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Identification and Management of Vertebral Column Fractures in Primary Care

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Identification and Management of Vertebral Column Fractures in Primary Care

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A Clinical Scholarship Submitted to The Graduate School
at the University of Missouri- St. Louis in partial fulfillment
of the requirement for the degree

Doctor of Nursing Practice

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Abstract

Identification and Management of Vertebral Column Fractures in Primary Care

The purpose of this project is to perform a program evaluation of current treatment patterns of primary care providers for osteoporotic vertebral compression fractures (VCF). VCF's result in significant morbidity and long term sequelae following a VCF is not uncommon. Additionally, there is controversy regarding the diagnosis and management of this disorder, especially as these relate to the clinical practice guidelines.

This practice evaluation project included a pre and post-test survey and a continuing education offering. Thirty-nine physicians and nurse practitioners completed the survey instruments and attended the continuing education sessions. The educational session resulted in improvement of the provider's comfort level and understanding of vertebral column fracture identification and management ($F=4.709$, $df=4$, $p=0.004$). Eighty-two percent of the respondents were unfamiliar with the current practice guidelines for compression fractures prior to the educational session. The post survey response to changing practice pattern after continuing education was 71.8%. Of note, there was a significant difference in the use of clinical practice guidelines between physicians and nurse practitioners ($F=5.941$, $df=4$, $p=0.001$).

The information obtained from this project could be used as a spring board for a large scale project. Further study is needed to determine if these results are reproducible in other settings and with larger more heterogeneous samples. Additionally, the statistically significant difference between physicians and nurse practitioners use of the current practice guidelines

merits further research. Nonetheless, preliminary findings suggest that continuing education can improve primary care providers understanding of vertebral column fractures in the short term.

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Project purpose

The purpose of this project is to perform a program evaluation of current treatment patterns of primary care providers for osteoporotic vertebral compression fractures. The National Osteoporosis Foundation estimates that currently over 10 million individuals in the United States have osteoporosis. Further, over 34 million have low bone mass or osteopenia which increases the risk of sustaining a fracture (Sherman & Cailliet, 2010). It is estimated that over 700,000 vertebral compression fractures occur each year with many going undiagnosed (Brunton, Carmichael, Gold, Hull, Kauffman, and Stracke 2005). The economic impact of managing vertebral column fracture to the already overloaded healthcare system exceeds 17 billion dollars. In comparison the total cost of breast care is estimated to be 13 billion and that of heart disease to be around 19 billion dollars annually (Zampini, McGuire, and White, 2010).

The disease process of osteopenia is commonly seen in females starting around age 51-65 years. By age 75 years of age this disease process is seen in both male and female in a 2:1 ratio of women to men (Sherman & Cailliet, 2010). The epidemic of vertebral compression fractures only is going to worsen with the increase in age of the baby boomer population according to the most recent 2010 United States census data. This age demographic grew at a much higher rate than the rest of the population. The population growth rate for those 44 and younger was slower than that for the 45 year old and greater demographic growing at rate of 31.5 % (US Census Bureau, 2010).

Currently, there is only one practice guideline developed by the American Academy of Orthopedic Surgeons for the treatment of osteoporotic vertebral compression fractures. Further, once a patient sustains their first fracture they are at a fivefold risk for another fracture in the

following year (Lindsay, 2001). The magnitude of quality of life loss in persons with vertebral deformities and in persons with osteoarthritis of the spine appears comparable to that associated with chronic obstructive pulmonary disease and cardiac disease. Peripheral artery disease, diabetes, cerebrovascular accident, and cancer cause a considerable larger loss of quality of life; however, persons with three or more vertebral deformities or severe vertebral deformities had comparable quality of life loss as a person with cerebrovascular accident or cancer (Van Schoor, Smit, Twisk, & Lips, 2005).

The identification and management of vertebral column fractures has long term significance beyond the initial morbidity of this condition is well documented that a fractured vertebra body causes the affected individual short term pain and decreased mobility. There are a number of long term complications from vertebral column fractures that cause substantial healthcare dollar expenditures. These long term complications include abdominal protuberance, reflux, shortness of breath, weight loss, and reduced lung function (Brunton, et al, 2005). Research indicates that lung function reduces by as much as 9% for each thoracic vertebral compression fracture (Leech, Dulberg, Kellie, & Gay 1990)

Most clinicians acknowledge that fractures of any type cause patients significant pain. In the older populations pain is a known correlate with impaired functional ability. As patients are less mobile, they may experience a fear of falling that further limits their mobility resulting in, depression, sleep disruption, and a decrease in overall health status (Brunton et al, 2005).

A diagnosis of compression fracture in an elderly individual is diagnostic of osteoporosis regardless of the bone density scores (Cumings, Nevitt, & Browner 1995). Risk factors for osteoporosis, a leading cause of vertebral column fractures, are generally classified as modifiable

or non-modifiable. Non-modifiable risk factors for vertebral compression fracture include female gender, age over 60 years, Caucasian, diagnosis of dementia, history of previous fracture, and family history of first degree relative with fractures (Old & Calvert, 2004). Modifiable risk factors for VCF include tobacco use, alcohol consumption, menopause prior to age 45 years, impaired eyesight, low body weight, corticosteroid use, and deficiency of calcium and/ or vitamin D (Old and Calvert, 2004).

VCF prevalence continues to increase as the general population ages. Mild to severe compression fractures are the most common consequence of osteoporosis. Of the 1.5 million osteoporotic fractures that occur each year approximately 700,000 are described as spinal fractures (USDHHS, 2002). It is estimated that 50% of women and 25 % of men ages 50 years and older will have an osteoporosis related fracture in their lifetime (Grafe, DaFonseca, & Hillmeier, 2000). Vertebral compression fractures can occur anywhere from the occiput to the sacrum, although they usually occur at the lumbodorsal junction, between thoracic vertebrae 8 and 12, the first lumbar vertebrae, or the fourth lumbar vertebrae (Crandall, 2004).

Comprehensive review of current literature

Although there is some controversy regarding management of vertebral compression fractures after the first three to six weeks, the literature supports non-operative treatment prior to this point. The clinical guidelines set forth by the American Association of Orthopedic Surgeons for treatment of symptomatic osteoporotic spinal compression fractures were established in 2010 (Esses, McGuire, Jenkins, Finkelstein & Woodward, 2010). The professional panel performed a literature review and made recommendations regarding the provider's use of common treatments with analgesics, braces, electric stimulation, exercise, acupuncture, massage as well as dietary

changes. Modalities such as bed rest, bracing, and exercise all of which fall into routine conservative measures, are deemed inconclusive by the American Academy of Orthopedic Surgeons (see table 1).

Table 1

AAOS Recommendation	Strength of Recommendation
Use of bed rest, complementary and alternative medicine, opioids analgesia for patients with compression fracture	Inconclusive
Treatment of compression fracture with bracing	Inconclusive
Electrical stimulation for patients with compression fracture	Inconclusive
Recommend against vertebroplasty with compression fracture	Strong
Kyphoplasty is an option for patients with compression fracture	Weak
Treatment with calcitonin for 4 weeks after identification of an acute compression fracture	Moderate
	Adapted from American Academy of Orthopedic Surgeons, 2010

Dr. Paul Chesis, clinical associate professor of radiology at University of Missouri Kansas City, cautions providers about the complications of conservative management of compression fractures that confine patients to bed rest. He suggests that there is a loss in bone density of 2% per week, loss of muscle strength by 10% per week, increase risk of pressure sores, increase risk of deep vein thrombosis & pulmonary embolism, and an increase in constipation with fecal impaction in elderly patient confined to bed (Chesis, 2010).

