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# A Qualitative Review of Healthcare Provider Interventions on Osteoporosis-Related Care and the Improvement on Patient Outcomes

Cayla Roby

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# A QUALITATIVE REVIEW OF HEALTHCARE PROVIDER INTERVENTIONS ON OSTEOPOROSIS-RELATED CARE AND THE IMPROVEMENT ON PATIENT OUTCOMES

By

CAYLA D. ROBY

Completion Date: May 1, 2017

## ABSTRACT:

**INTRODUCTION:** The older adult population is one of the largest and fastest growing population segments within the United States. With this rise in the older adult population, healthcare systems should work to prevent and treat conditions that disproportionately affect the elderly. Of the many conditions that typically begin onset in older adulthood, osteoporosis is one of the most prevalent. As the number of older adults rise, so will the number of osteoporosis cases. The clinical outcomes of osteoporosis, such as fragility fractures, are associated with increased risk of death and an impaired quality of life and ability to interact with others socially. This qualitative review examines the reported effectiveness of healthcare provider interventions on osteoporosis patients.

**METHODS:** A qualitative review of peer-review articles was conducted. A total of 11 articles were included in this qualitative review. Pertinent information within each article was identified and compared. The intervention primary goals, inclusion criteria, state of assessment, nature of intervention, and results were all collected within this review. Study limitations were also noted to assist in future implications and research.

**RESULTS:** A large majority of the interventions utilized the role of nurses within the intervention to communicate with patients and initiate diagnosis or treatment within patients. Many of the interventions targeted older adults and utilized DXA as the assessment tool to assess bone mineral density. The literature is still inconclusive as to the most effective method to improving diagnosis or treatment of osteoporosis. There was no consistent pattern of positive improvement in osteoporosis management. Medication adherence was the most prominent challenge to patients involved in the interventions.

**Recommendations:** The interventions identified made strides to improving osteoporosis management by identifying the nurse's role as an influencing form of social support. However, there is the need to also ensure patients are not only referred for specialized care, bone mineral density tests or prescribed prescriptions, but that patients are adherent to osteoporosis medications. Healthcare providers should work to close all gaps in osteoporosis management including areas of improvement not only influencing the provider, but behavioral changes for the patient as well.

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APPROVAL PAGE

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## Author's Statement Page

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Cayla D. Roby

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## CHAPTER 1 INTRODUCTION

### **Background**

The older adult population is one of the fastest growing segments of the populations within the United States. With respect to other developed nations, the United States is projected to have one of the largest older adult populations with 83.7 million older adults by 2050 (Ortman, 2014). This is almost double the estimated population for 2012 of 43.1 million older adults (Ortman, 2014).

With this rise in the older adult population, healthcare systems should work to prevent and treat conditions that disproportionately affect the elderly. Of the many conditions that typically begin onset in older adulthood, osteoporosis is one of the most prevalent. As the number of older adults rise, so will the number of osteoporosis cases.

As a result of our ever increasing older adult population, the social and economic costs of osteoporosis is increasing steadily (Lane, 2006). Osteoporosis currently affects over than 10 million individuals in the United States and is projected to impact approximately 14 million lives by year 2020 (Lane, 2006). Osteoporosis has become a major public health concern, especially for older adult women (Bohaty, Rocole, Wehling, & Waltman, 2008). From a global view, approximately 200 million women have been diagnosed with osteoporosis worldwide (Lane, 2006). The Office of the Surgeon General estimates that the number of cases will double or even triple by year 2040 (Services, 2004). Osteoporosis has become the most common metabolic bone disease (Bohaty et al., 2008).

The clinical outcomes of osteoporosis, such as fragility fractures, are linked to a patient's increased risk of death and an impaired quality of life and ability to interact with others socially (Kastner, 2011). To better address the needs of older adults with osteoporosis, interventions have been developed to increase adherence to osteoporosis-related medication, to reduce risk of injury, and improve quality of life. This qualitative review examines the effectiveness of healthcare provider interventions on outcomes of osteoporosis patients. The following research questions are the basis for understanding the potential effectiveness of healthcare providers as a source of formal social support in osteoporosis-related care:

- Is there a positive impact of healthcare providers in closing the care gap in osteoporosis-related care?
- Can the nurse's role in particular be adapted to close the care gap in osteoporosis care and improve patient outcomes?

## CHAPTER 2 LITERATURE REVIEW

### **Overview of osteoporosis**

Osteoporosis is defined as a skeletal disorder that is characterized by an individual's compromised bone strength (Lane, 2006). Within a biological scope, osteoporosis is characterized as the demineralization of bones that occurs when resorption of bone is greater than the rate of buildup by the osteoblasts (Sedlak, Doheny, Estok, & Zeller, 2005). This in turn results in an increased risk of fragility fracture (Lane, 2006). There are a number of factors that are related to osteoporosis and bone formation including: gender and associated changes in the depletion of hormones, steroid use, and the aging process generally (Sedlak et al., 2005). In addition, lifestyle factors of dietary intake (calcium and vitamins), weight bearing and strengthening activities, and other behaviors such as smoking and excessive alcohol use affect an individual's likelihood to develop osteoporosis and risk of fragility fracture (Sedlak et al., 2005).

There is strong evidence within the literature that indicates early identification and treatment of osteoporosis is critical to prevent reoccurring fractures (Giles et al., 2011). Individuals with a medical history of having a clinical fracture are at an increased risk of having a subsequent fracture within a reasonably short period of time (Huntjens et al., 2011). With early treatment following the first fracture, recurrent fracture rates can be decreased between 30% and 60 % (Giles et al., 2011). Bisphosphonate therapy alone has been shown to reduce an individual's fracture risk anywhere from 50% to 70% (Giles et al., 2011). However, it is reported that less than 10% of patients that have been

diagnosed with osteoporosis are prescribed osteoporosis pharmacotherapy or any other form of bone strengthening therapy (Giles et al., 2011). A number of studies question if the nurse's involvement can be utilized as a form of social support through a number of interventions, especially those around clinical outcomes focusing on protocol.

### **Interventions on osteoporosis diagnosis and treatment**

Healthcare providers have faced some barriers to implementing osteoporosis guidelines. Barriers such as costs of patient's diagnosis and therapy, concerns many patients about medications, and some lack of clarity on which healthcare provider should be responsible for a patient's follow-up even after a fracture has occurred make successful implementation difficult (Huntjens et al., 2011).

Consequently, there have been some healthcare gaps between evidence-based best practices and the usual care for patients who are at high risk for fractures (Majumdar et al., 2011). In the United States and Canada, audits have reported rates of bone mineral density (BMD) testing or osteoporosis treatment of less than 10%-20% in the year following a fracture to the wrist, hip, or spine (Majumdar et al., 2011). To remedy this problem, a number of interventions have been created to improve the quality of care through enhancing delivery of primary and secondary prevention services. These interventions range from simple interventions such as letters to the patients primary care physician to more complex and costly interventions such as introducing population-wide clinical pathways or care coordinators (Majumdar et al., 2011).

## **Primary and Secondary Interventions**

The Surgeon General's guidelines suggest that fracture prevention programs be developed to reduce the annual number of fractures (Huntjens et al., 2011). Primary prevention intervention strategies target lifestyle changes, modifications to the home for fall prevention, and prescription drug treatment if appropriate (Huntjens et al., 2011). These interventions look to mitigate an individual's risk of experiencing a fragility fracture. These preventive measures can be adapted throughout the life course.

Lifestyle change strategies can be implemented early in an adult's life to ensure an individual does not develop osteoporosis later in older adulthood. Primary prevention encompasses the range of the lifestyle changes an individual can make to lessen the risk of developing osteoporosis (Sedlak et al., 2005). This form of prevention focuses on monitoring bone density through dietary patterns, exercise, and DXA testing. Dietary patterns include the individual's level of vitamin consumption through food choices and supplements. An increase in weight bearing and strengthening activities such as walking, jogging, dancing all assist in minimizing bone loss throughout the life course and assist in maintaining bone mass in older adulthood (Sedlak et al., 2005). Through DXA testing, post-menopausal women and men over the age of 50 are able to detect osteoporosis.

