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Program to Prevent Subsequent Fragility Fractures

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This is to certify that the doctoral study by

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

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MSN, Husson College, 1998

BSN, University of Maine, 1990

Project Submitted in Partial Fulfillment

of the Requirements for the Degree of

Doctor of Nursing Practice

Walden University

February 2018

Abstract

One out of 2 women and 1 out of 5 men over age 50 will sustain a fragility fracture (FF) in their lifetime. The risk of a 2nd FF increases dramatically after the 1st fracture and can lead to pain, disability, and mortality. Despite the evidence that secondary prevention programs are effective, the local facility did not have a formal mechanism to address this need. The purpose of this project was to design a program for secondary prevention of FFs and to address the need for a program for secondary FF prevention that was sustainable locally. The program was designed for facility patients age 50 or older who sustained a wrist fragility fracture within 6 months. The reach, effectiveness, adoption, implementation, maintenance (RE-AIM) framework was used to guide the project and program evaluation. A needs assessment was conducted prior to developing the program and included secondary data from the facility's provider survey. The 'Own the Bone' program, a nationally recognized program, was chosen as the intervention model. The 'Own the Bone' program provided a registry data for performance measures which assisted in the development of the program. The program included a short survey for providers to assess satisfaction with the referral process, and a telephone survey to referred patients who chose not to attend. Patient satisfaction with the program incorporated the Standardized Clinician Group Consumer Assessment of Healthcare Providers and Systems survey. Data collection and analysis plans were provided to the site with recommendations for implementation. This program was the 1st step in closing the local research-practice gap of secondary fragility fracture prevention. The project offers an opportunity to promote positive social change through the prevention of FF in a setting that had not previously addressed the problem.

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Dedication

I would like to dedicate this project to my husband Ray, who has been so supportive while I completed this degree and to Dr. Diane Whitehead who was always there for me.

Acknowledgments

I would like to thank my wonderful family and friends who have always been encouraging and understanding. They believed in me and stayed close to me even though I did not have much time for them. I want to thank my preceptor, Dr. Barbara Sorondo and her staff, physician colleagues, co-workers, practice manager, librarians, secretary, and staff for your support and guidance during my journey to attain this doctoral degree. I appreciated your patience and willingness to help. Lastly, I want to thank my committee members and instructors. I am grateful for all of those who supported me through this.

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Section 1: Nature of the Project

Introduction

Fragility fractures (FFs) are defined as a break in a bone from a nontraumatic event such as a fall from a standing height or less, often with underlying untreated osteoporosis (Bunta et al., 2016). One out of two women and one out of five men over age 50 will sustain a FF in their lifetime, which gives them at least twice the risk for subsequent fractures within the first year (Akesson et al., 2013; Mackey & Whitaker, 2015). Fragility fractures are sentinel events and result in disability, pain, suffering, cost, lost productivity, comorbidity, mortality, and decreased quality of life requiring increased costly healthcare use such as hospitalization, office visits, and diagnostics. There is up to a 20% mortality rate for women and 40% for men in the first year after a hip fracture (Rosenwasser & Cuellar, 2016). Despite evidence that many patients with FFs have underlying osteoporosis, fewer than 20% of them receive appropriate bone health follow-up according to Akesson et al.(2013).

Coordinator-led fracture liaison services(FLSs) have been developed worldwide to successfully address the research-practice gap in the lack of secondary prevention according to Lems, et al. (2017). These programs have been shown to be both outcomes-positive and cost-effective (Eckman et al., 2014; Van Der Kallen et al., 2014). The purpose of this DNP project was to design a program for secondary prevention of FFs for the facility, which is a tertiary care hospital in a rural state in the northeastern United States. This research-practice gap in the clinical practice setting at the facility provided an opportunity to improve bone health care, decrease resource use, and coordinate care.

Problem Statement

The Surgeon General's recommendation in 2004, the National Institute of Health's recommendations, and the Centers for Medicare and Medicaid Services with performance measures have all called for more standardized, quality, and cost-effective care measures (Myrick, 2011). Fragility fractures in this country are expected to increase by 50% by 2025. Despite the known effectiveness of FLSs, only 22% of these patients receive recommended follow-up for many reasons, including care fragmentation as outlined by Licata (2015).

Despite the evidence that FLSs were effective, only about 25% of patients with distal radius fractures received subsequent evidence-based practice bone health care (Morgan, Crawford, Scully, & Noce, 2014). There was no formal mechanism locally to address secondary FF prevention despite the evidence and increasing number of FFs.

Initial FFs are strong predictors of future fractures with their potential complications, but only up to 20% of these patients receive the recommended follow-up evaluation after the FF. Patients who sustain an upper extremity FF such as wrist fractures are less likely than those with hip fractures to receive secondary prevention (Liu et al., 2013). This northeastern rural state has a 95% Caucasian high aging population and increased rates of tobacco dependence and a northern climate (Centers for Disease Control and Prevention [CDC], 2017), which are risk factors for FFs. This state has limited tertiary care centers and no large research centers for patients to access.

Nurse practitioners (NPs) possess the skills to develop and lead a FLS. Nurse practitioners coordinate care with patients to navigate the system efficiently and decrease the risk of subsequent FFs by 40% as well as associated disability, suffering, mortality, morbidity, and costs (Mackey & Whitaker, 2015).

For this DNP project, I designed an NP-led program for the facility where I illustrated how I gained specialty expertise, designed a quality improvement program, evaluated data types and sources, used frameworks, and collaborated to design a mechanism for knowledge translation that improved patient care opportunities with evidence-based practice as described by Myrick (2011). I included a program dissemination plan as well as an evaluation plan for financial sustainability.

Purpose

This purpose of this DNP project was to design a FLS for a tertiary hospital in a rural state in the northeastern United States. The practice focused question that guided this program design was: How can the research-practice gap in secondary FF prevention be improved at the local facility? I designed this program to answer this question for the facility so that a sustainable mechanism to address the issue locally was developed.

Nature of the Doctoral Project

This doctoral project was to design a program for the facility staff to implement. This program was the guide for further FLS implementation by the facility and an evaluation tool for facility FLS growth and redesign. This program was the first step in the facility staff ‘s long-term plan to develop a sustainable FLS to better meet community needs such as written by Van Der Kallen et al. in 2014. Fracture liaison

services were designated program pathways to identify patients and provide secondary FF prevention, usually with a coordinator. Health care providers evaluated patients and gave best practice care such as education, and registry data were entered for benchmarking for quality improvement which met regulatory measures. The providers followed the patients and improved communication with primary care providers (PCPs).

Significance

This DNP project provided a mechanism for the facility staff to begin development of a FLS. There was no formal mechanism to address the research-practice gap at the tertiary hospital that served two-thirds of the rural northeastern state. The program provided information on current practice and access to care with a proposed referral mechanism. This quality improvement project provided an opportunity for facility staff to implement, evaluate, and plan a full FLS to close the practice gap.

Multiple stakeholders were affected by the program. Support staff such as schedulers, coders, medical assistants, and radiology technicians would have increased workflow with more patients and new types of visits. I had engaged them in the program's referral process as stakeholder input and buy-in were known key factors that affected program success and sustainability.

I included stakeholders such as dieticians, pharmacists, physical and occupational therapists, geriatricians, orthotists, managers, PCPs, and orthopedists as the program began with their input and that I needed subsquent referrals and cooperation for secondary prevention visits. I anticipated increased volume of office vistis and diagnostic tests which affected revenue, staffing, supplies, and space well as costs which were

contained in the administrator's budget. Administrators used data from initial programs like this and similar programs in full program budgeting for sustainability. I also anticipated increased community bone health group membership with the community members including patients and families more involved in preventing secondary FFs after they receive more efficient quality bone health care from the program. Radiologists and laboratory technicians had anticipated increased diagnostic studies and the coding and billing staff had new coding and more billing which affected workflow and revenue.

This program design project provided the facility with a mechanism for implementation and evaluation in preparation for a full FLS . The stakeholders would evaluate the program for redesign and implementation in other healthcare system facilities with an APN as the champion and expert resource. Clinicians throughout the world could use the program as a model to improve on for secondary FF prevention. Providing evidence-based care through a FLS can meet the measures of the physician quality reporting system (PQRS) to keep reimbursement and address future Joint Commission requirements for hospitals (Joint Commission, 2013). The facility administrators could use the patient visit data entered by the NP provider into the national registry for benchmarking as well as a public relations tool after the initial program completion. This designed program, its implementation, and its evaluation by the facility staff contributed to the body of knowledge on secondary FF prevention models and advanced nursing roles.

Summary

There was evidence that subsequent FFs were a significant problem worldwide with low secondary prevention rates as discussed by Mitchell & Chem (2013), and no formal mechanism to address this issue locally. The rural tertiary hospital in the northeastern United States had silos of expertise and no formal mechanism to provide this secondary prevention care, which resulted in inefficient and inaccessible care. The facility administration supported starting a FLS to promote evidence-based practice for the community. I designed the program to answer the practice focused question of how to address the research-practice gap for secondary FF prevention at the local facility.

Section 2: Background and Context

Introduction

The facility for which this project was designed for is a tertiary care hospital that provided services that were not accessible elsewhere to people in the northeastern two-thirds of this rural state in the northeastern United States such as diagnostics, specialty care, and increased PCPs. Patients with FFs are treated by orthopedic surgeons for their FF and then referred to their PCP for medical issues leading to silos of care (Licata, 2015). There was no formal method to identify patients with FFs nor a designated program to refer patients to. During my practicum in 2017, my preceptor, the facility's clinical research director, and I discussed developing a program to begin to close the gap in secondary FF prevention that would be used to shape a full program. The designed program would be used as an implementation evaluation model to guide a future full FLS. The practice focused question that guided this program design was: How can the research-practice gap in secondary FF prevention be improved at the local facility?

Concepts, Models, and Theories

This DNP project was to design a FLS for a tertiary hospital facility in the rural northeastern United States. I assumed that providers and patients wanted a way to decrease the risk of a subsequent FF. I also assumed that if a program was available, patients would have access, and that such a program would be effective. In 2011, Hodges & Videto wrote about the importance of stakeholder input and buy-in, so I included a plan to engage stakeholders in the program.

I used a logic model as I commonly found these models in program planning so it was familiar to the stakeholders. A logic model was a clear visual representation that aided me as the planner and future stakeholders to understand the program and its process, organized pieces, changes tracking, communication, and evaluation with the desired outcomes in mind as written by Israel (2016). The logic model was simple to understand and allowed for input changes while tracking outcomes which was vital to sustainability according to Allmark, Baxter, Goyder, Guillaume, & Crofton-Martin (2013). Figure 1 shows a generic logic model and how I applied evidence-based practice to a research-practice gap as described by Kettner, Moroney, & Martin in 2013. This model was appropriate for designing a program to meet that goal. I also developed an evaluation plan and included it in the program design.

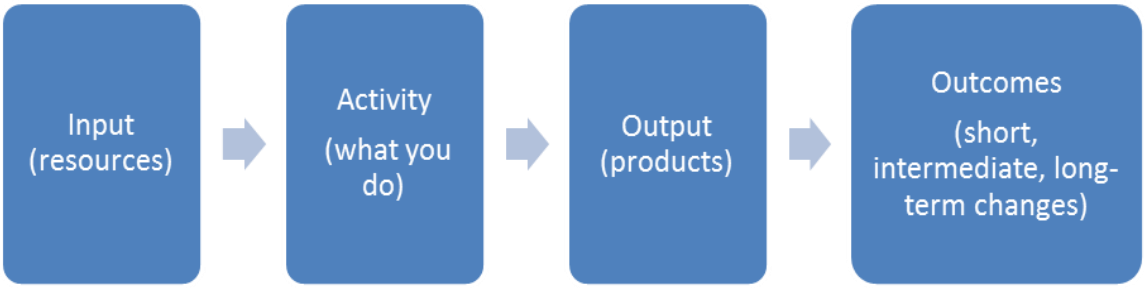


Figure 1. Sample generic logic model.

To design the program, I used concepts from a nationally recognized effective program to improve bone health care. The 'Own the Bone' program (Bunta et al., 2016) was national registry program that was a best practice model that has been shown to be effective in preventing subsequent FF as well as track performance and patient follow-up (Licata, 2015). I described the 'Own the Bone' program more thoroughly in Section 4.

Relevance to Nursing Practice

For the literature review, I used online databases including CINAHL & MEDLINE simultaneous, PubMed, Science Direct, Academic Search Complete, Google Scholar, and Thoreau Multi-Database. In addition, I attended conferences and queried the Joanna Briggs Institute, Cochrane Database of Systematic Reviews, ProQuest, and Walden University Dissertations. Inclusion criteria for the literature were English language, years 2011-2017, people over age 50 years, published, peer-reviewed, and full text. The BOOLEAN phrases were: *minimal trauma/fragility fracture and/or secondary prevention, fracture prevention, distal radius fractures, osteoporosis assessment,* and *fracture liaison service.*

The literature review matrix showing supporting evidence for my practice focused question is in Appendix A. I used the Johns Hopkins Nursing Evidence-Based Practice (JHNEBP) rating scale to grade the evidence, after obtaining permission to use the tools and model in Appendix B. This system is well-known and frequently used, nursing-based, and allows for evaluation of research, nonresearch studies, and systematic reviews in more detail. The rating tools were simple with definitions for both strength and quality ratings for each category as depicted in Appendix C. I used the JHNEBP model because I found it used to evaluate other orthopedic issues in the literature such as surgical site infections (Mori, 2015) and modified for operating room nurse standards and practices (Spruce, Van Wicklin, Hicks, Conner, & Dunn, 2014).

Gap and Barriers

I found that secondary prevention opportunities were usually missed with only about 20% of people with FF received any secondary prevention and that barriers were time consuming patient identification, lack of provider and patient awareness, fragmented health care system with silos of care, silent underlying chronic disease, multiple comorbidities, insurance, cost, distance, lack of coordinated programs, mobility, uncertainty about standard of care, communication, lack of identified provider responsibility, fear of side effects from treatments, lack of standardized intervention, and limited resources including time according to Lems et al. (2017) and Licata (2015).

Recommendations to Close Gaps

I outlined that studies showed FLS benefit in my literature review in Appenidix A which included the benefit of a FLS with a program provider champion and coordinator that decreased subsequent FF risk up to 40% and mortality with increased follow-up, adherence to medications, and communication. Bone mineral density was not the only FF risk factor, so a multifaceted interventional program with multidisciplinary providers showed the most effectiveness including costs. Sale, Beaton, Posen, & Bogoch (2014) wrote that studies were heterogeneous and it was difficult to know which component was the most effective according to Nakayama, Major, Holliday, Attia, & Bogduk (2016). Mitchell, et al. (2016) described the lack of secondary prevention to be like the Bermuda triangle with a patient, PCP, and orthopedist where the patient gets lost in the system after a FF which is a sentinel event and opportunity to improve bone health through FLS.

Intervention Models

Ganda et al. (2013) described four types of models that have been used for FLS in their systematic review with meta-analysis. They described model type A as the most intensive which included identification, evaluation, treatment, and follow-up with a coordinator who was usually a nurse or advanced practice nurse (APN). Model type B such as the 'Own the Bone' (Licata, 2015), was the same as type A except it did not involve treatment initiation. Model type C included identification, education, and communication with the PCP. Model type D included identification and education only. Ganda, et al. (2013) noted that the suggested initial appointment was within 3 to 6 months after the FF with personal contact and higher intensity programs because education alone for providers and/or patients did not show significant effectiveness. Aizer & Bolster in 2014 found model types A and B were cost-effective and that exact design was setting dependent. Wrist fracture patients, especially men, were offered evaluation less frequently than hip fracture patients but were younger and more likely to attend appointments according to Mitchell & Chem (2013). Mears & Kates (2015) noted that the trend for FLS programs in the United States was to provide the FLS in the orthopedic department as the FF was an opportunity to capture the patient's attention to bone health.

