eat foods naturally rich or fortified in vitamin D. Here is information about how and why to help you decide what is best for you:

How much do we need? The American Academy of Pediatrics (AAP) recommends that infants, from birth to age one, be supplemented with 400 IU of vitamin D daily. And, infants who are breast-fed, need to be supplemented with 400 IU of vitamin D daily to prevent the occurrence of rickets, as human milk does not satisfy an infants vitamin D requirements (2011). The Institute of Medicine (IOM) has recently updated the vitamin D daily requirements from 400IU to 600 IU daily for everyone ages 1-70 and 800 IU for adults 71 and older (2010). The upper level intake of vitamin D has also been increased from 2000 IU a day to 4000 IU a day (IOM, 2010). Very high levels of vitamin D, greater than 10,000 IU, can cause kidney and tissue damage, so high levels of vitamin D intake above this amount should not be taken for long periods of time (IOM, 2010). The International Osteoporosis Foundation (IOF) recommends 700-1000 IU vitamin D for fall prevention and also notes that greater than 400 IU, and up to 800 IU of daily vitamin D, reduces limb and hip fractures by 20% (2010). The preferred supplement form is vitamin D3 (cholecalciferol) as it is a more readily available biological form.

How do we get it? Age, skin color, weight, angle of the sun, sunscreen, and covering our skin, all impact how much vitamin D we are able to absorb. Some people really can rely on getting their needs met from the sun, but for most of us, supplementing will be a more reliable approach. You get some vitamin D in a multiple vitamin pill, and also in most calcium supplements. If you drink milk or soy milk on a regular basis you can add that in too. Add up the various dietary sources, and take additional supplementation to reach 600-1000 IU daily, depending on your age and health needs. Some of the more progressive advocates are even recommending up to 4,000 IU as a maintenance dose.

Why is vitamin D important? Vitamin D is really a hormone rather than a true vitamin. We have known for a long time that it is required for calcium absorption, bone growth and bone density. In fact, osteoporosis prevention starts with having adequate vitamin D and calcium in childhood and continues throughout our lives. Newer research is linking

vitamin D to muscle growth, immune function, inflammation and uncontrolled cell growth. For a long time researchers have noticed that winter is associated with more symptoms for Multiple Sclerosis and rheumatoid arthritis, and an increase in the diagnosis of cancer, diabetes and other autoimmune diseases. They now think it is related to getting less vitamin D from the sun in the winter. Getting less sun from too much time indoors is one factor, but living in higher latitudes (above the 42nd parallel) is also recognized as a factor for getting less sun for vitamin D synthesis.

Vitamin D stimulates muscle strength. When researchers gave vitamin D to older women, they saw an increase in protein synthesis, which means an increase in muscle growth and size. Older people with higher blood levels of vitamin D do better on tests that require muscle strength and balance. They can walk faster and have an easier time getting out of a chair and fall less (IOF, 2010).

Some studies show a relationship between vitamin D status and many of the immune diseases, like Multiple Sclerosis (MS), rheumatoid arthritis and type 1 diabetes. Vitamin D is thought to maintain the balance of types of cells in the immune response, limiting the excessive development of the factors leading to inflammation. It lowers MS risk, stimulates insulin production and protects against the autoimmune response of attacking your own body. Vitamin D also promotes healthy cardiovascular function and may play a role in the prevention of high blood pressure and heart disease. Vitamin D appears to make cancer cells less abnormal, less likely to multiply, and more likely to die. There is evidence that vitamin D may make cancer cells adhere to the tumor, which could keep them from branching out and becoming metastatic. Currently the Institute of Medicine is recommending more research be conducted to prove these relationships so recommendations can be made regarding vitamin D and if supplementation is important in the prevention of these diseases (IOM, 2010).