Increasing the osteoporosis-related knowledge base for an individual is another type of primary prevention intervention. Patient-centered education is traditionally thought to assist an individual in making more informed decisions. However, Sedlak (2005) mentions that interventions with an aim to increase knowledge alone have not

been consistently sufficient in creating change in health behaviors of patients. Factors such as an increase in health behaviors, motivation and self-efficacy are the more effective aspects of health promotion (Sedlak et al., 2005)

Osteoporosis- related pharmacotherapy is primarily a focus secondary prevention. Although, primary prevention interventions many times incorporate medication therapy, (Huntjens 2011), secondary interventions in osteoporosis care include the use of osteoporosis related medications. Many physicians have prescribed their patients bisphosphonate medications to assist older adults with the management of osteoporosis (McClung, 2013). The goal of bisphosphonates is to decrease the amount of bone resorption by inhibiting osteoclast function (McClung, 2013). Osteoclasts are responsible for bone reabsorption, resulting in the breaking down of bones. Bones are later remodeled and formed by osteoblasts. Approximately 4 million women in America were prescribed bisphosphonates in 2008 to assist with osteoporosis related health concerns (McClung, 2013).

Prescription nonadherence can lead to a number of health-related consequences for older adults. Trends have shown the changes in mortality and morbidity rates of infectious disease and chronic conditions (Crimmins & Beltrán-Sánchez, 2011). Chronic disease management can influence or be influenced by the environment and health behaviors in which one is surrounded. In order to lessen negative health outcomes associated with medication nonadherence, researchers must understand medication adherence and ways to increase the adherence within older adults. Unfortunately, one barrier to ensuring patients obtain effective results through

pharmacology is to ensure patients remain adherent with osteoporosis-related medication.

In addition to concerns about adverse use of bisphosphonates, there is also concern about effects, particularly in low-risk older adults. In a particular study on bisphosphonate risks, McClung discusses the monitoring of a period of nonadherence (McClung, 2013). A period of nonadherence are defined as the days, weeks, or even years that an individual stops taking their prescribed medications. McClung highlighted that there was no data providing information how to monitor patients or even how to restart a prescription therapy once a patient takes a holiday (McClung, 2013). There is also the need to determine optimal therapies during a medication holiday (McClung, 2013).

The Geisinger Health System Osteoporosis Program was one successful in utilizing both primary and secondary interventions to assist older adults with osteoporosis. This program works to address some of the care gaps preventing older adults from successful treatment and maintenance (Newman, 2011). This program's primary objective was to increase awareness, diagnosis, and treatment of osteoporosis (Newman, 2011). The program's success resided in its ability to fully reduce the number of hip fracture and treatment cost. The program reorganized care to address four major osteoporosis care gaps (Newman, 2011) : 1) reduce the number of at risk patients not getting tested, 2) test patients not being accurately assessed, 3) ensure high risk patients get treated, and 4) ensure treated patients maintain adherence to osteoporosis



related treatment (Newman, 2011). Nurses were critical in every implication of these successes.

### **Conceptual Framework**

The Andersen Model of Health Care Utilization as seen in Figure 1 identifies the pathways of health behaviors (Andersen, 1995). This model provides a framework to understand factors that affect access to care and the utilization of healthcare services. This model takes into consideration environmental and patient factors resulting in overall quality of health.

Patient factors include predisposing factors, enabling factors and perceived need. These factors affect the patient's initiation and maintenance of health behaviors. Patient factors include demographics and social structure, while enabling factors include the family and community involvement and perceived need for treatment. Personal health choices include preferences for alternative treatment outcomes.

Environmental factors include the external and health care environment. These factors include interactions between the patient and health care provider and structural barriers that affect access to care, ability to understand diagnosis or the patient's ability to understand treatment. Some environmental factors include access to adequate healthcare, ability to obtain health insurance benefits, and the ability to afford various healthcare services. These environmental factors are external to the patient, yet can result in negative health effects. Changes in healthcare policy directly affect these environmental factors.

This conceptual framework is useful for examining the role of nurses and non-physician healthcare providers within the healthcare environment and evaluating if they can influence a patient's likelihood to engage in osteoporosis-related care. Nurse and non-physician healthcare providers can possibly change the healthcare environment and improve the quality of life for patients that have been diagnosed with osteoporosis, at risk of an unintentional fragility fracture, or at risk of subsequent fracture.

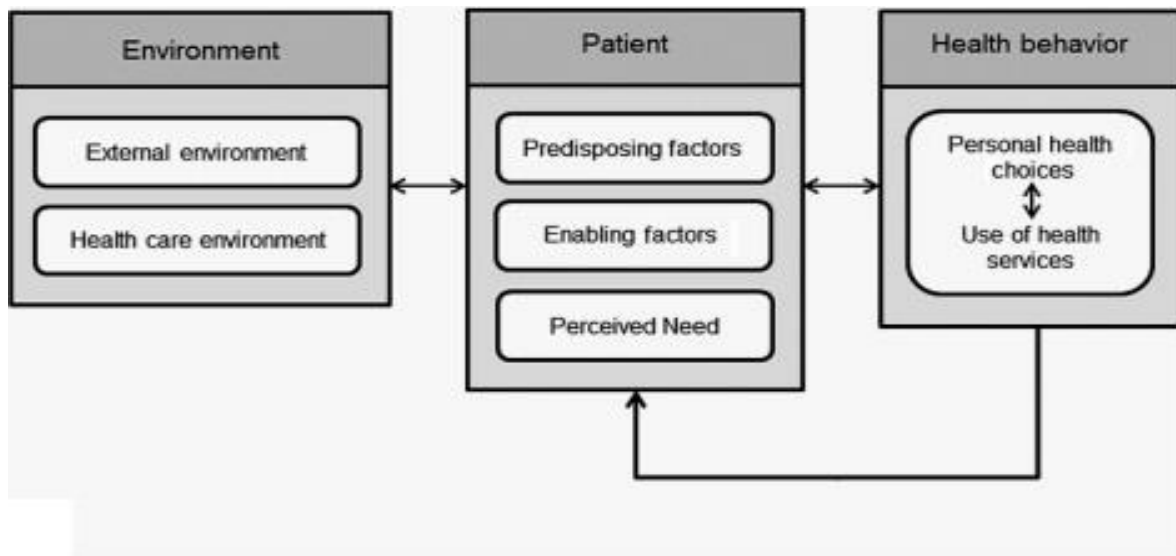


Figure 1. Andersen Model of Health Care Utilization

### Access to Care

There is a remarkable amount of value that non-physicians provide in healthcare delivery. Due to the shortage of primary care physicians there is a need for non-physicians to fill the gaps to delivery such as taking responsibility for tracking, monitoring and referring patients for osteoporosis related care (Huntjens, 2011). This

shortage in primary care physicians is due to the static growth in physicians annually (Pericak, 2011). The Healthcare Association of New York State (HANYS) survey suggests one way to bridge this gap is by increasing the usage of mid-level providers including nurse practitioners (Pericak, 2011).

The increased need for primary care physicians, especially in areas of need such as low income and rural areas, stands as a major barrier to delivering quality healthcare (Pericak, 2011). Nurse practitioners are seen to more than likely provide care to low income and underserved populations than physicians (Hooker, 2006). Throughout the healthcare system, nurses are on the frontlines of healthcare delivery and interact with patients at higher frequencies than physicians (Pericak, 2011). Nurses are a form of social support for patients in osteoporosis related care.

### **Social Support**

Social support can be described as an enabling factor of Andersen's model. Much of the literature speaks to the importance of social support and how it impacts the lives of older adults. A considerable amount of the literature speaks to the importance of social support and how it impacts the lives of older adults. Hand (2014) describes social support as the resources that an individual receives from others including emotional, instrumental, appraisal, or informational. The use of informational social support is often related to prescription management in that it is used to increase the knowledge base of older adults and their health literacy. However, the instrumental

form of social support can levy a great amount of influence on older adults as they work to moderate certain behaviors that relate to medication adherence.

To better understand the influence of the various types of social supports and their effectiveness, Hand's study looked to determine which types of social support provokes participation in everyday activities (Hand, Law, McColl, Hanna, & Elliott, 2014). This study determined that tangible (instrumental) social support and positive social interaction showed to provide increased levels of satisfaction with study participation compared to older adults with lower levels of these types of support. When examining social support and its effectiveness for older adults, there is a need to determine which instrumental activities can increase older adults' medication adherence.

The use of formal and informal social support can lead to an increase in overall health and wellbeing of older adults (Rosland et al., 2013). Formal social support is the care provided by individuals such as doctors, nurses, social workers and the like while informal social support is provided by family and friends (Greenwood & Smith, 2015). Interaction with these healthcare professionals can leave a lasting impression on patients due to their educational expertise. This influence has the possibility to positively influence negative health behaviors.