Financial Considerations

Ganda, et al. (2013) found that model types A and B programs were cost-effective but study outcomes were heterogeneous and the interventions were multifaceted so more research is needed particularly using prospective cost data with financial outcomes. Using APNs instead of physicians further decreased the cost of the program

(Senay et al., 2016). Providers using a program registry tracked patient follow-up efficiently, benchmarked facilities, and met PQRS measures which affected keeping reimbursement and FLSs decreased the use of society resources according to Mackey & Whitaker (2015). Stakeholder involvement aided in support including resource allocation (Drew et al., 2015). A FLS decreased future FF by approximately 40% and decreased mortality, readmission, cost, disability, and silos of uncoordinated care.

Historically, nurses were not usually included in this facility's program planning. This project was relevant to nursing practice because designing a program to close a facility research-practice gap provided a new role for nurses and I illustrated the skills of a doctoral-prepared APN by developing such a program which included nursing contribution through the coordinator. I developed my doctoral nursing skills through scholarly work to design a new comprehensive quality improvement program for the facility as outlined in the Doctor of Nursing Practice Essentials (American Association of Colleges of Nursing [AACN], 2015).

Advanced practice nurses must remain current on best practice to provide quality care and seek ways to improve ourselves profesisonally. Nursing ethics demanded that I provide quality care for patients and this program made best practice care available.

Advanced practice nurse led clinics were effective in secondary FF prevention (Akesson et al., 2013) and increased patient satisfaction in ambulatory settings (Ranaghan et al., 2015). Quality improvement (QI) for patients, fiscal responsibility, nursing profession promotion, and adding to nursing literature were parts of nursing practice that I used for the program design as discussed by the AACN (2015).

Evidence Summary

There was an abundance of literature regarding the gap in secondary FF prevention and recommendations to address this gap with a FLS. I did not find many randomized controlled studies (RCT) in the literature because withholding known therapeutic care as a control is unethical as mentioned by Senay et al. (2016) and not always applicable to daily clinical practice settings according to Eisman et al. (2012). Sale, et al. (2014b) wrote that the studies were heterogeneous, so comparisons of interventions regrading settings, outcomes, populations, and geography were difficult. I illustrated my reviewed literature using the JHNEBP model rating scale in Table 1 with strength level one as experimental, level two as quasiexperimental, level three as nonexperimental, level four as expert consensus panels, and level five as single expert, financial, QI, and case studies. The three quality categories in the JHNEBP model were high, good, and low with low quality studies as ones that had flaws in consistency, design, and clarity. The permission to use JHNEBP tools was outlined in Appendix B with the tools themselves shown in Appendix C. I used the JHNEBP model because it has been used in the nursing literature, and evaluated both strength and quality, as well as had tools to evaluate both research and non-research evidence which were applicable to my literature search findings.

Table 1

Reviewed Evidence Summary Using JHNEBP Criteria

Level	Type	# A quality	# B quality	# C quality	Total/85
I	RCT	1	5	0	6
II	Quasi-experi	4	6	0	10
III	Non-experi	16	13	3	32
IV	Expert/panel	3	5	0	8
V	Lit rev/QI/$	11	17	1	29
Total:	5 levels	35 articles	46 articles	4 articles	85 articles

Local Background and Context

Orthopedic providers frequently saw patients who never had secondary prevention in the facility's emergency room or clinic with multiple subsequent FFs. This state had higher than average risk factors for osteoporosis which was often the underlying cause of FF according to the Centers for Disease Control and Prevention [CDC], 2017). There were no research or academic centers locally so the tertiary facility provided orthopedic care for many patients living up to a four hour drive away in the northeastern two-thirds of the state. Similar to other states, the facility's orthopedists treated the fractures but did not perform bone health prevention follow-up (Rosenwasser & Cuellar, 2016). This state had a high percentage of Caucasian and elderly people with a higher than national tobacco dependence rate, all of which increased the risk of underlying osteoporosis for FFs. Some patients did not have a PCP or insurance. The endocrinologists and

rheumatologists in our area did not want to manage all of the FF patients, but were willing to support a FLS with secondary consultations. Primary care providers followed the patients but usually bone health was only one of their comorbidities and often did not get evaluated or treated. This led to silos of care with a gap, inefficiency, and lack of appropriate follow-up.

The orthopedic providers agreed at a staff meeting in January, 2016 that lack of a formal mechanism for secondary FF prevention was a problem and were supportive of program development as a mechanism to address the problem. During my practicum, I discussed this idea with my preceptor, then we gained administrative support and held a stakeholder's meeting. This led to the practice focused question of how can we improve on the local research-practice gap? The designed program had to be in compliance with facility, state, and federal guidelines regarding consent, billing, coding, intervention standards, ethics, safety, competence, privacy, data collection, facility environment, documentation, and insurer regulations. There were no specific local terms to define.

Role of the DNP Student

I worked as a nurse practitioner in the Orthopedic Surgery department at the facility. The facility stakeholders and decision makers agreed with the need to close the gap as described previously, and encouraged me to seek approval through my DNP project committee to design a FLS for the facility staff to implement. This project allowed me to develop doctoral level knowledge and skills as well as provided the facility's stakeholders with an evidence-based designed program to implement and evaluate.

Summary

There was a research-practice gap at our local facility in secondary FF prevention. I found that the reviewed evidence supported an FLS as the best way to address this gap and the importance of a multidisciplinary team with a nurse coordinator, champion, and administration buy-in, as well as patient and provider awareness of its significance.The practice-focused question and evidence guided this project design (Peters, 2014), that used applicable models discussed in this section. The next section containeddata sources that guided the project design.

Section 3: Collection and Analysis of Evidence

Introduction

Mears & Kates in 2015 noted there was a lack of secondary FF prevention nationally as well as locally as described previously, there was also a national movement to improve bone health care for the aging population according to Myrick (2011). The first FF is a strong predictor for subsequent FF. Despite the evidence that secondary prevention through a FLS waseffective to decrease risk of subsequent FF rate by 30-50%, only about 20% of people with FF received the proper follow-up (Adler, 2012).

Generally, FF were treated acutely by orthopedic surgeons and then referred back to their PCP for their chronic medical issues. There were silos of care in the local facility as was seen in many parts of the world as previously mentioned. There was no formal secondary prevention mechanism at the facility to address FF. Current recommendations supported a coordinated FLS multidisciplinary program addressing secondary FF prevention (Ganda et al., 2013). This DNP project was to design a FLS program for the local facility staff use as a QI to decrease the local research-practice gap.

Practice-Focused Question

The practice-focused question that guided my program design was: How could the research-practice gap in secondary FF prevention be improved at the local facility?

Operational definitions include:

Fragility fracture (FF): A 'fragility fracture' was defined as a broken bone from a low impact activity such as a fall from a standing height or less or any minimal trauma from which a young and healthy person would not have sustained a fracture.

Fracture Liaison Service (FLS): A 'Fracture Liaison Service' was defined as an organized program to provide secondary FF prevention.

Index fracture: An 'index fracture' was the first FF which is acute for usually three months.

Program design: 'Program design' referred to developing the program including the service components (Kettner, Moroney, & Martin, 2013, p. 154).

Sources of Evidence

Archival and Operational Data

A needs assessment was designed by the facility staff as a survey and sent electronically via email to all of the facility and network providers then 2 weeks later sent again. The survey was deidentified and had been reviewed by the facility's Internal Review Board (IRB), information technology security staff, chief medical officer, facility clinical research director, community relations staff, and information technology staff. I assessed the providers' views concerning the need for a program using the summary of de-identified survey data (Appendix D). The survey results were anonymous as they were user and password protected at the facility. When secondary data were analyzed with the literature evidence, it provided information that guided the program design to address the practice-focused question as described by Kettner, Moroney, & Martin (2013)

and Hodges & Videto (2011) of how to improve the local facility's research-practice gap. The survey may have been biased by the facility staff's design as it was designed for program development, sent through secure email, designed with the select survey program, as well as response bias.

Evidence Generated for the Doctoral Project

This project was to design a program to address the local gap in care so there was no evidence generated at the facility for the doctoral project itself. I designed the program using the logic model approach. The program included:

- Inputs: what they invested
- Outputs: what they did and who they reached
- Outcomes: short, intermediate, and long term
- Evaluation plan for the facility staff utilization

IRB approval (#10-19-17-0485708) was obtained from Walden University prior to program development. The facility clinical research director approved the use of deidentified survey data.

Analysis and Synthesis

The secondary data that I used were a summary from the facility's secured email survey results which were user and password protected with tracked access. The facility staff used select survey software to compile the results. I used the quantitative (percentage) and qualitative (comments) provider survey summary data as the needs assessment to guide program design as described by Timmins (2015). I compared the few outliers in the deidentified data to the literature evidence outlined in section 2.

Summary

This section included a review of the project problem, background, and purpose. It contained the data type and source as well as how it was protected and used as a needs assessment to guide program design described in the next section.

Section 4: Findings and Recommendations

Introduction

Index FFs are strong predictors of future FFs with their associated pain, suffering, disability, and use of resources but despite the evidence previously reviewed that FLS were effective mechanisms to address secondary FF prevention, only about 20% of patients over the age of 50 years, receive the appropriate secondary prevention as noted by Lewiecki in 2015. According to Licata (2015), the number of FFs in the United States was anticipated to increase by 50% by 2025. This northeastern rural state had higher than average risk factors with no formal mechanism for secondary prevention at the local tertiary care facility that covered the northeastern two-thirds of the state. The facility leadership asked me to design a program to address this need at the facility. The purpose of this project was to design a program for the facility staff to use to address the following practice focused question: How could the research-practice gap of secondary FF prevention be improved at the local facility?

The local facility's clinical research director provided a summary of the deidentified data from a short electronic survey. I reviewed the data summary per my IRB approval # 10-19-17-0485708, as the individual survey results were username and password protected at the facility from the select survey program with access tracking. The data were both quantitative (percent of responses to question answer options) and qualitative (typed comments). Mixed data provided objective information with more depth for understanding as discussed by Bachkirova, Arthur, & Reading (2015).

Findings and Implications

The facility staff developed the provider survey and sent it electronically via secure email to the facility's 765 providers, including physicians, nurse practitioners, and physician assistants. The response rate from the 291 providers was 38% during the survey month of August 2017. Most of the providers who identified their specialty in the survey were from medical groups of which 71% were physicians. The de-identified data from the survey (see Appendix D) are provided in summary in Table 2. I used the data summary shown in Appendix D as the needs assessment to design the program in Appendix E. The data supported the conclusions that no specific single model for comprehensive FF care was used at the location, that most providers have patients that they would refer, and almost all supported program development. I addressed the survey findings in the program design by including a specific simple referral pathway, coordinated care, communication, single intervention model, and follow-up.

Table 2

Facility Survey Data Summary

Question	Most frequent	Least frequent	Assessment used
Care to over age 50	Yes (249/291) 86%	No (42/291) 14%	Most adult provider
Past three months with distal radius fx	Yes (106/155) 68%	No (49/155) 32%	Over 2/3 with FF pt
Standard protocol for FF risk assess	No (138/154) 90%	Yes (16/154) 10%	Not comprehensive; fall risk, frax, dexa
If program, do refer	Yes (120/153) 78%	No (33/153) 22%	No mostly because PCP should refer pt
What expectations	Decrease FF, EBP multidisciplinary comprehensive care with f/u, shared decision-making, referral criteria, include geriatrics, pt access & experience	Lead to increased fragmentation and that PCP should do	Added geriatrician to stakeholders, tx comprehensive with EBP, pt access & satisfaction eval. Pt & provider education about program for outliers
What program role	Refer (77/147) 52% None (58/147) 39%	Advise (6/147) 4% Participate(7/147)5%	Most wanted to refer & no role

Health professional survey rates were historically low and responses can be biased with electronic surveys due to the type of responders, lack of face-to-face encounters, and question wording, but it provided a simple, fast, cost-effective means to reaching a large number of facility providers as discussed by Chizawsky, Estabrooks, & Sales (2011). I thought it was important to assess the facility providers'perspectives of such a program as the providers would be the program's main referral base initially. I could only review the data summary so I was not able to review the individual surveys that may have indicated reasons, such as specialty, for particular responses. I gained insight into some of the providers' perspectives by using the facility's data which influenced the program design for the facility where they practice. These providers care for the patients in the local community.

In addition to obtaining information for a needs assessment, the survey also alerted providers to the issue and that the facility was going to have such a program. That may have affected their care of these patients as well as referrals to the program, which would increase the rate of evidence-based secondary FF prevention locally.

Recommendations

There was a research-practice gap at the local facility as evidenced by the needs assessment and the fact that there was no formal mechanism for secondary FF prevention. My review of the evidence as previously outlined supported a FLS that included a coordinator such as an APN, as the mechanism to address this gap. Based on the needs assessment data, I designed a secondary FF prevention program that targeted patients who had already sustained a FF instead of a primary prevention program that targeted all patients before a FF. I designed a secondary prevention program for the facility instead of a primary prevention program because patients with prior FFs were at the highest risk of subsequent FFs and were able to be tracked. The number of patients needed to treat in a primary prevention program to prevent an initial FF for all facility patients was much higher as well as less cost-effective and manageable at the small local clinic. Starting with a secondary prevention program identified patients through claims data, provided a registry to easily track outcomes, and orthopedists treated the majority of FF which was consistent with Miller, Lake, & Emory (2015). The program I designed to address the practice-focused question is shown in Appendix E and outlined in the logic model as shown in Figure 2.

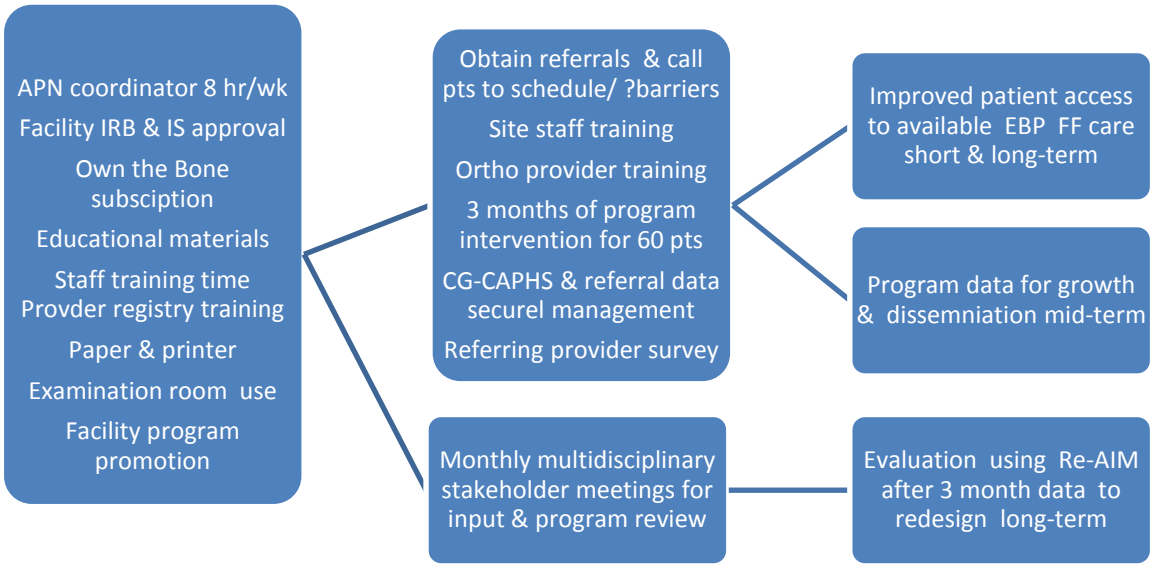


Figure 2. Program logic model.

The previously reviewed literature evidence and needs assessment data supported the need for a comprehensive program as education and alerts alone were not enough to promote proper understanding of the seriousness of a FF or need for secondary prevention. I included background and provider education in the program design in addition to other methods as recommended by Ganda, et al. (2013) through the introduction of the program to the facility orthopedic providers and office staff.

The evidence supported me to use one of the national FLS programs as an intervention model when developing a program. Such a program includes a registry which provided data for quality improvement and benchmarking. I incorporated the American Orthopedic Association's 'Own the Bone' model into the designed program as the intervention model as it had been used extensively in the United States according to

Bunta, et al. (2016) and Tingle (2016). I considered that the three geographically closest FLS programs to the facility use this intervention model so the use of this model would give the facility the opportunity to benchmark with other regional facilities through the 'Own the Bone' national registry and the clinician & group adult surveys (CG-CAHPS).

