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Educating Staff on the Benefits of Vitamin D Therapy for Multiple Sclerosis

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This is to certify that the doctoral study by

Cheniece Harris

has been found to be complete and satisfactory in all respects,
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Walden University
2020

Abstract

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MS, Walden University, 2013

BS, Oakland University, 2009

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

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Abstract

Clinical competency is an important factor when delivering care to those with chronic conditions such as multiple sclerosis. Vitamin D therapy through diet, supplements, and sunlight may decrease physical complications. The gap in practice this doctoral project addressed is the lack of education provided to healthcare professionals to promote the benefits of vitamin D. The project examined whether registered nurses who are provided education on the benefits of vitamin D therapy can apply the knowledge into the plan of care for patients with MS within 6 months versus those provided no education. Paradigms and models that were used include the health belief model, and Rodgers' evolutionary theory. An extensive literature review was conducted to determine evidence-based best practices. A quantitative method design was used with a random sample of 108 participants. The Vitamin D Questionnaire was a 10-question pre-/posttest that assessed knowledge of sun exposure, dietary supplements, and nutrition. Using a *t* test and chi-square test, the extrapolated de-identified data showed an increase in scores when comparing the pre- (53.0%) and posttest (96.9%) scores, indicating a gap in knowledge. The *t* statistic showed a p value coefficient higher than 0.7 ($p = 0.135$), a variance of 0.0047 (posttest) and 0.032 (pretest). The chi-square test showed no association between gender and formal training. Recommendations include educating healthcare professionals on vitamin D and implementing standard guidelines for practice for clinicians. The potential implication for positive social change is decreasing the use of prescribed medication. Addressing this problem may decrease the expense of government-funded research costs and enhance the quality of life at the individual level.

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Dedication

I thank the Lord and Savior Jesus Christ, for whom I give all praise and worship. I dedicate this DNP project to every patient and caregiver who struggles with the complicated disease of Multiple Sclerosis (MS). I want to acknowledge Mr. and Mrs. Vito Lumetta specifically. We will fight MS one day at a time! Keep smiling.

To my parents Daniel and Leila Leonard, I thank you for the endless love and support that you have provided throughout this strenuous journey. Mom, to the many days that I required words of motivation, you refused to give up on me. Dan, you envisioned something in me that no one can take away and helped me to stay on track.

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Section 1: Nature of the Project

Introduction

Clinical competence is an important factor when delivering care to those with chronic conditions such as multiple sclerosis (MS). Due to the detrimental side effects of the condition and high cost of pharmaceutical drugs, some individuals do not live with an adequate quality of life. A low-cost complementary alternative modality such as vitamin D therapy through diet, nutritional supplements, and sun exposure may decrease some of the physical complications that are experienced. Through the translation of evidence to clinical practice, registered nurses can be educated on the benefit of vitamin D for patients with MS. The purpose of the project was to ensure that healthcare professionals have an adequate level of knowledge and can effectively communicate with patients regarding health behaviors that can enhance the well-being of individuals.

Problem Statement

The selected population health problem was the chronic condition of MS. As of 2018, data shows that approximately 2.3 million people are diagnosed with this condition (National Multiple Sclerosis Society, 2018). The goal of Healthy People 2020 is to improve health-related quality of life and well-being for all individuals (U.S. Department of Health and Human Service, 2019). MS is an ailment of the central nervous system (optic nerve, brain, spinal cord) that can trigger side effects in multiple areas of the body (National Multiple Sclerosis Society, 2018). Researchers consider it to be an autoimmune disorder, where the body recognizes cells to be foreign and ultimately destroys itself (National Multiple Sclerosis Society, 2018). The health population that was of concern in

this study is the incidence of MS in the Midwest. As of 2018, over 15,000 people have been identified with this debilitating disease in one of the states (University of Michigan Health System, 2018).

The issue being addressed was the lack of vitamin D consumption through diet, nutritional supplements, and sun exposure for patients with a diagnosis of MS (Bjørnevik et al., 2014). Research has shown that increased consumption of vitamin D can significantly decrease the rate of exacerbations and may prevent acquiring the disease if taken prenatally (Sintzel, Rametta & Reder, 2018). With proper staff education health professionals can incorporate this modality into the plan of care for patients with a diagnosis of MS in hopes to one day mitigate the condition.

Purpose of the Doctoral Project

The gap in practice this doctoral project addressed is the lack of education provided to registered nurses as well as other healthcare professionals to promote the benefits of vitamin D (see American Public Health Association, 2019). I sought to answer the following practice focused question:

> PFQ: Will registered nurses who are provided education on the benefits of vitamin D therapy apply the knowledge into the plan of care for patients with MS within 6 months versus those provided no education?

I utilized the PICOT format as a guiding framework to develop the question. This doctoral project has the potential to address the gap in practice because I will continue to provide education to more registered nurses in the future. As this information is obtained and communicated to the community, those with MS may begin new wellness behaviors.

Nature of the Doctoral Project

Using the Cumulative Index of Nursing and Allied Health Literature database, I retrieved peer-reviewed, evidence-based, articles published within the past 5 years that supported the implementation of vitamin D in reducing exacerbations of MS. I sought to obtain data that is current and relative to the diagnosis and implications of care related to MS via the National Center for Biotechnology Information. Data retrieval of this type delivers existing literature that provides supporting evidence regarding the rate and dissemination of disease (Friis & Sellers, 2014). Also, I retrieved information from the National Multiple Sclerosis Society website, which strives to educate patients on diagnosis, disease progression, new research initiatives, and new advances in medication. I followed procedural steps that modelled the Centers for Disease Control and Prevention (CDC, 2011) outline for a systematic approach to investigation.

The steps that I chose to follow were supported by the CDC and consisted of a six-step method. The progression from one step to another included: (a) engaging stakeholders, (b) describing the program, (c) focusing the evaluation design, (d) gathering credible evidence, (e) justifying conclusions, and (f) ensuring use and sharing lessons learned (CDC, 2011). Evaluation is the final step when conducting the evidence translation project and should be completed in a manner that ensures credibility and validity. The purpose of the doctoral project was to educate nurses on the benefits of vitamin D therapy so that they may apply the knowledge to the patients' plan of care. The anticipated findings were that the mean pretest scores would be significantly lower than the posttest results indicating that the education program had a positive impact. This

would advance clinical practice at the bedside, permitting the medical personnel to deliver superior, sound patient care, which would potentially enhance patient results. Registered nurses who take part in the project receive fundamental, scientifically-based information that will influence and assist them in providing individualized care to the patient with MS.

Significance of the Doctoral Project

The stakeholders who were involved in the project and had direct impact were the registered nurses and healthcare professionals who attended the educational training. Those who were providing direct care were the decision makers regarding whether the change would be adopted into practice. Patients with a diagnosis of MS are stakeholders because the information received is going to impact their daily lives. They may view lifestyle modification as an adverse effect and having a differing opinion can alter the study's credibility (CDC, 2011). In addition, I collaborated with the respective organization to communicate the goal and objectives to the leadership team. It was essential to ensure that the educational program was in alignment with the values and missions of both parties to obtain stakeholder buy-in.

Potential contributions of the doctoral project to nursing practice include this material as a module for registered nurses who are seeking to obtain their credentials as a certified multiple sclerosis registered nurse. In working directly with the MS population, a nurse with this specific specialty will gain fundamental knowledge of complementary alternative modalities outside of traditional treatment. Furthermore, collaboration with

multidisciplinary teams is beneficial when ensuring the delivery of safe and effective care.

There is a potential of transferability of the doctoral project to similar practice areas in medicine. This same project can be implemented with the education of medical residents who are completing their training on various units in the hospital setting. The information can be applied to populations such as individuals with MS and their caregivers but also women who are planning on becoming pregnant. Vitamin D therapy concepts are also relevant to the pediatric community, specifically with infants and toddlers. Further analysis may be completed to determine if vitamin D helps with other chronic autoimmune disorders.

One potential implication for positive social change is decreasing or eliminating the use of prescribed medication. A recent study discovered that the financial obligation of purchasing first generation disease-modifying medications for MS increased from $8,000 to $11,000 annually in the 1990s to roughly $60,000 per year as of 2015 (Hartung, Bourdette, Ahmed & Whitham, 2015). This cost does not include hospitalization, physical therapy, and in-home nursing services. Addressing this problem as a population will decrease the expense of government-funded research costs and enhance the quality of life at the individual level. According to Trisolini, Honeycutt, Wiener, and Lesesne (2014), various research studies have shown that chronic conditions such as MS inflict a significant cost on people, their relatives, and society. This is caused by a decrease in quality of life, indirect compared to direct expenses, and other unquantifiable factors.

This project supports the mission of Walden University to promote positive social change by ensuring that registered nurses, as well as other healthcare professionals, are providing low-cost treatment options that can significantly increase the quality of life for patients with MS. As social change agents, we must understand that the information that we provide impacts the future nurses' skills and knowledge and ultimately patient care. The Doctor of Nursing Practice (DNP) program prepares the graduate to apply relevant findings to develop practice guidelines and improve practice and the practice environment (American Association of Colleges of Nursing, 2006).

Summary

The DNP project was an effort to educate healthcare professionals who care for patients with MS on the benefits of vitamin D therapy. The overall goal from the staff perspective was to report that they are incorporating the knowledge into daily bedside care. The mission locally is to see a decrease in hospital admissions of MS exacerbations. Using an evidence-based literature review, the staff received education using teaching methods centered around adult learning. The next section provides detailed data on the nursing model and the roles of the project team.

Section 2: Background and Context

Introduction

As previously mentioned, the problem was the lack of information that healthcare providers who are caring for patients with MS had regarding the benefits of vitamin D. The role of nurses as social change agents is to provide vulnerable populations with the most up-to-date evidence-based care and knowledge to enhance and/or maintain their quality of life. I sought to answer the following question:

> PFQ: Will registered nurses who are provided education on the benefits of vitamin D therapy apply the knowledge into the plan of care for patients with MS within 6 months versus those provided no education?

This doctoral project had many benefits, but the primary purpose was to educate healthcare staff so that they may provide patients with an alternate holistic method to manage the disease process.

Concepts, Models, and Theories

Concepts, models, and theories that informed the doctoral project were centered on increasing the healthcare professionals' understanding of the advantages of vitamin D and empowering the staff to apply wellness-based interventions. The goal is that the project will result in the MS population reporting a decrease in symptoms and a greater quality of life.

A framework that was appropriate for this problem was the health belief model (HBM; see Appendix A). According to Hodges and Videto (2011), this model suggested that the likelihood of someone engaging in a recommended health action is based

predominantly on that individual's perceptions. The main concepts of the HBM are perceived susceptibility, perceived severity, perceived benefits, and perceived barriers (Hodges & Videto, 2011). If nurses who are caring for patients who are suffering from side-effects of MS are presented with the proper education and statistical data on the benefits of vitamin D consumption, their belief may trigger the implementation of health promotion tactics into the plan of care. I must obtain the feedback of the nurses based on their perception that the information presented is proven to be effective based on evidence.

Having a greater understanding of the beneficial effects of vitamin D, the model also proposed that cues motivate the nurse's actions or response to action (Sharafkhani, Khorsandi, Shamsi & Ranjbaran, 2016). With this project, the external factor for encouraging engagement was the educator who provided information to the healthcare professional. The HBM helped to direct the DNP project because participants were allowed to communicate and express variables that would deter their approval. Furthermore, individual relationships were built amongst the learners and instructor through discussion of shared experiences, prior knowledge, and belief patterns.

Patients with MS may present with varying levels of severity. When caring for them, knowing simple ways to reduce symptoms and enhance the quality of life is significant. I incorporated the concept of continuing education into the DNP project. Continuing education refers to any information or topic that is taught to the healthcare professional outside of their primary schooling. Rodgers' evolutionary theory (see Appendix B) was used as a foundation for the development of this teaching plan.

Rodgers' evolutionary concept analysis is a process of application and understanding of nursing science principles.