Informal social support refers to the instrumental, material, socio-emotional, and informational resources individuals receive from those in their personal social network (Hand et al., 2014). Informal social support can improve health outcomes among older adults in everyday life assistance with a number of health-promoting behaviors (Rosland et al., 2013). Family and friends assist patients with remembering to

take, fill, and refill medications. They also assist with remembering various complications related to medication and communicating these incidences with healthcare providers.

Though proper communication, healthcare providers can possibly lead to improved health behaviors in their patients. Proper communication with healthcare providers can leverage an increase their knowledge base and health outcomes (Sedlak et al., 2005). The patient-provider relationship is critical to ensuring physicians have a true context of the patient's health (Schillinger, Bindman, Wang, Stewart, & Piette, 2004).

## CHAPTER 3

### METHODS

The qualitative review process began with the construction of the research questions, “Do non-physician healthcare providers, particularly nurses, close the diagnosis and treatment gaps in osteoporosis-related care and improve patient outcomes?” A literature search was conducted through the Georgia State University library system. This system included the databases PubMed, Global Health, MedLine, which were selected as the most appropriate databases for this qualitative review.

Search strategies were developed for each of the databases and included the phrases “osteoporosis”, “interventions”, and “healthcare providers”. Other key search terms were “older adults”, “fractures” “DEXA” and “DXA”. Included articles must be full text and published between the years 2000 and 2016.

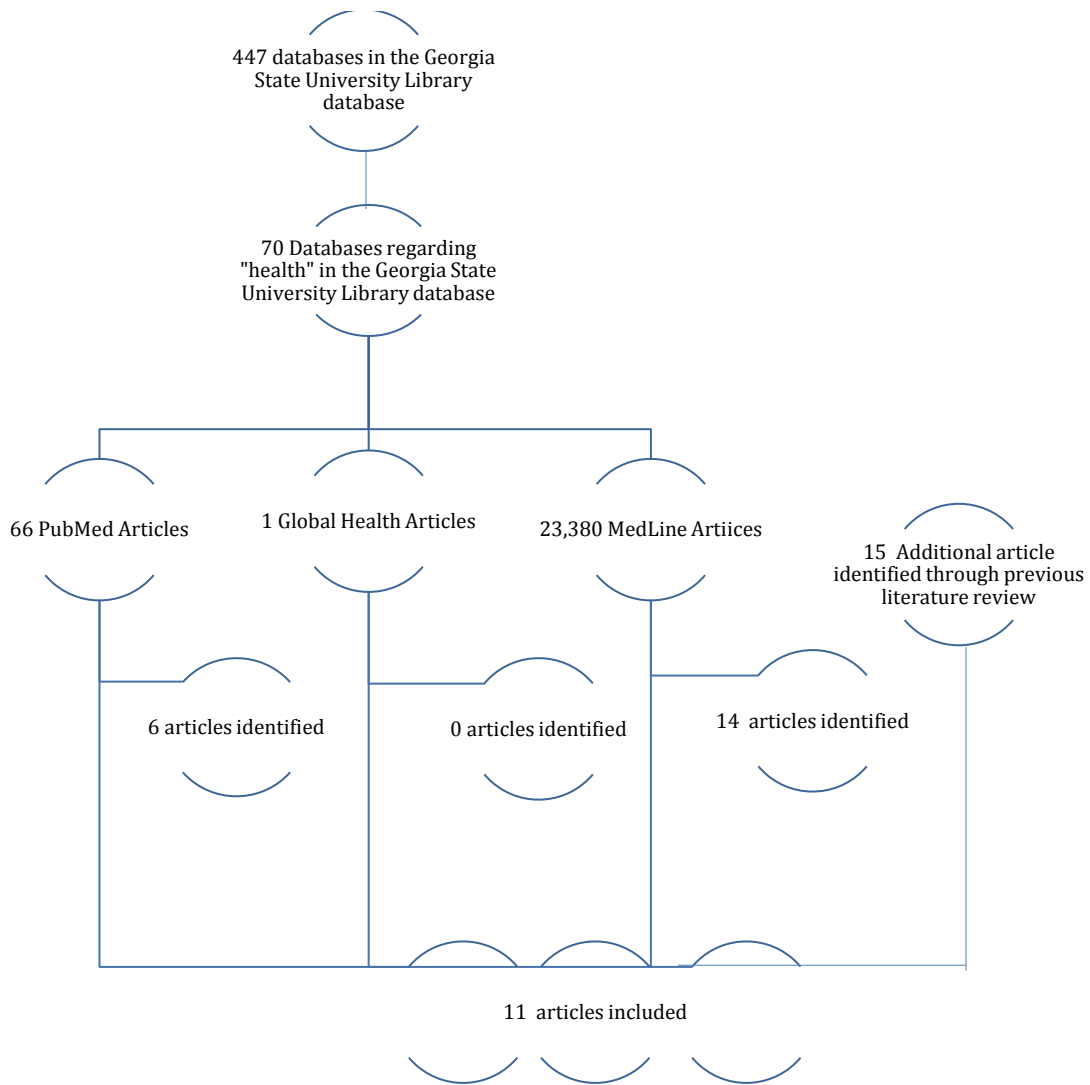
To be included in the review the studies had to evaluate an intervention centered on those at risk of developing a fracture or osteoporosis, those diagnosed with osteoporosis, or those at risk of developing a subsequent fracture. This qualitative review was not limited only to studies that improved quality of life but also included studies that showed no improvement. Included articles had to mention the role of non-physician healthcare providers within the interventions. Each of the articles was evaluated by its title and abstract to determine its relevance to the research question. Articles that were descriptive studies or opinion papers and content analyses were excluded from the review.

A total of 11 articles were selected for this qualitative review. Pertinent information within each article was identified and compared in Table 2 located in the results section. The intervention’s primary goals, inclusion criteria, state of assessment, nature of intervention, and results were summarized. Study limitations were also noted to assist in interpretation and generalizability of study results.

Table 1: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
➤ Full text articles written in any language	➤ Systematic Review
➤ Published between 2010 and 2016	➤ Opinion Papers or White Paper
➤ Osteoporosis-related intervention	➤ Letters to editors
➤ Include the role of healthcare provider in intervention	➤ Studies including nonhuman subject participants

Figure 2: Flowchart of selection process for review articles:





CHAPTER 4

RESULTS

Table 2: Study Design

<b>Article Name</b>	<b>Author</b>	<b>Year Published</b>	<b>Study Date</b>	<b>Type of Study</b>	<b>Study Setting (HMO, Non-HMO, Community based vs. Hospital based) Where?</b>
<b>FRAX counseling for bone health behavior change in women 50 years of age and older</b>	Diane L. Dunniway	2012	August 2009-February 2010	Randomized Control Study (Convenience sample)	Non- HMO
<b>The impact of monitoring on adherence and persistence with antiresorptive treatment for postmenopausal osteoporosis: a randomized controlled trial.</b>	Jackie A Clowes, Niccola F.A. Peel, and Richard Eastell	2004	May 1999-December 2000	Randomized Control Trial	Non-HMO (Osteoporosis Center, Northern General Hospital)
<b>Testing the effectiveness of an educational intervention to increase dietary intake of calcium and vitamin D in young adult women</b>	Karen Bohaty, Holly Rocole, Kelli Wehling, and Nancy Waltman	2008		Randomized Control Trial (Convenience Sample)	Community based
<b>A team approach: implementing a model of care for preventing osteoporosis related fractures</b>	M. Giles, J. Van Der Kallen, V. Parker, K. Cooper, K. Gill, L. Ross, S. McNeill	2010	2007-2008	Non Randomized Control Trial: Control before and after	Non-HMO
<b>Education and Phone Follow-Up in Postmenopausal Women at Risk for Osteoporosis: Effects on calcium intake, exercise frequency, and Medication Use</b>	John T. Schouseboe, Rowan C. DeBold, Linda S. Kuno, Thomas W. Weiss, Ya-Ting Chen, and Thomas A. Abbott III	2005	January 1999 - March 2001	Randomized Control Trial	Non-HMO (Large multidisciplinary community practice)
<b>Impact of guidelines implementation by a fracture nurse on subsequent fractures and mortality in patient presenting with non-vertebral fractures.</b>	Kristen M.B. Huntjens, Tineke C.M. van Geel, Piet P. Geusens, Bjorn Winkens, Paul Willems, Joop van den Bergh, Peter R. G. Brink, Svenhjalmar van Helden	2011	January 1999-December 2001 and September 2004-September 2006	Non randomized control study: Control before and after	Non-HMO