I found that the 'Own the Bone' program national registry contained data collection for performance improvement, long-term patient tracking, benchmarking, the opportunity to comply with performance measures which prevented loss of facility revenue. The 'Own the Bone' website had provider and patient education materials with appointment communication tools to PCPs, referring providers, and patients. The program coordinator tracks 10 measures in a secure national registry with no personal information as outlined in Table 3, with written permission to show the measures shown in Appendix F.

Table 3

Program Intervention Measures Adapted From 'Own the Bone' Model With Permission

Domain	Testing	Lifestyle	Physical	Medication	Communication	Nutrition
Intervention	Dexa or order	Smoking & alcohol counseling	Counsel Exercise & falls	Medication rx or rx recommend	Letter to provider & patient	Counsel calcium & vit D

I designed the program using the 'Own the Bone' model as the intervention model and it provided useful data for sustainability evaluation and direct growth which was pertinent to the practice-focused question as well as stakeholder experience with the model for redesign. Iconsidered efficiency, usability, cost, and available materials.

I chose the orthopedic clinic as the site for the designed program as the orthopedic providers treated most of the FFs at the facility such as was the case in Miller, Lake, &

Emory in 2015. The orthopedic proveders therefore had the opportunity to promote secondary prevention as written by Akesson (2013), with as recommended timeframe of within 6 months by Sale (2016). I included patients over age 50 years with wrist FFs as Vergara (2016) and Viprey (2015) wrote that wrist FFs were one of the most common, yet undertreated FFs, and were early signs of bone fragility. Kimber (2011b) wrote that wrist FF patients were more likely to attend a FLS than hip fracture patients. I also considered local barriers and systems for the program design as well as ethics to not withhold known effective treatment. Facility providers and administrators had supported an outpatient program initially. I developed the program to target an identifiable group as the initial program population with an APN as the coordinator and provider.

I planned data collection and analysis methods before implementation as recommended by Kettner, Moroney, & Martin (2013). I described a referral mechanism in the designed program and collection of patient barrier information from patients who were referred but chose not to attend. Through this data, I provided the facility staff with information about barriers to and beliefs about attending a FLS program to guide program redesign. The designed program included a short post program electronic survey for the referring providers about their referral experience and ways to improve the program to meet their needs. Nursing researchers frequently used surveys as they were a cost-effective, efficient, and anonymous way to reach a large number of providers with standardized questions according to Cope (2014).

I included having patients who attend the program complete the CG-CAHPS version 3.0 to assess their experience after their appointment in the program design. The

CG-CAHPS survey sample shown in Appendix G is a standard questionnaire used by the facility to assess patient experience with permission to show the survey in my project in Appendix H. This survey was comparable to those used by other facilities and useful for facility improvement. Facility administrators used the CG-CAHPS to evaluate aspects of care that are important to patients according to the Agency for Healthcare Research & Quality (AHRQ) in 2014. I included this aspect because administrators used patient experience data as benchmarks for improvement and program redesign as well as the fact that patient perception was valued and included to address the local research-practice gap in Shipman, Stammers, Doyle, & Gittoes (2016).

I chose the Reach, Effectiveness, Adoption Implementation, and Maintenance (RE-AIM) framework shown in Table 4 as the evaluation tool to answer the practice focused question of how to address the local research-practice gap by using data from patient telephone calls with provider and patient surveys. I found RE-AIM applicable as the evaluation framework as it had been used in many healthcare studies and programs for almost 20 years according to Gaglio, Shoup, & Glasgow (2013). Facility project teams have used RE-AIM in other programs, so they were familiar with it. I used the RE-AIM framework in the designed program to guide program improvement with datat collection, implementation and evaluation procedures shown in Table 4 and described in the designed program outlined in Appendix E.

Table 4

RE-AIM Use for Designed Program Evaluation

Domain	Program evaluation criteria

Reach	Number or proportion of people willing to participate in the program
Efficacy	Impact of the program intervention on outcomes including participation, intervention measures, satisfaction, & economic basis
Adoption	Number or proportion of agents/staff willing to start the program
Implementation	How well did we follow the program elements and why or why not
Maintenance	Extent that the program becomes part of the facility's practice/policy and that it outcomes are maintained for six months or more

Contribution of the Doctoral Project Team

There was no project team involvement for my program design. The facility's clinical research director gave me the secondary survey data summary that I used as a needs assessment and my chair advised me on the format for contents in this manuscript. The facility leadership intends to use the designed program as the initial step to address a local research-practice gap and plans to build a full FLS with data from this program.

Strengths and Limitations of the Project

This doctoral project was limited due to the fact that it was only for me to design a program to address the practice-focused question, not for me to implement or evaluate the program at the facility. I designed it as an implementation evaluation for the facility staff to use as the first step to address the research-practice gap of secondary FF prevention at only one local facility with one provider, so therefore it is not generalizable. There was expected low facility survey response but the summary data were consistent with my previously reviewed evidence and my experience with silos of care where chances to improve care were missed as described by Rossenwasser & Cuellar (2016).

The strengths of this project are that I designed a program to provide a mechanism for the facility staff to begin to address the gap in care and as a basis for program growth. I designed this program to be consistent with national evidence-based FLSs with setting consideration and promotion of the nursing profession. I used anonymous provider survey results, nationally recognized patient surveys, and frameworks. Facility providers, administrators, and stakeholders supported the project, therefore according to White and Dudley-Brown (2012), program implementation was more likely to be accepted.

Section 5: Dissemination Plan

I designed this program using the facility's project format shown in Appendix E so that I could give it to the facility's clinical research director to implement at the facility. I will be the initial provider/coordinator for the program and will assist with program growth so that a comprehensive FLS program will be developed. I included an introduction to the program and reminders for orthopedic providers and program staff to increase awareness and aid dissemination (Aghamirsalim, Mehrpour, Kamrani, & Sorbi, 2012). I included the use of a standard facility evaluation form in the program as needed to provide data about the effectiveness of the notification and increase participation. The facility's community relations department will announce the program through the healthcare system-wide computer system and newsletter. As the coordinator, I will send an email to all of the providers about the program. The program design included monthly stakeholders meetings that I used to engage stakeholders and continue dissemination. There are national conferences where I can share my experience and I plan to write an article about this program to add to the body of nursing literature and for replication.

Analysis of Self

The idea for this project came from my clinical experience interacting with patients sustaining subsequent FFs with no secondary prevention. I increased my clinical knowledge through my literature review and my ability as a scholar through evaluating it. I discussed designing this program with multidisciplinary professionals, which helped me grow as a team member and leader to consider all of the stakeholders in program design. I learned to use frameworks and design a program as well as improve scholarly writing

with renewed appreciation for previous work by others. I grew academically and professionally including as a leader while completing this project. I am looking forward to adding this new role as program coordinator to my other clinical duties and working with the team to build a sustainable, quality FLS for the local facility and community.

Eventually, I would like to serve as a mentor to APNs developing FLS programs. I finished the project for the designed program and it is ready for the facility staff to begin implementation with facility approvals. I was challenged with the amount of evidence and how to condense it as well as how to properly format it for project requirements. My chairperson was invaluable as was reading other manuscripts and attending writing webinars. I redesigned the program a couple of times using recommendations from my previously reviewed evidence and frameworks. I accounted for the local setting as the purpose of this project was to design a program for the local facility only. I learned that using evidence and experts are invaluable approaches and that I had the facility decision-makers' support. I attained doctoral level skills through this project including confidence, passion for leading social change for the improvement of patient care, and determination.

Summary

When I started my practicums, I knew that I wanted to make a difference in FF prevention because I frequently saw patients suffering multiple FFs with no secondary prevention. The lack of FF prevention leads to an increased risk of subsequent fractures with unnecessary pain, suffering, disability, and resource use. I used this project as an opportunity to grow and to make a difference by designing a program for social change to address this issue locally and increase my professional knowledge and skills.

References

American Association of Colleges of Nursing. (2015). The Doctor of Nursing Practice: Current issues and clarifying recommendations. *Report from the task force on the implementation of the DNP*. Retrieved from http://www.aacn.nche.edu

Adler, R. (2012). Secondary fracture prevention. *Curr Osteoporosis Reports, 10*, 22-27. doi:10.1007/s1194-011-0090-z

Agharmirsalim, M., Mehrpour, S., Kamrani, R., & Sorbi, R. (2012). Effectiveness of educational intervention on undermanagement of osteoporosis in fragility fracture *Archives of Orthapaedic and Trauma Surgery, 132*, 1461-1465. doi:10.1007/s00402-012-1569-5

Agency for Healthcare Research & Quality. (2014). CAPHS: Assessing health care quality from the patient's perspective. *Publ. No. 14-P004-EF*, 1-6. Retrieved from www.ahrq.gov

Aizer, J, & Bolster, M. (2014). Fracture liaison services: Promoting enhanced bone health care. *Current Rheumatology Reports, 16*(455), 1-8. doi:10.1007/s11926-014-0455-2

Akesson, K., Marsh, D., Mitchell, P., McLellan, A., Stenmark, J., Pierroz, D., Kyer, C., & Cooper, C. (2013). Capture the fracture: A best practice framework and global campaign to break the fragility fracture cycle. *Osteoporosis International, 24*, 2135-2152. doi:10.1007/s00198-013-2348

Allmark, P., Baxter, S., Goyder, E., Guillaume, L., & Crofton-Martin, G. (2013). Assessing the health benefits of advice services: Using research evidence & logic

model methods to explore complex pathways. *Health & Social Care, 21*(1), 59-68. doi: 10.1111/j.1365-2524.2012.01087.x

Andrew, S., Salamonson, Y., Everett, B., Halcomb, E., & Davidson, P. (2011). Beyond the ceiling effect: Using a mixed methods approach to measure patient satisfaction. *International Journal of Multiple Research Approaches, 5*(1), 52-63. doi:10.5172/mra.2011.5.1.52

Bachkirova, T., Arthur, L., & Reading, E. (2015). Evaluating a coaching & mentoring programme: Challenges & solutions. *International Coaching Psychology Review, 10*(2), 175-189. Retrieved from https://radar.brookes.ac.uk/radar/items/77ed92e5-3489-4d52-9711-09cf21b466c5/1/

Bunta, A., Edwards, B., Macaulay, W., Jeray, K., Tosi, L., Jones, Clifford, Sietsema, D., Kaufman, J., Murphy, S., Song, J., Goulet, J., Friedlaender, G., Swiontkowski, M., & Dirschl, D. (2016). Own the Bone, a system-based intervention, improves osteoporosis care after fragility fractures. *Journal of Bone and Joint Surgery, 98*(e109), 1-8. doi:10.2106/JBJS.15.01494

Centers for Disease Control and Prevention (CDC). (2017). *Health Stats, State Fast Facts, National Health Center, & STATE Systems.* Retrieved from https://www.cdc.gov

Chandran, M., Tan, M., Cheen, M., Tan, S., Leong, M., & Lau, T. (2013). Secondary fracture prevention of osteoporotic fractures-an "Optimal" model of care from Singapore. *Osteoporosis International, 24*, 2809-2817. doi:10.1007/s00198-013-2368-8

Chizawsky, L., Estabrooks, C., & Sales, A. (2015). The feasibility of web-based surveys as a data collection tool: A process evaluation. *Applied Nursing Research, 24*, 37-44. doi:10.1016/j.apnr.2009.03.006

Cope, D. (2014). Using electronic surveys in nursing research. *Oncology Forum Nursing, 41*(6), 681-682. doi:10.1188/14.ONF.681-682

Drew, S., Gooberman-Hill, R., Farmer, A., Graham, L., Javaid, M., Cooper, C., Judge, A., & REFRESH study group. (2015). Making the case for a fracture liaison service: A qualitative study of the experiences of clinicians & managers. *BMC Musculoskeletal Disorders, 16* (274), 1-8. doi:10.1186/s12891-015-0722-z

Eekman, D., Van Helden, S., Huisman, A., Verhaar, H., Bultink, E., Geusens, P., Lips. P., & Lems, W. (2014). Optimizing fracture prevention: The fracture liaison service, an observational study. *Osteoporosis International, 25*, 701-709. doi:10.1007/s00198-013-2481-8

Eisman, J., Bogoch, E., Dell, R., Harrington, T., McKinney, R., McLellan, A., … Siris, E. (2012). Making the first fracture the last fracture: ASBMR task force report on secondary fracture prevention. *Journal of Bone & Mineral Research*, *27*(10), 2039-2046. doi:10.1002/jbmr.1698

Gaglio, B., Shoup, J., & Glasgow, R. (2013). The RE-AIM framework: A systematic review of use over time. *American Journal of Public Health*, e1-e9. doi:10.2105/AJPH.2013.301299

Ganda, K., Puech, M., Chen, J., Speerin, R., Bleasel, J., Center, J., … Seibel, M. (2013). Models of care for the secondary prevention of osteoporotic fractures: A

systematic review and meta-analysis. *Osteoporosis International*, *24*, 393-406. doi:10.1007/s00198-012-2090-y

Hodges, B., & Videto, D. (2011). *Assessment & Planning in Health Programs* (2nd ed.). Sudbury, MA: Jones & Bartlett Learning.

Israel, G. (2016). Using logic models for program development. *Department of Agriculture Education & Communication, UF/IFAS Extension document AEC360*, 1-4. Retrieved from http://edis.ifas.ufl.edu

Joint Commission. (2013). *Osteoporosis-associated fracture implementation guide*, 1-69. Retrieved from http://www.jointcommission.org

Kettner, P., Moroney, R., & Martin, L. (2013*). Designing & managing programs: An effectiveness-based approach* (4th ed.). Thousand Oaks, CA: Sage.

Lems, W., Dreinhofer, K., Bischoff-Ferrari, H., Blauth, M., Czerwinski, E., Da Silva, J., … Geusens, P. (2017). EULAR/EFFORT recommendations for management of patients older than 50 years with a fragility fracture and prevention of subsequent fractures. *Annals of the Rheumatic Diseases, 76*, 802-810. doi:10.1136/annrheumdis-2016-210289

Leslie, W., LaBine, L., Klassen, P., Dreilich, D., & Caetano, P. (2012). Closing the gap in postfracture care at the population level: A randomized controlled trial. *CMAJ, 184*(3), 290-296. doi:10.1503/cmaj.111158

Lewiecki, E. (2015). Secondary fracture prevention via a fracture liaison service. *Women's Health, 11*(3), 269-271. doi:10.2217/WHE.15.5

Licata, A. (2015, Spring). Closing the gap: Preventing secondary fractures. *Osteoporosis*

Clinical Updates, 1-30. Retrieved from www.nof.org

Liu, S., Munson, J., Bell, J., Mecchella, J., Toteson, A., & Morden, N. (2013). Quality of osteoporosis care of older Medicare recipients with fragility fractures: 2006 to 2010. *JAGS, 61*(11), 1855-1862. doi: 10.1111/jgs.12507

Mackey, P., & Whitaker, M. (2015). Osteoporosis: A therapeutic update. *The Journal for Nurse Practitioners, 11*(10), 1011-1017. doi:10.1016/j.nupra.2015.08.010

Miller, A., Lake, A., & Emory, C. (2015). Establishing a fracture liaison service: An orthopaedic approach. *Journal of Bone & Joint Surgery, 97A*(8), 675-681. doi:10.2106/JBJS.N.00957

Mori, C. (2015). Implementing evidence-based practice to reduce infections following arthroplasty. *Orthopaedic Nursing, 34*(4), 188-194. doi: 10.1097/NOR.0000000000000157

Myrick, K. (2011). Improving follow-up after fragility fractures: An evidence-based initiative. *Orthopaedic Nursing, 30*(3), 174-179. doi:10.1097/NOR.0b013e318219ac9f

Mears, S., & Kates, S. (2015). A guide to improving the care of patients with fragility fractures, edition 2. *Geriatric Orthopaedic Surgery & Rehabilitation, 6*(2), 58-120. doi:10.1177/2151458515572697

Mitchell, P., Akesson, K., Chandran, M., Cooper, C., Ganda, K., & Schneider, M. (2016). Implementation of models of care for secondary osteoporotic fracture prevention and orthogeriatric models of care for osteoporotic hip fracture. *Best*