For over 15 years, vertebral augmentation via kyphoplasty or vertebroplasty has been an option for patients suffering with persistent pain from a vertebral compression fracture despite the clinical practice guideline recommendation against using these procedures. Although both procedures are similar in that they deliver medical grade cement to the vertebral fracture, these procedures have significant differences. Vertebroplasty generally uses a uni-pedicle approach without the use of a balloon tamp. In other words, the vertebroplasty requires the provider to place a needle into the patients back at only one point through a small bone called the pedicle. This process is achieved by using a real time x ray machine called a “C” arm. Once the needle is correctly positioned by the provider via “C” arm guidance, then medical grade cement can be deposited into the fractured area. The cement is injected with a high pressure system into the trabeculae of the vertebral body to give support to the fractured area.

Kyphoplasty uses a slightly different approach than vertebroplasty. The kyphoplasty procedure uses two needles with each being inserted into the bone called the pedicle on the left and right side of the patient. Once the appropriate needle placement has been confirmed with “C” arm then a small balloon is inflated to create a cavity and restore height to the fractured vertebrae prior to installing the cement under a low pressure.

Many studies compare vertebroplasty and kyphoplasty to non-operative modalities, and there is evidence these procedures provide better results than conservative modalities especially early on in the convalescent period (Do, Marcellus, Curtis, & Marks, 2005). Do et al prospectively followed 167 patients who had a total of 207 vertebral augmentations completed over a 4 year period. The total number of procedures was greater than the number of patients enrolled because some patients were treated for more than one fracture at a time. The criteria for measurement was both pre and post procedural measurements of pain on a 1-10 likert scale,

mobility, analgesic use, and short form 36 (SF-36) scores were compared at one month, six month, and three years' post procedure. Pain reduction post vertebroplasty & kyphoplasty was reduced from 8.71 to 2.77 on a likert scale, a finding that was statistically significant ($P < 0.00001$). There was also notable improvement in the SF-36 in 9 of 10 categories in the one month post procedure follow up. The three year follow up demonstrated continued improvement in 8 out of 10 SF-36 categories. The one month follow up was statically significant ($P < 0.001$), respectively, improvement in the treatment groups at three years was still statically significant ($P < 0.02$) (Do et al, 2005)).

Another large study supporting the effects of vertebral augmentation was published in March 2009 in *Lancet*. Efficacy and Safety of Balloon Kyphoplasty vs. Non-Surgical Care of Vertebral Compression Fracture (FREE) study was completed in 2009 and suggested that superiority over traditional treatment. The study demonstrated improved quality of life, quicker return to physical function, and faster pain relief than non-surgical care (Cummings, et al, 2009).

A paper presented at the North American Spine Society annual meeting in September 2011 also suggests that treatment of vertebral compression fractures with vertebral augmentation rather than traditional conservative modalities results in improved patient outcomes (Jarzem et al, 2011). A multicenter, randomized trial studying a total of 134 participants with painful compression fractures. These patients were randomized into kyphoplasty (N=70) and nonsurgical modalities previously described (n=64). The SF-36 was used to determine changes in quality of life with or without the procedure from one through twelve months post treatment. The kyphoplasty group showed statically significant improvement in all SF-36 groups at one month whereas the nonsurgical did not have improvement in any portion of the SF-36 ($P = 0.0001$). Long term (12 month) follow was unable to be accurately evaluated due to high cross over rate from

control to treatment status of 59% after one month (Jarzem, Pflugmacher, Berenson, Zonder, Tillman, Bastian, & Ashraf, 2011).

Lastly, a meta-analysis of randomized and non-randomized patients with VCF who underwent vertebral augmentation versus non-surgical management was also presented at the North American Spine Society annual meeting in 2011 (Papanastassiou, Van Meirhaeghe, Anderson, Berenson, Chung, & Small, 2011). This analysis reviewed 1539 articles but only 27 studies were included on the final analysis. The criteria for utilization in the analysis included prospective studies with the cohorts greater than 20 patients. The vertebral augmentation group demonstrated superior pain improvement over the non-surgical group in the studies reviewed ($P=0.01$) (Papanastassiou et al, 2011).

The widely popular use of vertebral augmentation entered the media spot light in 2009 when two articles were published in the New England Journal of Medicine found that kyphoplasty and vertebroplasty were no more beneficial than placebo or sham procedures. When these studies came out, the media reported that these procedures were being used to increase Medicare reimbursement to healthcare providers (LaPook, 2009). Until 2009, many healthcare providers who specialize in the management of spinal conditions regularly used kyphoplasty and vertebroplasty to give patients pain control and improvement with their quality of life. The first of the two articles was titled “A Randomized Trial of for Painful Osteoporotic Vertebral Fractures” (Buchbinder, Osborne, Ebeling, Wark, Mitchell, Wriedt, & Graves, 2009). This was a multicenter, randomized, double blind, placebo controlled trial in which patients had one or two vertebral compression fractures that were less than 12 months old. Acuity of these fractures was documented by MRI imaging for edema as per the current standards of care. The patients were then randomized to receive vertebroplasty or placebo treatment. Individuals in the placebo arm

of the study have all the same interventions that the vertebroplasty group has except they did not have cement injected into the vertebrae. Similar improvements were seen in both groups with respect to pain at night, rest, physical function, quality of life, and perceived improvement. This study found no benefit with vertebroplasty compared to placebo in patients with painful compression fractures at intervals of one week, one month, three months, or six months following treatment (Buchbinder et al, 2009). Dr. Buchbinder's study concluded that at three months the pain scores for the treated group averaged 2.6 (0-10 scale) and the placebo group 1.9 respectively. The statistical significance for all assessments of interaction in this study was $P > 0.10$.

The second study published in the same volume of the *New England Journal of Medicine* documented a similar study to the work done by Buchbinder et al, 2009 (Kallmes et al, 2009). This study was called "A Randomized Trial of for Osteoporotic Spinal Fractures" used similar techniques and a placebo group who received infiltration of local anesthesia and medical grade cement odor in the procedure room. The conclusion of this study was that pain scores were very similar in both the treated and placebo procedures at one month post treatment. The mean pain intensity rating in the vertebroplasty group was 3.9 (0-10 scale) and 4.6 in the placebo group which was maintained up to one month post treatment ($P = 0.19$). Interestingly, at three months 43% of the placebo group crossed over to the treatment group ($P < 0.001$) which makes analysis of greater than one month difficult due to small number of patients.