<u>Article Name</u>	<u>Author</u>	<u>Year Published</u>	<u>Study Date</u>	<u>Type of Study</u>	<u>Study Setting (HMO, Non-HMO, Community based vs. Hospital based) Where?</u>
<b>Nurse case manager vs. multifaceted intervention to improve quality of osteoporosis care after wrist fracture: randomized control pilot study.</b>	S. R. Majumdar, J.A. Johnson, D.Bellerose, F.A. McAllister, A.S.Russel, D.A.Hanley, S.Garg, D.A. Lier, W.P. Maksymowych, D.W.Morrish, B.H. Rowe	2011	2004 to 2006	Randomized control Trial	Non-HMO
<b>Successful knowledge translation intervention in long-term care: final results from the vitamin D and osteoporosis study( ViDOS) pilot cluster randomized controlled trial</b>	Courtney Kennedy, George Ionnidis, LeHana Thabane, Jonathan D Adachi, Sharon Marr, Lora Gingregorio, et.al	2015		Randomized Control Trial	Non-HMO
<b>Outcomes of an osteoporosis disease-management program managed by nurse practitioners</b>	Denise Greene and Richard M. Dell	2010	2002-2007	Cohort Study	HMO (Kaiser)
<b>Tailored Interventions to Enhance Osteoporosis Prevention in Women.</b>	Carol Sedlak, Margaret O. Doheny, Patricia Estok, Richard A. Zeller	2005		Quasi-experimental design	
<b>The impact of two educational interventions on osteoporosis diagnosis and treatment rates after fragility fracture: a population-based randomized controlled trial.</b>	L. Bessette, K.S. Davison, S.Jean, S. Roby, L.G. Ste-Marie, J.P. Brown	2010	September 2003 - September 2005 and September 2004-August 2006	Randomized Control Trial	

Table 3: Primary Prevention Results<sup>1</sup>

<b>Author</b>	<b>Primary Outcome: (What is the goal of this study?) Primary vs. secondary fracture prevention</b>	<b>Knowledge</b>	<b>Exercise</b>	<b>Calcium/ Vitamin D intake</b>	<b>Referral for Care</b>	<b>Reduction of Subsequent Fracture</b>	<b>Medication</b>
<b>Dunniway (2012)</b>	Primary Fracture: To examine if utilizing counseling through the universal recommendations within the NOF Clinician's Guide to Prevention and Treatment of Osteoporosis, with discussion of DXA results and FRAX for absolute risk as it applies, have a positive reported impact on modifiable bone health risk factors in menopausal women 50 years of age and older.		↑	↑			
<b>Bohaty, Rocole, Wehling, Waltman (2008)</b>	Primary Fracture: Test the effectiveness of an educational intervention to increase dietary intake of calcium and vitamin D in females ages 19-30.			→			
<b>Schousebow (2005)</b>	Primary and Secondary Fracture: To determine the effect of an intervention providing nurse education and a follow up care on the initiation and the persistent adherence to antiresorptive drug therapy, an increase in calcium intake and weight bearing exercise.		↑	↑			→
<b>Kennedy (2015)</b>	Primary Fracture: To examine the effectiveness of a multifaceted, interdisciplinary knowledge translation intervention for improving the prescribing of Vitamin D, calcium and osteoporosis medications over a 12-month period. .			↑			→
<b>Sedlak, Doheny, Estok, and Zellar (2005)</b>	Primary Fracture: to determine the effectiveness of a tailored nursing intervention on the personal knowledge of bone mineral density from a DXA in the change in knowledge, health beliefs or calcium intake, exercise, smoking or alcohol use.	→	↓	→			

<sup>1</sup> Arrows pointing up represent improvement, arrows pointing to the right represent no change, and arrows pointing down represent a decrease in the intervention strategy.

Table 4: Secondary Prevention Results<sup>2</sup>

<u>Author</u>	<u>Primary Outcome: (What is the goal of this study? Primary vs. secondary fracture prevention)</u>	<u>Knowledge</u>	<u>Exercise</u>	<u>Calcium/ Vitamin D intake</u>	<u>Referral for Care</u>	<u>Reduction of Subsequent Fracture</u>	<u>Medication</u>
<b>Clowes, Peel, Eastell (2004)</b>	Secondary Fracture: To examine whether monitoring by nurse staff could enhance adherence and persistence with antiresorptive therapy and whether presenting information nonresponse to therapy provided additional benefit. In addition the impact of monitoring on treatment efficacy was evaluated.						↑
<b>Giles et.al (2010)</b>	Secondary Fracture: To develop and implement a model of care for at risk patients that would improve the identification, referral and ongoing management of patients over 50 years old presenting to the emergency department with a minimal trauma fracture.	↑			↑		
<b>Schousebow (2005)</b>	Primary and Secondary Fracture: To determine the effect of in intervention providing nurse education and a follow up care on the initiation and the persistent adherence to antiresorptive drug therapy, an increase in calcium intake and weight bearing exercise.		↑	↑			→

<sup>2</sup> Arrows pointing up represent improvement, arrows pointing to the right represent no change, and arrows pointing down represent a decrease in the intervention strategy.

<u>Author</u>	<u>Primary Outcome: (What is the goal of this study? Primary vs. secondary fracture prevention)</u>	<u>Knowledge</u>	<u>Exercise</u>	<u>Calcium/ Vitamin D intake</u>	<u>Referral for Care</u>	<u>Reduction of Subsequent Fracture</u>	<u>Medication</u>
<b>Huntjens (2011)</b>	Secondary Fracture: To determine the impact of an intervention on the risk of subsequent fractures and mortality on patients with a non-vertebral fracture (NVF). The aim of the intervention was to evaluate subsequent fracture risk, to identify risk factors, and to take measures to reduce fracture incidence.					↑	
<b>Majumdar (2011)</b>	Secondary fracture: This pilot study compared a nurse case-manager to a multifaceted intervention using RCT.				↑		
<b>Greene and Dell (2010)</b>	Secondary Fracture: To assist in reducing the hip fracture rate in the Kaiser system through increasing the DXA scan utilization and increasing the anti-osteoporosis medication					↑	↑
<b>Bessette et. al (2010)</b>	Secondary Fracture: This study was to investigate the impact of two educational based interventions that were targeted to treat osteoporosis in women aged 50 or older that have a fragility fracture.				↓		

## CHAPTER 5

### DISCUSSION

#### **Study Design**

Of the 11 studies, 7 were randomized control trials, 2 were non-randomized control trials, 1 was a quasi-experimental study and 1 was a prospective cohort study. Of the 11 studies, 6 reported small sample size being a limitation to study generalizability. All of these studies had less than 350 participants. Most (10) of the interventions recruited older adults. Only 1 of the studies (Bohaty, 2008) included younger adults who were between 19 and 30 years of age.

The studies occurred in both HMO and non-HMO settings. Of the 11 studies, 7 were in non-HMO settings; 1 occurred in an HMO setting (Kaiser). Only 1 study was community based. The selected studies did not state if the participants were selected from academic medical centers.

The studies selected involved modification of patient and provider knowledge and behaviors. Of the 11 studies, 6 focused exclusively on modifying patient knowledge and behaviors, 3 focused primarily on physician and non-physician health care provider behaviors; and 1 involved modifying both patient and physician and non-physician healthcare provider behaviors.

The study design that seemed to show the most positive results were randomized control trials. Of the 7 randomized control trials, 6 showed a positive influence in education, vitamin intake referral for specialized care or risk for a subsequent fracture. Randomized control trials showed to be strength in evaluating the influence of the various interventions.

## **Intervention Design**

The interventions had both a primary and secondary prevention as a clinical focus. Of the 11 studies, 4 were primary prevention and aimed at reducing risk of a fragility fracture. The majority of studies (6), however had protocols to reduce risk of a secondary fracture. One study (Schousebow, 2005) was designed to focus on both primary and secondary prevention of osteoporosis-related outcomes. This study used a multidimensional approach to lifestyle changes (calcium and Vitamin D intake), DXA testing, and medication use.

Of the 4 studies that focused on primary fracture prevention (Dunniway, 2012 ;Bohaty, 2008; Kennedy, 2015; Sedlak, 2005), the primary focus was lifestyle change (such as vitamin D intake) or general education on knowledge about osteoporosis. None of the studies indicated that education about bisphosphonate use was part of the intervention protocol.