Practice & Research Clinical Rheumatology, 30, 536-558. doi:10.1016/j.berh.2016.09.008

Mitchell, P., & Chem, C. (2013). Secondary prevention and estimation of fracture risk. *Best Practice & Research Clinical Rheumatology, 27,* 789-803. doi:10.1016/j.berh.2013.11.004

Morgan, E., Crawford, D., Scully, W., & Noce, N. (2014). Medical management of fragility fractures of the distal radius. *Orthopedics, 37*(12), e1068-e1073. doi:10.3928/01477447-20141124-53

Nakayama, A., Major, G., Holliday, E., Attia, J., & Bogduk, N. (2016). Evidence of effectiveness of a fracture liaison service to reduce the re-fracture rate. *OsteoporosInt, 27,* 873-879. doi:10.1007/s00198-015-3443-0

Peters, D., Adam, T., Alonge, O., Agyepong, A., & Tran, N. (2014). Republishedresearch: Implementation research: What it is and how to do it. *British Journal of Sports Medicine, 48*(8), 731-736. doi:10.1136/bmj.f6753

Ranaghan, C., Boyle, K., Fraser, P., Meehan, M., Moustapha, S., & Concert, C. (2015). The effectiveness of a patient navigator on patient satisfaction in adult patients in ambulatory settings: a systematic review. *JBI database of Systemic Reviews & Implementation Reports, 13*(8), 54-69. doi:10.11124/jbisrir-2015-2323

Roberts, T. (2012). Understanding survey research: Applications & processes. *British Journal of Midwifery, 20*(2), 1-7. doi:10.12968/bjom

Rosenwasser, M., & Cuellar, D. (2016). Medical management of osteoporosis and the surgeon's role. *Injury, International Journal of the Care of the Injured, 47*(S1), 562-564. doi:10.1016/S0020-1383(16)30014-6

Sale, J., Beaton, D., Posen, J., Elliott-Gibson, V., & Bogoch, E.(2014b). Key outcomes are usually not published in fracture secondary prevention programs: Results of systematic review. *Archives of Orthapaedic and Trauma Surgery, 134*, 283-289. doi:10.1007/s00402-011-1442-y

Senay, A., Delisle, J., Geroux, M., Malo, M., Nguyen, H., Ranger, P., & Fernandes, J. (2016). The impact of a standardized order set for the management of non-hip fractures in a fracture liaison service. *Osteoporosis International, 27*, 3439-3447. doi: 10.1007/s00198-016-3669-5

Shipman, K., Stammers, J., Doyle, A., Gittoes, N. (2016). Delivering a quality-assured fracture liaison service in a UK teaching hospital-is it achievable? *Osteoporosis International, 27*, 3049-3056. doi:10.1007/s00198-016-3639-y

Timmins, F. (2015). Surveys & questionnaires in nursing research. Art & science research: Part 16. *Nursing Standard, 29*(42), 42-50. doi:10.7748/ns.29.42.42.e8904

Tingle, C. (2016). Surgeons can help establish a fracture liaison service for the treatment of osteoporosis. *Orthopedics Today, 36*(12), 1 & 10-12. Retrieved from Healio.com/Orthopedic

Vaile, J., Sullivan, L., Connor, D., & Bleasel, J. (2013). A year of fractures: A snapshot analysis of the logistics, problems, and outcomes of a hospital-based fracture

liaison service. *Osteoporosis International, 24*, 2619-2625. doi:10.1007/s00198-013-2357-y

Van Der Kallen, J., Giles, M., Cooper, K., Gill, K., Parker, V., Tembo, A., … Carter, J. (2014). A fracture prevention service reduces further fractures two years after incident minimal trauma fracture. *International Journal of Rheumatic Diseases, 17*(2),195-203. doi: 10.1111/1756-185x.12101

Walden University. (2017). *Manual for quality improvement evaluation projects*: *DNP scholarly project*, 1-10. Retrieved from http://ademicguides.waldenu.edu/dnp

Appendix A: Literature Review Matrix

Literature Review Matrix for Secondary Fragility Fracture Prevention

Full Reference	**Study question or aim**	**Research Methods & model**	**Analysis & Results & limitations**	**Conclusion/ Implication project/pract**	**JHNE BP Rated**
1. Adler, R., Bates, D., Dell, R., LeBoff, M., Majumber, S., Saag, K….& Suarez-Almazor. (2011). Systems-based approach to osteoporosis and fracture care: policy & research recommendations from the workgroups. *Osteoporosis Int., 22*(S3), S495-S500. doi: 10.007/s00198-011-1708-9	Use of CM; ? effective, barriers, feasible, & Inform tech (IT)	4 Work groups with normative group technique and summary of recommendations; chosen for interest & experience	Closed system; workgroups; team with coordinator best such as a nurse; harder to do in fee-for-service areas; use best-practice protocol. Only 20% pt with FF get f/u eval or tx	Nurses be used to improve communication in silos; registry aid & tie to perform measure; team; list of inpt barriers. Use Best practice protocol (BPP)	IV B
2. Adler, R. (2012). Secondary fracture prevention. *Curr Osteoporosis Rep, 10*, 22-27. doi: 10.1007/ s11914-011-0090-z	Summary of eval & tx post-ff	Descriptive expert summary	More difficult in open US sx due to fragment of surgeon/pt/ PCP. Kaiser, Gesinger, VA closed.	NP, Own the Bone, types effective; we can improve dramatically; fx is an opportunity	VA
3.Agency for Healthcare Research & Quality. (2012). *National Guideline 146: Osteoporosis: Assessing the risk*	Provide guidance for assessing risk of ff	NICE & GRADE	Systematic review with meta-analysis & panel consensus guideline; less than	No DEXA for under 50 unless risks such as ff; not assess DEXA for all; use screening tool first	IVA

of fragility fracture. London, U.K.: National Institute for Health & Clinical Excellence (NICE)			68% need dexa initially ; use frax or q-fx pre DEXA.		
4.Aizer, J., & Bolster, M. (2014). Fracture liaison services: Promoting enhanced bone health care. *Curr Rheumatol Report, 16*(455), 1-8. doi: 10.1007/s11926-014-0455-2	? factors in gap, function of fracture liaison service (FLS), and lessons learned	expert opinion article after lit review	Discusses stats. Difficult ethics for randomize if withholding known tx. Few RCT exact future ff rate; BPP disseminated in 0.9-1.7 hr; need stakeholders & champion. Need RCT for cost-effective and real rate of recurrent. NP/RN/in-person best with interdisciplin	Ed alone not sufficient; FLS less gap & improves outcomes. Wrist more likely to attend than hip fx but harder to ID (MD, EMR, XR, NCM). Own the Bone/PQRS; Nurse role in person with access; ID	VA
5.Akesson, K., Marsh, D., Mitchell, P., McLellan, A., Stenmark, J., Pierroz, D…& Cooper, C. (2013). Capture the fracture: a best practice framework & global campaign to break the	Support implement ation of (FLS)	Position paper: IOF capture the fx campaign and best practice framework	FLS closes post fx tx gap from silos of care and should be done at onset & 2/3 programs had coordinator, rates of fx and tx less than 20%	Data of rate and less that 20% women received osteoporosis tx, gap reasons, need to define scope of each program; framework with 13 standards with pt ID, eval, tx, f/u	IVB

fragility fracture cycle. *Osteoporosis Int., 24*, 2135-2152. doi: 10. 1007/ s00198-013-2348			women received osteoporosis tx after fx; stats. Link between fx tx & outpt care & f/u eval osteoporosis		
6.Balasubramanian, A., Tosi, l., Lane, J., Dirschl, D., Ho, P-R., & O'Malley, C. (2014). Declining rates of osteoporosis management following fragility fractures in the U.S., 2000 through 2009. *Journal of Bone & Joint Surgery, 96*(e52), 1-8. doi: 10. 2106/ JBJS.L.01781	Assess eval & tx patterns of ff pts & short rx adhere	Retrospect cohort > 100, 000 pt without fx prior year over age 50 community dwellers	Pearson-Chi, Cochrane-Armitage. Bias community & insured 2001-2009 assess by rx refill. FF strong predictor but not eval / tx	Rx adhere best short-term but wane over time; UE tx rates lowest; <1/3 women & < 1/6 men. 23.8% 2001-2002 compared to 15.9% tx in 2007-2009	IIIA
7.Beaton, D., Vidmar, M., Pitzul, K., Sujic, R., Rotondo, N., Bogoch, E., Sale, J…Weldon, J. (2017). Addition of a fracture risk assessment to coordinator's role improved treatment rates within 6 months of screening in a fragility fracture screening	Would a more intensive FLS program improve tx rates?	Followed Ganda's models; descriptive stats. Added full risk assess & commun with PCP to current program; Quasiexper-imental :2 matched groups over age 50 of	90% went back to PCP to discuss bone health compared to 60% matched controls (TM & PS); Canadian study. Within 6 months tx rate went form 16% or 21% up to	Type B better than C with increased eval & PCP communicate increased f/u & tx; more cost-effective non-hip	IIB

program. *Osteoporosis Int.*, *28*(3), 863-869. doi: 10.1007/s00198-016-3794-1		usual tx & BMD fast track (new); matched	32% & BMD done in 96% cases compared to usual 66%		
9.Bell, K., Srand, H., & Inder, W.(2014). Effect of a dedicated osteoporosis health professional on screening & treatment in outpatients presenting with acute low trauma non-hip fracture: a systematic review. *Arch Osteoporosis*, *9*(167), 1-9. doi:10.1007/s11657-013-0167-7	ID effect dedicated professional on screen & tx on outpt FF	Systematic review using Joanna Briggs Institute (JBI) meta-analysis tool	2 readers, Fisher exact tests, odds ratio, JBI tool, outpatients ages 40-100 years old with non-hip FF	Coordinator increased rates of BMD, labs, referrals, decreased fx rate, and ortho not comfortable with rx but have the opportunity	IIIA
10.Benzvi, L., Gershon, A., Lavi, I., & Wollstein, R. (2016). Secondary prevention of osteoporosis following fragility fractures of the distal radius in a large health maintenance organization. *Arch. Osteoporosis*, *11*(20). doi: 10.1007/s11657-016-0275-2	Eval tx in HMO after distal radius ff	Retrospect chart review in HMO: 82 pts mean age 64	Retrospective chart review in HMO showed 28% subsequent fracture in just over 2 yr, 47% with fx and 25% without fx had dx osteoporosis/ osteopenia and none referred to endocrinologist & 21% at any point tx	Distal radius fx occur early in osteoporosis so good target for secondary prevention & remain undiagnosed & untreated so need program; double risk for FF post 1	VB

			osteoporosis		
11.Biluc, D., Alarkawi, D., Nguyen, T., Eisman, J., & Center, J. (2014). Risk of subsequent fragility fractures & mortality in elderly women & men with & without osteoporotic bone density: The Dubbo Osteoporosis Epidemiology Study. *Journal of Bone & Mineral Research, 30*(4), 637-646. doi: 10. /jbmr.23931002	What are the risks/ predictors subsequen t FF & mortality	Epidemiolog ical study; Dubbo Osteoporo; cohort prospective; age over 60	Cox, AIC,, Cox prop hazard, Poisson distribut; Australian community dwelling. 50% BMD >-2.5 t-score. Older pts had increased mortality	Quad function & elderly even without t-score for osteoporosis had fx & increased mortality	IIIA
12.Bogoch, E., Elliott-Gibson, V., Beaton, D. Sale, J., & Josse, R. (2017). Fracture prevention in the Orthopaedic environment: Outcomes of a coordinator-based fracture liaison service. *Journal of Bone & Joint Surgery, 99A* (10), 820-831. doi: 10.2106/ JBJS. 16.01042	Describe key clinical primary outcomes	Prospective observation study using descriptive stats; upaired & paired chi-2, SPSS	Inclusion better than RCT; inpt & outpt male & female. Ages 40 & up; 1 center; self-report who were not already on rx showed increased rate rx, eval, educ with coordinator	Coordinator helps but not just educ. 69-90 FF pts have osteoporos including 20% wrist	IIIA
13.Bukata, S., Kates, S., & O'Keefe, R.	Modifica-tions FF tx	Review PubMed for literature	FLS not well described; choices #	Ortho ID; comprehensive eval needed as	VB

(2011). Short-term & long-term orthopaedic issues in patients with fragility fractures. *Clin Orthop Relat Res*, *469*(8), 2225-2236. doi:10.1007/ s199-011-1779-0		after 2000	WB/ORIF for displacement ; Full eval as 30% hsd secondary cause for osteop; early recognition	30% have secondary causes; ck comorbidity, vit-D hydr25 & OR early;	
14. Bunta, A. (2011). It is time for everyone to own the bone. *Osteoporosis Int*, *22*(S3), S477-S482. doi: 10.1007/ s00198-011-1704-0	Can program help decrease re-fx rate?	Quality improve: Own the Bone; expert opinion	50 females & 25% males with hip fx had prior ff; Followed AHA program with beta-blockers to change physician & pt behavior; AOA program works well. Teachable time	Outpt wrist fx, stats (20%), important to ID pt to prevent further not just tx fx, do the right thing; 17 yrs to get EBP implemented	VB
15.Bunta, A., Edwards, B., Macaulay, W., Jeray, K., Tosi, L., Jones, C…… & Dirschl, D. (2016). Own the Bone, a system-based intervention, improves osteoporosis care after fragility fractures. *Journal of Bone & Joint Surgery*, *98A* (24),	Assess the dissem & effect of Own the Bone second prevent program on rx & BMD	QI cohort study with disseminate of 'Own the Bone' program model for patients 50 or over FF.	53% had BMD and/or tx initiated for osteoporosis & 14 sties 2005-177 sites 2015. 32% had prior fx; Used SAS, mean, SD, %. Mostly ortho practices; bias; more	Own the Bone program is being used at many more institutions now for secondary prevention after dissem, educ, progr develop intervention, implement & eval. Eval within 6 mo. of fx for CMS/HEDIS	VA

e109, 1-8. doi:10.2106/JBJS.15.01494			communicate		
16. Bynum, J., Bell, J., Cantu, R., Wang, Q., McDonough, C., Carmichael, D…& Tosteson, A. (2016). Second fractures among older adults in the year following hip, shoulder, or wrist fracture. *Osteopor Int, 27*(7), 2207-2215.doi: 10.1007/ 00198-016-3542-6	Estimate a second fracture risk for older US	Observational cohort with time-to-even & Cox proport Hazard, & Kaplan-Meier plot models for 273,330 people.	4.3% had second ff within a year with hip most common. Medicare 2009 with fx hip, wrist shoulder. Wrist more % women that other ff. 7.4% wrist fx die within yr, 13.2% prox hum; & 26.6% hips	Women over 85 highest risk; CI= male/female; Index fx site not matter for risk. Wrist & UE need attn. not just hips. DR younger	IIIB
17. Cooper, M., Palmer, A., & Seibel, M. (2012). Cost-effectiveness of the Concord minimal trauma FLS; a prospective, controlled fracture prevention study. *Osteoporosis Int., 23*, 97-107. doi; 10.1007/s00198-011-1802-z	Assess cost-effectiveness of MFTL (FLS0 service	Australian used 4 yr study that showed 80 % risk reduction of subsequent fragility fx to simulate 10 yr cost-effective	Markov model, costs and QALY; univariate, probabilistic sensitivity analyses; computer simulation model showed improved QALY by 0.089 yr, cost AUD additional 1486 per pt over 10 yr period simul	Cost-effective to reduce subsequent fx	IIA
18. Dehamchia-Rehailia, N., Urso, D., Henry-Desailly, I.,	Assess performance and results of	Observational single center ambispectiv	Mean age 63 with 71% female (872 of 1439	Secondary prevention improved with FLS,	IVA