These two studies made many providers question the use of kyphoplasty and vertebroplasty. Anecdotally, this procedure has had tremendous success in the practice where this author practices; however, many patients have questions about the procedure especially after the media made this such a publicized topic for a short period of time. Shortly after these studies

became available in the literature many questions about the studies began to arise. Letters to the editor at the *New England Journal of Medicine* began to pour in scrutinizing the previously discussed Buchbinder and Kallmes studies. These studies completed in 2009 by Dr's Buchbinder and Kallmes included patients with diagnosed fracture up to 12 months prior to treatment, many suggested the people in these studies had impaired healing. Bone marrow edema may be present on MRI for months after the fracture heals so it is possible that some patients with healed fractures were included in the study thus biasing the results to no effect. The Kallmes study did not include hospitalized patients who benefit greatly from this technology. Other concerns with these studies were that patients with severe back pain, that typically benefit the most from these procedures, may not want to participate in fear of being randomized into the non- treatment group. One of the most common criticisms of these studies is the amount of medical grade cement instilled in these studies was very small. The maximum was 3 cc but the average was around 1.6cc of cement. Many providers who are well versed in this procedure agree that this volume of cement is not enough to provide structural support and more aggressive amounts can lead to better outcomes clinically (Piper, 2011). The many opinions by various authors only strengthen a need for evidence based treatments for this condition and further research is needed.

The topic of vertebral augmentation was a main point of discussion at the most recent meeting of the North American Spine Society (NASS) in November of 2011. Several new studies were presented regarding the efficacy of vertebral augmentation in the treatment of vertebral compression fractures. A concern for many providers is the recurrence of vertebral fracture in those treated with vertebral augmentation. One study of over 288 patients contained only patients with osteoporosis induced fractures (Faloon, Ruoff, Hohman, Dunn, & Patel 2011). This cohort was divided into surgical and non-surgical treatment groups. One hundred and

twenty-one patients were treated non-operative modalities and one hundred sixty-seven underwent vertebral augmentation. Patients with cancer, such as multiple myeloma infection or metastasis, were excluded. There was no significant difference in co morbidities between the surgical and non-surgical group. The group treated with non-operative modalities was 2.28 times more likely to sustain another fracture than those treated with the cement augmentation (Faloon et al, 2011).

Another study presented at NASS by Jarzem et al used kyphoplasty for treatment of painful vertebral fractures in those patients with cancer related pathology. This multicenter study did not blind the participants to surgical versus conservative treatment for vertebral compression fractures and looked at the response to treatment with both SF-36 quality of life scores as well as height reduction of the fracture being treated. The kyphoplasty group showed statistical improvement ($p < 0.0001$) at the one month follow up compared to the non-treated group. The surgical group also had an increase in mid-vertebral height when compared to the non-surgical group. In fact, the non-surgical group actually loss vertebral height at one month due to progressive collapse of the pathologic fracture. Fifty-nine percent of the non-surgical patients enrolled crossed over to kyphoplasty treatment making the non-surgical sample very small and limiting its power when examined. Nonetheless, this study does suggest that patients with a cancer related compression fractures do have substantial benefit in reduction of pain via kyphoplasty. The SF-36 scores in the kyphoplasty groups showed statistical significant improvement in all areas evaluated; bodily pain $P < 0.0001$, physical function $P < 0.0001$, and social function $P = 0.0008$ when compared to non-surgical treatment (Jarzem et al, 2011).

Lastly, a meta-analysis of randomized and non-randomized level I & II studies compared kyphoplasty, vertebroplasty, and non-surgical management (Papanastassiou, et al 2011).

Papanastassiou, et al included twenty-seven studies with greater than twenty patient cohorts. Treatment with vertebral augmentation was statistically superior to non-surgical management in improvement with pain ($p < 0.01$) in both the kyphoplasty and vertebroplasty groups. The risk for new fracture was higher in the non-surgical treatment group over the augmentation groups. Interestingly, the kyphoplasty group demonstrated superior improvement over the vertebroplasty group in quality of life ($p < 0.04$). The conclusion of this meta-analysis is that both kyphoplasty and vertebroplasty are superior to non-surgical management; however, kyphoplasty showed superiority to vertebroplasty with respect to quality of life scores. Surgical intervention for compression fractures seems to have the best results when treated within the acute phase (first seven weeks) for pain relief.

In summation, the results of these studies on the use of vertebral augmentation are varied. While some studies indicate little to no improvement in pain, others would argue that this technology offers substantial pain control and stabilization to a fractured vertebra. There is clearly various opinions about the use of this technology reinforcing the need for further studies in the future.

Project stakeholders

The stakeholders for this project will be those clinicians who care for patients that are at risk for vertebral column fractures. These stakeholders may be physicians, nurse practitioners, physician assistants, chiropractors, or any other allied health personal that cares for those patients at risk for compression fractures. The primary emphasis with this project will be on primary care providers however implications of this study can easily include those in geriatrics and emergency medicine.

Design

Prior to implementing the full scale project a beta test of the instrument and questionnaire was performed. Experts in the field of spine disease and treatment were given the study instruments and reviewed them for accuracy and ease of use. These experts are all physicians who are board certified in either orthopedic spine surgery or neuro-spine surgery. The study instrument was reviewed by various doctoral faculty members at the University of Missouri St. Louis and Saint Louis University to provide content validity. Lastly, five non-expert doctoral students reviewed the above materials for content clarity. This information was used for the purpose of ensuring clear and concise questioning. None of the survey information from the experts, faculty, or doctoral students was included in data collection. Suggestions for instrument improvement were incorporated into the final proposed instrument.

This practice evaluation project included a pre and post test survey and a continuing education offering. As previously described, there is a lot of controversy surrounding the treatment of acute compression fractures. Most concerning to this author is the data that indicate up to two thirds of these fractures goes undiagnosed (Brunton et al, 2005). It is hypothesized that if provider awareness and treatment of these fractures improve, the quality of life of the individuals with these fractures will improve as well. Also, by improving diagnosis and management of VCF's, the extensive co-morbidities associated with this diagnosis would diminish. In order to improve overall provider management of VCF's, the current state of knowledge of primary care providers regarding the diagnosis and treatment of VCF's must be explored. To that end, the aims of this project were to measure provider understanding of the current practice guidelines and assess how providers apply these guidelines. Another secondary aim of the study was to provide continuing education on VCF's, which was anticipated to

facilitate practice change measured as change between the pre and post survey questionnaire responses.

Resources

The largest resource for this project was time. Healthcare providers are constantly being pulled in many directions all day long for a minute of their time. Time consideration was given by setting up times for the intervention which worked for the provider or the office such as in the morning prior to clinic or in the evening after hours. It was the author's expectation that each pre-test session would take approximately thirty minutes depending on the amount of questions at the end of the power point presentation. In actuality the time for the pre-test varied from session to session by how many providers were in attendance but generally averaged about 20-25 minutes. However, post test completion of the questionnaire was much faster for the participants and generally it was completed within ten minutes.

The financial cost for this project did not exceed five hundred dollars in total. Less than fifty dollars was used for purchasing large, plain, sealable envelopes, and questionnaire printing costs. The investigator purchased a box of pens with all the same colored ink which was used by all the collection sites which cost less than ten dollars. The same printing company and ink pens were used to avoid any possible recognition of participant responses. Twelve sites were visited to collect a sample size of 34 providers. A budget of twenty dollars for food was proposed for each visit as appreciation for the disruption in the provider's day and schedule. The budget for food varied from visit to visit based on how many providers were participating. Furthermore, morning meetings were less expensive than afternoon or lunch meetings. The total for this portion spent for food was just under three hundred dollars for all twelve sites visited.

Sample

The author recruited local primary care providers to participate in this project. Potential subjects were identified by reviewing online primary care provider lists from local hospitals, online providers search via hospital systems, online internet searches using primary care within St. Charles Missouri area, and use of the “Blue Book”. Providers from the St. Charles county area were contacted by the project investigator to determine participation interest and to discuss project goals. Eligible providers were medical doctors, doctors of osteopathic medicine, doctor of chiropractic medicine, physician assistants, and nurse practitioners. If the provider expressed an interest in project participation a site visit was scheduled at the provider’s office. During this visit the project investigator obtained informed consent, participants were asked to complete pre-test instrument, and continuing education was provided.