Through the analysis of various concepts, Rodgers' evolutionary theory (see Appendix B) identifies the meaning of how providing continuing education to others has antecedents, attributes, and consequences (Gallagher, 2007). These three factors all positively enhanced the professional development of nurses, improve patient care, incorporate the evidence-based practice, offer direction and goals for the patients' plan of care, and hone in on the critical thinking component (Gallagher, 2007). The constant acquisition of knowledge through continuing education is an obligation for health professionals, including nurses, who must maintain licensure. Furthermore, understanding the current practice of vitamin D therapy and its benefits maintains professional standards of practice.

In the field of nursing, the HBM has been applied to numerous articles. During a research literature review, I found information on the application of the HBM to determine whether patients with MS would adhere to their disease-modifying therapy. The study included 89 veterans with an MS diagnosis who were surveyed via telephone monthly for 6 months (Turner, Kivlahan, Sloan & Haselkorn, 2007). Data was collected via the Adherence Determinants Questionnaire and Barriers to Care Scale. Results showed adherence in this population of ongoing disease-modifying therapy users was relatively high; over 80% achieved 80% adherence at follow-up time points (Turner et al., 2007). With the use of the HBM, the researchers gained an understanding of psychosocial methods that sustain obedient actions.

The concepts of Rodgers' evolutionary method (see Appendix B) have been applied to subjects within the nursing field, such as cultural competence (Gallagher, 2007). With the growing demands of nurses caring for patients from different backgrounds, researchers identified a need for cultural competence training to facilitate individualized care. Data validated that nursing personnel, the population of college professors/instructors, and the undergraduate student population do not mirror the statistical demographics within the United States. In a previous study, a concept analysis identified 388 articles, of which 137 articles were selected for inclusion using a random table of numbers (Dudas, 2012). In all, 30 articles from nursing, representing 54.5 of the literature, and 30 articles from nursing education, representing 36.6 of the literature, were selected (Dudas, 2012). The results indicated various concepts related to cultural competence and the consistent need for nursing education. An anticipated outcome of attaining cultural competence is the eradication of healthcare inequalities through the provision of culturally congruent care (Dudas, 2012).

Terms that I used in the doctoral project that may have multiple meanings are the following:

Educator: An individual who is assigned by the organization that provides training.

Healthcare provider: The organization or individual rendering services, which included physicians and nurses.

Nurses: An individual who has received certification and licensure to practice nursing within a specific state; this included licensed practical nurses, registered nurses, and advanced practice nurses.

Staff education: Education provided to healthcare professionals who are employed at the organization. Other terms that were used include continuing education and professional development.

Vitamin D therapy: The acquisition of vitamin D through direct exposure from sunlight, dietary supplements, and nutritional intake.

Relevance to Nursing Practice

There are many sources of literature that support the use of vitamin D in the form of sunlight exposure, dietary intake, and vitamin supplements to decrease the physical ailments and exacerbations related to MS. In a study by Constantinescu, Hill, Magyari and Warnke, (2014), implementation of vitamin D at the early warning signs resulted in a reduction in the frequency of additional cerebral plaques by 57%, a decline of 57% with recurring exacerbations, and a 25% reduction of brain volume and lesions within 1 to 5 years. Although no definitive amount of vitamin D can be suggested, the data and author support the concept that this type of therapy should begin at the initial diagnosis of MS (Constantinescu et al., 2014).

Within the clinical setting, many healthcare professionals are reluctant to educate patients on the benefits of vitamin D and resort strictly to pharmaceutical modalities (Bowling, 2009). While researching, I found guidelines for controlling vitamin D deficiency for patients with MS. According to Bowling (2009), one implication for

clinical practice is to check the blood serum levels of the patient to determine deficiency. If the results indicate a problem (below 35–40 ng/mL), then physicians and nurse practitioners should recommend and encourage a diet enriched with vitamin D and supplements (Bowling, 2009). Furthermore, for individuals who reside in the United States, a suggestion for clinical practice is to prescribe 1,000 IU of vitamin D every day for laboratory values ranging from 20 and 35–40 ng/mL and 2,000 IU daily for numbers less than 20 ng/mL (Bowling, 2009).

Researchers have found that one of the main risk factors associated with MS is a lack of exposure to the sun and vitamin D deficiency. Increased laboratory values of vitamin D are linked to a diminished possibility for acquiring MS and with decreased incidence of relapse and decline in disease progression on brain MRI (Sintzel et al., 2018). Furthermore, foods enriched with vitamin D and sun exposure may lessen the chance of MS in the overall population (Sintzel et al., 2018). Studies have shown that fetuses of women supplemented before and throughout pregnancy have not acquired MS (Sintzel et al., 2018). In addition, female patients who had increased consumption of vitamin D (700 IU/day) via oral nutrition such as consumption of fish had a 33% lower occurrence of MS (Sintzel et al., 2018).

In a study in Norway and Italy, investigators found an association between sun exposure and the occurrence of MS. The results showed that less exposure to direct sunlight had a straight correlation with higher risk of MS. In a study performed in 2014, researchers found that in Norway, serum cholecalciferol laboratory values during the frigid months were 50% less than the levels during the warmer seasons and that 76% of

the study participants' were found to be vitamin D deficient (Bjørnevik et al., 2014). Furthermore, increased outdoor activity during the summer specifically during the toddler and teenage years was linked with minimal risk (Bjørnevik et al., 2014).

A second study validated that over a lifetime if there is little exposure to sunlight that the risk of acquiring MS is greater (Langer-Gould et al., 2018). In a five-year study, following 145 people with low exposure to sunlight, 69% of the participants' acquired MS and experienced 252 relapses (Simpson et al., 2018). The data in comparison to other studies refute the concept that vitamin D has an impact on disease progression (Langer-Gould et al., 2018). Lastly, individuals need to increase their exposure to sunlight by sitting outside, walking around outdoors, and having direct exposure for at least 15 minutes a day in the springtime, summer, and autumn (Day, 2013).

The evidence justifies that staff education is vital to the nursing profession because the MS population is suffering due to lack of proper education and knowledge of simple wellness behaviors that can have a significant impact on their quality of life (American Public Health Association, 2019). It is the role of the nurse to promote and empower clinical decision-making. Presenting information to the staff is a means of transitioning evidence-based practice to daily care.

Strategies and standard practice that has been used previously are focused on the patient care realm where researchers were implementing studies to determine if there was a significant benefit of vitamin D in the role of MS treatment. Dr. Ellen Mowry (2018) stated that since 2007, vitamin D had been a topic of discussion, but in 2010, there was consistent evidence showing the correlation between low serum levels and increased

demyelination via magnetic resonance imaging. Through research trials such as the VIDAMS (Vitamin D to Ameliorate MS), clinicians sought to find disease-modifying tactics for treatment. When reviewing the literature, there are no articles which address the gap in practice issue of lack of staff education.

The American Public Health Association (APHA) (2019) stated that it is imperative to foster clinicians and health educators to endorse enhanced vitamin D consumption among minority populations of all ages and other cultural groups. Furthermore, the APHA has an action item for the CDC, to be a social change agent and allocate money towards an evidence-based and theory-driven method to educating healthcare providers, about the science and advantages of sufficient amounts of vitamin D (American Public Health Association, 2019). The National Institutes of Health (2019) provides the Recommended Dietary Allowances (RDAs) for vitamin D for all age groups (see Appendix E).

The doctoral project advanced nursing practice by allowing the healthcare provider to partake in a professional development course where they left with knowledge that can be applied to any clinical, outpatient, and public setting. Nurses are able to autonomously deliver evidence-based care and educate individuals within the MS community. The project fulfilled the gap in practice by reaching out to organizations such as hospitals, clinics, and societies to educate nurses on the topic. The higher the number of people that received this information such as those who attended the session, the more potential we have to enhance the quality of life for others.

Local Background and Context

Research has shown that low vitamin D levels are a concern throughout the country and are linked to numerous medical conditions. Mercy Medical Center (2018), stated that 42% of individuals living in the United States have vitamin D deficiency. One of the primary ways that the human body absorbs this nutrient is through exposure to sunlight. In the state of Michigan, this is a concern because out of 365 days within a year, only 155 to 180 have sunshine. Locally, those who live in the city of Detroit have access to sun exposure, only 27% of the year (Miaschi, 2018). Nearly 5–30 minutes of direct sunlight from 10 a.m. to 3 p.m. biweekly to the face, bilateral upper extremities, bilateral lower extremities, or back lacking sunscreen usually lead to sufficient vitamin D synthesis (National Institutes of Health, 2019). With such inadequate access to the sun, those living in Michigan have an increased risk of developing MS compared to other cities and prolonged exacerbations. These alarming statistics supported the need for clinicians to educate their patients regarding alternate vitamin D modalities via supplements and diet.

The setting for the doctoral project was a facility that provides resources to patients with a diagnosis of MS and their families. There was direct patient care at the center and various other informative tools were obtained, such as healthy eating habits, exercise regimes, and incorporating mindfulness into daily practice. This facility supported professional education and provided programs which promote health and wellness behaviors. The setting was in a metropolitan area within the Midwest region and served thousands of people with various demographic backgrounds and socioeconomic

status. The regulatory environment was led by a national advisory council which consisted of presidents, chief medical and chief executive officers from hospitals across the United States of America. Medical directors from MS centers, as well as consulting firms and insurance companies, govern specific operations that the facility followed. The vision of the facility was to eradicate the chronic disease of MS. A mission the facility strived to uphold is enhancing the quality of life for patients with MS and restoring the mind, body, and spirit.

This project was accomplished in the identified setting where many healthcare professionals were employed who had direct access to individuals with the chronic condition. There were classrooms with smartboard access which accommodated those who decided to participate in the staff education project.

At the governmental level, there were collaborative efforts with the National Multiple Sclerosis Society to find pioneering ways to support and mend the lives of veterans. It is estimated that nearly 20,000 veterans with MS received care from the Veterans Health Administration (U.S. Department of Veterans Affairs, 2019). The U.S. Department of Veterans Affairs worked with the National Multiple Sclerosis Society to increase access to care, provide educational opportunities, self-efficacy, and promote healthy goals. With distributed resources and joined forces on educational and research initiatives, patients made sound decisions regarding care.

Role of the Doctor of Nursing Practice Student

As a registered nurse, I have been practicing bedside care for the last 10 years. I began working on a medical/surgical, neurological, stroke-certified, telemetry unit. On

this unit, I cared for patients with various neurological conditions which included MS. I had a passion for wanting to gain more experience, so I transferred to the hospital system float pool. In this capacity, I extended my critical thinking skills and knowledge to the step-down intensive care unit, clinical decision unit, medical/surgical, oncology, and adult rehabilitation.

While on the units, I found myself gravitating to nursing students and teaching hands-on clinical skills. In 2012, I was hired as a Visiting Instructor at a local university where I taught clinical, lecture, lab, and online courses for students in the following programs: licensed practical nurse, traditional Bachelor of Science in Nursing, and the Accelerated Second Degree in Nursing. I received my Master of Science in Nursing Education from Walden University. Since then, I have held the position of Director of Nursing for the licensed practical nurse and patient care technician program. Also, when there is free time, I am a legal nurse consultant for 2 attorneys.

I completed the DNP program at Walden University while teaching and working at the hospital. Concerning the doctoral project, I was the investigator and author of the manuscript. I was the lead project facilitator who communicated and collaborated with the facility where the staff education project was completed.

The role of the DNP graduate within this assignment was to assess, design, implement and evaluate the staff education project. As the investigator, I was responsible for ensuring that the information presented to the healthcare professionals was evidence-based and could be applied to nursing practice. I communicated with the collaborating institution and gained buy-in and support for the initiative. During the design phase,

materials such as flyers were distributed to recruit participants. The information was presented via powerpoint format, during the next step, I incorporated the data into a presentable platform. The participants included healthcare professionals, such as registered nurses. Since I am a nurse and a patient with MS, I had a precise understanding of the lack of knowledge and needs of this vulnerable population. As part of the practicum experience, I completed the remaining 400 hours at the institution working alongside the Chief Nursing Officer.