Of the 6 studies that focused on secondary fracture prevention, lifestyle change, general education about osteoporosis, medication use, and referral for DXA screening were included in the intervention protocol. The one study (Schousebow, 2005) that targeted both primary and secondary intervention had a protocol that covered lifestyle change, education about osteoporosis, and medication adherence. Majumdar (2011) showed an increase in patient education DXA testing through face-to-face and phone call counseling with patients. Green (2010) saw a 153% increase in patients receiving osteoporosis related education through the generation of monthly reports which identified at risk patients.

Of the 11 studies, 8 involved a nurse as a case manager or care coordinator who had been trained in osteoporosis management and fracture prevention strategies. The nurses in these studies played a role in providing osteoporosis education to patients (Schousebow, 2005), provided counseling on the patient's individual bone health (Dunniway, 2012), and follow up related to intake of supplements post fracture (Huntjens, 2011). In 2 studies, the nurse provided care within multidisciplinary team. The nurse's role was influential in the implementation of the intervention however, unlike the previously mentioned 8 studies, the role of the nurse in these teams was not explicitly described.

In 9 of the 11 studies, the mode of contact between the nurse and patients was described. Of the 9 studies, 5 involved face-to-face contact, 1 used both face-to-face and remote (webinar if available or teleconference) contact, 2 involved telephone contact only; and 1 used both telephone and letter.

### **Intervention Results**

Most of the studies focused on older adults aged 50 years of age or older and osteoporosis-related issues. Of these 10 studies involving older adults, 1 found improvements in osteoporosis-related knowledge (Majumdar, 2011), 3 found improvements in lifestyle (Schouseboe, 2005; Dunniway, 2012; Kennedy, 2015) 2 found improvements in medication adherence (Clowes, 2004; Greene, 2010), 1 found a reduction in subsequent fracture (Huntjens, 2011) and 2 found improvements in DXA referrals (Giles, 2010; Greene, 2011). The one study that recruited younger adults showed no increase in osteoporosis knowledge nor was there a change in the intake of calcium, vitamin D, or dairy products (Bohaty, 2008).



In 6 of the studies where the nurse was the primary provider of osteoporosis-related education or consultation, 3 studies found significant improvements in vitamin D intake (Schousebow, 2005; Dunniway, 2012; Kennedy, 2015) or osteoporosis-related medication use (Clowes, 2004). Where the nurse functioned as part of a multidisciplinary team (Giles, 2010; Greene, 2010) significant improvements were achieved in increase knowledge and identification of at risk patients and referral of patients to a fracture prevention clinic (Giles, 2010) and increase in DXA scans and prescribed osteoporotic medication (Greene, 2010).

For the 5 studies which involved primary prevention with or without secondary prevention, 4 showed improvement in the following outcomes: 3 showed improvements in dietary intake or vitamin D supplementation (Schousebow 2005; Dunniway, 2012; Kennedy 2015) and 2 studies showed an increase in exercise frequency (Dunniway, 2012; Schousebow 2005). There were no studies that showed an increase in osteoporosis-related knowledge, referral for specialized care or improvements in medication adherence or medication prescribed.

For the 7 studies which involved secondary prevention (with or without primary prevention), 6 showed improvement in the following outcomes: 1 found improvements in osteoporosis-related knowledge (Giles, 2010) , 1 found an increase in exercise (Schousebow 2005), 2 found increases in DXA scans and referrals for specialized care (Giles 2010; Majumdar, 2011), 1 found a reduction in subsequent fracture (Greene, 2010) , 1 found improvements in calcium intake (Schousebow 2005) ,and 2 found improvements in medication prescribed (Clowes, 2010; Greene 2010)

## CHAPTER 5

### CONCLUSION

When examining the role of nurses in their influence on osteoporosis-related outcomes, 5 of the 6 studies utilizing the nurse alone or in a multidisciplinary team showed positive results. Of the primary prevention strategies, dietary intake or vitamin D supplementation and exercise frequency improved were the improved outcomes through these primary interventions. Dietary intake and vitamin D supplementation stood out within the studies selected. Of the secondary prevention strategies, education, referrals for specialized care, and prescribing medication were the improved outcomes through these secondary interventions. The results show that interventions utilizing nurses as a source of contact identify nurses as a possible contributing role in osteoporosis outcome improvement. To better improve osteoporosis treatment and management, healthcare provider and clinicians should widen their scope in addressing the issue of medication adherence before they can appropriately address treatment. Of the studies identified, nurses positively influenced the increase in the number of DXA scan and number of patients that were referred for further specialized.

I believe many of the interventions are on the right path to improving osteoporosis management by identifying the nurse's role as an influencing form of social support. However, there is the need to also ensure patients are not only referred for care and bone mineral density tests or prescribed prescriptions, but that they actually take them. It seems as though many of the interventions fall short of the planned goals and objectives because medication adherence is still a major barrier to osteoporosis management. None of the studies went in to

detail on measuring the appropriateness of use or counseled women when taking bisphosphonates inappropriately.

Both the primary and secondary interventions showed mixed results on the improvement in osteoporosis related fragility as related to primary prevention such as diet, knowledge, or vitamin intake or secondary interventions such as medication adherence. Many of the articles allude to the possible influence of medication adherence on results, but none of the studies properly track adherence or identify if patient's participated in a period of nonadherence. There is definitely a gap in the literature around osteoporosis treatment and management. The influence of medication adherence on an older adult's ability to reduce risk of fragility fracture through taking osteoporosis related medications appropriately is not always considered. Many of the studies seem to be evidence based, but there was a large lack of consistent data showing significant improvement in patients.

## REFERENCES:

- Andersen, R. M. (1995). Revisiting the Behavioral Model and Access to Medical Care: Does it Matter?, 1.
- Bohaty, K., Rocolo, H., Wehling, K., & Waltman, N. (2008). Testing the effectiveness of an educational intervention to increase dietary intake of calcium and vitamin D in young adult women. *Journal of the American Academy of Nurse Practitioners*, 20(2), 93-99. doi:10.1111/j.1745-7599.2007.00281.x
- Clowes, J. A., Peel, N. F. A., & Eastell, R. (2004). The impact of monitoring on adherence and persistence with antiresorptive treatment for postmenopausal osteoporosis: A randomized controlled. *JOURNAL OF CLINICAL ENDOCRINOLOGY & METABOLISM*, 89(3), 1117-1123.
- Crimmins, E. M., & Beltrán-Sánchez, H. (2011). Mortality and Morbidity Trends: Is There Compression of Morbidity? *Journals of Gerontology Series B: Psychological Sciences & Social Sciences*, 66B(1), 75-86 12p. doi:geronb/gbq088
- Dunniway, D. L., Camune, B., Baldwin, K., & Crane, J. K. (2012). FRAX® counseling for bone health behavior change in women 50 years of age and older. *Journal of the American Academy of Nurse Practitioners*, 24(6), 382-389. doi:10.1111/j.1745-7599.2012.00700.x
- Giles, M., Van Der Kallen, J., Parker, V., Cooper, K., Gill, K., Ross, L., & McNeill, S. (2011). A team approach: implementing a model of care for preventing osteoporosis related fractures. (Vol. 22, pp. 2321-2328): Osteoporosis International.
- Greene, D., & Dell, R. M. (2010). Outcomes of an osteoporosis disease-management program managed by nurse practitioners. *Journal of the American Academy of Nurse Practitioners*, 22(6), 326-329. doi:10.1111/j.1745-7599.2010.00515.x
- Greenwood, N., & Smith, R. (2015). Review article: Barriers and facilitators for male carers in accessing formal and informal support: A systematic review. *Maturitas*, 82, 162-169. doi:10.1016/j.maturitas.2015.07.013
- Hand, C., Law, M., McColl, M. A., Hanna, S., & Elliott, S. (2014). An examination of social support influences on participation for older adults with chronic health conditions. *Disability & Rehabilitation*, 36(17), 1439-1444. doi:10.3109/09638288.2013.845258
- Huntjens, K. M. B., van Geel, T. C. M., Geusens, P. P., Winkens, B., Willems, P., van den Bergh, J., . . . van Helden, S. (2011). Impact of guideline implementation by a fracture nurse on subsequent fractures and mortality in patients presenting with non-vertebral fractures. (Vol. 42, pp. S39-S43): Injury.
- Kennedy, C. C., Ioannidis, G., Thabane, L., Adachi, J. D., Marr, S., Giangregorio, L. M., . . . Papaioannou, A. (2015). Successful knowledge translation intervention in long-term care: final results from the vitamin D and osteoporosis study (ViDOS) pilot cluster randomized controlled trial. *Trials*, 16, 214-214. doi:10.1186/s13063-015-0720-3
- Lane, N. E. (2006). Epidemiology, etiology, and diagnosis of osteoporosis. (Vol. 194, pp. S3-11). Sacramento, CA: American Journal of Obstetrics and Gynecology.
- Majumdar, S. R., Johnson, J. A., Bellerose, D., McAllister, F. A., Russell, A. S., Hanley, D. A., . . . Rowe, B. H. (2011). Nurse case-manager vs. multifaceted intervention to improve quality of osteoporosis care after wrist fracture: randomized controlled pilot study (Vol. 22, pp. 155-160): Osteoporosis International.