Fardelione, P., & Paccou, J. (2014). Secondary prevention of osteoporotic fractures: evaluation of Amiens University Hospital's fracture liaison service between January 2010 and December 2011. *Osteoporosis Int., 25*, 2409-2416. doi: 10.10 07/s00198-014-2774-6.	FLS	e study Telephone questionnair e May-Oct 2013 closed ended questions.	eligible). 396 refused and 138 no show appt; 1--9 mo post fx with wrist fx second most common at 28%. 20% d/c tx after 6 months but 67% at 18 months and used dexa and lower recruitment rate. SAS descriptive stats $p<0.05$, two-sided, chi-square or Fisher's exact, Kruskal-wallis, student's t-test or analysis of variance for the variables Wilcoxon's rank test, Kaplan-Meier survival analysis of persistence	participation rate 38 % Main reason for lack of rx adherence at 12 an 18 months was non-refill by PCP. Nurse coordinator, pts over 49, advice to PCP. Full FLS more effective than just ed/alerts; EMR ID;	
19. Drew, et al.(2015). Making the case for a fracture liaison service: A qualitative study of the experiences	Explore experience ID, decision factors, and describe	33 clinicians in 11 hospitals in UK were interviewed for 30-50 mins in	NVivo software after anonymous and transcribed. Felt financial	Champion and nurse coordinator with manager to improve communication and affect	IIIB

of clinicians and service managers. BMC Musculoskeletal disorders, 16(274), 1-8. doi: 10.1186/s12891-015-0722-z	views of making case for FLS	2013 after pilot and used probing techniques	more important than quality or outcome to decision-makers. Personality affects & data/ guides/ programs/ cost-savings. collaborate / stakeholders	decisions	
20. Eckman, D., Helden, S., Huisman, A., Verhaar, H., Bultink, E., Geusens, P., Lips, P., & Lems,W. (2014).Optimizing fracture prevention: the fracture liaison service; an observational study. *Osteoporosis Int., 25*, 701-709. doi: 10.1007/ s00198-013-2481-8	Evaluate response rate and reasons for nonrespon se to FLS invitation	Observation al study in 4 Dutch hospitals pts 50 yr or over with written invitation	2207 pts invited & 50.6% responded; barriers: not interested, on tx, physically unable, death. 2% re-fx, 88% rx at 12 mo. Paired t	Wrist fx more likely to visit clinic; hip fx lowest response. NP/ MD; wrist fx most common; 61 % US resp; ? ed increase	IIIB
21. Eisman, J., et al. (2012). Making the first fracture the last fracture: ASBMR task force report on secondary fracture prevention. *JBMR, 27*(10), 2039-2046. doi:10. 1002/jbmr.1698	Provide back, rationale, & toolkit to reduce fractures & costs	Literature review & task force recommend	Multi initiatives, cost-effective, ed alone not effect. 3 steps ID, investigate, intervene. Ortho ID but needs more f/u to effect.	Hip fx most impact, coordinator FLS decrease burden, decrease duplication of initiatives, ortho, national registry, nurse, worldwide type	IVA

22.Farmer, R., Herbert, B., Cuellar, D., Hao, J., Stahel, P., Yasui, R., Hak, D., & Mauffrey, C. (2014). Osteoporosis and the orthopaedic surgeon: basic concepts for successful co-management of patients' bone health. *International Orthopaedics, 38,* 1731-1738. doi: 10.1007/s00264-014-2317-y	Provide framework for dx & tx of pts with low BMD (FF)	Review article	Algorithm with early intervene ortho then refer prn back to PCP or specialists; 'Own the Bone' measures and rx table; ? bias AOA	ortho has opportunity to intervene early and improve communication as recommended by surgeon general 2004	VA-
23.Fraser, L., Ioannidis, G., Adachi, J., Pickard, L., Kaiser, S., Prior, J., Brown, J., … Papiaoannon, A. (2011). Fragility fractures and the osteoporosis care gap in women: The Canadian Multicenter osteoporosis Study. *Osteoporosis Int., 22*, 789-796.. doi: 10.1007 /s00198-010-1359-2	Describe post fracture care form 1995-1997 study	Annual question or interview, XR, BMD. Mail and if fx then call; alpha=0.05 with stats SAS/STAT program for generalized estimated equations approach	5566 women over age 50 Canadian Multicenter followed for 10 yr cohort population-based study with CI 95% 42-56% not tx with rx osteoporosis	Fx predicts another , bisphosphonates being used more but still gap 50%. Tx in Canada 5-38% after fragility fx	IIIA
24. Ganda, K., Puech, M., Chen, S., Speerin, R., Bleasel, J., Center, J., Eisman, J.,	Critically appraise studies on models of care to	8 medical literature databases 1996-2011 to describe	Types of programs A,B, C, D described & reviewed	A & B cost-effective with varying definitions. And coordinator.	IIA

March, L., & Seibel, M. (2013). Models for secondary prevention of osteoporotic fractures: A systematic review and meta-analysis. *Osteoporosis Int., 24*(2), 393-406. doi:10.1007/s00198-012-2090-y	identify specific features that are effective	models of care. 42 studies in English for secondary prevention with outcomes of BMD testing and osteoporosis tx At least 2 reviewers	separately. Meta-analysis on studies with control groups. Meta-regress. Studies heterogeneou	Alerts and education only less effective on outcomes. Cost-effect only eval in A & B predicted. Want tx under 6 mo post fx and women more likely and type of HC sx vary. Need more prospective studies & out-come standard	
25.Giles, M., Van de Kalen,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. *Osteoporosis Int., 22*, 2321-2328. doi: 10.1007/s 00198-010-1466-0	Design and implement care model for pts over 50 in ED with fragility fx	Piloted electronic flagging sx, referral pathway for 2049 pts over 50 from ED from July-Dec 2007 and 2008 Canadian. Report weekly by coordinator obtained and data = #/% referral	100% ID and referred from ED records and formal eval model being done. Phone calls and letters used to contact pts & in ED d/c. Increase to 29% attend from 2007 11% ($p<0.001$).	Nurse coordinator & multidiscipline with 100% capture pts & reduced time to tx, increased staff awareness. Previously only 5% pts referred. ID, referral, & prevention protocol developed but need outcome data	IIB
26. Lems, W. (2015). Fracture risk estimation may facilitate the treatment gap in osteoporosis. *Ann Rheum Dis, 74*, 1943-1945. doi: 10.1136/annrheumdis -2015-208245		Expert review	Guideline pub does not change practice. MD and pt unaware and lack of infrastruct are barriers. Heterogeneit	Implement focus on evidence, barriers, active dissemination & implement strategies. If falls with FRAX +Garvan	VB

			in studies comparing risk tools. Lack pract standard		
27. Lems, W., Dreinhofer, K., Bischoff-Ferrari, H., Blauth, M., Czerwinski, E., Da Silva, J., …….& Geusens, P. (2017). EULAR/EFFORT recommendations for management of patients older than 50 years with a fragility fracture and prevention of subsequent fractures. *Ann Rheum Dis, 76*, 802-810. doi: 10.1136/annrheumdis-2016-210289	Establish collabora-tive recom-mendation for ff over 50 with risk	EULAR SOP, Oxford LOE, task force using EFFORT, 2 boards with fellows, Delphi consensus, syst review has RCT	Large gap best addressed by FLS with coordinator, local champion and specific local stakeholder needs, not just ed alone, FLS best proven way to address secondary prevention increased eval & tx initiation. Rate from 26% to 46% with coord	Osteoporosis most common underlying case of ff, silos with multispecialty, recommend FLS such as AOA Own the Bone, coordinating care with multidiscipl as pt over 50 with ff should have eval risk	IIIA
28.Leppin, A., Gionfriddo, M., Kessler, M., Brito, J.,Mair, F., Gallacher, K.,…& Montori, V. (2014). Preventing 30 days hospital readmissions: A systematic review & meta-analysis of randomized trials. *JAMA Intern Med., 174*(7), 1095-	Synthesize evidence of interven decrease 30 day readm rate	Cummulativ e complexity Model with consensus	Post-hoc regression with 4 analyzers and pooled Cochrane Q with activity based coding, RR. Limited 1990-2013, single set not specific. 10 factors with decrease rate including FF	Personal pt contact & care coordination, d/c info, communicate with PCP decreases readmission and use bundled interventions. Readm increases cost and decrease revenue	IB

1107. doi: 10.001/jamaintern-med.2014.1608					
29. Leslie, W., LaBine, L., Klassen, P., Dreilich, D., & Caetano, P. (2012). Closing the gap in postfracture care at the population level: A randomized controlled trial. *CMAJ, 184*(3), 290-296. doi: 10.1503/cmaj.111158	Would mailed notification to pts and PCP improve postfx care?	4264 FF Canadian pts age 50+ within 6 mo ICD-9 claims data for 2 yrs randomized to 3 groups computer algorithm = usual, PCP letter, pt & PCP letter	Canadian HC/ PCP, BMD or rx outcome increase by 15% combo groups with notification. CI 95%, p< 0.001; OR & logistic regres # need to call to change= 7	Gap missed opportunity and post fx care suboptimal and 32% forearm. Simple notification helped and can complement other tx plan; forearm most common.	1A-
30.Lewiecki, E. (2015). Secondary fracture prevention via a fracture liaison service. *Women's Health, 11*(3), 269-271. doi: 10.1007/s00776-015-0700-1	Expert opinion	Description strategies.	Capture the fracture FLS program is effective & AOA	Need coordinator, ID, database, variety of types, outcomes	VB
31. Licata, A. (2015). Closing the gap: Preventing secondary fractures. *Osteoporosis Clinical Updates (Spring),* 1-30. Retrieved from www.nof.org	Assess FLS	Described measures, need, FLS roles	Defined problem & ff & stats, case studies, IT for tracking, test, Algorithm. Medical home model & complex sx/comorbid	Coordinated FLS is successful, early ID best with first ff, chronic condition; IT best efficient	VB
32. Lih, A., Nandapaan, H.,	Does the MTF	Prospective controlled	Reduced re-fx risk by	1/3 & 1/5 risk ff lifetime	IIIA

Kim, M., Yap, C., Lee, P., Ganda, K., & Seibel, J. (2011). Targeted intervention reduces refracture rate in patients with incident non-vertebral osteoporotic fractures: A 4-year prospective controlled study. *Osteoporosis Int., 22*, 849-858. doi:10.1007/ s00198-010-1477.x	service decrease re-fx rate?	observational comparing subsequent fx rate control & FLS 4 years; not random. SPSS, MAN-U Whitney & student-t for pt variables; Cox proport, HR with 95% CI, National bureau stats for soc/econ data	80% (4.1 from 19.7%), 5 times more likely to fx in control in single center who elected to participate or not. No program define but not just educ	nonvertebral 94% ff with $ 17 bill US ID & manage decreases future ff risk; not just ed; not random due to ethics	
33.Little, E., & Eccles, M. (2010). A systematic review of the effectiveness of interventions to improve post-fracture investigation & management of patients at risk for osteoporosis. *Implementation Science, 5*(80), 1-17. doi:10.1186/ 1748-5908-5-80	Effective-ness of intervene in RCT	Systematic review RCT with meta-analysis. Full text 9 in English in No. America RCT 3 of which were with wrist ff. Cochrane collaboration and EOPC criteria by 2 reviewers	Outcomes bmd & antresportive rx eval in studies 1994-2010 for endpoint. Some bias in selection. Short-term f/u for 6 months & no $ data. Any intervene better than none (usual)	ID & tx rates suboptimal but all interventions helpful but should communicate with PCP; Majumber Canada 2008 helpful design. Need cost analysis & long-term	IB
34. Liu, S., Munson, J., Bell, J., Zaha, R., Mecchella, J., Tosteson, & Morden, N. (2013). Quality of osteoporosis care of older Medicare	Assess uptake of postfx care guideline after fx	Cohort claims retrospective study 2003-2010 Poisson regression model. Pts retrieved	40% random of 61,832 pts with mean age 81 mostly white and female of which 22% received	Disparities common men, blacks, regions, upper extremity such as prim & 2ndary prevent uncommon. Tx not trigger post FF 43%. Care	VA

recipients with fragility fractures: 2006-2010. *JAGS, 61*, 1855-1862. doi:10.1111/igs.12507		Medicare data for pts at least 68 who survived 1yr post fx; HRR	testing +/- rx within 6 mo post fx. Proportion increased over time but not include pts died 1yr	gap evident.	
35.Mackey, P. & Whitaker, M. (2015). Osteoporosis: A therapeutic update. *Journal for Nurse Practitioners, 11*(10), 1011-1017. doi:10.1016/j.nurpra.2015.08.010	Tx update education activity	None; therapeutic update & review	20% pts with fragility fx have second fx within yr & tx available. Reviews stats, guide, screening, tx options, etiol	FLS decrease rate second fx by 40% & public burden; described eval & tx options; eval other dx	VB
36. Majumber, S., Lier, A., Rowe, B., Russell, A., McAllister, F. Makysymoych, W., …& Johnson,J. (2011). Cost-effectiveness of a multifaceted intervention to improve quality of osteoporosis care after wrist fracture. *Osteoporosis Int., 22*, 1799-1808. doi:10.1007/s00198-010-1412-1	Is the intervent cost-effective compared to usual care?	Randomized trial in Canada 272 pts over 50 put into multifaceted intervention median age of 60 with IOF program	Markov process and IOF model, one-way sensitivity model and QALY and probabilistic sensitivity analysis. For every 100pts, 1 hip fx saved and 1 QALY, and $26,800 CND at one yr f/u. Wrist fx Canadian study. BMD cost-saving 80% and cost of intervention	FLS are cost-effective for wrist fx. Outcome starting bisphosphon & bmd ? generalizable, health system barriers cause gaps too.	IB

			$12		
37. Marsh, D., Akesson, K., Beaton, D., Bogoch, E., Boonen, S., Brandi, L., McLellan, A., Mitchell, P., Sale, J., & Wahl, D. (2011). Coordinator-based systems for secondary prevention in fragility fracture patients. *Osteoporosis Int., 22*, 2051-2065. doi:10.1007/s00198-011-1642-x	Evaluate published models	Literature review/ recommend for position paper from expert panel	Described best practice recommend 2009 as second level with hip fx care first. Varied interventions, some did not describe outcome, educ alone not effective. In 2004 Surgeon General called for bone health	65% coordinator with ortho, PCP, pt, PT, endocrinology within 6 months of ff. Not educ alone & is cost-effective. Need advocacy & database & incremental implement. Ortho has pt access	IVB
38. Mathew, S., Gane, E., Heesch, K., & McPhail, S. (2016). Risk factors for hospital re-presentation among older adults following fragility fractures: A systematic review & meta-analysis. *BMC Medicine, 14*(136), 1-20. doi: 10.1186/s12916-016-0671-x	What are risk factors for FF readmit?	11/35 studies were quality & reviewed with OR, RR,HR using effective public health practice project quality assessment tool& pool for meta by 2 reviewers	Heterogene, no qual or gray lit, age over 65 yrs, background FF & age risk factors for readmit	QI usually moderate; risk increases with age & prior ff. Death, cost, hospital & care gap. Cannot modify age.	IIIA
39. McLellan, et al. (2011) Fracture liaison services for the evaluation & management of	Evaluate cost-effectiveness of FLS in U.K.	Audit data from West Glasgow FLS hypothetical	18 fx prevented with L 2100 saved per 1000 pts as	FLS are cost-effective to prevent future fragility fx including wrist ?	IIIB

patients with osteoporotic fracture: A cost-effectiveness evaluation based on data collected over 8 years of service provision. Osteoporos *Int., 22*, 2083-2098. doi: 10.1007/ s 00198-011-1534-0	and cost of wide adoption in U.K.	cohort 2009 prices from 11,000 pts not random. Used probabilistic sensitivity analysis & .	only 11-28% fx pts receive care in UK NOF guidelines UK setup cost would be L 9.7 mill initially. 15-38% of pts who need osteoporosis care receive it but true # receiving care not known.FF save 31,000 & L 522 mill	efficacy data & cost effectiveness in different healthcare system ?	
40. Mears, S., & Kates, S. (2015). A guide to improving care of patients with fragility fractures, edition 2. *Geriatric Orthopaedic Surgery, 6*(2), 58-120. doi: 10.1177/ 21514585/5572697	Follow principles =optimize care	Literature review and expert opinion	US 2.1 million ff/yr including 200, 000 distal radius ff with only 16-20% post FF proper assess, older factor BH	Ortho has opportunity to intervene with ff so ID; meeting PQRS measures also saves $. Need champion & coordinator	VA
41. Mehta, S., McDermid, J., Richardson, J., MacIntyre, N., & Grewal, R. (2014). A structured literature synthesis to identify measures for screening for the risk of adverse outcomes in	What is best current evidence for OT assess fall & ff risk?	Literature synthesis; narrative synthesis; 2 tools found useful	Tools & FRAX to be used;narrative synthesis discriminates cores & multiple facets of fall prevention. Author bias/ small sample	Not really pertinent to the project but to practice for eval tools & multifaceted fall prevent.	IIIC