The motivation for this project stemmed from a personal nature. I was diagnosed with MS at the age of 21 but began having classic symptoms at 17. Throughout my journey as a patient, I experienced unpleasurable side effects. While in nursing school, I developed optic neuritis (inflammation of the optic nerve), in both eyes and lost total vision. After regaining my vision, the sequela was nystagmus (involuntary rapid eye muscle movement), which resulted in deficits with reading and driving. Years later, the condition progressed to flaccid paralysis of the bilateral upper and lower extremities. After multiple rounds of plasmapheresis, high dose steroids, and vigorous physical therapy, I gained admittance into a nursing home. Having to re-learn how to write and walk was a traumatic experience. Upon discharge, I was sent home with a polypharmacy treatment. The physicians expected me to take 40 pills a day plus 1 injection to maintain the symptoms of MS. I felt that this was poor quality of life and that there had to be another alternative. As a patient, many nurses were unable to answer my questions, which led to the research of vitamin D. Since then, I have weaned myself off the 40 pills. I

receive one infusion every 6 months and take vitamin D consistently. I have had 1 exacerbation in 8 years and do not require the use of any assistive devices for mobility.

During the care of patients with MS, I had come across numerous healthcare professionals who did not understand the impact of the disease and simple measures that can enhance a person's quality of life. I had watched patients receive inadequate care and little to no education upon discharge. After staff received education on the benefits of vitamin D, they incorporated this measure into the plan of care and discharge information. My personal story was not shared during the general open discussion to rid an impact on the participants. This health promotion initiative had a significant impact on the lives of others.

One perspective that may have affected the doctoral project is that I am pro-holistic medicine. I believe that traditional medicine is valid, but that its use is overabundant. I recognized this potential bias, and only included statistical, data-driven, evidence-based practice into the staff education project. My personal story was not shared during the general open discussion to rid an impact on the participants.

Summary

To address the gap in practice, the next section provided a detailed blueprint of the staff education project. Information included the method for participant recruitment, techniques for literature retrieval, how the evidence-based data supports the topic and evaluation procedures. Furthermore, an example of the measurement tools that were used to collect evidence was presented as an appendix.

Section 3: Collection and Analysis of Evidence

Introduction

By providing knowledge on the health benefits of increased consumption of vitamin D, the objective of the project was that healthcare professionals such as registered nurses will incorporate the information obtained into the plan of care for patients with MS. From a social impact perspective, more people may adopt the new health behavior and report decreased MS exacerbations, lower healthcare costs, and increased quality of life. As previously stated, individuals who live in the Midwest region are at an increased likelihood of developing MS compared to southern states due to the lack of exposure to the sun. Research showed that those who live in states farther from the equator have an increased risk of developing MS (see Appendix D).

In knowing this, I collaborated with a medical facility in the Midwest region to conduct the project. With such a lack of sun exposure to this specific population, it is important for nurses to educate members of society (American Public Health Association, 2019). Furthermore, the U.S. Department of Veteran Affairs worked with the National Multiple Sclerosis Society to provide adequate resources for veterans with MS (U.S. Department of Veterans Affairs, 2019). The facility where the evaluation was held is in a metropolitan Midwest region, where 2 organizations who provide services to veterans are located. By partnering with veterans, healthcare professionals made every effort to reduce damage and expand the standards of healthcare.

Practice-Focused Question

The local problem was that in a sunshine deprived state in which I live, approximately 15,000 individuals have been diagnosed with MS. The quantity of people who are experiencing mild to severe side-effects is unknown. Moreover, the number of nurses who provided care to this vulnerable population and require information related to vitamin D treatment for MS is undetermined. The gap-in-practice is that outside of the education that is acquired in a basic nursing program, staff lack specific knowledge regarding vitamin D and its impact on MS exacerbations. I sought to answer the following question:

> PFQ: Will registered nurses who are provided education on the benefits of vitamin D therapy apply the knowledge into the plan of care for patients with MS within 6 months versus those provided no education?

In alignment with the practice-focused question and the American Association of Colleges of Nursing (2006) *Essentials,* I intend to publicize statistical results from evidence-based initiatives and studies to meet goals and objectives that promote health and wellness outcomes.

Sources of Evidence

The sources of evidence on which I relied to address the practice-focused question included articles retrieved from master journal databases that cover a multitude of disciplines and research topics. Furthermore, the evidenced-based archives included empirical studies supported by the American Nurses Association. This doctoral project addressed the lack of education provided to registered nurses as well as other healthcare

professionals to promote the benefits of vitamin D by disseminating the information found in the evidence. Collection and analysis of this evidence provided the appropriate way to address the practice-focused question by completing a systematic literature review, critical analysis, and synthesis of previous research on the topic. The assessment of such periodicals included the use of quantitative and qualitative methods for concept clustering.

Databases and search engines that I used to find outcomes and research related to the practice problem included Science Citation Index, Medline, the National Center for Biotechnology Information, the Cumulative Index of Nursing and Allied Health Literature and EBSCOhost. I utilized the following key search terms: *vitamin D, vitamin D therapy, vitamin D deficiency, MS, multiple sclerosis, sunshine, sun exposure, diet, vitamin D supplements, MS exacerbations, lack of knowledge, nurses,* and *education*. Furthermore, a combination of words yielded greater results related to the practice problem. The total number of inquiries found with each grouping of terms were as follows: *vitamin D therapy + multiple sclerosis* (16), *sunshine + multiple sclerosis* (39), *sun exposure + MS* (60), *vitamin D supplements + MS* (39), *vitamin D + diet + MS* (78), *vitamin D + nursing + MS* (18), *vitamin D deficiency + multiple sclerosis* (59), and *education of nurses + multiple sclerosis* (12). In terms of years searched, the scope of this systematic review included empirical articles from 2009 to 2019. The type of literature searched included full text, peer-reviewed, scholarly journals, randomized controlled trials, pilot studies, and evidence-based practice. This search was exhaustive and comprehensive because there were specific inclusion and exclusion standards. The

inclusion criteria encompassed research that discussed the influence of sun exposure, vitamin D supplements, and diet related to the effects of MS. Moreover, I analyzed research papers that addressed the education of nurses, patient outcomes, and vitamin D deficiency. Studies that were omitted consisted of acute/chronic conditions other than MS, those which promoted pharmacological interventions, and articles that did not discuss the impact of vitamin D.

Individuals who contributed evidence to address the practice-focused question included registered nurses, physicians, physical therapists, and registered dietitians. The participants consisted of those of various ages, socioeconomic statuses, and ethnicities. A requirement was that they hold a degree in a healthcare field, which includes nursing, dietitians, managers, and physical therapists. I posted flyers and sent a general email to all staff regarding the graduate project. Attendance was voluntary, so there was no specific selection process. The only people who were excluded from attending the presentation were the MS patient population and their caregivers. This organization offers assistance at three locations where I delivered education. The participants were recruited at the established sites. The anticipated sample size was 60 people who would offer voluntary consent to partake in the study. Institutional Review Board (IRB) approval was needed at the site as well as that of the IRB at Walden. The participants were relevant to the practice-focused question because they deliver care and amenities to patients with MS. Over 2,500 MS patients per year received services from the facility. With having access and direct communication with their clients, healthcare professionals can educate those with MS on the benefits of vitamin D through evidence-based research.

A survey that I used to collect the evidence was the Vitamin D Questionnaire (VDQ; see Appendix C). This 10-question pre-/posttest assessed the healthcare professionals' knowledge regarding sun exposure, dietary supplements, and nutritional benefit of vitamin D for individuals with MS. Before the presentation, the volunteers were asked to complete the questionnaire, which included obtaining the following demographic data: gender, age, occupation, and highest degree obtained. The tool was split into Part I and II due to the various types of questions. I evaluated the same information once the presentation was over. The expected results after listening to the presentation were that the posttest scores would be higher than the pretest scores. I anticipated that the participants' answers would change based on the increase in knowledge. The VDQ asked the following:

- Have you ever received formal training about vitamin D and MS?
- As of 2018, how many people in Michigan have been diagnosed with MS?
- What is the recommended daily allowance (RDA) of vitamin D in the adult population for those with low serum levels?
- Does the RDA of vitamin D vary among gender?
- What is the minimum amount of direct sun exposure a person should receive per day to decrease the side effects of MS?
- The federal government's 2015-2020 Dietary Guidelines for Americans states that "Nutritional needs should be met primarily from foods."
- All the following are food sources of vitamin D, *except* ___.

- A vitamin D deficiency can occur when the usual intake is lower than recommended levels over time, exposure to sunlight is limited, or absorption of vitamin D from the digestive tract is inadequate.
- Do ethnicities with darker pigmented skin have a decreased ability to produce vitamin D from sunlight?
- The information from this training session will allow me to ___.

Permission was granted to me for use of valid and reliable data and figures from the National Institutes of Health (see Appendix F) within the VDQ. Furthermore, the Institute of Medicine, committee review board, and expert panel supported the information located in the figures (see Appendix E and Appendix G). To gain feedback and endorsement from an expert panel, I collaborated with Dr. Holka, DNP Adjunct Instructor, BSN Special Projects Coordinator at the university, and J. Butterfield, Chief Strategy and Nursing Officer at a Neurological clinic. Their opinions were integrated into the VDQ. I developed the questionnaire in correlation with the information presented in the PowerPoint. The material in the questions were obtained from scientific, evidence-based research to ensure validity and alignment with the constructs of the doctoral project.

Strategies that were used include true and false assessment and multiple-choice answer choices. The VDQ allowed for one correct answer choice via a paper/pencil evaluation, where the overall score determined an increase in cognitive ability. Furthermore, the de-identified data from the VDQ was analyzed using a computer software application by the name of NVivo. NVivo is a statistical, exploration, computer

operations package created by QSR International. For those measuring numerical data, the program is intended for the analysis of small or large capacities. This type of technology permits entering quantitative (participant test scores), dichotomous (true/false answers), and qualitative data (participant responses to application of knowledge) into the network for evaluation (Andrew, Salamonson & Halcomb, 2008).

Procedures used to ensure the ethical protection of the participants' in the doctoral project included guaranteeing that the test was anonymous. A sign-in sheet was not allowed in the classroom, and volunteers were instructed not to write their names on the consent form or the questionnaire. Each test was assigned a correlated number and collected once complete. The answers were discussed in an open forum format to hide the identity of each participants' results. Data retention included placing the results in a locked cabinet behind a locked door where only I had access. The name of the collaborating organization was masked. Volunteers did not receive any incentive for completing the test. The consent process consisted of the participant reading the participant consent form and indicating approval to contribute by completing the first and second VDQ. A paragraph was included, which outlined the purpose of the project, risks, benefits, and the sharing of de-identified data. As a participant in the project, involvement was voluntary. The individual could have refused to participate before the study began, withdraw at any time, or skip questions/procedures that made them feel uncomfortable without penalty.

Walden University's IRB role is to protect the moral rights of the human subjects who participated in the project. Through analysis and evaluation, the IRB authorized me

to proceed with the project (Walden IRB approval number 12-19-19-0318247). All documents, including marketing materials, powerpoint, consent form, and VDQ, are maintained for a minimum of three years to comply with the Food and Drug Administration (FDA) regulations (Food and Drug Administration, 2019). Moreover, I obtained IRB approval from the organization.

Analysis and Synthesis

The system that was used to record the participants' answers pre- and posttest is the VDQ. Each form was identified via an alpha character. Tracking, organization, and analysis of the evidence consisted of exploring quantitative data via the NVivo software application. Using NVivo allowed me to assess surveys, place the responses into specific categories, and construct graphs for visual presentation. The VDQ individual surveys were uploaded to the NVivo software, and the information was placed in an Excel spreadsheet (see Appendix H). Pre- and post- de-identified data for each question of the VDQ was summarized through bar graphs and quantifiable tables. Transformation of knowledge about the number of people in the Midwest with MS, RDA of vitamin D, RDA among gender, amount of sun exposure, federal government guidelines, nutritional food sources, vitamin D deficiency, and the impact of individuals with darker pigmented skin was evaluated. The test scores prior to the presentation and following were analyzed. Also, the impact of the training session was recorded.

To assure the integrity of the evidence, I previewed the VDQ to safeguard that there were no identifiers on the document and that all questions were answered to mitigate missing information. The de-identified outlier data was stated in the report.