Why are so many of us deficient? Many things impact how much vitamin D we get from the sun:

Sun Exposure: If applied as directed, a sunscreen with an SPF of 15 or more can decrease vitamin D production by as much as 99%! The angle of the sun also makes a difference. Between the winter months of November through February, the sun's rays are not strong enough to produce pre-vitamin D above a latitude of 42 degrees North or 42 degrees South. Even during the summer months, the further away from the equator you go, the more sun exposure you need to make adequate vitamin D. In most latitudes, sun exposure for 15 to 20 minutes a day in summer, before applying sunscreen, is recommended for light skinned people. The more

skin that is exposed, the more opportunity for absorption and vitamin D synthesis.

Age: Older people often get less exposure to sun, and their ability to make vitamin

D from the sun decreases by 75% by the age of 70.

Skin Color: The darker your skin, the more difficult it is to produce vitamin D. It can take 5 to 10 times the amount of sun exposure for an individual with very dark skin to produce the same amount of pre-vitamin D compared to an individual with very light skin.

Pregnant Women and Children: Pregnant women, infants (especially those solely breast-fed) and children are at risk. The vitamin D status of an infant at birth is related to the vitamin D status of the mother. Supplementation improves vitamin D status, and as mentioned above, is recommended for breast-fed infants by the AAP (NIH, 2011).

Weight: Vitamin D is stored in the body's fat cells. In overweight people, that stored vitamin D may not be available for use even if adequate vitamin D is produced by the sun.

Testing for vitamin D: In the past, the normal range for blood levels of vitamin D was approximately 30 nmol/L. That amount has been lowered by the IOM to 20 nmol/L (2010). The IOF recommends a normal range of vitamin D levels to be 20-30 nmol/L (IOF, 2010). The National Institutes of Health (NIH) states that signs of toxicity (hypercalcemia) begin to appear at blood levels of 150 nmol/L (NIH, 2011). If you get your blood tested for vitamin D, be sure that the test is for 25-hydroxyvitamin D. While the standard recommended doses are listed above, the dose to correct a deficiency could be much higher until the desired blood level is reached.

Bottom Line: Are you convinced that vitamin D is important? Keep watching as the research on vitamin D continues and the recommendations get fine-tuned. Currently, the IOM does not recommend routine blood testing for vitamin D, unless you are in a high-risk group (IOM, 2010). If you are unsure if you are at risk for low vitamin D, discuss with your health care provider your risks for vitamin D deficiency and whether vitamin D testing is appropriate for you.

Selected Food Sources of Vitamin D:

Food	IUs per serving*	Percent DV**
Cod liver oil, 1 tablespoon	1,360	340
Salmon (sockeye), cooked, 3 ounces	794	199
Mushrooms that have been exposed to ultraviolet light to increase vitamin D, 3 ounces (not yet commonly available)	400	100
Mackerel, cooked, 3 ounces	388	97
Tuna fish, canned in water, drained, 3 ounces	154	39

Milk, nonfat, reduced fat, and whole, vitamin D-fortified, 1 cup	115-124	29-31
Orange juice fortified with vitamin D, 1 cup (check product labels, as amount of added vitamin D varies)	100	25
Yogurt, fortified with 20% of the DV for vitamin D, 6 ounces (more heavily fortified yogurts provide more of the DV)	80	20
Margarine, fortified, 1 tablespoon	60	15
Sardines, canned in oil, drained, 2 sardines	46	12
Liver, beef, cooked, 3.5 ounces	46	12
Ready-to-eat cereal, fortified with 10% of the DV for vitamin D, 0.75-1 cup (more heavily fortified cereals might provide more of the DV)	40	10
Egg, 1 whole (vitamin D is found in yolk)	25	6
Cheese, Swiss, 1 ounce	6	2

*IUs = International Units.

**DV = Daily Value. DVs were developed by the U.S. Food and Drug Administration to help consumers compare the nutrient contents of products within the context of a total diet. The DV for vitamin D is 400 IU for adults and children age 4 and older. Food labels, however, are not required to list vitamin D content unless a food has been fortified with this nutrient. Foods providing 20% or more of the DV are considered to be high sources of a nutrient.

Table of selected food sources obtained from the vitamin D fact sheet provided by the Office of Dietary Supplements (NIH, 2009).