individuals following a distal radius fracture. *Critical Reviews in Physical & Rehabilitation Med, 26*(3-4), 145-164. Retrieved from Bogel House, Inc.					
42. Miller, A., Lake, A., & Emory, C. (2015). Establishing a fracture liaison service: An Orthopaedic approach. *JBJS Am., 97*, 675-681. doi: 10.2106/ JBJS.N.00957	Concept review for FLS using Ortho approach	Peer-reviewed current concepts review by experts with own FLS ortho based both in & outpts	Need buy-in for funding concerns & fls paid for itself. HER, coordinator, data key, & program successful. Stats for FF in US, cost, & increased risk 86%	*Ortho start MD/APN/ITmultidiscipl with nurse coordinator; get buy-in; APN runs it. Team & ID important; more QALY	VA
43. Mitchell, P. (2013). Best practices in secondary fracture prevention: Fracture liaison services. *Curr Osteoporos Rep, 11*, 52-60. doi: 10.1007/s11914-012-0130-3	What has been done & what can be done FF ?	Expert systemic review	Stats, types, worldwide problem with still low tx rates. Respond to index FF to prevent 2nd	Still gap even with knowledge FLS works, 65% programs with coordinators & which types best	VA
44. Mitchell, P., & Chem, C. (2013). Secondary prevention & estimation of fracture risk. *Best Practice & Research Clinical Rheumatology, 27,* 789-803.	How can FF risk be measured, what is the best sx for secondary prevention , and how do we implement	Expert review	Usual care less than 20% receiving appropriate care, types A & B the most effective. Worldwide	ID, investigate, initiate and f/u long-term chronic illness with systems approach; Bermuda triangle	IIIB

doi:10.1016/ j.berh.2013.11.004	systems?		initiatives.		
45. Mitchell, P., Akesson, K., Chandran, M., Cooper, C., Ganda, K., & Schneider, M. (2016). Implementation of models of care for secondary osteoporotic fracture prevention & orthogeriatric models of care for osteoporotic hip fracture. *Best Practice & Research Clinical Rheumatology,30,* 536-558. doi: 10.106/j.berh. 2016.09.008	Assess evidence base worldwide FLS	Literature review synthesis	Multiple FLS described; Fx begets fx. FLS decreases future ff rate by 50%, in pts with ff over age 50. longitudinal but had campaign before so bias. Need PCP commu NBHA has 350 sites with needed benchmarks.	Different challenges each locality, need ortho coordinator & champion. FLS effective. Baby boomers increase # of ff and osteoporosis most common bone disease	VA
46. Morgan, E., Crawford, D., Scully, W., & Noce, N. (2014). Medical management of distal radius fractures. *Orthopedics, 37*(12), e1068-e1073. Retrieved from Walden University Library Thoreau database	Determine prevalence of DEXA/ Calcium/ Vitamin D post distal radius ff	Retrospectiv e review cohort in military facility in 6 states using HER pt 50 & over with distal radius fragility fx 2004-2010. 210 pts avg age 67 yr Record rev cohorts/sex	Less than 25% pts received dexa or calc with D. Power anal needed 30 pts with chi-sq, Fischer exact & student-t, <0.0083 & 0.001; power analysis	Disparities in rx for men, ortho apprehension to manage, opportunity but need dedicated provider; VA sx so not generalizable	IIIB
47. Morgan, G. (2013). Falls and fractures: a	Present epidemiol ogical	Literature review, professional	Falls & fx are public health	Cumulate the literature to encourage	VB

literature review & Welsh perspective. *Working with Older People, 17*(4), 170-178. doi: 10.1108/ WWOP-07-2013-0016	considerations, describe risks and possible intervene, &present a case study on the Welsh situation	experience, epidemiological data , case control. Modeling methods NNT=50 with L 20 saving per pt	concerns as mortality rate in over 65 ten-fold that without FF within a year; 1/3 fall yr 50,000 pts calcium/vit D decreased falls by 1/3. Welsh.	policy change in Wales as some factors are modifiable with FLS. Need to put together falls as opportune. Convert evidence into practice	
48. Myrick, K. (2011). Improving follow-up after fragility fractures. An evidence-based initiative. *Orthopedic Nursing, 30*(3), 174-179. doi: 10.1097/ NOR.Ob013e318219ac9f	Can f/u of ff pts be improved?	Iowa EBP model with QI action plan. Agree framework. 1 yr retro chart review: 0% receiving tx prior; no pathway	Power needed 10% of # & SPSS used. 100% pts received f/u with this program with 73% distal radius. Outpt clinic with 1 yr tel f/u. NIH said ortho ID to start eval/ tx	DNP can be champion to initiate EBP, time, lack of pathway, knowledge, organizational influence can be barriers, want early such as within 3 mos, ID by ortho included staff education.	IIA
49. Nakayama, A., Major, G., Holliday, E., Attia, J., & Bogduk, N. (2016). Evidence of effectiveness of a fracture liaison service to reduce the re-fracture rate. *Osteoporos Int, 27,* 873-879. doi:10.1007/ s00198-015-3443-0	? FLS decreases re-fx rate	Historical cohort using intent to treat analysis comparing FLS & non-FLS hospital. Retrospect Observation; descriptive. Not RCT due to ethics. Used IOF capture fx program	HR, Cox proportional, multivariate analysis of pts age 50 & over with FF in Australia ED tertiary intervene not describe & unsure what piece makes difference. NNT=20 & 30-40% less re-fx rate 3yr	FLS effective to decrease subsequent ff rate but not clear on which component of program most effective so will want multifaceted. Half hip fx had prior FF.	IIIA

50. Naranjo, A., Ojeda-Bruno, S., Bilbao-Cantarero, A., Quevedo-Abeledo, J., Diaz-Gonzalez, B., & Rodriguez-Lozano, C. (2015). Two-year adherence to treatment & associated factors in a fracture liaison service in Spain. *Osteoporos Int., 26,* 2579-2585. doi: 10. 1007/s00198-015-3185-z	Evaluate the 2 year effective-ness of a program for the secondary prevention of fracture	Prospective longitudinal observationa l for 2 years at 1 center of pts from ED ICD codes with ff over age 50 with type A FLS program.	Primary & rheumatolog y in Spain. Hip and older pts tend to refuse to participate more. With FLS from 16% up to 52% on anti-resortive & 73% maintain rx. RN, dexa, Rx rheumatolog y/PCP.	Providers don't adhere to guidelines. Calls to pts 3, 6.9, 12 month. RN with ICD alert identifies & contacts. Educ to MD.	IIIA-
51. National Osteoporosis Society. (2015). Effective secondary prevention of fragility fractures: Clinical standards for fracture liaison services, version 1, 5-45. Retrieved from nos.org.uk/ standard	Set U.K. standards for care in secondary FF prevent	Expert panel for Clinical standards of FLS in UK. PDSA.	Most common bone disease, worldwide problem,2-3 more risk with ff for subsequent, 50% hip fx had prior ff, quality measures & benchmark so need registry. Generalizabl e. Describes standard	Wrist most common; to do primary prevention would need to assess 5-6 times more pt. ID, invest, inform, intervene, & integrate	VA

52. Nelson, S., Nelson, R., Cannon, G., Lawrence, P., Battistone, M., Grotzke, M.,…, & Lafleur, J. (2014). Cost-effectiveness of training rural providers to identify and treat patients at risk for fragility fractures. *Osteoporos Int, 25*, 2701-2707. doi:10.1007/s00198-014-2815-1	Evaluate cost-effectiveness of training rural providers compared to current method of referring to center specialist.	Markov micro simulation model & probabilistic sensitivity analysis & proposed mini-residency; used simulation. Sensitive to small diff in effectiveness	Veteran males over 70 in rural areas with costs & QALYs with base-case analysis. Small sample with slight difference in fx rate, increased QALY years, cost savings in prior. Not generalizable Potential cost-effective; shows more rate tx & life yrs, sm rate decrease re-ff	Provider educ not sufficient to make a difference but has potential to be cost-effective.	VC
53. Olenginski, T., Maloney-Saxton, G., Matzko, C., Mackiewic K., Kirchner, H., Bengier, A., & Newman, E. (2015). *Osteoporosis Int., 26*, 801-810. doi: 10.1007/ s00198-014-2967-z	Evaluate FLS program vs PCP care in high risk pts for tx	EMR random sample analysis of 200 ff pts 2008-2011 in Geisinger	More likely tx FLS 81% versus 32% PCP p<0.0001but in a closed system. 6 month f/u 15% inpt consults had died; Outpt & inpt	Outpt FLS better than PCP for rate of treatment	IIB
54. Piscitelli, P., Brandi, M., Chitano, G., Argentiero, A., Neglia, C.,	Calculate incidence of major ff in Italy	Retrospective study with hospital d/c databases	Database eval past 3 years increased rates FF	Need to start prevention services	VB

Distante, A., Saturnino, L., & Tarantino,U. (2011). Epidemiology of fragility fractures in Italy. *Clinical Cases in Mineral & Bone Metabolism, 8*(2), 29-34. doi:			minor underanalyze with highest rates among women over 75 & men over 80 with wrist fx ages 55-85 in 311/100,000. FF high burden Italy. Ital hospital		
55. Porucznik, M. (2013). Appropriate treatment of distal radius fractures. Appropriate Use Criteria by the American Academy of Orthopaedic Surgeons. *AAOS Now,* 1-74. Retrieved from www.aaos.org/auc	Provide guidance for tx of DR fx	Writing, review, & voting panels of experts. Consensus panel US professional association guideline	Does not discuss FLS, just ortho operative & non-operative tx	No discussion of FLS in AAOS AUC.	IVB
56. Rosenwasser, M., & Cuellar, D. (2016). *Injury, Int. Care Journal, 47*(51), 562-564. Retrieved from www.elsevier.com	Increase commit-ment to care gap	Expert opinion citing survey results	Cited survey results. Surgeon opportunity with fx but PCP role to do & untrained. Pts under ed risk. 20% get rx & FF 1-9 X more likely re-fx	Pts take cues from MD, ortho needs to collaborate & increase role for best care. Increase aware pt/MD; gap in care	VB
57. Roux, S., Beaulieu, M., Beaulieu, M., Cabana, F., &	Compare educ/moti vation of PCP with	Intent to tx; RCT 2 level interviews with 2	20-30% FF eval & less tx & FF one of strongest	Communicate & education close gap with PCP; assess barriers	IB

Boire, G. (2013). Priming primary care physicians to treat osteoporosis after a fragility fracture: An integrated multidisciplinary approach. *Journal of Rheumatology, 40* (5), 703-711. doi:10.3899 /jrheum.120908	standard	groups over age 50 but 19% refused & 75% not prior tx over 12 mo	predictors of future ff Different contact frequency & content; outpts. Negative predictors are male, age, & non-major ff. Ortho clinic & some may not have PCP	with pts with negative predictors. If we ID, investigate soon, & send results to PCP to do rx; more	
58. Sale, J., Beaton, D., Posen, J., Elliott-Gibson, V., & Bogoch, E. (2011). Systematic review on interventions to improve osteoporosis investigation & treatment in fragility fracture patients. *Osteoporos Int, 22*, 2067-2082. doi: 10.1007/s00198-011-1544-y	Assess osteoporos investigati on & tx in initiative in ortho	Intent to treat Systematic review 57 articles with outcome BMD, rx & adherence. @ reviewers in 6 months with 3rd party if disagree	Cochrane risk of bias tool for studies and not use heel u/s. Equated proportions of pts taking rx 6 mo, re-fx @ 6mo, Checked rx not OTC limitation. Intense program/ coordinator best outcomes with BMD, variable study quality heterogeneit	Need longer, coordinator & systems prog	IIIB
59. Sale, J., Beaton, D., Posen, J., & Bogoch, E. (2013). Medication intiation rates not	Examine methods used to calculate med adhere	Systematic review with 2 reviewers with articles that could be compared.	Ortho enviro in secondary prevent clinic found heterogenou standards so	Need standardized reporting mechanism in program to assess rx	IIIB

directly comparable across secondary fracture prevention programs: reporting standards based on systematic review. *Journal of Clinical Epidemiology, 66*(4), 379-385.e4. doi: 10.1016/ j.jclin-epi. 2012.10.013	rates in secondary fx prevent program	57 articles found 28 combo in 49 of 64 intervention s then with incl/exclus left 3	comparison difficult	initiation rates	
60. Sale, J., Bogoch, E., Hawker, G., Gignac, M., Beaton, D., Jaglal, S., & Frankel, L. (2014a). Patient perceptions of provider barriers to post-fracture secondary prevention. *Osteoporos Int, 25*, 2581-2589. doi: 10.1007/ s00198 -014-2804-4	Assess pt experience with BMD & tx after eval	Phenomolog methodolog y prospective qualitative study. 2 researchers =51 interview (6 & 18 mo same person) 25 mostly female pts over 50 in Canada single site.	Giorgi's procedures transcripts. Barriers pre= surgeon or PCP saying not needed & post were lack of communicat e & incorrect info Both pt & provider barriers	Sentinel event that needs proper communicate regarding dx/tx	IIIA
61. Sale, J., Beaton, D., Posen, J., Elliott-Gibson, V., & Bogoch, E. (2014b). Key outcomes are usually not reported in published fracture secondary prevention programs: results	Perform secondary analysis of systematic review on intervent to examine outcomes such as cost, med adherence, refracture	Systematic review by 2 reviewers	Cochrane risk of bias & equated proportion using denominator form intention to treat of 54 studies in 57 articles in 11 countries	Most studies do not report key outcomes & have varying timeframes so cannot directly compare; need well-designed studies with standardize outcomes	IIIB

of a systematic review. *Arch Orthop Trauma Surg, 134*, 283-289. doi: 10.1007/s00402-011-1442y			various types. 2 stated cost analysis, 4 studies med adherence over 6 mo 17-56%, 4 study re-fracture rate 0-5%. Heterogen or just hip FF		
62. Sale, J., Gignac, M., Hawker, G., Beaton, D., Frankel, L., Bogoch, E., & Elliott-Gibson, V. (2016). Patients do not have a consistent understanding of high risk for future fracture: Qualitative study of patients from a post-fracture secondary prevention program. *Osteoporos Int, 27*, 65-73. doi: 10.1007/s00198-015-3214-y	Examine FF pts if understand is high risk for FF	Qualitative phenomenol with Giorgi's prcedures with 27 interviews current pts after 6 mo	1/3 not see PCP after fx, HCP message after fx confusing. Outpt FLS clinic. 50% told high risk but did not think it applied to them	Pts do not think they are high risk so need to modify messages & repeat	IIIA
63. Saxena, A., Honig, S., Rivera, S., Pean, C., & Egol, K. (2015). The NYU osteoporosis model of care experience.	To see if program helped with ID/eval	Quasi-exper with NYU model of care with survey, calls, educ, letters to PCP & ortho	Used d/c dx data &20 d post sent questionnaire & ed material & call to to pts to enroll &	NYU has template; challenge ID & engage; include MD/pt educ	IIB