Analysis procedures used in the doctoral project to address the practice-focused question were a t-test and chi-square test. Parametric assessments such as the t-test analyzed data in search of substantial variances between the two separate groups (Gray, Grove & Sutherland, 2017).

First, I tabulated the mean for the pre- and posttest scores. Then, an analysis between the two assessments using a *t* test determined the significance. The *t* test allowed me to distinguish if the means/averages supported the hypothesis, and learning was achieved, or if there was no statistical correlation. When analyzing, the dichotomous true/false and yes/no answers were measured by coding and assigning a 1 or 0 using a chi-square test to calculate if binary groups of variables had an association. A straightforward narrative specified the percentage of participants' who received formal training and the application to nursing practice.

Summary

The evidenced-based project stemmed from the current research efforts of previous authors that had sought to determine whether vitamin D had an impact on the side-effects of MS. The information in the presentation drew from empirical data from various literature sources. The approach consisted of obtaining quantitative information from healthcare professionals at the facilities three locations. Tools such as NVivo and the *t* test were used to analyze the results of the VDQ to determine validity and relevance. The next section discussed the relevant findings outside of numerical results, for example, if staff had a transition in knowledge and if the highest degree obtained had an impact. Moreover, recommended solutions and practice guidelines for hospital

organizations and future studies were included along with the strengths and limitations of the project.

Section 4: Findings and Recommendations

Introduction

The local problem was that in the sunshine deprived state in which I live, approximately 15,000 individuals have a diagnosis of MS. The quantity of people who had experienced mild to severe side-effects was unknown. Moreover, the number of nurses who provided care to this vulnerable population and require information related to vitamin D treatment for MS patients was undetermined. The gap-in-practice was that outside of the education that is acquired in a basic nursing program, staff lacked specific knowledge regarding vitamin D and its impact on MS exacerbations. I sought to answer the following question:

> PFQ: Will registered nurses who are provided education on the benefits of vitamin D therapy apply the knowledge into the plan of care for patients with MS within 6 months versus those provided no education?

In alignment with the practice-focused question and the American Association of Colleges of Nursing (2006) *Essentials,* I intend to publicize statistical results from evidence-based initiatives and studies to meet goals and objectives that will promote health and wellness outcomes.

The sources of evidence on which I relied to address the practice-focused question included articles retrieved from master journal databases that covered a multitude of disciplines and research topics. Furthermore, the evidenced-based archives included empirical studies supported by the American Nurses Association. The doctoral project addressed the lack of education provided to registered nurses as well as other healthcare

professionals to promote the benefits of vitamin D by disseminating the information found in the evidence. Collection and analysis of this evidence provided the appropriate way to address the practice-focused question by completing a systematic literature review, critical analysis, and synthesis of previous research on the topic. The assessment of such periodicals included the use of quantitative and qualitative methods for concept clustering. Moreover, I analyzed research papers that addressed the education of nurses, patient outcomes, and vitamin D deficiency.

The anticipated sample size was 60 people. After the project, I had 108 random participants who offered voluntary consent to partake in and complete the project. The participants consisted of men and women of various ages, socioeconomic statuses, ethnicities, and levels of degree completion. Furthermore, the various healthcare occupations consisted of registered nurses, nurse practitioners, nurse educators, registered dietitians, and physical therapists who cared for patients with MS.

A survey that I used to collect the evidence was the VDQ (see Appendix C). This 10-question pre-/posttest assessed the healthcare professionals' knowledge regarding sun exposure, dietary supplements, and nutritional benefit of vitamin D for individuals with MS. Analysis procedures used in the doctoral project to address the practice-focused question were a *t* test and chi-square test.

Findings and Implications

The initial data collection process began with me entering the participant demographic information and answers to the VDQ into an Excel spreadsheet. Results such as highest degree obtained were assigned a numeric value ranging from 2 =

associate degree (AD) to 5 = DNP or doctor of philosophy (Ph.D.). All participants met the inclusion criteria of having a degree in a medical-related field. I recorded and assessed the pre- and posttest scores from the VDQ across all disciplines, including nursing, dietetics, and physical therapy. An Excel spreadsheet summarizes the information that I obtained from the VDQ for each participant (see Appendix K). The extrapolated data showed that there was a significant increase in scores when comparing the pre- and posttest scores, indicating a gap in knowledge at all educational levels and disciplines. Out of 108 participants, the average pretest score was 53.0% compared to the posttest mean of 96.9%. Based on the results of the *t* test, the two variables had a strong association when the Pearson correlation coefficient was higher than 0.7 ($p = 0.135$) with a variance of 0.0047 for the posttest and 0.032 for the pretest (see Appendix L).

Utilizing Pearson's chi-square test, I sought to determine whether there was a relationship between gender and formal training. While evaluating the numbers, men nor women who received formal training or lacked knowledge had a significant difference in the pre- and posttest scores. The *p*-value of 0.4408 showed no statistical relevance or impact on the study results (see Appendix N).

Other findings that resulted from the analysis and synthesis of the evidence that was collected were that there was no significant difference in the pretest among females (numerical value 1) versus males (numerical value 0). Both genders scored poorly on the VDQ before the educational in-service, indicating that one specific gender did not have more knowledge than the other. There were outliers where 7 females scored above 80% and 2 at 12.5% out of 108 total participants on the pretest (see Appendix M).

The final source of data that I deemed essential to note is that participants with terminal degrees, such as the DNP, did not score the highest on the pretest VDQ. The group that obtained the top scores were individuals who held a master's of science degree (see Appendix O). This may be attributed to the fact that some master's prepared nurses are employed in clinical practice as nurse practitioners and have knowledge of the benefits of vitamin D for patients with MS due to working directly with a physician.

An outcome that I did not anticipate was participants who reported that the information presented was not applicable to practice. Healthcare professionals, whether in a managerial role, social work, or education, encounter others from various disciplines who care for patients with MS and could benefit from this knowledge. The impact on the findings is that the outliers skewed the data. Furthermore, this perception of irrelevancy hindered some individuals from disseminating the material. Table 1 illustrates the participants' feelings towards being able to apply the knowledge to patient care.

Table 1

Question10: The Information From This Training Session Will Allow Me to?

	Apply the knowledge	Is irrelevant to practice	Change
Participants	105	3	-3

Whereas Table 1 depicts the application of information, the Table 2 shows the unforeseen low number of healthcare professionals who had not received formal training on the benefits of vitamin D for patients with MS. As MS is a specialty, it is possible that the general population of nurses, dietitians, and physical therapists would only acquire

this information if there were a personal connection through life experiences. Overall, those who received formal training had an average of 57.6% on the VDQ pretest. The results did not assist me in determining whether previous formal education was significant.

Table 2

Question 1: Have You Ever Received Formal Training About Vitamin D and Multiple Sclerosis?

	Yes	No	Change
Participants	13	95	-13

The inferences resulting from the findings in terms of individuals indicated that the hypothesis was correct, and there is a need to educate healthcare professionals on the benefits of vitamin D for patients with MS. The gap in knowledge was shown across multiple disciplines and various degree levels. Without proper knowledge, providers and educators cannot decrease the risk of people acquiring this chronic autoimmune disease. From a community standpoint, most participants felt that the information was applicable to practice. This increases the likelihood of what is considered the ripple effect, meaning that if a person perceives the information as being important, then they will disseminate it to others, causing a multiplication in the number of people who are aware. The more people incorporate this modality into their activities of daily living, the more the community or population of MS patients may report decreased symptoms or enhanced quality of life.

Presenting this information to the organization has impacted the administrative team and staff. Showing the prior gap in knowledge via the pretest and the importance of vitamin D, the chief nursing officer wants this information to be presented to the frontline staff and medical assistants. Ensuring that everyone is sending the same message to patients may impact adherence and compliance. When it comes to healthcare systems, delivering safe, efficient, quality care is vital. Having knowledgeable and competent staff is the hallmark of keeping a business viable. The future of the healthcare system or industry requires partnership and acceptance from stakeholders. Bridging the gap between staff education and patient collaboration, a more holistic approach or perspective versus only traditional medicine may arise.

As previously mentioned, a potential implication for positive social change is decreasing or eliminating the use of prescribed medication. A recent study discovered that the financial obligation of purchasing first generation disease-modifying medications for MS increased from $8,000 to $11,000 annually in the 1990s to roughly $60,000 per year as of 2015 (Hartung et al., 2015). This cost did not include hospitalization, physical therapy, and in-home nursing services. Addressing this problem as a population may decrease the expense of government-funded research costs and enhance the quality of life at the individual level. According to Trisolini et al. (2014), various research studies had shown that chronic conditions such as MS inflict a significant cost on people, their relatives, and society. This is caused by a decrease in quality of life, indirect compared to direct expenses, and other unquantifiable factors.

Recommendations

The proposed or recommended solutions that will potentially address the gap-in-practice, as informed by the findings discussed above include educating healthcare professionals on the benefits and importance of vitamin D for people with MS. Standard guidelines for practice for clinicians who are treating MS patients included augmenting with dietary vitamin D supplements whether or not the serum levels had been drawn and analyzed. According to Bowling (2009), the best practice is to draw serum levels ahead of time to determine if the patient is vitamin D deficient. As noted in the *Implications for Clinical Practice: A Clinical Bulletin From the Professional Resource Center of the National Multiple Sclerosis Society* (see Appendix I), the initial dose of treatment may vary depending on the individual's geographical location. Moreover, vitamin D3 supplements are preferred over vitamin D2 due to economic efficiency and a significant rise in blood levels.

A proposed secondary product that may guide the use of the original product in practice is the Patient Assessment Survey (see Appendix J). The document was developed collaboratively between the chief nursing officer at the organization and me. Experts in the neurological field approved the use of the form in clinical practice. This 9-question survey can aid the primary care physician and registered nurse in better understanding the lifestyle choices of the patient concerning sun exposure, foods fortified with vitamin D, the use of dietary supplements, and the adult-learning style that best meets their needs.

The recommended implementation and evaluation procedures that administrative decision-makers not involved in development and planning assigned and supervised included ensuring that information on vitamin D is being dispersed to patients by the staff. The managerial team deciphered and evaluated whether the resources were being used and handed out or merely sitting on a shelf. With the use of the patient assessment survey, the administrative team mandated that all nurses document in the electronic medical record the education that was received, materials used for education (explanation, demonstration, hand-outs), and the patient's understanding. For evaluation purposes, the clinical leader can complete chart audits to determine if compliance is being met. One of the goals and objectives for the organization is to have a 5% increase in vitamin D serum levels drawn to determine a deficiency. Implementation strategies consisted of the nurses and medical assistants stressing the importance of the lab value and the physician/patient relationship for better outcomes. Again, this can be evaluated through quarterly chart audits.

Strength and Limitations of the Project

The strengths of the project included that I have educated more individuals than the original sample size of 60 people. I provided information at all educational levels for registered nurses. Each registered nurse had various experiences and backgrounds in their career in nursing. After the educational in-service, the participants were provided the opportunity to openly discuss and ask questions relevant to the topic. Numerous people verbalized that they received information that had never been incorporated into their

formal education. I have now identified specific questions from a professional standpoint that can be further addressed through the process of research.

Limitations of the doctoral project included the number of male participants, which was a small sample size that impacted the results. I did not include licensed practical nurses into the project. This group of nurses still provides care to patients with MS, and their knowledge level should have been taken into consideration. Another drawback I experienced was trying to accommodate the day and night shift schedule to provide education to the healthcare team. During this time, the participants were engaged in holiday vacations and time-off, which made it challenging to present to larger groups.

Any future similar studies should include participants such as medical physicians, physician assistants, licensed practical nurses, medical assistants, and frontline staff who have direct contact and communication with patients with MS. It would be noteworthy to assess if physicians received formal education on this topic or if they are educated through personal research. Also, ancillary staff can reiterate information to the patient and should also receive training. The last recommendation is to provide three take-away messages for all staff to remember that can resonate with the general public.