- Newman, E. (2011). Perspectives on pre-fracture intervention strategies: the Geisinger Health System Osteoporosis Program...[corrected] [published erratum appears in OSTEOPOROSIS INT 2011; 22(11):2913]. *Osteoporosis International*, 22, 451-455. doi:10.1007/s00198-011-1695-x
- Ortman, J. M., Velkoff, Victoria. A., & Hogan, Howard (2014). *The Aging Nation: The Older Population in the United States. Population Estimates and Projections. Current Populations Report*. Retrieved from
- Rosland, A.-M., Heisler, M., Janevic, M. R., Connell, C. M., Langa, K. M., Kerr, E. A., & Piette, J. D. (2013). Current and potential support for chronic disease management in the United States: The perspective of family and friends of chronically ill adults. *Families, Systems, & Health*, 31(2), 119-131. doi:10.1037/a003153510.1037/a0031535.supp (Supplemental)
- Schillinger, D., Bindman, A., Wang, F., Stewart, A., & Piette, J. (2004). Functional health literacy and the quality of physician–patient communication among diabetes patients. *Patient Education and Counseling*, 52, 315-323. doi:10.1016/S0738-3991(03)00107-1
- Schousboe, J. T., DeBold, R. C., Kuno, L. S., Weiss, T. W., Chen, Y.-T., & Abbott III, T. A. (2005). Education and Phone Follow-Up in Postmenopausal Women at Risk for Osteoporosis (Vol. 13, pp. 396-404): Dis Manage Health Outcomes.
- Sedlak, C. A., Doheny, M. O., Estok, P. J., & Zeller, R. A. (2005). Tailored interventions to enhance osteoporosis prevention in women. *Orthopaedic Nursing*, 24(4), 270-278.
- Services, U. S. D. o. H. a. H. (2004). Bone health and osteoporosis: A report of the Surgeon General. Retrieved from [https://www.ncbi.nlm.nih.gov/books/NBK45513/pdf/Bookshelf\\_NBK45513.pdf](https://www.ncbi.nlm.nih.gov/books/NBK45513/pdf/Bookshelf_NBK45513.pdf)

APPENDIX

Table 5: Detailed Results

<u>Article Name</u>	<u>Author</u>	<u>Year Published</u>	<u>Study Date</u>	<u>Type of Study</u>
<b>FRAX counseling for bone health behavior change in women 50 years of age and older</b>	Diane L. Dunniway	2012	August 2009- February 2010	Randomized Control Study (Convenience sample)
<b>The impact of monitoring on adherence and persistence with antiresorptive treatment for postmenopausal osteoporosis: a randomized controlled trial.</b>	Jackie A Clowes, Niccola F.A. Peel, and Richard Eastell	2004	May 1999- December 2000	Randomized Control Trial
<b>Testing the effectiveness of an educational intervention to increase dietary intake of calcium and vitamin D in young adult women</b>	Karen Bohaty, Holly Rocole, Kelli Wehling, and Nancy Waltman	2008		Randomized Control Trial (Convenience Sample)
<b>A team approach: implementing a model of care for preventing osteoporosis related fractures</b>	M. Giles, J. Van Der Kallen, V. Parker, K. Cooper, K. Gill, L. Ross, S. McNeill	2010	2007-2008	Non Randomized Control Trial: Control before and after
<b>Education and Phone Follow-Up in Postmenopausal Women at Risk for Osteoporosis: Effects on calcium intake, exercise frequency, and Medication Use</b>	John T. Schouseboe, Rowan C. DeBold, Linda S. Kuno, Thomas W. Weiss, Ya-Ting Chen, and Thomas A. Abbott III	2005	January 1999 - March 2001	Randomized Control Trial
<b>Impact of guidelines implementation by a fracture nurse on subsequent fractures and mortality in patient presenting with non-vertebral fractures.</b>	Kristen M.B. Huntjens, Tineke C.M. van Geel, Piet P. Geusens, Bjorn Winkens, Paul Willems, Joop van den Bergh, Peter R. G. Brink, Svenhjalmar van Helden	2011	January 1999- December 2001 and September 2004- September 2006	Non randomized control study: Control before and after
<b>Nurse case manager vs. multifaceted intervention to improve quality of osteoporosis care after wrist fracture: randomized control pilot study.</b>	S. R. Majumdar, J.A. Johnson, D.Bellerose, F.A. McAllister, A.S.Russel, D.A.Hanley, S.Garg, D.A. Lier, W.P. Maksymowych, D.W.Morrish,	2011	2004 to 2006	Randomized control Trial

<u>Article Name</u>	<u>Author</u>	<u>Year Published</u>	<u>Study Date</u>	<u>Type of Study</u>
	B.H. Rowe			
<b>Successful knowledge translation intervention in long-term care: final results from the vitamin D and osteoporosis study( ViDOS) pilot cluster randomized controlled trial</b>	Courtney Kennedy, George Ionnidis, LeHana Thabane, Jonathan D Adachi, Sharon Marr, Lora Gingregorio, et.al	2015		Randomized Control Trial
<b>Outcomes of an osteoporosis disease-management program managed by nurse practitioners</b>	Denise Greene and Richard M. Dell	2010	2002-2007	Cohort Study
<b>Tailored Interventions to Enhance Osteoporosis Prevention in Women.</b>	Carol Sedlak, Margaret O. Doheny, Patricia Estok, Richard A. Zeller	2005		Quasi-experimental design
<b>The impact of two educational interventions on osteoporosis diagnosis and treatment rates after fragility fracture: a population-based randomized controlled trial.</b>	L. Bessette, K.S. Davison, S.Jean, S. Roby, L.G. Ste-Marie, J.P. Brown	2010	September 2003 -September 2005 and September 2004-August 2006	Randomized Control Trial

<b>Author</b>	<b>Primary Outcome: (What is the goal of this study?) Primary vs. secondary fracture prevention</b>	<b>Participant Detail (Patient or Provider)</b>	<b>Healthcare provider implementing intervention</b>	<b>Number of Participants</b>	<b>Study Setting (HMO, Non-HMO, Community based vs. Hospital based) Where?</b>
<b>Dunniway (2012)</b>	Primary Fracture: To examine if utilizing counseling through the universal recommendations within the NOF Clinician's Guide to Prevention and Treatment of Osteoporosis, with discussion of DXA results and FRAX for absolute risk as it applies, have a positive reported impact on modifiable bone health risk factors in menopausal women 50 years of age and older.	Patient	Non-physician, nurse	17	Non-HMO
<b>Clowes, Peel, Eastell (2004)</b>	Secondary Fracture: To examine whether monitoring by nurse staff could enhance adherence and persistence with antiresorptive therapy and whether presenting information nonresponse to therapy provided additional benefit. In addition the impact of monitoring on treatment efficacy was evaluated.	Patient	Non-physician, nurses	75	Non-HMO (Osteoporosis Center, Northern General Hospital)
<b>Bohaty, Rocolle, Wehling, Waltman (2008)</b>	Primary Fracture: Examine the effectiveness of an educational intervention to increase dietary intake of calcium and vitamin D in females ages 19-30.	Patient		80	Community based
<b>Giles et.al (2010)</b>	Secondary Fracture: To develop and implement a model of care for at risk patients that would improve the identification, referral and ongoing management of patients over 50 years old presenting to the emergency department with a minimal trauma fracture.	Provider	A multidisciplinary team of staff, fracture prevention nurse, possibly physicians in orthopedic ward (not explicitly stated)		Non-HMO
<b>Schousebow (2005)</b>	Primary and Secondary Fracture: To determine the effect of in intervention providing nurse education and a follow up care on the initiation and the persistent adherence to antiresorptive drug therapy, an increase	Patient	Non physician, nurse	310	Non-HMO(Large multispecialty community practice)