Geriatric Orthopaedic Society & Rehabilitation, 6(4), 276-281. doi: 10.1177/215145-8515604358			then in 6-12 mo.to women over 50 at single center Simple & cost-effective with 46% BMD & 40%rx. 40% responded & 41%prior		
64. Schray, D., Neuerburg, C., Stein, J., Gosch, M., Scheiker, M., Bocker, W., & Kammerlander, C. (2016). Value of coordinated management of osteoporosis via fracture liaison service for the treatment of orthogeriatric patients. *European Journal of Trauma & Emergency Surgery, 42*(5), 559-564. doi:10.1007/ s00068-016-0710-5	Does establ fls add to orthogeri care?	DVO guideline with prospective descriptive study	In 250pt in 3 months =40% had dx osteoporosis with and 65% with rx. Improved over usual care and coordinated care. Average pt 76 in Germany as 59% pts over 75 have osteop. Usual tx 16-21%	Coordinates care with multi special more efficiently & improves dx/tx	IIIB-
65. Senay, A., Delisle, J., Giroux, M., Laflamme, G., Leduc, S., Malo, M.,…& Frenandes, J. (2016). The	Eval impact of standard orders to empower nurses to manage fls	Retrospect retrieved data in single center Canada for 9 mo in non-hip over 50; Osteoporosi	ID increased after coordinator talked to ED; ID 30-70& by nurse with management	Communicate for ID & staff turnover needs new education & collaboration. Check ordersets for inpts perhaps standard referral	IIIC+

impact of a standardized order set for the management of non-hip fragility fractures in a fracture liaison service. *Osteoporos Int.*, *27*, 3439-3447. doi:10.1007/s00198-016-3669-5		s Canada model; Included trauma and breast ca pts.	of 60%. RN already worked there & trained on order set but needed some new training for turnover; effective	& ED	
66. Shipman, K., Stammers, J., Doyle, A., & Gittoes, N. (2016). Delivering quality-assured fracture liaison service in a UK teaching hospital-is it achievable? *Osteoporos Int.*, *27*, 3049-3056. doi:10. 1007/s00198-016-3639-y	Are NOS standards achievable practical Deliverab?	Prospective using 10 NOS fls standards & Microsoft excel	Practical for lg teaching ctr UK. 30% attrition, not all data entered pre nsg trained; seen within 6 wk. Paper, call, appt, educ, if 3 calls doc, f/u	Use multiple calls to reach; tracking excel. Study not generalizable	IIIA
67. Si, L., Winzenberg, M., & Palmer, A. (2013). A systematic review of models used in cost-effectiveness analyses of preventing osteoporotic fractures. *Osteoporos Int.*, *25*, 51-60. doi: 10.1007/s00198-013-2551-y	Assess evolution economic models of fls	PRISMA for English only articles for 74 models in 104 articles of which 69% European	Exchange rate dependent & complex. Simple decision tree then Markov then, simulation, univariate sens, pop mortality, QALY, LTC	Program design should have economic-based eval for cost-effective eval for info	IIIB

68. Siris, E., Adler, R., Bilezikian, J., Bolognese, M., Dawson-Hughes, B., Favus, M., …& Watts, N. (2014). The clinical diagnosis of osteoporosis: a position statement from the National Bone health Alliance Working Group. *Osteoporos Int., 25*, 1439-1443. doi: 10.1007/s00198-014-2655-z	How to clinically dx ff risk	National work group consensus position NBHA	Group reviewed evidence to reach consensus: Cont to use t-scores & FRAX >/= 3% hip & 20% 10 ff risk as dx when eval after ff age 50 or over. Not over dx. Ortho/PCP/ICD. FF leads to future FF & need standard dx model	Wrist dx with osteopenia on BMD if low energy min trauma; ways to ID; NOF	IVB+
69. Solomon, D., Patrick, A., Schousboe, J., & Losina, E., (2014). The potential economic benefits of improved postfracture care: A cost-effectiveness analysis of a fracture liaison service in the US health-care system. *Journal of Bone & Mineral Research, 29*(7), 1667-1674. doi:10.1002/ jbmr.2180	Assess cost-effective & benefits of fls & QALY	Validated Markov simulation model using insurance claims	Used multivar sensitivity anal. Less than 25% pt with ff get tx & fls can decrease secondary future ff rate by 50% in 5 yrs & more QALY. NP to see 500-1000 pt/yr to be cost-effect. Per 10,000 pt 153 fewer FF saving $66, 879, & add 37.43 QALY.	Need commitment from NP/FLS; cost-effective	VB

70. Song, X., Shi, N., Badamgarav, E., Kallich, J., Varker, H., Lenhart, G., & Curtis, J. (2011). Cost burden of second fracture in the US health system. *Bone, 48*, 828-836. doi: 10.1016/jbone.2010.12.021	To assess costs associated with second ff within 1 yr	Retrospective claim based study of 1 year costs with second fragility fx of pts over 50 Medicare & Thomas Reuters databases 2002-2008. Pts without second fx controls	Generalized linear models, selection parameter estimate and estimated coefficients and sensitivity analysis. Decomposition analysis for annual cost of second FF $834 private ins & estim 1.13 billion for Medicare pts. 1 yr 4-9% 2nd FF	Substantial cost & management of first ff may reduce long-term burden. Gave data on rates, first yr refx, second fracture costs 2-3 times more that year; potential cost savings	VB
71. Sorbi, R., & Aghamirsalim, M. (2013). Osteoporotic fracture programs management: who should be in charge? *Orthop Traumatol Surg Res, 99*(6), 723-730. doi: 10.1016/j.ostr.2013.03.022	Hypothe-size that internists may have more ability to assess & tx osteopo	7 closed questionnaire to 4700 orthopedic surgeons & internists with 3431 responses. Prospective dx study	Fewer than 10% ortho would order BMD compared to 79% internists with 33 ortho knowing correct calcium/vit D dose versus 76% internist; not all have internist US	Referral to internists but need commun ortho & intern	IIIB
72. Stevenson, M., & Selby, P. (2014). Modelling the cost effectiveness of	Assess areas associated with modeling	Financial eval with individual & cohort with ICER	UK, disease silent pre fx, not RCT available due to ethics.	Need head to head but ethics prevent but need more robust estimates	VB+

interventions for osteoporosis: Issues to consider. *Pharmaco Economics, 32,* 735-743	cost-effective for fx prevent	collection & Markov with 2 authors	Level of impact discussed & rating sx; not single dx threshold complex but harder to prove single		
73. Strudwick, K., Nelson, M., Martin-Khan, L., Bourke, M., Bell, A., & Russell, T. (2015). Quality indicators for musculoskeletal injury management in the emergency department: a systemic review. *Academic Emergency Medicine, 22,* 127-141. doi: 10. 1111/acem.12591	ID MS quality indicators for ED & eval the QI method quality	Systematic review by 2 reviewers with 1 to aid in 15/1805 articles reviewed	PRISMA, Prosp, & AIRE finding most ED QI are pain and imaging related. IOM/ Donabedian. Need quality measures to measure MS QI in ED & should be standardized as there is none now.	Need standard QI for MS ED so would affect how we can assess	IIIC+
74. Sujic, R., Gignac, A., Cockerill, R., & Beaton, D. (2011). A reviw of patient-centered post-fracture interventions in the context of theories of health behavior. *Osteoporos Int., 22,* 2213-2224. doi:10. S00198-010-1521-x	Do post fx intervent use theory & if so, are they more successful	Theory of behavior health change in a literature review of primary articles.	Some studies did not ID theory & only 3/42 had it listed. Ortho did not report using. Chronic disease teachable moment in this theory or cueing event; barriers. Theory	Pt perception in this theory & applicable to FLS but not cited in studies. Theory appropriate	VB

			under-utilized		
75. Tingle, C. (2016). Surgeons can help establish a fracture liaison service for the treatment of osteoporosis. *Orthopedics Today, 36*(12), 1 & 10-12. Retrieved from Healio.com/Ortho p-edics	Is FRAX a beneficial tool to ID osteoporos risk?	Expert(s) opinions.	FRAX helpful but has limits. NBHA AOA 'own the bone' way to address & ortho can seize owner opportunity with FF to do FRAX/PCP	FF is an opportunity for ortho to get ball rolling; use FRAX tool; sentinel event!	VB-
76. Tulk, C., Lane, P., Gilbey, A., Johnston, H., Chia,K., Mitchel, L., Bagga, H., & Wong, P. (2013). Improving osteoporosis management following minimal trauma fracture in a regional setting: The Coffs fracture card project. *Aust. J. Rural Health, 21*, 343-349, doi: 10.111/ajr.12072	Will this simple intervene increase rx, assays, dexas ?	Population intervention with card mailed to pt to discuss with PCP with cross-sectional longitudinal analysis	2 yr program mtf Increased vit d assay 42% & 35% DEXA orders but not more tx rx so FLS established. Australia had PCP. Used student's t-test & STATA. 1000 card cost effective. 28/50 tele interviews poor rx	Alert & educ not enough alone for tx	IIIA
77. Tzortziuo-Brown , V., Underwood,M., Mohamed, N., Westwood, O., & Morrissey, D. (2016).	Determine effective to equip GPs with to improve outcomes	Cochrane Systematic review & meta-analysis by 2 reviewer	Cochrane Review using PRISMA/ GRADE but difficult as 5/30 able to	Need local champion & alert PCP & alert pt with educ as well as reminder to see PCP to improve	IIIA

Professional interventions for general practitioners on the management of musculoskeletal conditions. *Cochrane Library of Cochrane Database of Systemic Reviews*, 1-186. doi: 10.1002/14651858CD007495.pub2			group due to heterogeneity. Check BMD & rx. Alert, educ, remind increased GP rates BMD/rx		
78. Vaile, J., Sullivan, L., Connor, D., & Bleasel, J. (2013). A year of fractures: A snapshot analysis of the logistics, problems and outcomes of a hospital-based fracture liaison service. *Osteoporos Int.*, *24*, 2619-2625. doi:10.1007/s00198-013-2357-y	Review process of fls	First fracture project retrospective review fls	Australian region Outpt clinic in Australia 768 pt/1 yr over 50 with 20% on tx so 570 called. 84% received assess. RN ID & track Cerner EHR time intensive & excel hard for lg #.	Need coord & database; organizational problems can be barriers (support, time, $)	VA-
79. Van Den Berg, P., Schweitzer, D., Van Haard, P., Van Den Berg, J., & Geusens, P. (2015). Meeting international standards of secondary fracture prevention: a survey on fracture liaison services in the Netherlands.	How was IOF implement	Descriptive Eval use of IOF 13 standards for FLS. IOF, self-report bias in survey. 24/ 90 responses to survey (27%) of which 67%	High compliance Dutch hospitals. Low pt response rate usually 28-61%; some standards open to interpretation & already had some in	ID & engage pts to come to fls needed due to usual low response. Systematic vs referral, personal vs written, FLS vs electronic mess & comm with GP better rates	IIIB-

Osteoporos Int., *26* (9), 2257-2263. doi:10.1007/s00198-015-3117-y		were teaching hospitals.	health sx		
80. Van Der Kallen, J., Giles, M., Cooper, K., Gill, K., Parker, V., Tembo, A.,…& Carter, J. (2014). A fracture prevention service reduces further fractures two years after incident minimal trauma fracture. *International Journal of Rheumatic Disease, 17*(2), 195-203. doi: 10.1111/1756-185x.12101	Did FLS program decrease ff	Prospective cohort over 50 ff not randomized but did use group already usual care =	Single Australian hospital with type A fls. Compared clinic & non-clinic attendees using Mann-U-Whitney, student t-tests, CHI-2, binary logic, & SPSS $p<0.001$. FLS more likely rx (81.3 not 54.1 %) & less likely FF(5.1 not 16.4%)	FLS effective for unmet need decrease ff rate & rx increase; coordinator pivotal with multifaceted. Not random due to ethics	IIA-
81. Vergara, I., Vrotsou, K., Orive, M. Garcia-Gutierrez, Gonzalez, N., Las hayas, C., Quintana, J. (2016). Wrist fractures & their impact in daily living functionality on elderly people: A prospective cohort study. *BMC Geriatrics, 16*(11), 1-8. doi: 10.1185/s12877-=15-0176-	Assess HC role & individual factors change after ff	Prospective cohort	6 hospital age 65 & over for 6 mo eval by 2 psycholog. SAS software; Hosmer-Lemeshaw test, logistic regress, chi-2, Mann-U-Whitney, Barthel index & Lawton IADL. Post 33%	Affects independence & most common UE but less studied & mostly female with ID effect burden; frailty phenotype	IIIA-

z			decrease More comorb & less preop function & less educ pred		
82. Viprey, M., Caillet, P., Canat, G., Jaglal, S., Haesebaert, J., Chapuriat, R., & Schoot, A. (2015). Low osteoporosis treatment initiation rate in women after distal forearm or proximal humerus fracture: A healthcare database nested cohort study. *PLOS ONE, 10*(12), 1-10. doi: 10.1371/journal.pone.0143842	Eval outpt rx initiate rate after hospital UE ff & what rx	Retrospective cohort observation form insurance data	Age 50 or older sample 2009-2011 hospitalized France from HC database. X-2 tests gourp compare, SAS version 4.3, p=.05. Inpts, rx data through ins info. Still low percent rx or eval 1 yr post FF despite guidelines. 29 % vit D/ ca, 9% rx, Bias ins/inpt	Less major threatening than spine or hip so may be overlooked.	IIB
83. Vranken, L., Wyers, C., Van Den Berg, J., & Geusens, P. (2017). The phenotype of patients with a recent fracture: A literature survey of the fracture liaison service. *Calcif Tissue Int*., doi: 10.1007/s00223-017-0284-1	What is published on FLS item & fall risk	Literature survey to eval phenotype	33 papers Heterogeneity high variable in pts 20-89% attended; call or letter to pt, exclusion vary, usually 50+, wrist most freq NVNH, BMD, Frax, 8 fall-risk,	Fall assess with FRAX. FLS with nurse coord best organizational model & initially start with subgroup then when well-established, expand to all	VB

			challenge enroll logisti		
84. Walters, S., Khan, T., Ong, T., & Sahota, O. (2017). Fracture liaison services: improving outcomes for patients with osteoporosis. *Clinical Interventions in Aging, 12*, 117-127. doi:10.2147/CIA.585551	Which FLS does what	Literature review	Wrist fx double second FF risk, CNS coordinator important, 12 models, aim decrease FF risk. Educ alone not OK; type A best, A & B more tx by PCP & decrease FF risk by 42%, no study A/B	Databases & list of guidelines available. A/B type effective including 'Own the Bone.'. Need comparative type A & B studies; not just ed	VB
85. Yong, J., Masucci, L., Hoch, J., Sujic, R., & Beaton, D. (2016). Cost-effectiveness of a fracture liaison service- a real-world evaluation after 6 years of service provision. *Osteoporos Int., 27*, 231-240. doi: 10.1007/s00198-015-3280-1	Are less intensive models cost-effective in Canada	Longitudinal study using prior rates with a type B model fls	Markov model with sensitivity & Delphi analysis used. Model types A & B cost-effective; less intensive less effective; age 50 & over. Less intensive still worthwhile & possibly cost-effective. 4.3 more QALY. Canada sx	More intense models cost-effective per Ganda's grading but less may still be worthwhile	IIB

Appendix B: Permission to Use JHNEBP Model and Tools

Thank you for submitting the requested information. You now have permission to use the JHN EBP model and tools.

Click here to download the tools. Reminder: You may not modify the model or the tools. All reference to source forms should include "©The Johns Hopkins Hospital/The Johns Hopkins University."

We offer an excellent online course about our model/tools. It is an engaging online experience, containing interactive elements, self-checks, instructional videos, and demonstrations of how to put EBP into use. The course follows the EBP process from beginning to end and provides guidance to the learner on how to proceed, using the tools that are part of the Johns Hopkins Nursing EBP model. Take a sneak peek of the course.

Do you prefer hands-on learning? We are offering a 5-day intensive Boot Camp where you will learn and master the entire EBP process from beginning to end. Take advantage of our retreat-type setting to focus on your project, collaborate with peers, and get the expertise and assistance from our faculty. Click here to learn more about EBP Boot Camp.

Sent: Wednesday, July 5, 2017 7:32 AM
Hello,

Thank you for your recent request. We are happy to give you permission to use the model and tools as you described. The zipped file of the tools are located here - [redacted]

If you choose to use the Johns Hopkins Nursing Evidence-Based Practice Model and Tools in any other way, please submit another request for that specific use. You may not modify the model or the tools. All reference to source forms should include "©The Johns Hopkins Hospital/The Johns Hopkins University." Please note, this permission does not include any commercial use.