Section 5: Dissemination Plan

The plan to disseminate this work to the institution experiencing the problem in practice is in the implementation and evaluation phase. The healthcare staff have received education on the benefits of vitamin D for patients with MS. Hand-outs and resources are now available for the team to disperse, which address additional questions that the patients may have. The plan is for the registered nurses to assess the client's knowledge level related to vitamin D and MS via an assessment survey (see Appendix J). Once a deficit has been identified, the registered nurse is to educate the individual based on their specific adult-learning style. This information is then documented in the electronic health record for consistent follow-up and appropriate referral services such as a registered dietitian.

Based on the nature of the product, the audience that is appropriate for the dissemination of the project would be all nurses, no matter their level of education. Nurses care for individuals with chronic conditions like MS in various settings such as hospitals, nursing homes, home healthcare, clinics, and within the community. Places that would also be suitable for the dissemination of information are community colleges and universities. The project results showed that there was a lack of education being provided in the nursing curricula ranging from the associates degree program to the DNP. Our goal as healthcare providers is to decrease the effects of chronic illnesses, but this can only be achieved through proper training. Another way to spread this information is by creating and presenting a poster at the Consortium of Multiple Sclerosis Centers conference. This annual meeting hosts over 2,300 medical experts and covers topics such as how to talk to

patients about their nutritional health and the importance of assessing nutritional health in patients with MS, which are both related to vitamin D. There are also opportunities through the Consortium of Multiple Sclerosis Centers to provide continuing education to those who offer support to this vulnerable population.

Analysis of Self

When I first began my journey of incorporating vitamin D into a daily regimen, I questioned why this wellness behavior was not mentioned 18 years ago when I started having symptoms of MS. Through reading articles and extensive research, my goal was to elicit a change in practice. When communicating with colleagues, I noticed that there was a significant lack of knowledge regarding symptom management and complementary alternative modalities. As a scholar, I find myself continuously subscribing to MS journals and attending seminars or conferences to stay abreast of the ever-evolving world of MS technology and treatment.

Being a nurse educator and practitioner, I consistently teach the general population, such as patients, friends, and family about the benefits of vitamin D for their health to reduce their chances of developing MS. From this experience, I had accepted an invitation to speak to the community support groups at the National Multiple Sclerosis Society. My goal is to also disseminate the information at the university during the graduate poster/abstract fair.

Overseeing, implementing, and evaluating this project as a manager has been a rewarding experience. I never anticipated working very closely with a registered dietitian and beginning the process of starting a support group at the organization. While

collaborating with the chief nursing officer, I had observed the nursing staff walk away discussing my project and how they learned so much information. Patients are now receiving teaching from the staff during their infusions, and my resources are located on the organization's patient portal. A long-term professional goal is to become an employee at the facility and help them to transition into a comprehensive care center. As a patient with MS and a practitioner, I understand and bring forth experience from both sides to enhance the population's overall well-being.

After the project, the only challenge that I experienced was trying to interpret the data accurately. Throughout the program term, I had 1 course at the beginning that briefly taught the basics of data analysis. I did not feel sufficiently competent to run an analysis check independently and correctly interpret Pearson's coefficient. I am currently an employee at a university, so I communicated with the mathematics department and met with a statistician who guided me through this process. I now understand the concept of validity and reliability because I am using it in current practice. I have gained a heightened awareness of the role of the DNP through intraprofessional collaboration while working as a team with other nursing prepared disciplines such as the nurse researcher, executive, and clinical nurse educators. According to Waxman and Maxworthy (2010), the best combination to nursing is for nurse scientists and clinicians to bridge the vast gap between evidence and implementation.

Summary

MS is a chronic autoimmune disease that impacts millions of patients and their caregivers emotionally, physically, and financially. Studies had shown that low cost

complementary alternative modalities such as vitamin D can reduce the side effects of MS, decrease the number of brain lesions found on scans, and help with cognitive issues such as depression. Healthcare professionals need to be educated on the benefits of vitamin D for patients with MS to address the gap in knowledge. Furthermore, this evidence should be implemented into the patient plan of care and disseminated into nursing curriculum.

References

American Association of Colleges of Nursing (2006). *The essentials of doctoral education for advanced nursing practice.* Washington, DC: Author. Retrieved from http://www.aacn.nche.edu/DNP/pdf/Essentials.pdf

American Public Health Association. (2019). Call for education and research into vitamin D deficiency/insufficiency. Retrieved from https://www.apha.org/policies-and-advocacy/public-health-policy-statements/policy-database/2014/07/07/18/10/call-for-education-and-research-into-vitamin-d-deficiency-insufficiency

Andrew, S., Salamonson, Y., & Halcomb, E. J. (2008). Integrating mixed methods data analysis using NVivo: An example examining attrition and persistence of nursing students. *International Journal of Multiple Research Approaches, 2*(1), 36–43. https://doi.org/10.5172/mra.455.2.1.36

Bjørnevik, K., Riise, T., Casetta, I., Drulovic, J., Granieri, E., Holmøy, T., . . . Pugliatti, M. (2014). Sun exposure and multiple sclerosis risk in Norway and Italy: The EnvIMS study. *Multiple Sclerosis, 20*(8), 1042–1049. https://doi.org/10.1177/1352458513513968

Bowling, A. (2009) Vitamin D and MS: Implications for clinical practice. A clinical bulletin from the professional resource center of the National Multiple Sclerosis Society. Retrieved from https://www.nationalmssociety.org/Living-Well-With-MS/Diet-Exercise-Healthy-Behaviors/Diet-Nutrition

Butterfield, J. (2019). Patient Assessment Survey. *Neurological Clinic*. United States.

Centers for Disease Control and Prevention. (2011). A framework for program evaluation. Retrieved from https://www.cdc.gov/eval/framework/index.htm

Constantinescu, C., Hill, A., Magyari, M., & Warnke, C. (2014). Vitamin D as an early predictor of multiple sclerosis activity and progression. *Current Medical Literature: Multiple Sclerosis, 6*(1), 27–28

Day, J. (2013). Getting vitamin D during the dead of winter. Retrieved from the Intermountain Healthcare website: https://intermountainhealthcare.org/blogs/topics/heart/2013/01/getting-vitamin-d-during-the-dead-of-winter/

Dudas, K. (2012). Cultural Competence: An evolutionary concept analysis. *Nursing Education Perspectives, 33*(5), 317–321. https://doi.org/10.5480/1536-5026-33.5.317

Food and Drug Administration. (2019). Institutional review boards frequently asked questions. Retrieved from https://www.fda.gov/regulatory-information/search-fda-guidance-documents/institutional-review-boards-frequently-asked-questions.

Friis, R. H., & Sellers, T. (2014). *Epidemiology for Public Health Practice* (5th ed.). Sudbury, MA: Jones & Bartlett Learning.

Gallagher, L. (2007). Continuing education in nursing: A concept analysis. *Nurse Education Today, 27 5*, 466-473. https://doi.org/10.1016/j.nedt.2006.08.007

Gray, J.R., Grove, S.K., & Sutherland, S. (2017). *Burns and Grove's the practice of nursing research: Appraisal, synthesis, and generation of evidence* (8th ed.). St. Louis, MO: Saunders Elsevier.

Hartung, D. M., Bourdette, D. N., Ahmed, S. M., & Whitham, R. H. (2015). The cost of multiple sclerosis drugs in the U.S. and the pharmaceutical industry: Too big to fail? *Neurology, 84*(21), 2185–2192. http://doi.org/10.1212/WNL.0000000000001608

Hodges, B. C., & Videto, D. M. (2011). *Assessment and planning in health programs* (2nd ed.). Sudbury, MA: Jones & Bartlett Learning.

Langer-Gould, A., Lucas, R., Xiang, A. H., Chen, L. H., Wu, J., Gonzalez, E., . . . Barcellos, L. F. (2018). MS sunshine study: Sun exposure but not vitamin D is associated with multiple sclerosis risk in Blacks and Hispanics. *Nutrients, 10*(3). https://doi.org/10.3390/nu10030268

Mercy Medical Center. (2018). 42% Percent of Americans are vitamin D deficient. Are you among them? Retrieved from https://www.cantonmercy.org/healthchat/42-percent-of-americans-are-vitamin-d-deficient/

Miaschi, J. (2018). The cloudiest cities in the United States. Retrieved from https://www.worldatlas.com/articles/the-cloudiest-cities-in-the-united-states.html

Mowry, E. (2018). A deeper understanding of MS and vitamin D. *Physician Update Spring 2018.* Retrieved from https://www.hopkinsmedicine.org/news/articles/a-deeper-understanding-of-ms-and-vitamin-d.

National Institutes of Health, Office of Dietary Supplements. (2019). Vitamin D fact sheet for health professionals. Retrieved from https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/

National Multiple Sclerosis Society. (2018). Who gets MS? Retrieved from https://www.nationalmssociety.org/What-is-MS/Who-Gets-MS

Sharafkhani, N., Khorsandi, M., Shamsi, M., & Ranjbaran, M. (2016). The effect of an educational intervention program on the adoption of low back pain preventive behaviors in nurses: An application of the health belief model. *Global Spine Journal*, *6*(1), 29–34. https://doi.org/10.1055/s-0035-1555658

Simpson, S., Van der Mei, I., Lucas, R. M., Ponsonby, A.-L., Broadley, S., Blizzard, L., . . . Valery, P. (2018). Sun exposure across the life course significantly modulates early multiple sclerosis clinical course. *Frontiers in Neurology*, *9*. https://doi.org/10.3389/fneur.2018.00016

Sintzel, M. B., Rametta, M., & Reder, A. T. (2018). Vitamin D and multiple sclerosis: A comprehensive review. *Neurology & Therapy*, *7*(1), 59-85. https://doi.org/10.1007/s40120-017-0086-4

Trisolini, M., Honeycutt, A., Wiener, J., & Lesesne, S. (2014). Global economic impact of multiple sclerosis. *Multiple Sclerosis International Federation*. Retrieved from https://www.msif.org/wp-content/uploads/2014/09/ExecSummary_English.pdf

Turner, A. P., Kivlahan, D. R., Sloan, A. P., & Haselkorn, J. K. (2007). Predicting ongoing adherence to disease modifying therapies in multiple sclerosis: Utility of the health beliefs model. *Multiple Sclerosis, 13*(9), 1146–1152. https://doi.org/10.1177/1352458507078911

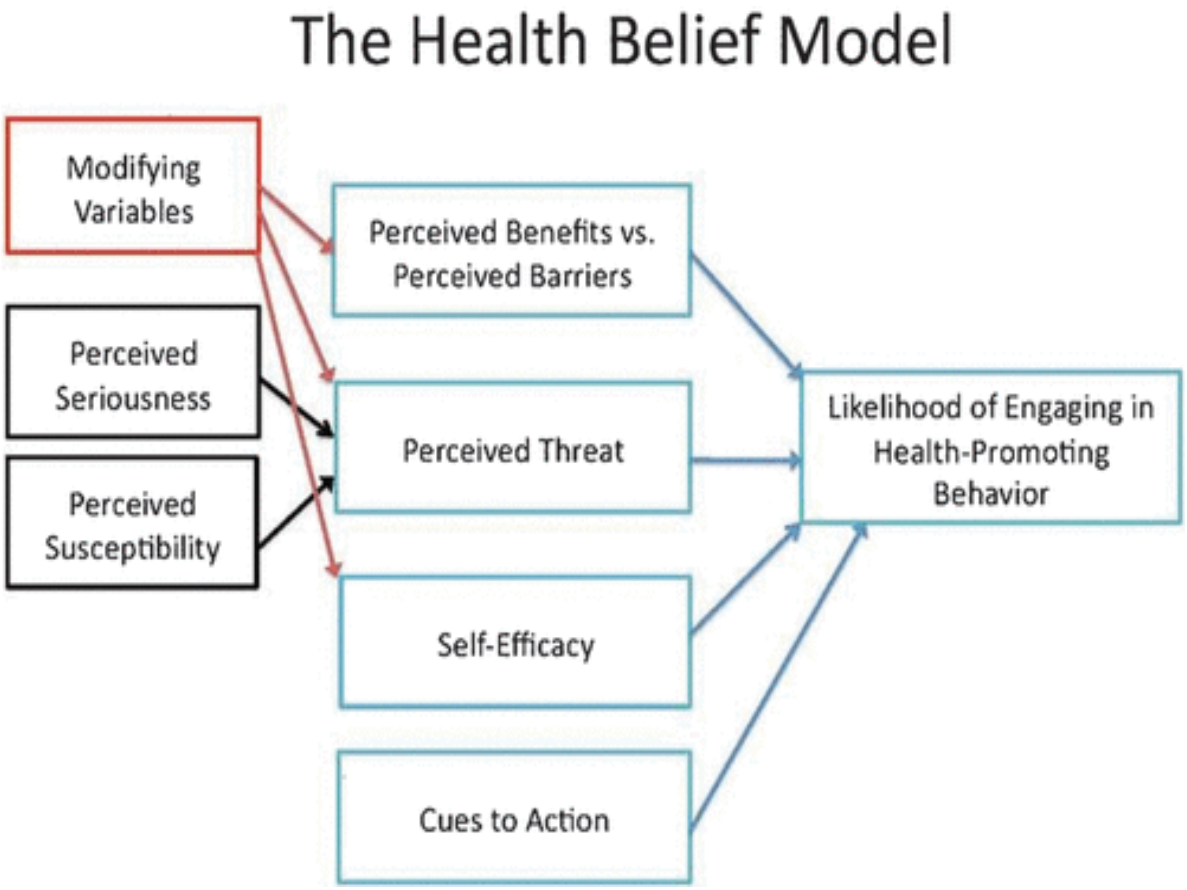
University of Michigan Health System. (2018). Multiple sclerosis–MidMichigan health. Retrieved from https://www.midmichigan.org/conditions-treatments/neuroscience/multiple-sclerosis