<u>Author</u>	<u>Primary Outcome: (What is the goal of this study?) Primary vs. secondary fracture prevention</u>	<u>Participant Detail (Patient or Provider)</u>	<u>Healthcare provider implementing intervention</u>	<u>Number of Participants</u>	<u>Study Setting (HMO, Non-HMO, Community based vs. Hospital based) Where?</u>
	in calcium intake and weight bearing exercise.				
<b>Huntjens (2011)</b>	Secondary Fracture: To determine the impact of an intervention on the risk of subsequent fractures and mortality on patients with a non vertebral fracture (NVF).The aim of the intervention was to evaluate subsequent fracture risk, to identify risk factors, and to take measures to reduce fracture incidence.	Patient	Fracture nurse trained in osteoporosis management and fall risk assessment.	3,255	Non-HMO
<b>Majumdar (2011)</b>	Secondary fracture: This pilot study compared a nurse case-manager to a multifaceted intervention using RCT.	Provider and patient	Non Physician, nurse case-manager	46	Non-HMO
<b>Kennedy (2015)</b>	Primary Fracture: To examine the effectiveness of a multifaceted, interdisciplinary knowledge translation intervention for improving the prescribing of Vitamin D, calcium and osteoporosis medications over a 12-month period. .	Provider	Study Coordinator	40 Long Term Care homes	Non-HMO
<b>Greene and Dell (2010)</b>	Secondary Fracture: To assist in reducing the hip fracture rate in the Kaiser system through increasing the DXA scan utilization and increasing the anti-osteoporosis medication	Provider	Healthcare providers; a nurse practitioner was given the role of the case manager.	Over 650,000 patients	HMO(Kaiser)
<b>Sedlak, Doheny, Estok, and Zellar (2005)</b>	Primary Fracture: to determine the effectiveness of a tailored nursing intervention on the personal knowledge of bone mineral density from a DXA in the change in knowledge, health beliefs or calcium intake, exercise, smoking or alcohol use.	Patient	Non physician, Nurse	124	
<b>Besette et. al (2010)</b>	Secondary Fracture: This study was to investigate the impact of two educational based interventions that were targeted to treat osteoporosis in women aged 50 or older that have a fragility fracture.	Patient/Provider	Study Coordinator	3919	

<b>Author</b>	<b>Inclusion Criteria</b>	<b>Assessment Tool Utilized</b>	<b>Post DXA?</b>	<b>Stage of Assessment</b>
<b>Dunniway (2012)</b>	Women 50 years of age or older, English speaking: able to read and write in English, Generally healthy, with ability to perform weight-bearing exercise.	DXA and FRAX	Pre DXA	Pre diagnosis: not already being treated for osteoporosis or osteopenia
<b>Clowes, Peel, Eastell (2004)</b>	Healthy postmenopausal women aged 50-80. Participants must have been diagnosed with osteopenia at either spine or hip, more than 5 years from menarche or after hysterectomy, under 55 years and had an elevated FSH. Subjects were excluded if they had taken any form of hormone replacement therapy or antiresorptive therapy within the past 6 months, had a metabolic bone disease or other medical condition or treatment likely to affect bone metabolism.	DXA and bone turnover markers with uNTX	Post DXA	Post acute: being treated for osteoporosis or osteoporosis
<b>Bohaty, Rocole, Wehling, Waltman (2008)</b>	Participants were eligible for inclusion if they were 19-30 years old, not currently pregnant or breastfeeding and able to speak, read, and write in English. 16 of the participants had a family history of osteoporosis and 8 were currently using cigarettes.	Pretest knowledge of osteoporosis and a Dietary intake of calcium and vitamin D was measured using 3-day dietary recalls and Nutritionist Five software program	Pre DXA	Pre-diagnosis
<b>Giles et.al (2010)</b>	An older adult that was 50 years of age or older that presented in the emergency department with a minimal trauma fracture.	DXA	Pre-DXA	Mixed
<b>Schousebow (2005)</b>	Women aged 50 years and older, 5 or more years post menopause, currently not on any hormone replacement therapy, and never been on any osteoporosis related drug therapy prior to entry. A score of 8 or less on the Simple Calculated Osteoporosis Risk Estimation (SCORE) and had not had a BMD test in 2 years of study.	DXA	Pre-DXA	Maintenance

<b>Huntjens (2011)</b>	All consecutive patients older than 50 years old presenting with a NVF at the emergency room. Patients were excluded when presenting with a pathological fracture, a clinical vertebral fracture, or a skull fracture.	DXA	Post DXA	Post acute
<b>Majumdar (2011)</b>	Subjects were drawn from a pool of 135 former usual care control patients who were still actively participating in the parent trial 1-year after their wrist fracture and who had not yet been tested or treated for osteoporosis.	DXA	Post DXA	Pre-diagnosis
<b>Kennedy (2015)</b>	LTC homes were eligible if they had more than one prescribing physician and received services from a large pharmacy provider. Participants were interdisciplinary care teams (physicians, nurses, consultant pharmacist, and other staff)			
<b>Greene and Dell (2010)</b>	Providers of patients were included in this study if they were 60 years of age or older as well as patients 50 years of age who sustained a fragility fracture, obtained a DXA scan or were on an anti-osteoporosis medication.	DXA	Pre/ Post DXA	Both

<b>Sedlak, Doheny, Estok, and Zellar (2005)</b>	Postmenopausal women aged 50-65 years old	DXA	Post DXA	Pre-diagnosis
<b>Besette et. al (2010)</b>	Women aged 50 years of age and older not residing in a long-term care facility prior to fracture. Participants must be able to understand the program information and sign the consent forms. The participants must have had one or more fracture in specific sites.	DXA	Post DXA	Pre and Post diagnosis

<u>Author</u>	<u>Nature of Intervention (Lifestyle change, knowledge, etc.)</u>	<u>Intervention Design: (Face to Face, Phone, Mixed?)</u>	<u>Follow up period? If so how long</u>	<u>Results</u>	<u>Limitations</u>
<b>Dunniway (2012)</b>	Lifestyle change and education: Each woman received counseling regarding her bone health behaviors that address modifiable risk factors. The perceptions of barriers, benefits, and self-efficacy were assessed related to National Osteoporosis Foundation recommendations	Face to face: Appointments were set with an advanced practice nurse within 1-2 weeks of the scan.	Follow up in person and 3 did so by mail.	Perceived susceptibility and perceived severity were addressed by the DXA and FRAX results. Women making the most positive bone health changes were diagnosed with osteoporosis, had family members with osteoporosis, or whose FRAX score met threshold for treatment. Those individuals whose DXA results were abnormal had increased changes in calcium intake as completed to those individuals whose DXA results were normal.	This was a qualitative pilot study of 17 participants making the results descriptive only. This convenience sample only included women. Season changes from summer to winter during the study may have been a confounding variable.

<u>Author</u>	<u>Nature of Intervention (Lifestyle change, knowledge, etc.)</u>	<u>Intervention Design: (Face to Face, Phone, Mixed?)</u>	<u>Follow up period? If so how long</u>	<u>Results</u>	<u>Limitations</u>
<b>Clowes, Peel, Eastell (2004)</b>	Medication: Improvement of antiresorptive medication adherence	Face to face: attended visits at 12, 24, and 36 weeks. Nursing staff followed up with a predefined interview consisting of 6 open ended questions	Biological response to therapy was determined at 1 year.	Monitoring or attention from a health care professional increased adherence by 57% compared to no monitoring. Marker measurements did not result in an additional improvement in adherence or persistence to therapy compared with nurse monitoring alone. There was a trend for the monitored group to remain persistent with therapy for 25% longer than the non-monitored group. An association between adherence to therapy at 1 year and percentage change in hip BMD and UNTX was made.	Small sample size. Subjects may change behaviors as associated with participating in research. They may increase adherence before clinical assessment "white coat effect". In this study tablet counts overestimated adherence, which is consistent with pill dumping.
<b>Bohaty, Rocolle, Wehling, Waltman (2008)</b>	Education	Face to face: each participant attended 1 of 10 45-minute slide show presentations on the importance of dietary intake of calcium and Vitamin D in prevention osteoporosis. The intervention worked to	Follow up phone call to reinforce information on vitamin D and calcium intake. Any questions from participants were also answered. Eight weeks after the initial educational intervention each	The participants did obtain knowledge on osteoporosis and the importance of calcium and vitamin D in the prevention of osteoporosis. There was no change in the dietary intake of calcium, vitamin D and dairy	This was a small sample size and consists of primarily Caucasian women. Findings cannot be generalized to other populations in other areas of the country outside of the Midwest United States. The use of subject self report for dietary intake may not be as accurate as objective measures.