Power analysis indicated that in order to detect a medium size effect with an alpha of 0.05 and a power of 80% a sample size of 34 participants is needed. However, to account for attrition a final sample of approximately 39 participants was obtained. We did not experience any provider drop out during the post data collection. Therefore, once we reached 34 completed surveys and met our sample size for power data collection was stopped. Five more providers completed the post survey around this same time and were included to make the total 39 participants.

Instrument

A multiple choice questionnaire ascertained the knowledge base of primary care providers related to vertebral column fractures. This 16 item instrument designed for this project includes items to assess provider knowledge, comfort level with fracture identification, VCF

epidemiology, and compliance with VCF clinical practice guidelines. All questionnaire items were based on the evidence contained in this project's literature review. Approximately four weeks later a post test questionnaire was given to the providers to re-evaluate the information obtained in the pre-test and to determine changes made in practice pattern following the continuing education offering (attachment 1). The questions addressed in the pre and post survey were evaluated by several faculty members from the local universities as well as physician spine experts for content validity.

Human subject's protection

Prior to data collection approval was obtained from the institutional review board (IRB) and Graduate School of the University of Missouri-St. Louis. Forty subjects who are primary care providers were approached to participate in this survey. If invited to the practice, the investigator went to the subjects' practice site and provided the subjects with an anonymous survey (pre-test questionnaire) to determine their beliefs and attitudes about vertebral compression fractures (VCF) and the clinical practice guidelines for management of VCF's. All surveys were anonymous with a subject derived identifier. Participants were asked to use their mother's numeric month and date as well as the first and last letter of their mother's maiden name to ensure anonymity when matching the pre and post surveys. Pens were provided and subjects were asked to place completed surveys in a sealed envelope to ensure anonymity. All instruments will remain anonymous and data will be de-identified. All survey materials were kept in a locked cabinet in a secure office. All data were reported in aggregate. No human subject problems or violation of confidentiality occurred during this project. The de-identified data were reviewed only by the principal investigator and committee chair. The de-identified data with the provider generated match codes were used to compare pre and post survey.

Subjects were not paid for participation but the investigator brought food, for example bagels and or sandwiches, to the initial meeting with participants.

Project Methods

Once a provider agreed to participate and informed consent was obtained (Appendix 3), a non-identifying pre-test questionnaire (Appendix 1) was given to the providers to complete while the project coordinator left the room. This was done to ensure privacy and anonymity. In some cases the room was large enough to leave the participants alone to complete the survey. The investigator had a few encounters when the participant insisted the investigator did not leave the room. In those cases the surveys were put into an envelope labeled “pre” and sealed by the last participant completing the questions or were given to the investigator to place in the envelope to seal.

After the pre-questionnaires were completed the project coordinator gave a brief fifteen minute power point presentation on the identification and treatment guidelines for vertebral compression fractures. A laptop and portable projector were used for the presentation. The slides covered current epidemiology of VCF's, identification of compression fractures, appropriate work up, conservative vs. operative management, and current practice guidelines from the American Academy of Orthopedic Surgeons (Appendix 1). Once the continuing education was completed, the project coordinator entertained questions from the participants prior to completing the meeting.

Approximately four weeks after the initial visit, the investigator returned to the participant's office to obtain the subject's post test responses (Appendix 2). The purpose of the post test was to ascertain if changes in knowledge and practice occurred following the

presentation. When this project was submitted for IRB approval the investigator was to meet with each provider after four weeks to administer a post survey. However, due to participants' time constraints a slight change of protocol occurred. Instead of trying to meet with each participant at a mutually agreeable time the investigator dropped off the post survey questionnaire four weeks after the continuing education session in a plain envelope marked "post" for the provider to complete at a more convenient time. A note on the outside of the envelope instructed the provider to complete the survey at their earliest convenience and to call the investigator for pick up. This allowed the providers to complete the post survey with less disruption in their day as well as maintain anonymity. The investigator had two offices that each had five providers participating in the project. Collection of the post survey data at these two large offices was rather slow due to the high volume of patients. The investigator solicited help from the office receptionist in collecting the completed surveys in an unmarked envelope. Once this was completed the receptionist notified the investigator and the data was collected. The investigator mailed a twenty dollar gift card to each of the two receptionists that assisted in this process. Neither receptionist was aware of the gift card until after the collection had been completed. Furthermore, neither person was present or had any part of the survey process pre or post aside from putting the data into the envelope and calling the investigator.

Project timeline

Data collection was initiated on 7/12/2012 after obtaining approval from the University of Missouri IRB committee and the Graduate School. The first week of the time line was used to set up multiple appointments with providers interested in participating in the project. The first pre survey presentation occurred on 7/19/2012 and the last of the pre survey data collection was completed on 8/21/12. The post survey data collection began on 8/17/2012 and

was completed on 9/26/12. Data collection for both pre and post survey consumed approximately ten weeks. The data was analyzed with the assistance of the investigators chair for significance. Final drafts of the project and outcomes was completed on 10/14/20012 and sent to committee for review and approval.

Data analysis

Data were analyzed using statistical package for the social sciences (SPSS). Descriptive statistics were used to describe the subjects and the pre and post test responses. Analysis of Variance (ANOVA) was used to examine the relationship between selected variables.

Outcomes

The outcome of this survey is to determine the primary care providers understanding of the current practice guidelines and assess how they apply these guidelines. Another aim was to provide continuing education on VCF's which was anticipated to facilitate practice change by increasing the knowledge of compression fractures. The author used a short multiple choice questionnaire/ survey to determine the VCF knowledge base of primary care providers and conducted a brief education intervention to see if knowledge and practice can be positively affected. The survey included clinical based questions about the epidemiology and practice patterns of providers specific to patients with vertebral compression fractures. It was hypothesized that the survey would identify deficient knowledge areas of primary care providers and the education session would result in practice change one month post intervention.

Data Summary

Pre and post test findings

The project enrolled a total of 39 participants all of whom completed both the pre and post survey questionnaire. All subjects approached for the study consented to participate. Subjects were primarily physicians and nurse practitioners which was question number 1 (Table 2).

Table 2. Respondent profession (n=39)

	Frequency	Percent
Physician	25	64.1
Advanced Practice Nurse	12	30.8
Physician Assistant	2	5.1
Total	39	100

Survey questions one through three of the pre and post survey inquired about the participants title, if they evaluate and treat vertebral compression fractures, and if so about how many per month. Many of the respondents, 85%, treat VCF's in their respective practices. However, of those providers surveyed very few diagnose more than two a month. In fact, 95 % of the primary care providers are in this category (Table3). As expected there were very little if any changes in the responses to these questions between pre and post test response. Question number four specifically asked how comfortable the provider was diagnosing vertebral column fractures. The post survey provided evidence that the providers had increased comfort in the diagnosing of VCF's post intervention (Table 4).