U.S. Department of Health and Human Service. (2019). *Healthy people 2020*. Washington, DC: Author. Retrieved from https://www.healthypeople.gov/2020/topics-objectives/topic/health-related-quality-of-life-well-being

U.S. Department of Veterans Affairs. (2019). VA and National Multiple Sclerosis Society join forces to enhance health care services for veterans. Office of Public and Intergovernmental Affairs. Retrieved from https://www.va.gov/opa/pressrel/pressrelease.cfm?id=5223

Waxman, K. T., & Maxworthy, J. (2010). The doctorate of nursing practice degree and the nurse executive: The perfect combination. *Nurse Leader, 8*(2), 31–33. https://doi.org/10.1016/j.mnl.2010.01.011

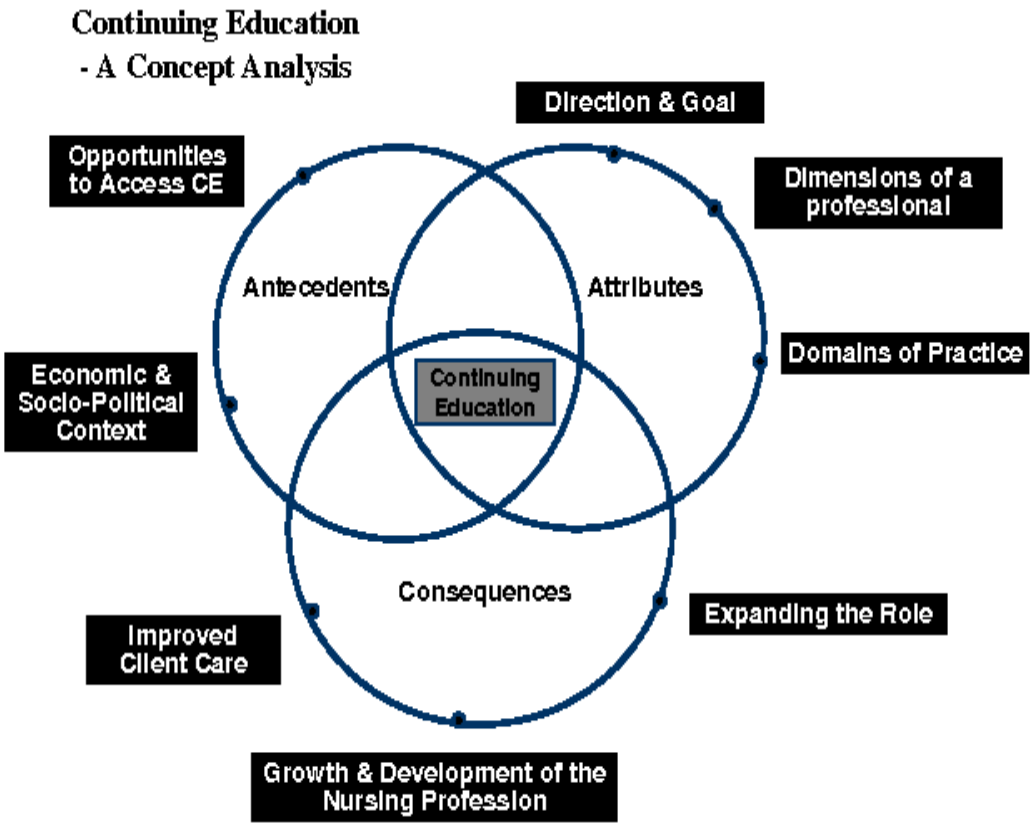
Appendix A: The Health Belief Model



Sharafkhani, Khorsandi, Shamsi. & Ranibaran, (2016).

This information is within the public domain at https://www.nlm.nih.gov/

Appendix B: Continuing Education—A Concept Analysis



Gallagher, (2007).
This information is within the public domain at https://www.nlm.nih.gov/

Appendix C: Vitamin D Questionnaire

Gender: Female Male **Age:**
Occupation: RN Physician Other
Highest degree obtained: Associate Baccalaureate Master Doctoral

Part One
Directions: Please circle T/F or yes/no for the questions below.

1) Have you ever received formal training about vitamin D and MS?
   a. Yes
   b. No

2) Does the RDA of vitamin D vary among gender?
   a. True
   b. False

3) The federal government's 2015-2020 Dietary Guidelines for Americans states that "Nutritional needs should be met primarily from foods."
   a. True
   b. False

4) A vitamin D deficiency can occur when the usual intake is lower than recommended levels over time, exposure to sunlight is limited, or absorption of vitamin D from the digestive tract is inadequate?
   a. True
   b. False

5) Do ethnicities with darker pigmented skin have a decreased ability to produce vitamin D from sunlight?
   a. True
   b. False

Part Two
Directions: Please circle the best response to the multiple-choice questions below. Only pick one answer.

6) As of 2018, how many people in Michigan have been diagnosed with (MS)?
   a. 8,000
   b. 15,000
   c. 30,000
   d. 50,000

7) What is the recommended daily allowance (RDA) of vitamin D in the adult population for those with low serum levels?
   a. 400 IU
   b. 800 IU
   c. 600 IU – 1,000 IU
   d. 1,000 IU – 2,000 IU

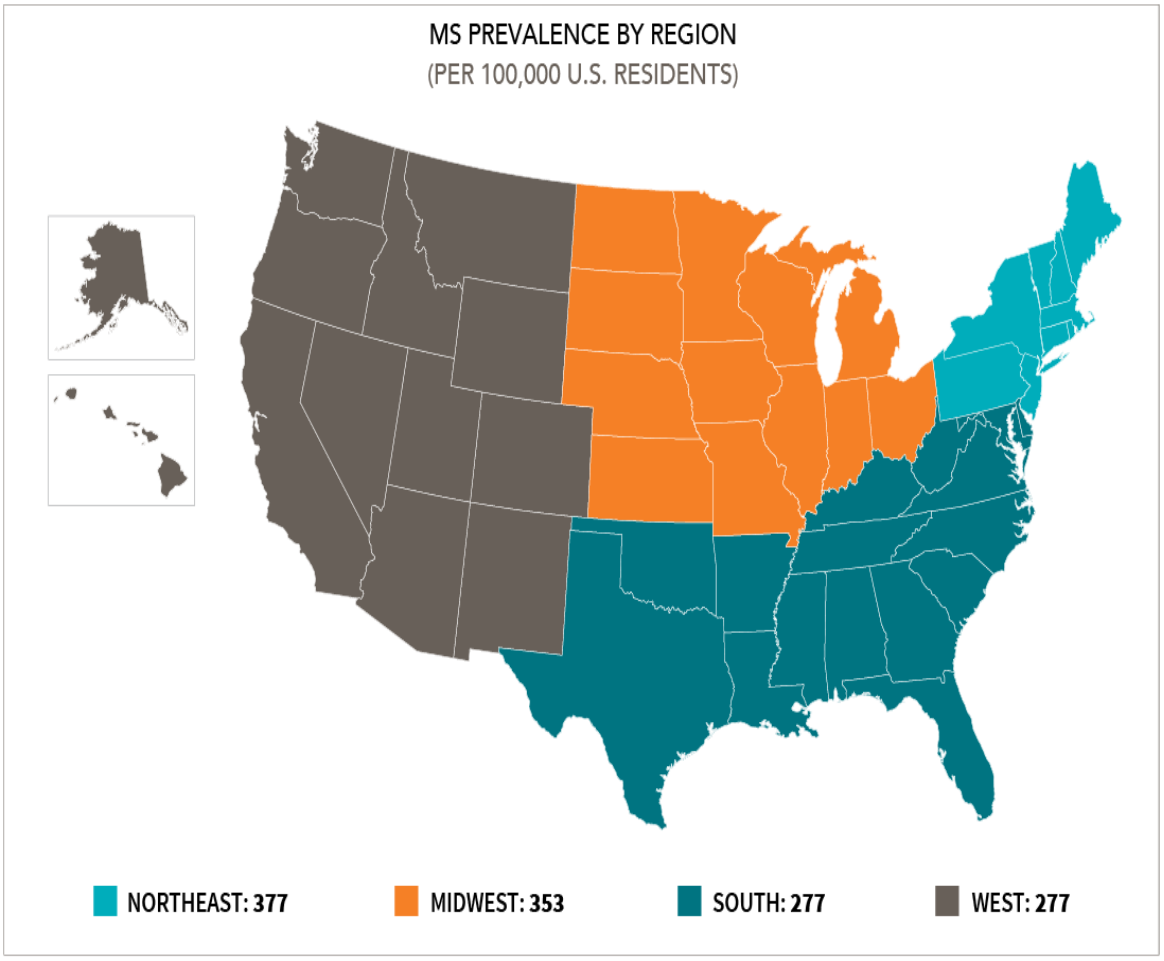
8) What is the minimum amount of direct sun exposure a person should receive per day to decrease the side effects of MS?
   a. 15 minutes
   b. 30 minutes
   c. 1 hour
   d. An individual does not require daily sun exposure.

9) All the following are food sources of vitamin D, *except*:
   a. Beets, carrots, tomatoes
   b. Milk, cereal, yogurt
   c. Liver, beef, fish
   d. Eggs, cheese, orange juice

10) The information from this training session will allow me to:
   a. Directly apply the knowledge to nursing practice.
   b. Improve patient outcomes.
   c. Educate patients with a diagnosis of multiple sclerosis (MS).
   d. All the above.
   e. The information was irrelevant.

Thank you for taking the time to complete this questionnaire.

Appendix D: Multiple Sclerosis Prevalence by Region



Source: Wallin, Mitchell T. "The prevalence of MS in the United States: A population-based estimate using health claims data." *Neurology*. February 2019. *Neurology Journal* Web. http://n.neurology.org/lookup/doi/10.1212/WNL.0000000000007035

Appendix E: Recommended Dietary Allowances for Vitamin D

Age	Male	Female	Pregnancy	Lactation
0–12 months*	400 IU (10 mcg)	400 IU (10 mcg)		
1–13 years	600 IU (15 mcg)	600 IU (15 mcg)		
14–18 years	600 IU (15 mcg)	600 IU (15 mcg)	600 IU (15 mcg)	600 IU (15 mcg)
19–50 years	600 IU (15 mcg)	600 IU (15 mcg)	600 IU (15 mcg)	600 IU (15 mcg)
51–70 years	600 IU (15 mcg)	600 IU (15 mcg)		
>70 years	800 IU (20 mcg)	800 IU (20 mcg)		

* Adequate Intake (AI)

National Institutes of Health. (2019). Vitamin D fact sheet for health professionals. Office of Dietary Supplements. Retrieved from https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/.