<u>Author</u>	<u>Nature of Intervention (Lifestyle change, knowledge, etc.)</u>	<u>Intervention Design: (Face to Face, Phone, Mixed?)</u>	<u>Follow up period? If so how long</u>	<u>Results</u>	<u>Limitations</u>
		promote confidence through problem solving and increase intake.	participant completed a second 3 day	products from pre to post intervention.	
<b>Giles et.al (2010)</b>	Lifestyle changes assist patients with referrals to orthopedic specialist.	Telephone call or letter	Varied on if patient was referred to fracture prevention clinic or not.	Implementation of the intervention resulted in better intelligence and subsequent identification of patients at risk. Referral of eligible patients to the fracture prevention clinic (FPC) increased from 9% to 34%. Earlier identification of patients also expedited referral to the FPC for assessment.	
<b>Schousebow (2005)</b>	Lifestyle change and medication: all participants were instructed to follow up with their primary care physician and given informational brochures regarding osteoporosis in general and to improve calcium and vitamin D intake. The nurse education group also received preliminary indicators of their BMD results by the nurse highlighting their fracture risk. The nurse also contacted the patient at 3, 6, and 9 months after BMD testing. Phone calls asked about their calcium intake, exercise habits and medication	Telephone	3,6,9 months for the nurse intervention. All participants received telephone surveys after 12 months of their BMD assessing study outcomes.	Nurse education and phone care was associated with an increase in self-reported calcium and exercise frequency. There was no effect on the use of antiresorptive drug therapy. Self-reported follow up with the participant's primary care physician was associated with all four outcomes including calcium intake, exercise	Only 66 participants that completed the study had osteoporosis. Medication adherence is more than likely over estimated because data collected was self-reported.

<u>Author</u>	<u>Nature of Intervention (Lifestyle change, knowledge, etc.)</u>	<u>Intervention Design: (Face to Face, Phone, Mixed?)</u>	<u>Follow up period? If so how long</u>	<u>Results</u>	<u>Limitations</u>
	use.			frequency, initiation of drug therapy and remaining on therapy at 12 months independent of care group.	
<b>Huntjens (2011)</b>	Medication: A post fracture nurse instructed participants about the need of adequate intake of calcium and vitamin D, provided general instructions about fall prevention. Patients with BMD-osteoporosis were treated with drugs known to reduce fracture incidence.	Face to Face for participants that had a subsequent fracture	For subsequent fractures, follow up time was defined as time between first fracture and subsequent fracture, death or end of study. For mortality, follow up time was defined as time between first fracture and death or end of study period.	Systematic implications of the validated guidelines for osteoporosis and fall prevention resulted in a significant reduction of subsequent fracture incidence by 35% within two years and a 33% reduction in subsequent mortality. Due to study design it is difficult to point out which components of the intervention contribute to this effect and what degree.	Approximately 31.6% of patients did not want to participate in the intervention program. This might be because many of the non-responders were older and sustained significantly more major fractures, including hip fractures.
<b>Majumdar (2011)</b>	Education: Case manager: Knowledge and medication of patients. Educated and counseled patients, arranged BMD test, standard laboratory test, determined suitability for bisphosphonate treatment, and initiated prescription treatment. The multi-faceted intervention patients were provided knowledge to patients and primary care physicians were	Case manager: Face to Face Multifaceted: brief phone counseling	6 months	The case manager was more effective than the multifaceted quality improvement intervention for increasing appropriate testing and treatment of osteoporosis in patients with a wrist fracture. Six months post-randomization, 9 of 21 case manager	Small sample size and the study focused on short-term evidence based processes of care rather change in BMD or reductions in fracture-related events. The study worked with patients that have wrist fracture 1 year before study entry and could have possibly been more effective if delivered closer to time of fracture.



<u>Author</u>	<u>Nature of Intervention (Lifestyle change, knowledge, etc.)</u>	<u>Intervention Design: (Face to Face, Phone, Mixed?)</u>	<u>Follow up period? If so how long</u>	<u>Results</u>	<u>Limitations</u>
	provided evidence based guidelines and reminders endorsed by local opinion.			patients compared to 3 of 25 multifaceted patients were treated with bisphosphonates. Case manager patients were more likely to have BMD test (81% to 51%) and receive appropriate care (57% to 28%).	
<b>Kennedy (2015)</b>	Education/ Lifestyle Change: A 12-month multifaceted intervention that provided three educational meetings that incorporated didactic presentation and interactive activities. Meeting typically included 5 to 10 participants. Best practices were presented including an emphasis on Vitamin D in the prevention of falls and fractures. Interdisciplinary teams also engaged in action planning and action plan worksheets were completed at each educational meeting.	Mixed: In person and remotely	12 months	Medication: There was a significantly greater uptake of appropriate vitamin D and calcium prescribed with an absolute improvement in prescribing over 12 months of approximately 15% for vitamin D and 7% for calcium. There was no significant effect in the amount of osteoporosis medication prescribed to patients.	This study's limitations include an over representation of chain affiliated and for-profit LTC homes. There were also some challenges in recruitment and retention of facilities.
<b>Greene and Dell (2010)</b>	Clinical Changes (Referrals): The nurse practitioner generated monthly reports from the Health Bones database to monitor and manage patients that were at risk. The reports included men over 70 and women over 65 who needed routine DXA, patients who had an			From 2002 to 2007 there was a 153% increase in the number of patients receiving anti osteoporotic medication in Kaiser SCAL. There was a 914% increase in the number	There is some lack in generalizability in that Kaiser Permanente has an integrated healthcare delivery program in contrast to other healthcare facilities.

<u>Author</u>	<u>Nature of Intervention (Lifestyle change, knowledge, etc.)</u>	<u>Intervention Design: (Face to Face, Phone, Mixed?)</u>	<u>Follow up period? If so how long</u>	<u>Results</u>	<u>Limitations</u>
	abnormal DXA result, and patients who had a fragility fracture however were not being treated. The NP was able to identify patient's risk and order DXA and treatment appropriately.			of DXZ scans administered annually. The overall hip fracture reduction rate was 38.1% for all sites with variation in rates from 50% to just below 30% among medical centers.	
<b>Sedlak, Doheny, Estok, and Zellar (2005)</b>	Education and lifestyle change: Treatment group received a phone call with her DXA and information on osteoporosis and osteoporosis prevention, discussing behaviors of calcium intake, smoking, exercise, and alcohol use. A mailed copy of the intervention followed the telephone interview. Approximately 6 months after intervention the women were given another questionnaire to determine if the intervention produced any effect.	Telephone	6 months	Knowledge: There was no difference in knowledge between the intervention and control group. The tailored intervention group actually produced more barriers to calcium. Both groups increased calcium intake however it was not significant. There were also barriers to exercise in the tailored group. Weight bearing exercise decreased in the tailored group and slightly increased in the non-tailored group. The non-tailored group slightly increased in the non-tailored group.	There were unequal sample sizes in the two groups. There was also a lack of precision and sensitivity of the exercise instrument.
<b>Besette et. al (2010)</b>	Education Intervention 1 included provided participants with written 2-page document on the risk of a subsequent fracture and a		12 months	Of the women that remained undiagnosed, 12% were of the control group, 15% were in the	The self-reporting of much of the data and there was a lack of information on vertebral fractures. The participants were not entirely

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	<p>summary of non-pharmacological therapy. Participants were invited to give their PCP a 19-page summary of the 2002 Clinical Practice Guidelines for Diagnosis and Management of Osteoporosis in Canada. Intervention 2: Participants received the same written information as the first intervention group. In addition, they received a 15-minute educational video on osteoporosis.</p>			<p>written intervention group and 16% were in the videotape group. The treatment rates of the participants after follow up were 8 % for the control, 12% for the written intervention and 11% for the video intervention group. Of the women, those without treatment after follow up was initiated 10% of the control, 13% of the written and 13% were of the video group. There was no written significant improvement in diagnosis or treatment.</p>	<p>randomized in the control group because participants were informed of the study objectives and filled out a questionnaire on osteoporosis. The study was initiated 6-8 months after fracture</p>