Table 3. Provider report of number of VCF's treated per month

	Frequency	Percent
Less than 1 fracture	29	74.4
1-2 fractures	8	20.5
2-3 fractures	2	5.1

Table 4. Providers comfort diagnosing vertebral compression fractures pre and post intervention
(n=39)

	Frequency	Percent	Frequency	Percent
	Pre-Survey		Post-Survey	
Very comfortable	10	25.6	12	30.8
Somewhat comfortable	18	46.2	18	46.2
Neither comfortable nor uncomfortable	5	12.8	4	10.3
Somewhat uncomfortable	4	10.3	4	10.3
Very uncomfortable	2	5.1	1	2.6

Survey questions number five, six, seven, eight, and nine assessed the current provider knowledge base of the epidemiology of vertebral column fractures in primary care. For each of these items there was improvement between pre and post participant scores (Table 5). This

would suggest that at least short term (4 weeks) retention of epidemiologic knowledge of lumbar spine compression fractures was maintained.

Table 5. Frequency of correct provider responses on survey questions 5-9 (n=39)

	Frequency	Percent	Frequency	Percent
	Pre-Survey		Post-Survey	
#5 How likely to re-fracture after the first VCF	15	38.5	18	46.2
#6 What % fracture undiagnosed yearly	11	28.2	21	53.8
#7 How many VCF each year	9	23.1	17	43.6
#8 Where most VCF occur anatomically	25	64.1	34	87.2
#9 Cost of VCF annually mirrors that of breast cancer	24	61.5	38	97.4

Survey questions ten through fifteen (Table6) were designed specifically to evaluate providers' knowledge of current practice guidelines (CPG's) and their knowledge regarding the evaluation and treatment of vertebral column fractures.

Table 6. Frequency of correct provider responses to questions 10-13 (n=39)

	Frequency	Percent	Frequency	Percent

	Pre-Test		Post-Test	
#10. All VCF can be found on X-ray within 7 days	32	82.1	37	94.9
#11. Which is not a risk for VCF	27	69.2	37	94.9
#12. All VCF occur with trauma	38	97.4	39	100
#13. Best imaging for VCF after x-ray with no contraindications	22	56.4	25	64.1

Survey questions 14 and 15 evaluate the providers' awareness of the current practice guidelines for compression fractures (Table 7). The pre-survey suggested that under 18% of those in primary care are aware of the current practice guidelines for VCF's. However, the post survey response to the same question was raised to just fewer than 70%. This was a 50% improvement in awareness during this four week period.

Table 7. Providers' responses to questions 14 and 15

	Frequency	Percent	Frequency	Percent
	Per-Test		Post-Test	
#14. Are you familiar with CPG's for VCF	Yes/No	Yes/No	Yes/ No	Yes/No
	7/32	17.9/ 82.1	27/12	69.2/30.8

#15. Do you follow the CPG for VCF's?				
All the time	3	7.7	4	10.3
Some of the time	7	17.9	22	56.4
Don't know guidelines	26	66.7	11	28.2
Rarely follow guidelines	1	2.6	0	0
Never follow guidelines	2	5.1	2	5.1

Survey questions 16-18 of the post survey were designed to evaluate if and how providers changed their practice based on the continuing education that they received (Table 8 & 9). Specifically, table seven graphically illustrates the findings of question 16. Over two thirds of the providers participating have changed some portion of their practice as it relates to vertebral column fractures.

Table 8. Respondents who have changed their practice patterns post survey question number 16 when treating VCF (n=39)

	Frequency	Percent
Yes	28	71.8
No	11	28.2

Question 17 asked the participants how their practice has changed as a result of the continuing education is represented below (Table9). The qualitative nature of this response required the investigator to evaluate for common themed responses. These themes were then clustered into

categories which were reviewed with the investigator's chair for accuracy. The survey responses were placed into one of four categories; increased awareness of risk, improved understanding of evaluation and treatment, and did not answer.

Table 9. How respondents changed their practice after the continuing education (n=39)

	Frequency	Percent
Increase awareness risk	9	23.1
Better understanding of work up/ treatment	12	30.8
Did not answer/ blank	14	35.9
Quicker referral to spine	4	10.3

Lastly, question 18 on the post survey asked if the provider did not change their practice why have they not changed or what would it take to facilitate a change. With 72% of the respondents replying that they have changed their practice this question did not receive many responses. The rate of no answer for question 18 was 87%. The other 13% was broken down into two other categories with the approval of the investigators chair. Even with the continuing education we had 10% (4 respondents) that stated they did not understand the guidelines enough to consider changing. Only 3% (1 respondent) suggested that time constraints prohibited them from making a practice change.

Physician vs. NP responses

Analysis of variance (ANOVA) was used to examine differences between nurse practitioners and physicians related to their use of VCF guidelines pre education. During the data

analysis an interesting finding was made. When we compared physician and nurse practitioners use of current practice guidelines we found a stark contrast. Analysis of variance (ANOVA) indicated a significant difference between physician and nurse practitioners who follow the current practice guidelines ($F=5.941(df=4)(p=0.001)$) (Table 10). Another unexpected difference was a significant difference between these two provider types' knowledge of how many vertebral fractures are undiagnosed each year ($F=2.976(df=3)(p=0.045)$ (Table 10).

Also of note is there are a number of survey answers that were not answered differently by nurse practitioners and physicians. For example on question number four respondents reported their comfort diagnosing VCF's ($F=1.763(df=4)(p=0.159)$ Table 10). Similarly, prior to the continuing education offering, physicians and nurse practitioners did not significantly differ in their report of the appropriate diagnostic imaging studies that should be used to diagnose VCF's ($F=.727(df=3)(p=0.543)$ (Table 10).

Table 10. Differences between nurse practitioner and physician responses (n=39)

Follow current practice guidelines	CPG	Does not know	Do not use CPG	ANOVA
Physician	6	17	2	F=5.941 df=4 P=0.001
Nurse Practitioner	2	9	1	
Physician Assistant	2	0	0	
% FX undiagnosed	90%	66% Correct	50%	ANOVA
Physician	5	9	9	F=2.976 df=3
Nurse Practitioner	1	2	8	

Physician Assistant	0	0	0	P=0.045	
Level of comfort Treating VCF's	Comfortable	Neither comfortable or uncomfortable	Uncomfortable	ANOVA	
Physician	21	2	2	F=1.763	
Nurse Practitioner	6	3	3	df=4	
Physician Assistant	1	0	1	P=0.159	
Correct imaging	CT Scan	Bone Scan	MRI Correct	PET Scan	ANOVA
Physician	4	4	16	1	F=0.727
Nurse Practitioner	3	4	5	0	df=3
Physician Assistant	1	0	1	0	P=0.543

Data analysis conclusion

Many of the responses from the survey questions indicated improvement from pre to post education. Analysis of variance was used to compare select clinically based questions to ascertain significant differences between groups. Question number four asked about providers comfort level of treating VCF's, comparison of pre and post education revealed a statistically significant finding (F=4.709(df=4)(p=0.004). Also significant was a difference in the provider's knowledge about risk factors for VCF's pre and post education (F=7.807(df=1)(p=0.008).

The survey questions answered by the providers were designed to evaluate the previously stated aims of this project. The first aim was to assess primary care providers' knowledge of the current VCF practice guidelines. Eighty-two percent of the respondents were unfamiliar with the current practice guidelines for compression fractures prior to the educational session. Pre and post education provider recognition of clinical practice guidelines was not significantly different, although approaching statistical significance ($F=3.985(df=1)(p=0.053)$).