Appendix F: Permission to Use Information From Fact Sheets from the NIH Office of Dietary Supplements

October 15, 2019

Dear

Thank you for contacting the Office of Dietary Supplements (ODS) about using information from our vitamin D fact sheet https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/

As I mentioned when we talked, most of the material on our website, such as our vitamin D fact sheet (as well as our other dietary supplement fact sheets https://ods.od.nih.gov/factsheets/list-all/) is not copyrighted and is within the public domain. Therefore, you may freely use it, provided the content has not been changed or modified. So you may freely reproduce Table 1, Table 4, or other tables or text from our vitamin D fact sheet, we just ask that the material be appropriately referenced.

Thank you again for contacting us and for your interest in our website. Please let me know if you need any further assistance.

Sincerely,

XX
Scientific and Health Communications Consultant (Contractor)
Office of Dietary Supplements, NIH

Appendix G: Selected Food Sources of Vitamin D

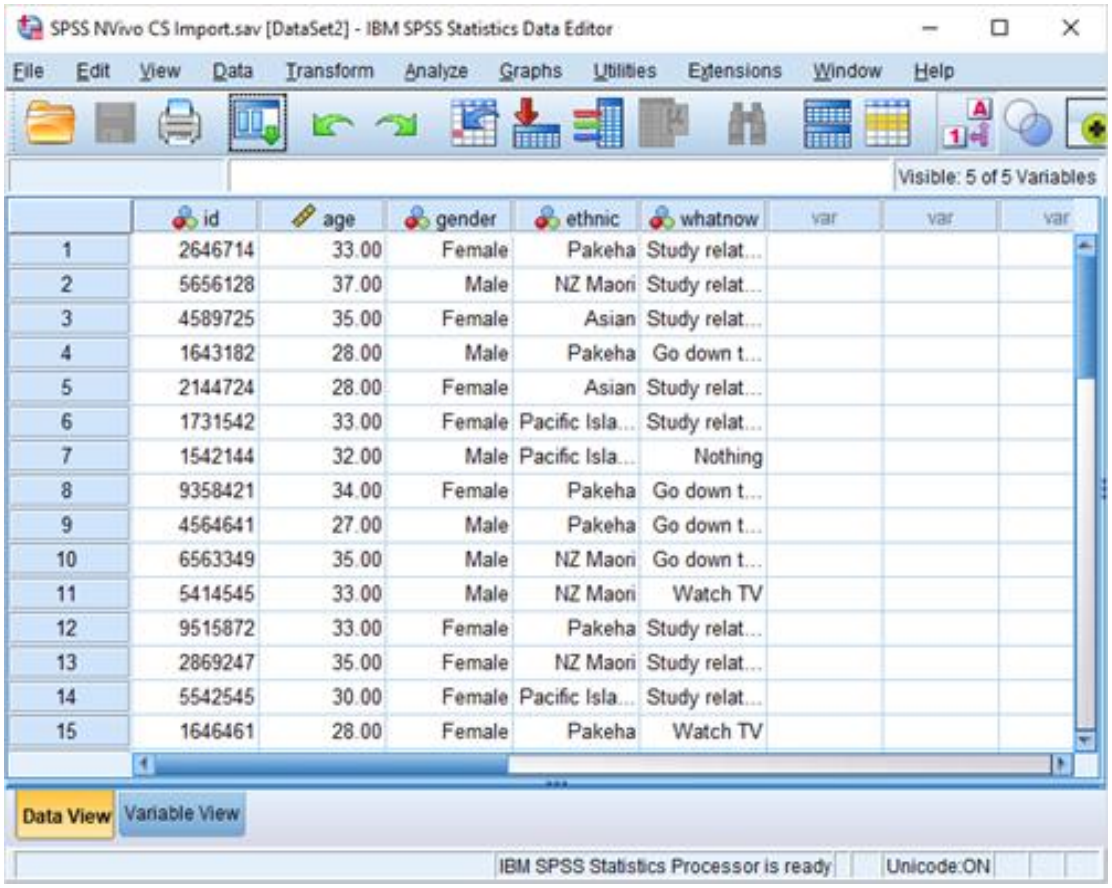
Food	IUs per serving*	Percent DV**
Cod liver oil, 1 tablespoon	1,360	340
Swordfish, cooked, 3 ounces	566	142
Salmon (sockeye), cooked, 3 ounces	447	112
Tuna fish, canned in water, drained, 3 ounces	154	39
Orange juice fortified with vitamin D, 1 cup (check product labels, as amount of added vitamin D varies)	137	34
Milk, nonfat, reduced fat, and whole, vitamin D-fortified, 1 cup	115-124	29-31
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 ounces	42	11
Egg, 1 large (vitamin D is found in yolk)	41	10
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
Cheese, Swiss, 1 ounce	6	2

* IUs = International Units.

** DV = Daily Value.

National Institutes of Health. (2019). Vitamin D fact sheet for health professionals. Office of Dietary Supplements. Retrieved from https://ods.od.nih.gov/factsheets/VitaminD-HealthProfessional/.

Appendix H: NVivo Spreadsheet



	id	age	gender	ethnic	whatnow	var	var	var
1	2646714	33.00	Female	Pakeha	Study relat...			
2	5656128	37.00	Male	NZ Maori	Study relat...			
3	4589725	35.00	Female	Asian	Study relat...			
4	1643182	28.00	Male	Pakeha	Go down t...			
5	2144724	28.00	Female	Asian	Study relat...			
6	1731542	33.00	Female	Pacific Isla...	Study relat...			
7	1542144	32.00	Male	Pacific Isla...	Nothing			
8	9358421	34.00	Female	Pakeha	Go down t...			
9	4564641	27.00	Male	Pakeha	Go down t...			
10	6563349	35.00	Male	NZ Maori	Go down t...			
11	5414545	33.00	Male	NZ Maori	Watch TV			
12	9515872	33.00	Female	Pakeha	Study relat...			
13	2869247	35.00	Female	NZ Maori	Study relat...			
14	5542545	30.00	Female	Pacific Isla...	Study relat...			
15	1646461	28.00	Female	Pakeha	Watch TV			

Appendix I: Vitamin D and MS: Implications for Clinical Practice

Allen C. Bowling, MD, PhD

What to Do in Clinical Practice?

Current research indicates that vitamin D may play an important role in MS. However, additional research needs to be done in this area. Specifically, there is a need for studies, especially large-scale clinical trials, to determine the exact effects of vitamin D supplementation on the disease process and the symptoms of MS. In the meantime, should clinicians check vitamin D levels or recommend vitamin D supplements? There are general strategies that may be used in clinical practice.

Supplement "Blindly" (recommend vitamin D supplements without checking vitamin D levels)

With this approach, vitamin D levels are not obtained but a modest dose of vitamin D, such as 1,000 IU daily, is recommended.

- Advantages: For those who are vitamin D-deficient, this approach may provide benefits for bone health as well as strength, general health and, possibly, MS. This approach avoids the inconvenience and cost ($50–200) of the blood test.
- Disadvantages: For those who are not vitamin D-deficient, this approach will result in unnecessary supplementation—this supplementation has associated inconvenience and cost. For those who have deficiency that is not corrected with the "blind" supplementation, there will be a false sense of security and they will, unknowingly, still be at risk for various vitamin D deficiency-related conditions.

Supplement if Blood Levels Are Low (check vitamin D levels and recommend vitamin D supplements if blood levels are low)

With this approach, blood levels of "25-hydroxyvitamin D" are obtained. If the level is normal, vitamin D supplements are not recommended. If the vitamin D level is low (below 35–40 ng/mL), then vitamin D supplements, as well as vitamin D-rich foods are. After supplementing for three to six months, the blood level is rechecked to be certain that it is in the normal range. It may then be reasonable to check blood levels on a yearly basis (Cannell and Hollis, 2008; Moyad, 2008). The optimal approaches for supplementing in the general population and in those with MS have not been established. General guidelines have been proposed (Cannell and Hollis, 2008; Holick, 2007; Moyad, 2008). The amount of supplementation that is needed varies between individual patients and depends on where one lives and the time of year. A general strategy that may be effective in many parts of the United States is 1,000 IU of vitamin D daily for levels between 20 and 35–40 ng/mL and 2,000 IU daily for levels below 20 ng/mL. In some regions, such as the Pacific Northwest, higher doses may be necessary: after initial treatment with 50,000 IU weekly for two months, maintenance dosing with 2,000–5,000

IU daily or 50,000 IU every two weeks may be needed. As noted, the official standards, which are controversial (Holick 2008; Moyad 2008; Ginde et al, 2009), state that the tolerable upper intake level (UL), which is the safe upper limit for regular use, is 2,000 IU daily for vitamin D. Vitamin D3 supplements, which are about the same price as vitamin D2 supplements, appear to be preferable because, relative to vitamin D2, vitamin D3 is more active biologically, raises blood levels more effectively, and is more stable on the shelf (Cannell and Hollis, 2008; Holick, 2007; Moyad, 2008). Calcium supplements are often taken with vitamin D. Daily doses of 1,000–1,200 mg of calcium is generally recommended (Jellin, 2009). Importantly, these strategies for diagnosing and treating vitamin D deficiency are "best guesses" based on current evidence. Ongoing research in this area may, in the future, lead to more formal protocols, changes in the "normal" blood level ranges for 25-hydroxyvitamin D, and changes in the recommended daily amounts and tolerable upper intake levels for vitamin D. In addition, further research may lead to MS-specific guidelines for optimal blood levels and supplementation strategies.

- Advantages: For those who are not vitamin D-deficient, this approach avoids unnecessary supplementation. For those who are found to be vitamin D-deficient, this strategy may improve bone health and, additionally, could increase muscle strength, slow the disease course of MS, and improve general health. Through prevention, this approach may avoid the costs of bone densitometry ($150–250) and osteoporosis medications ($50–100/month), and the costs ($6,000–25,000) and morbidity of bone fractures. This approach may also avoid the costs and adverse health effects associated with developing other vitamin D deficiency-associated diseases, such as other immune diseases and cancers.
- Disadvantages: This approach relies on vitamin D information that is not complete—as a result, it is conceivable, although very unlikely, that additional research will identify concerns about the safety or effectiveness of treating vitamin D deficiency in those with MS. Also, this strategy incurs costs for the blood test ($50–200), and, if indicated, vitamin D supplements ($3–6/month).

Clinicians who treat people with MS should become familiar with current vitamin D information so that they are able to educate their patients, and, if appropriate, diagnose and treat vitamin D deficiency. Also, due to the inherited risk of MS and the possible preventative effect of vitamin D supplementation, it may be reasonable for clinicians to discuss the possible implications of vitamin D deficiency and supplementation for the children of those with MS.

Appendix J: Patient Assessment Survey

Patient Assessment Survey

Directions: Please circle yes/no for the questions below.