A second aim of the project was to improve provider knowledge base by providing a continuing education about VCF to study participants. The data indicate that the information provided to the participants lead to improvement in overall knowledge of VCF's as demonstrated by improvement in all applicable survey questions four weeks post education.

Lastly, one of the aims of this project was to facilitate practice change following continuing education regarding VCF diagnosis and management. Almost 72% of the respondents "reported changing their practice pattern because of knowledge obtained at the continuing education session". Those who reported the intervention not changing their practice cited several reasons for this. Some of the participants did not treat compression fractures. Four of those surveyed did not feel they understood the current practice guidelines well enough to consider changing their practice and three of those participants listed time constraints as a limiting factor to changing their diagnostic work-up of vertebral compression fractures.

Of those who stated how they changed their practice ($n=25$), 23% stated an increased awareness of risk factors for vertebral compression fractures. Over 30.8% of respondents felt as though they could better work up a patient with a suspected compression fracture while 10.3% replied they would refer the patient to a specialist in a more timely fashion. In total, 63% of the

respondents felt as though the education received changed their practice so they now provide better care for those patients with vertebral compression fractures. Almost 36% (14 of 39) did not respond to the question of how the education changed their practice. The evidence obtained four weeks post the continuing education session indicate that the continuing education offering did result in increased self-report of primary care provider identification and management of VCF's, and improved providers adherence to current practice guidelines in the short term.

Barriers and challenges

One of the main challenges of this project was getting to speak with the providers to enlist their recruitment. Although the investigator had no difficulty finding the names of providers in the area, it was difficult actually reaching the providers on the phone. Often, requests to speak to the providers did not make it further than the office staff who answered the practice's phone line. This caused delays between subject identification and subject recruitment. Once the investigator was able to speak with those who met inclusion criteria the process of enrolling subjects was rather smooth. One of the mechanisms used to reach providers directly without going through office staff was by approaching primary care providers at the local hospitals to schedule a time to meet. Other solutions included calling the nurse practitioner or physician assistant and asking for a back line or point of contact person who would schedule an appointment with the provider(s). Many office managers were gate keepers and treated this investigator like a sales representative competing for time. Unfortunately, some of the primary care providers wanted for recruitment for the project do not see patients at the hospital which made contacting them more difficult. In these situations repeated calls to the office and request to speak with the provider (which rarely occurred) and would keep a log of the person contacted for

follow up in 24-48 hours by a return call. This persistence and being pleasant on the phone resulted in more than a couple of appointments for subject recruitment.

Another challenge which was not anticipated was the impact of collecting data during the summer months. Many primary care practices have providers out disproportionately in the summer on vacation than any other time. This not only made it more difficult to obtain the number of surveys needed it made follow up collection difficult as well. Many of these providers were so busy with vacation coverage during this season that some reported completing the post test was a low priority. As previously discussed, there was a small deviation in collection with two of the larger offices and rewarded two receptionists with a small gift card for their assistance in reminding the providers to complete the post survey. This change of protocol seemed to help expedite survey completion and return with these offices.

Application

This capstone project was chosen by the author because of the significant number of patients treated each year with vertebral compression fractures. This problem will only worsen with the aging of the baby boomers and its effects can be catastrophic on human life. As previously noted, many adults age sixty years and older consider back pain to be part of the normal aging process. Commonly, older adults with VCF's are initially diagnosed with osteoarthritis. Many articles in the past have discounted the need for x-ray with back pain patients which have spawned this idea that back pain patients do not need imaging (Lateef & Patel, 2009). Another misconception by the provider is the initial x-ray is negative and therefore further work does not need to be done on the patient with acute back pain. Some of our oldest patients just feel that this is a cross they have to bear and do not want to complain about their

aches or be a burden. Unfortunately, some of the primary care providers still subscribe to outdated knowledge that the only treatment for compression fractures is rest or physical therapy. This project aimed to provide insight into primary care provider's knowledge regarding VCF. In addition, this project aimed to improve the knowledge base and thereby facilitate practice change for primary care providers who treat vertebral compression fractures.

The information obtained from this project could be used as a spring board for a large scale project. It is feasible that this same model could be used on a larger scale at local or county medical society meetings. This brief educational session could be offered as a continuing education program, thereby allowing for a large audience to be reached in one sitting. There are several specialty groups in the St. Louis area such as Saint Louis Nurses in Advanced Practice (SNAP), Saint Charles Medical Society, or grand rounds for family practice or internal medicine residents that would be appropriate venues for a continuing education session about VCF's.

Further application of this project could extend well beyond internal medicine and family practice. As the baby boomers continue to increase in age the emergence of geriatric specialist is more common. This sub-specialty of medicine will be even more in the forefront of this problem given the demographics of vertebral column fractures. Lastly, this type of project would benefit those providers in emergency medicine and urgent care practices. The providers in these acute settings are generally the ones who initially see patients with VCF's and it is imperative that these providers offer the patient all options available or at the very least refer them to those trained in treating this diagnosis.

As a provider in one of two full time spine practices in Saint Charles County it is hoped that this project will illuminate the problem of VCF and eventually lead to decreasing the

morbidity associated with this diagnosis. The dissemination of VCF's education could be shared by the spine community in this county at each of our respective hospital department meetings. This model could easily be applied in other hospitals to further reach the primary care community.

Implication of Further Research

It is uncertain if the knowledge changes noted in this study are permanent. It is possible that the differences noted would diminish over time. The sample size of our survey was only 39 participants. It may be that if a larger sample was to be investigated that there would be changes in the statistical significance of more variables studied. Further research is needed to determine if provider knowledge and practice change is sustainable for longer periods of time.

All the education sessions were given by the same investigator. It is uncertain if results were influenced by the skill of this individual and it is possible that subtle changes in the education session occurred over time because of informal feedback received from audiences. Further, as many of the providers participating are personally known to the principal investigator the participants may have felt more at ease to ask questions or were more engaged than they would be with an unknown investigator. Therefore, further research should be conducted with another cohort with a different educator to determine if the findings can be replicated before planning a large scale project.

It is possible that there could have been unintended bias that resulted from the principal investigator varying his approach based on feedback and experience with the early education sessions. Great care was taken to have all the responses placed into a sealed envelope with no markings to maintain subject anonymity and to prevent the investigator from knowing how

subjects responded to pre and post items. Further, each participant created his or her own personal subject identifier. These identifiers were not known to the investigator blinding the investigator to each provider's responses. None of the completed surveys were looked at by the investigator until after all study data collection closed.

One final implication for future research relates to the differences between physician and nurse practitioner responses on the survey. Further work is needed to determine if a larger sample would allow for more precision in the study findings and studies should be designed to explore why these differences occurred. However, it is important to note that future work would require DNP and PhD collaboration to ensure correct methodological and statistical approaches.

DNP Influenced Practice

The process towards identifying a DNP project began with introspection about what areas of the author's practice needed improvement. Realization of the number of people annually treated with vertebral compression fractures, and that often many of the patients seen had received incorrect treatment. The two years of didactic studies during the DNP education helped me become much more than a nurse practitioner who only sees the needs of individual patients. DNP education has opened the author's eyes to the influences of disease on populations and patient aggregates. Prior to beginning doctoral study anecdotal evidence may be sufficient to result in practice change, mostly because my education focused on clinical and not research expertise. Early on in the DNP program, awareness is made of the dearth of published evidence to support common healthcare practices. As a result, questions rose in regards to common practices. Now the challenge is to ensure that only the use evidence based care approaches are utilized.