1) Have you ever been told that you are vitamin D deficient?
   a. Yes
   b. No

2) Have you ever had your blood drawn for vitamin D levels?
   a. Yes
   b. No

3) Are you aware of the benefits of vitamin D related to Multiple Sclerosis (MS)?
   a. Yes
   b. No

4) Are you familiar with the three ways to obtain vitamin D?
   a. Yes
   b. No

5) Do you currently take a vitamin D supplement?
   a. Yes
   b. No

6) Are you familiar with foods that are rich in vitamin D?
   a. Yes
   b. No

7) Do you spend at least 15 minutes outside per day?
   a. Yes
   b. No

8) Have you ever considered speaking with a registered dietician?
   a. Yes
   b. No

9) How do you learn best?
   a. Seeing pictures
   b. Explanation
   c. Doing things hands-on

Appendix K: Excel Spreadsheet

Participant	Age	Gender	Occupation	Degree	Formal Training	Applicable to practice	Pre-test Score	Pre-test Mean	Post-test Score	Post-test Mean
A1	36	0	3	2	0	1	50.0%		100.0%	
A2	52	1	3	4	0	1	12.5%		100.0%	
A3	48	0	3	4	1	1	37.5%		100.0%	
A4	31	0	3	2	0	1	25.0%		100.0%	
A5	46	1	3	3	1	1	37.5%		100.0%	
B1	35	1	3	2	0	1	50.0%		100.0%	
B2	59	1	3	4	0	1	25.0%		87.5%	
B3	47	1	3	4	0	1	25.0%		87.5%	
B4	54	1	3	5	1	1	62.5%		100.0%	
B5	44	1	4	4	0	1	87.5%		100.0%	
B6	35	1	4	5	0	1	62.5%		87.5%	
B7	36	1	4	5	0	1	62.5%		100.0%	
B8	52	1	3	3	1	1	75.0%		100.0%	
B9	39	1	3	3	0	1	75.0%		100.0%	
B10	43	1	3	3	0	0	62.5%		87.5%	
B11	44	1	4	4	0	1	87.5%		87.5%	
B12	36	1	3	3	1	1	75.0%		87.5%	
B13	53	1	3	5	0	1	62.5%		100.0%	
B14	40	1	4	5	0	1	62.5%		100.0%	

(table continues)

Legend
0 = No /Male/Other
1 = Yes/Female
2 = ADN
3 = BSN/RN
4 = MSN/NP/NA
5 = DNP/PhD

Participant	Age	Gender	Occupation	Degree	Formal Training	Applicable to practice	Pre-test Score	Pre-test Mean	Post-test Score	Post-test Mean
B15	50	1	3	4	0	1	50.0%		87.5%	
B16	57	1	3	4	1	1	50.0%		75.0%	
B17	49	1	3	2	1	1	75.0%		100.0%	
B18	66	1	4	4	0	1	87.5%		100.0%	
B19	65	1	3	4	0	1	75.0%		87.5%	
B20	32	1	4	5	0	1	87.5%		100.0%	
B21	49	1	3	4	0	1	25.0%		100.0%	
B22	53	1	3	3	0	1	62.5%		100.0%	
B23	46	1	3	3	0	1	50.0%		100.0%	
B24	61	1	3	4	0	1	50.0%		100.0%	
B25	48	1	3	4	0	1	37.5%		100.0%	
B26	35	1	3	4	0	1	62.5%		100.0%	
B27	47	1	3	3	0	1	50.0%		87.5%	
B28	36	1	3	3	0	1	62.5%		87.5%	
B29	46	1	3	2	0	1	62.5%		100.0%	
B30	66	1	3	2	0	1	62.5%		100.0%	
B31	40	1	3	3	1	1	62.5%		100.0%	
B32	38	1	3	3	0	1	50.0%		87.5%	
B33	64	1	3	4	1	1	100.0%		100.0%	
B34	66	1	3	3	1	1	87.5%		100.0%	
B35	65	1	4	4	0	1	25.0%		87.5%	
B36	33	0	3	3	0	1	50.0%		100.0%	
B37	70	0	3	4	0	1	50.0%		87.5%	
B38	59	1	3	4	0	1	50.0%		100.0%	
B39	67	1	3	4	0	1	62.5%		100.0%	
B40	53	1	3	4	0	1	62.5%		100.0%	
B41	31	1	3	2	0	1	62.5%		100.0%	
B42	59	1	3	5	0	1	37.5%		100.0%	
B43	55	1	3	5	0	1	50.0%		100.0%	
B44	39	0	3	3	0	1	50.0%		87.5%	
B45	35	1	3	3	0	1	25.0%		100.0%	

(table continues)

Participant	Age	Gender	Occupation	Degree	Formal Training	Applicable to practice	Pre-test Score	Pre-test Mean	Post-test Score	Post-test Mean
C1	32	1	3	3	0	1	50.0%		100.0%	
C2	38	1	3	3	0	1	50.0%		100.0%	
C3	47	1	3	4	0	1	62.5%		100.0%	
C4	24	1	3	3	0	1	25.0%		100.0%	
C5	24	1	3	2	0	1	37.5%		100.0%	
C6	64	1	3	3	0	1	62.5%		100.0%	
C7	36	1	3	3	0	1	37.5%		87.5%	
C8	24	1	0	4	0	1	62.5%		100.0%	
D1	34	1	3	2	0	1	50.0%		100.0%	
D2	26	0	3	3	0	1	62.5%		100.0%	
D3	62	1	3	3	0	1	75.0%		100.0%	
D4	25	1	3	3	0	1	62.5%		100.0%	
D5	48	1	3	2	0	1	62.5%		75.0%	
D6	28	1	3	3	0	1	37.5%		75.0%	
D7	54	1	3	3	0	1	37.5%		100.0%	
D8	39	1	3	2	1	1	37.5%		100.0%	
D9	45	1	3	3	0	1	37.5%		100.0%	
D10	34	1	3	3	0	1	87.5%		100.0%	
D11	51	1	3	3	0	1	37.5%		100.0%	
D12	34	1	3	3	0	1	37.5%		100.0%	
D13	33	0	3	3	0	1	50.0%		100.0%	
D14	32	1	3	3	0	1	37.5%		100.0%	
D15	63	1	3	3	0	1	37.5%		100.0%	
D16	47	1	3	2	0	1	37.5%		100.0%	
D17	29	1	3	2	0	1	62.5%		100.0%	
D18	40	1	3	2	0	1	62.5%		100.0%	
D19	25	1	3	3	0	1	37.5%		100.0%	
D20	23	1	3	3	0	1	62.5%		100.0%	
D21	32	1	3	2	0	1	75.0%		100.0%	
D22	38	1	3	3	0	1	62.5%		100.0%	
D23	34	1	3	3	0	1	12.5%		62.5%	
D24	31	0	3	2	0	1	75.0%		100.0%	
D25	53	1	3	3	0	1	62.5%		100.0%	

(table continues)

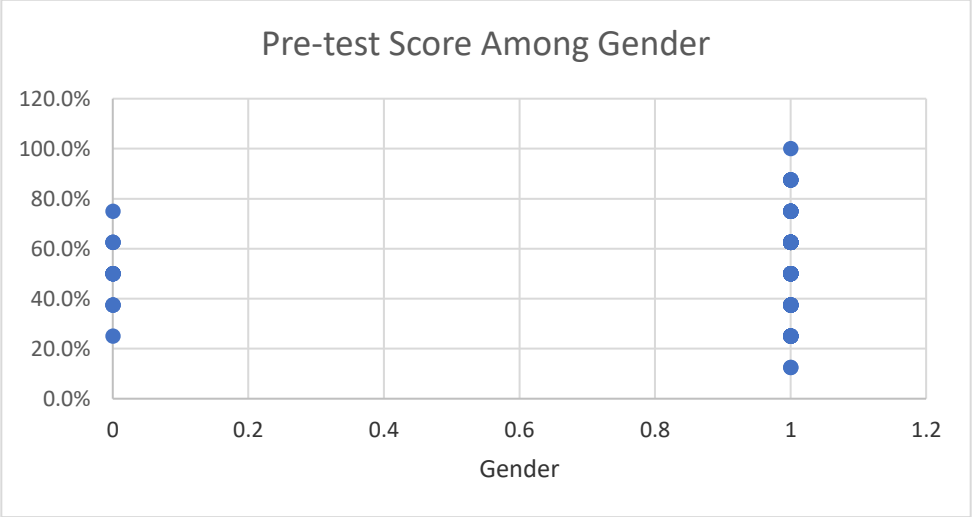
Participant	Age	Gender	Occupation	Degree	Formal Training	Applicable to practice	Pre-test Score	Pre-test Mean	Post-test Score	Post-test Mean
D26	45	1	3	2	0	1	62.5%		100.0%	
D27	37	1	3	2	0	1	50.0%		100.0%	
D28	39	0	3	2	0	1	37.5%		100.0%	
D29	37	1	3	3	0	1	75.0%		100.0%	
D30	29	0	3	3	0	1	62.5%		100.0%	
D31	32	0	3	3	0	1	62.5%		100.0%	
D32	48	0	3	3	0	1	50.0%		87.5%	
D33	26	0	3	3	0	1	37.5%		100.0%	
D34	23	1	3	3	0	1	50.0%		100.0%	
D35	26	1	3	3	0	0	62.5%		100.0%	
D36	22	1	3	3	0	1	25.0%		100.0%	
D37	48	1	3	4	1	1	25.0%		100.0%	
E1	60	1	3	3	1	1	25.0%		100.0%	
E2	60	1	3	2	0	1	25.0%		100.0%	
E3	42	1	3	2	0	1	62.5%		100.0%	
E4	66	0	3	4	0	1	50.0%		100.0%	
E5	58	1	0	3	0	1	62.5%		87.5%	
E6	52	1	0	3	0	1	37.5%		100.0%	
E7	50	1	0	4	0	1	62.5%		100.0%	
E8	52	1	3	3	0	0	75.0%		100.0%	
E9	51	0	0	3	0	1	50.0%		100.0%	
E10	34	1	3	2	0	1	50.0%		100.0%	
E11	50	1	0	4	0	1	50.0%		100.0%	
E12	47	1	3	2	0	1	50.0%		87.5%	
E13	56	1	3	3	0	1	25.0%		100.0%	
Totals	43.97	85.2%	3	3	12.04%	97%	53.0%	49.5%	96.9%	96.6%

Appendix L: *t*-Test: Paired Two Sample for Means

t-Test: Paired Two Sample for Means to show the program really increases the knowledge score

	Post-score	*Pre-score*
Mean	0.96875	0.530092593
Variance	0.004709404	0.032380365
Observations	108	108
Pearson Correlation	0.135991021	
Hypothesized Mean Difference	0	
df	107	
t Stat	24.82115207	
P(T<=t) one-tail	1.67704E-46	
t Critical one-tail	1.659219312	
P(T<=t) two-tail	3.35407E-46	
t Critical two-tail	1.98238337	

Appendix M: Pretest Score Among Gender



Numerical value 0 = Male

Numerical value 1 = Female

Appendix N: Comparison Among Gender and Training

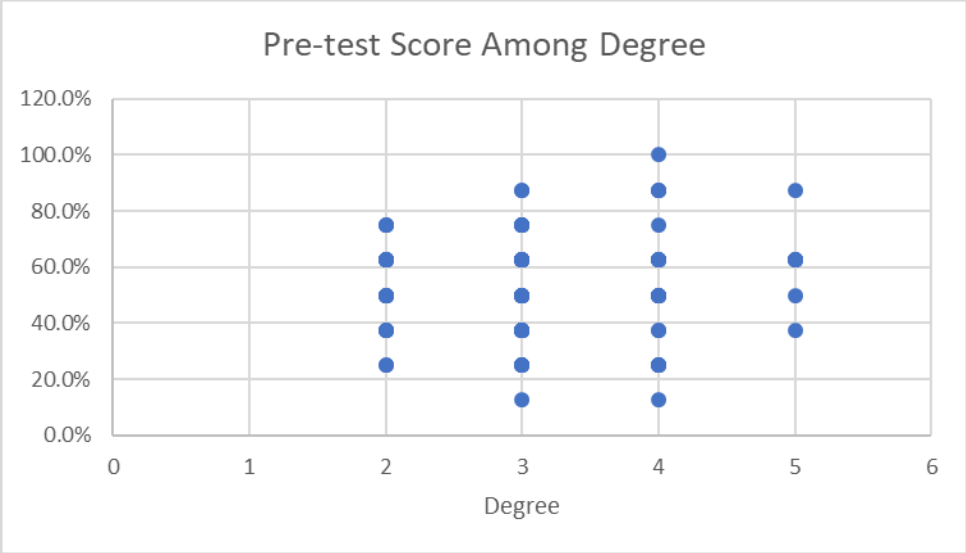
Gender	Formal training	No training
0	1	15
1	12	80

Numerical value 0 = Male

Numerical value 1 = Female

Pearson's Chi-squared test
data: M/F
X-squared = 0.59409, df = 1, p-value = 0.4408
This means whether individuals get trained or not has no association with gender

Appendix O: Pretest Score Among Degree



Numerical value 2 = Associate

Numerical value 3 = Baccalaureate

Numerical value 2 = Master

Numerical value 3 = Doctor