Much information was learned upon reviewing the literature extensively about a topic that was previously thought known. Many practices were truly anecdotal after reviewing the literature! Upon reviewing, I found countless journal articles that suggested treatment modalities that were poorly powered or did not demonstrate statistical significance. It became quickly evident that the sub specialty of spine care has very few practice guidelines and some of those in print are very nonspecific. This project represents a small part of the patient mix treated daily in this author's practice but has made the author rethink many of the modalities that are commonly discussed. As a result, treatments come into question if not based on sound scientific principal.

The DNP project has without question elevated the knowledge as a provider. The education received to evaluate treatment options objectively based on scientific data has been invaluable. The program provided the education to translate clinical care from research into practice. Translational research has the potential to transform nurse practitioner practices. NP's contribute to science by translating research into practice and by being active members of research teams by identifying phenomenon that need to be researched. Anticipation for graduation with my DNP will allow opportunities for further analysis of current practices in the spine care community.

References

- Brunton, S., Carmichael, B., Gold, D., Hull, B., Kauffman, T., Papaioannou, A., . . . Stracke, H. (2005, September). Vertebral compression fracture in primary care. *The Journal of Family Practice*, 781-788.
- Buchbinder, R., Osborne, R., Ebeling, P., Wark, J., Mitchell, P., Wriedt, C., & Graves, S. (2009, August). A randomized Trial of Vertebroplasty for Painful Osteoporotic Vertebral Fractures. *New England Journal of Medicine*, 361(6), 557-568.
- Bureau, U. C. (2010). *Population by Sex and Selected Age Groups 200-2010*. US Census Bureau.
- Chesis, P. (2011). Management of Vertebral Compression Fracture. *Continuing Education St. Josephs Hospital West*. Lake St. Louis.
- Crandall, D. (2004). Acute vs Chronic Compression Fractures treated with Kyphoplasty. *Spine Journal*, 4(4), 418-424.
- Cumings, S., Nevitt, M., & Browner, W. (1995). Risk Factors for Hip Fractures in Women. *New England Journal of Medicine*, 332(12), 767-773.
- Cummings, W. M. (2009). Fracture Reduction Evaluation. *Lancet*, 373, 1016-24.
- Do, H., Kim, B., Marcellus, M., Curtis, L., & Marks, M. (2005, August). Prospective Analysis of Clinical Outcomes after Percutaneous Vertebroplasty for Painful Osteoporotic Vertebral Body fractures. *American Journal of Neuroradiology*, 1623-1628.
- Dr. Terrence Piper, M. (2012, January 14). Treatment of Spinal Compression Fractures. (C. Hemmer, Interviewer)
- Esses, S., Mcguire, R., Jenkins, J., Finkelstein, J., & Woodard, E. (2010). *Clinical Practice guidelines for Painful Vertebral Compression Fracture*. Chicago: American Academy of Orthopaedic Surgeons.
- Esses, S., McGuire, R., Watters, W., Keith, M., & Goldberg, M. (2010). Treating spinal compression fractures. *AAOS New treatment guidelines for spinal fractures* (pp. 1-192). Chicago: American Academy of Orthopedic Surgeons.
- Faloon, M., Ruoff, M., Hohman, D., Dunn, C., & Patel, D. (2011). Increased Risk of Subsequent Fracture with Nonoperative Treatment of Osteoporotic Vertebral Compression Fractures. *North American Spine Society 26th Annual Meeting*. Chicago.

- Grafe, I., Da Fonseca, K., & Hillmeier, J. (2000). Reduction of Pain and Fracture incidence after Kyphoplasty. *Osteoporosis*, 16, 2005-2012.
- Jarzem, P., Pflugmacher, R., Berenson, J., Zonder, J., Tillman, J., Bastian, L., & Ashraf, T. (2011). Balloon Kyphoplasty Improves Quality of Life, Body Pain and Vertebral Height Compared to Non-Surgical Management. *North American Spine Society 26th Annual Meeting*. Chicago.
- Kallmes, D., Comstock, B., Heagerty, P., Turner, J., Wilson, D., Diamond, T., & Edwards, R. (2009). A Randomized Trial of Vertebroplasty for Osteoporotic Spinal Fractures. *New England Journal of Medicine*, 569-579. doi:10.1056/NEJMoa0900563
- LaPook, J. (2009, August 5). Is a Common Medical Procedure Unnecessary? CBS News .
- Lateef, H. &. (2009, June). What is the role of imaging in acute low back pain? *Current Review of Musculoskeletal Medicine*, 2(2), 69-73. doi:10.1007/s12178-008-9037-0
- Leech, J., Dulberg, C., Kellie, S., & Gay, J. (1990). Relationship of Lung Function to Severity of Osteoporosis in Women. *American Review of Respiratory Disease*, 141, 68-71.
- Lindsay, R. (2001). Increase Risk of New Fractures in Patients with Compression Fracture. *Journal of American Medical Association*, 285(3), 320-323.
- Lindsey, R., Silverman, T., & Cooper, S. (2001). Risk of New Fracture in the Year Following a Fracture. *Journal of American Medical Association*, 285, 320-323.
- Old, J. L., & Calvert, M. (2004). Vertebral Compression Fractures in the Elderly. *American Academy of family Physicians*, 69(1), 111-116.
- Papanastassiou, I., Frank, P., Van Meirhaeghe, J., Anderson, G., Berenson, J., Chung, G., & Small, B. (2011). Comparison of Kyphoplasty, Vertebroplasty, and Non-Surgical Management. *North American Spine Society 26th Annual Meeting*. Chicago.
- Services, U. D. (2002). *Surgeon General Workshop on Osteoporosis and Bone Health*. Washington.
- Sherman, A., & Cailliet, R. (2010, March 25). Lumbar Compression Fracture. Retrieved March 3, 2012, from <http://emedicine.medscape.com/article/309615-overview>
- Strom, O., Leonard, C., March, D., & Cooper, C. (2010). Cost Effectiveness of Balloon Kyphoplasty in Patients with Symptomatic Vertebral Compression fractures in UK Setting. *Osteoporosis International*, 1599-1608. doi:10.1007/s00198-009-1096-6

VanSchoor, N., Smit, J., Twisk, J., & Lips, P. (2005). Impact of Vertebral Deformities, Osteoarthritis, and Other Chronic diseases on Quality of Life. *Osteoporosis International*, 749-756. doi:10.1007/s00198-004-1744-9

Zampini, J., White, A., & McGuire, K. (2010). Comparison of 5766 Vertebral Compression Fractures Treated with and without Kyphoplasty. *Clinical Orthopaedics and Related Research*, 468, 1773-1780. doi:10.1007/s11999-010-1279-7

Appendix 1 (Pre test)

Numeric month of mother's birthday _____

Numeric day of mother's birthday _____

First and last letter of mother's maiden name _____

Practice Pattern

1. Which best describes you title?
 - a. Physician
 - b. Advanced Practice Nurse
 - c. Other
2. Do you treat vertebral compression fractures in your practice?
 - a. Yes
 - b. No
3. How many vertebral fractures do you typically diagnose per month?
 - a. Less than 1
 - b. 1-2
 - c. 2-3
 - d. 4 or more
4. How comfortable are you in diagnosing vertebral compression fractures?
 - a. Very comfortable
 - b. Somewhat comfortable
 - c. Neither comfortable or uncomfortable
 - d. Somewhat uncomfortable
 - e. Very uncomfortable

Evaluation and treatment of Compression Fractures

5. How likely is a patient to fracture another vertebra after their first vertebral fracture?
 - a. 1 times
 - b. 3 times
 - c. 5times
 - d. 10 times
6. What percentage of vertebral fractures goes undiagnosed yearly?
 - a. 90%
 - b. 66%
 - c. 50%
 - d. 30%
7. Approximately how many vertebral fractures occur each year?
 - a. 100,000
 - b. 250,000
 - c. 700,000
 - d. I don't know

8. Vertebral fractures most commonly occur where?
 - a. Sacrum
 - b. Lumbar spine
 - c. Thoracolumbar spine
 - d. Cervical spine
9. The total treatment cost for vertebral compression fractures mirrors that of breast cancer and heart disease?
 - a. True
 - b. False
10. All vertebral column fractures can be found with plain x-ray within seven days of injury?
 - a. True
 - b. False
11. Which is **NOT** a risk factor for vertebral compression fracture?
 - a. 60 years or older
 - b. Low body weight
 - c. Chronic steroid use
 - d. Obesity
12. All vertebral compression fractures are associated with a history of trauma?
 - a. True
 - b. False
13. In a patient with no contraindications what is the best imaging after x ray for work up to discern the acuity of a compression fracture?
 - a. CT scan
 - b. Bone scan
 - c. MRI
 - d. PET scan
14. Are you familiar with the clinical practice guidelines for the identification & treatment of vertebral compression fractures?
 - a. Yes
 - b. No
15. Do you follow the clinical practice guidelines for identification and treatment of vertebral compression fracture?
 - a. All the time
 - b. Some of the time
 - c. I don't know the guidelines
 - d. Rarely
 - e. Never
16. Why do you use/ not use the current practice guidelines for vertebral column fractures?

Thank you for taking time to complete this survey

Appendix 2 (Post test)

Numeric month of mother's birthday _____

Numeric day of mother's birthday _____

First and last letter of mother's maiden name _____

Practice Pattern Post Test

1. Which best describes your title?
 - a. Physician
 - b. Advanced Practice Nurse
 - c. Other
2. Do you treat vertebral compression fractures in your practice?
 - a. Yes
 - b. No
3. How many vertebral fractures do you typically diagnose per month?
 - a. Less than 1
 - b. 1-2
 - c. 2-3
 - d. 4 or more
4. How comfortable are you in diagnosing vertebral compression fractures?
 - a. Very comfortable
 - b. Somewhat comfortable
 - c. Neither comfortable or uncomfortable
 - d. Somewhat uncomfortable
 - e. Very uncomfortable

Evaluation and treatment of Compression Fractures

5. How likely is a patient to fracture another vertebra after their first vertebral fracture?
 - a. 1 time
 - b. 3 times
 - c. 5 times
 - d. 10 times
6. What percentage of vertebral fractures goes undiagnosed yearly?
 - a. 90%
 - b. 66%
 - c. 50%
 - d. 30%

7. Approximately how many vertebral fractures occur each year?
 - a. 100,000
 - b. 250,000
 - c. 700,000
 - d. I don't know

8. Vertebral fractures most commonly occur where?
 - a. Sacrum
 - b. Lumbar spine
 - c. Thoracolumbar spine
 - d. Cervical spine

9. The total treatment cost for vertebral compression fractures mirrors that of breast cancer and heart disease?
 - a. True
 - b. False

10. All vertebral column fractures can be found with plain x-ray within seven days of injury?
 - a. True
 - b. False

11. Which is **NOT** a risk factor for vertebral compression fracture?
 - a. 60 years or older
 - b. Low body weight
 - c. Chronic steroid use
 - d. Obesity

12. All vertebral compression fractures are associated with a history of trauma?
 - a. True
 - b. False

13. In a patient with no contraindications what is the best imaging after x ray for work up to discern the acuity of a compression fracture?
 - a. CT scan
 - b. Bone scan
 - c. MRI
 - d. PET scan

14. Are you familiar with the clinical practice guidelines for the identification & treatment of vertebral compression fractures?
 - a. Yes
 - b. No

15. Do you follow the clinical practice guidelines for identification and treatment of vertebral compression fracture?

- a. All the time
- b. Some of the time
- c. I don't know the guidelines
- d. Rarely
- e. Never

16. Have you changed your practice pattern when treating vertebral column fractures since the continuing education session?

- a. Yes
- b. No

17. If your practice has changed, how has it changed?

18. If your practice has not changed, why has it not changed and what would you need to be comfortable making a practice change?

Thank you for taking time to complete this survey

Appendix 3: Consent form



Department of Nursing

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Informed Consent for Participation in Research Activities

Primary Care Providers' Knowledge & Use of the Clinical Practice Guidelines for Vertebral Column Fractures

Participant _____ HSC Approval Number 339248-1

Principal Investigator Christopher Hemmer PI's Phone Number 636-697-5227

1. You are invited to participate in a research study conducted by Christopher Hemmer and Dr. Dawn Garzon. The purpose of this research is to perform a program evaluation of current treatment patterns of primary care providers for osteoporotic vertebral compression fractures.

2. a. Your participation will involve completing a multiple choice survey to help understand the current practice patterns and knowledge base of primary care providers. This survey will remain anonymous as the participant will create their own identifier (known only to the participant) for comparison with a post test 4 weeks later. The project director will come to the participant's office or meeting area to facilitate participation in all aspects of this project.

b. Once completed a short continuing education session via power point will be provided to the participants. This power point will address the issue of osteoporotic compression fractures as well as current practice guidelines.

c. Approximately 4 weeks later a post survey will be given anonymously and collected. The identifiers created by the participants will allow the project director to compare pre and post data while keeping anonymity of the participants.

Approximately 50 subjects may be involved in this research at the University of Missouri-St. Louis.

b) The amount of time involved in your participation will be 25 minutes for the pre survey and continuing education and less than 15 minutes for the post survey four weeks later.

3. There are no known risks associated with this research other than potential for mild boredom or fatigue.
4. The possible benefits to you from this research are improved knowledge of the current practice guidelines for treating vertebral compression fractures, increased awareness of the morbidity associated with untreated vertebral compression fractures, and options for treatment.
5. Your participation is voluntary and you may choose not to participate in this research study or withdraw your consent at any time. You may also choose to not answer any question on the survey instrument. You will NOT be penalized in any way should you choose not to participate or withdraw.
6. We will do everything we can to protect your privacy. As part of this effort, your identity will not be revealed in any publication that may result from this study. In rare instances, a researcher's study must undergo an audit or program evaluation by an oversight agency (such as the Office for Human Research Protection) that would lead to disclosure of your data as well as any other information collected by the researcher.
7. If you have any questions or concerns regarding this study, or if any problems arise, you may call the Investigator, Christopher Hemmer @ 636-697-5227 or the Faculty Advisor Dr. Dawn Garzon @ 314-516-7094. You may also ask questions or state concerns regarding your rights as a research participant to the Office of Research, at 516-5899.

I have read this consent form and have been given the opportunity to ask questions. I will also be given a copy of this consent form for my records. I hereby consent to my participation in the research described above.

Participant's Signature

Date

Signature of Investigator or Designee

Date