Please check our website for other useful resources: [redacted]

Thanks, [redacted]

[redacted]

Appendix C: JHNEBP Rating Tools (Used With Permission)

Johns Hopkins Nursing Evidence-Based Practice
Appendix C: Evidence Level and Quality Guide

Evidence Levels	Quality Guides
Level I Experimental study, randomized controlled trial (RCT) Systematic review of RCTs, with or without meta-analysis	**A <u>High quality:</u>** Consistent, generalizable results; sufficient sample size for the study design; adequate control; definitive conclusions; consistent recommendations based on comprehensive literature review that includes thorough reference to scientific evidence **B <u>Good quality:</u>** Reasonably consistent results; sufficient sample size for the study design; some control, fairly definitive conclusions; reasonably consistent recommendations based on fairly comprehensive literature review that includes some reference to scientific evidence **C <u>Low quality or major flaws</u>:** Little evidence with inconsistent results; insufficient sample size for the study design; conclusions cannot be drawn
Level II Quasi-experimental study Systematic review of a combination of RCTs and quasi-experimental, or quasi-experimental studies only, with or without meta-analysis	
Level III Non-experimental study Systematic review of a combination of RCTs, quasi-experimental and non-experimental studies, or non-experimental studies only, with or without meta-analysis Qualitative study or systematic review with or without a meta-synthesis	

Evidence Levels	Quality Guides
Level IV Opinion of respected authorities and/or nationally recognized expert committees/consensus panels based on scientific evidence Includes: • Clinical practice guidelines • Consensus panels	**A <u>High quality:</u>** Material officially sponsored by a professional, public, private organization, or government agency; documentation of a systematic literature search strategy; consistent results with sufficient numbers of well-designed studies; criteria-based evaluation of overall scientific strength and quality of included studies and definitive conclusions; national expertise is clearly evident; developed or revised within the last 5 years **B <u>Good quality:</u>** Material officially sponsored by a professional, public, private organization, or government agency; reasonably thorough and appropriate systematic literature search strategy; reasonably consistent results, sufficient numbers of well-designed studies; evaluation of strengths and limitations of included studies with fairly definitive conclusions; national expertise is clearly evident; developed or revised within the last 5 years **C <u>Low quality or major flaws:</u>** Material not sponsored by an official organization or agency; undefined, poorly defined, or limited literature search strategy; no evaluation of strengths and limitations of included studies, insufficient evidence with inconsistent results, conclusions cannot be drawn; not revised within the last 5 yrs.

Level V Based on experiential and non-research evidence Includes: • Literature reviews • Quality improvement, program or financial evaluation • Case reports • Opinion of nationally recognized experts(s) based on experiential evidence	**Organizational Experience:** **A <u>High quality:</u>** Clear aims and objectives; consistent results across multiple settings; formal quality improvement, financial or program evaluation methods used; definitive conclusions; consistent recommendations with thorough reference to scientific evidence **B <u>Good quality:</u>** Clear aims and objectives; consistent results in a single setting; formal quality improvement or financial or program evaluation methods used; reasonably consistent recommendations with some reference to scientific evidence **C <u>Low quality or major flaws:</u>** Unclear or missing aims and objectives; inconsistent results; poorly defined quality improvement, financial or program evaluation methods; recommendations cannot be made **Literature Review, Expert Opinion, Case Report, Community Standard, Clinician Experience, Consumer Preference:** **A <u>High quality:</u>** Expertise is clearly evident; draws definitive conclusions; provides scientific rationale; thought leader(s) in the field **B <u>Good quality:</u>** Expertise appears to be credible; draws fairly definitive conclusions; provides logical argument for opinions **C <u>Low quality or major flaws:</u>** Expertise is not discernable or is dubious; conclusions cannot be drawn

Appendix D: Facility Survey Data Summary

Summary of Responses to the Provider Survey

Prepared by Clinical Research Center, 10/25/2017

Fragility fractures are fractures occurring from a fall from a standing height or less, without major trauma such as a motor vehicle accident. Worldwide, nearly 20% of these fractures occur in the forearm. Fragility fractures are associated with an increased mortality rate, limitation of ambulation, depression, loss of independence, and chronic pain. The Pilot Provider Program Survey was designed to gauge the need and interest among providers for a comprehensive fragility fracture prevention program that they could refer patients to. It was sent electronically to 765 providers during the month of September 2017.

A total of 291 providers responded to the question, out of 765 providers who received the survey, for an overall response rate of 38%. Of those who answered the question about provider type, 108 (70.6%) identified as MD/DO, 37 (24.2%) as NP/PA, and 8 (5.2%) as other. 138 did not identify their provider type. In addition, 151 providers identified their specialty. Those responses are summarized in figure 1.

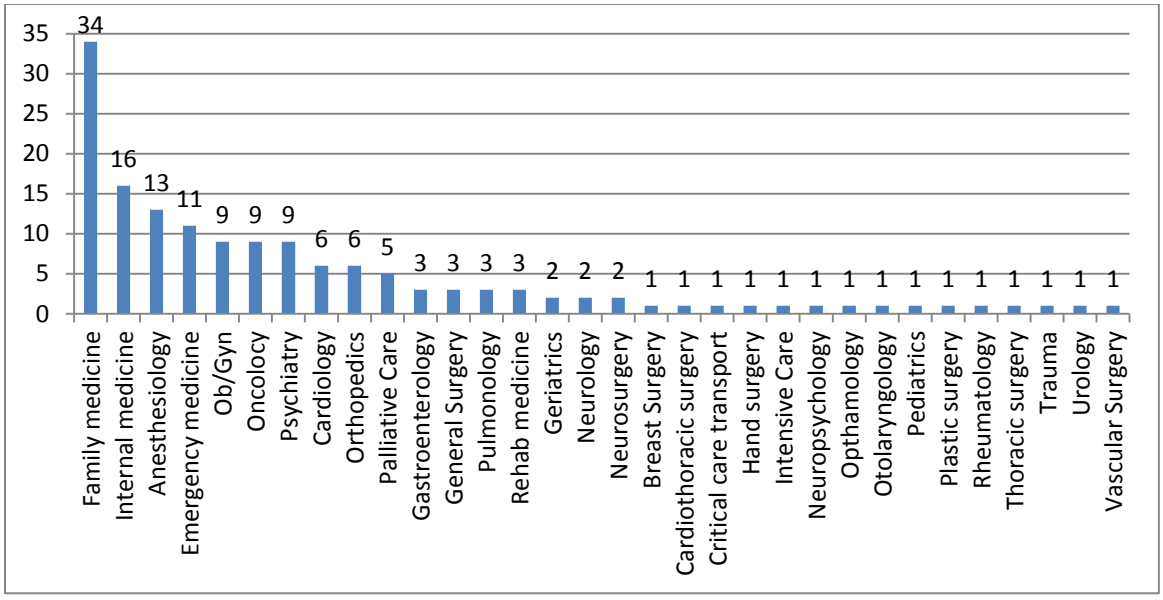


Figure 1. Specialties of survey respondents.

Question 1: "Do you provide care for patients over age 50?"

A total of 249 answered "yes" to the question, "Do you provide care for patients over age 50?" Assuming that the sample (n=291) is representative of the population (n=765), we estimate that 85.5 ± 4.5% of providers are working with patients over age 50.

Among those respondents who answered "yes," to the question, 108 identified as MD/DO, 37 as NP/PA, and 8 as other. An additional 96 respondents who answered "yes" did not respond to the question about provider type. No providers who identified provider type answered "no" to question 1.

Table 1

Overall Responses to Question 1

Response	Count
Yes	249
No	42
TOTAL	291

Question 2: "In the past 3 months, have you had patients in your practice over the age 50 with distal radius fractures?"

Among 155 providers who responded to question 2, 106 (68.4%) responded "yes." Of the providers who provided a response to "provider type," 29 (36.7%) of MD/DOs, and 60.9% of NP/PAs responded "yes."

Table 2

Overall Responses to Question 2

Response	Count
Yes	106
No	49
TOTAL	155

Question 3: "For patients with fragility fracture, do you have a standardized prevention protocol to address risk for subsequently fragility fracture?"

Out of 154 providers who responded to Question 3, only 16 (10.4%) reported having a standard prevention protocol. This included 9 of 108 identified MD/POs (8.3%) and 6 of 37 NP/PAs (16.2%).

Table 3

Overall Answers to Question 3

Response	Count
Yes	16
No	138
TOTAL	154

Several respondents commented on the kinds of protocols in place. These included:

- Assessment during outpatient visit
- bone-density scan
- EMR-based fall risk assessment
- Fall Risk Survey / FRAX tool
- Positioning measures
- Home fall prevention advice

Question 4: "If the facility opens a comprehensive fragility fracture secondary prevention program, would you refer your patients?"

120 of 153 providers (78.4%) who responded to Question 4 answered "yes." Of those who answered "no," most stated that they would not be the appropriate provider to make the referral, or specifically that the referral should come from the patient's PCP.

Table 4

Overall Answers to Question 4

Response	Count
Yes	120
No	33
TOTAL	153

Question 5: "What will be your expectations for this program? What current problems will the program solve?"

The 10 most frequent themes in responses to Question 5 were, in order:
Reduce incidence of fractures
Include comprehensive assessment for PCPs (bone density, DEXA, etc.)
Provide patient education
Ongoing follow up
Incorporate shared decision-making
Prioritize patient experience and accessibility

Include clear criteria for providers to know when to refer
Provide care that is comprehensive and multidisciplinary
Provide comprehensive and up to date care
Work closely/integrate with geriatric services

One negative expectation that was mentioned was that the program could lead to increased fragmentation of care, when a PCP should be able to care for patients with osteoporosis as it is.

Question 6: "What role, if any, would you like to have in secondary prevention or the program itself?"

A referring role was the response option selected most frequently by 147 providers who responded to Question 5 (52.4%)

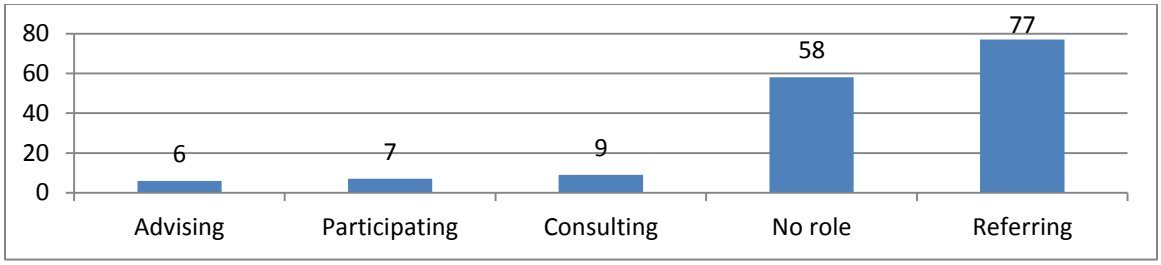


Figure 2. What role responding providers would have in the program?

Appendix E: Designed Program

Program Protocol

A. Title: Designed Program to Prevent Subsequent Fragility Fractures.

B. Purpose: The aim of the program is to increase patient access to internationally accepted secondary fragility fracture prevention care and to demonstrate the feasibility of the implementation within the hospital system. Currently there is no formal mechanism to provide this type of care at the facility. This initial program will use the needs assessment data findings to assess 1) the need for a fracture liaison service, 2) if the availability of such a program increases patients' access to secondary fragility fracture prevention, and 3) the quality and sustainability of a bone health care coordination. This intial program will provide data as a foundation for future program development and redesign to meet the needs of the patients, community, and facility. This program provides the formal mechanism to address the research-practice gap of secondary fragility fracture prevention at this facility can aid in future program planning, ability to improve care, promote efficiency, and assess treatment effectiveness as well as provide data for sustainability.

C. History/background: This facility is a regional care facility for the northeastern two-thirds of the state with a mission to provide excellent quality specialty care. This state has an aging population with risk factors for osteoporosis which is the usual cause for fragility fractures with falls and limited resources or access to specialty care.

The facility currently has no formal mechanism to coordinate further care for these patients for secondary fracture prevention. Initial fragility fractures alone significantly increase the

risk of subsequent fractures significantly, which leads to pain, disability, cost, and resource utilization. Coordinator led fragility fracture programs decrease the rate of recurrent fragility fractures, but less than one-quarter of patients over 50 with distal radius fractures receive the appropriate care for secondary prevention. Patient identification for referral for secondary prevention is the first step to closing this practice gap and can be a basis for quality improvement. Survey needs assessment data supported the need for such a program.

A fragility fracture secondary prevention program provides us with an opportunity to coordinate care and avoid ineffective silos in our fragmented system. Most often in our healthcare environment, patients with wrist fragility fractures are referred to Orthopedic providers for short-term treatment of their fractures. These providers do not usually follow the patients long-term and therefore do not initiate further bone health evaluation or longterm interventions as they do not provide longterm care. Patients follows up with their primary care provider for their other issues and secondary fracture prevention is often not addressed due to the multitude of more pressing issues, lack of patient follow-up, or provider expertise. Orthopedic providers and administrators supported this program.

A logic model has been developed to clearly communicate the program at stakeholder meetings and may be changed as the program progresses. The reach, efficacy, adoption, implementation and maintenance (RE-AIM) model will be used as the planning and evaluation framework as it provides a mechanism to aid in program redesign for growth and financial sustainability. Both the logic and RE-AIM models have been used for projects at the facility previously. This program will serve as an implementation evaluation for a foundation for future programming and/or studies while

addressing the research practice gap at the facility consistent with our mission and values. This program will allow us to provide better evidence-based care in the region as there is only one other program statewide.

D. Subject recruitment and selection**:** The target populations for this program include all patients age 50 years and older with fragility wrist fractures within the past 180 days treated by facilty providers for a distal radius fragility fracture and all referring providers to help assess the program. Upper extremity fragility fractures are risk factors for subsequent fractures particularly within the first year, but are less likely to receive follow-up care than hip fracture patients but more likely to attend an outpatient clinic when referred. The results from the provider needs assessment electronic survery were used to design this program.

1) Patient recruitment: This initial program will be managed by a nurse practitioner who also serves as the principal investigator (PI) of this project. The PI will contact patients from the standard referral log who are referred by their treating providers to invite them to the program and explain its importance. If the patient cannot be contacted via telephone after two attempts, a letter will be mailed to them asking them to contact the PI. If they choose to attend, then an appointment with the nurse practitioner (NP) will be scheduled through usual office scheduling within one month from the patient contact. Patients will be seen within six months of their wrist fracture which is the usual timeframe that the Orthopedist is treating their fracture and when there is the most opportunity to make an impact. It is anticipated that 50 patients with distal radius and/or ulna fragility fractures will access the program within 180 days.

2) Referring providers: a de-identified short electronic survey in section J (*Referring and Orthopaedic Provider Survey)* will be sent to the Orthopedic and referring providers after the initial program to obtain information about their experience with the program and ways to improve the referral process for future program design.

E. Location: All patients are expected to be referred to and treated at the the outpatient elective orthopedic office by the NP/PI.

F. Duration**:** The proposed program will be conducted for a period of six months.

G. Program Design**:** Prospective descriptive exploratory implementation evaluation to assess if a nurse coordinator-led fragility fracture program is needed, feasible, accessible, & sustainable. The program will address the following:

1**.** Needs assessment: a) to identify the number of patients who could benefit from the service in our region, b) to determine referring providers' experience with the program, c) to determine patients' expectations and barriers with results kept in folders in a locked box in the clinic until project evaluation.

2. Program awareness: The PI will introduce the program at the full Orthopedic service meeting outlining the program and its importance and send an email to Orthopedic providers about the pilot program referral process. To maintain the awareness that the program, the PI will email the Orthopedic providers with patient criteria for the program weekly for one month, and then monthly for the rest of the six month program period. The facility's Patient Relations Department staff will put information about the program on the computer homepage and facility newsletter. The NP/PI will introduce the program at the orthopedic practice staff meeting and team meeting.

3. Patient experience and barriers: Patients referred to the program who are contacted by the PI via telephone, but decline an appointment will be asked: "are there any specific reasons why you would rather not attend?" This question can provide information about barriers. Patients who were contacted by the PI and attend an appointment will be asked by the medical assistant immediately after the appointment to complete the CG-CAHPS which is a standard survey used by the facility after appointments. This data can be used for quality improvement as well as benchmarking nationally. The completed surveys will provide information on patient satisfaction and will be kept in a folder in a locked box by the PI in the clinic until the end of six month period for project evaluation. Surveys will not have any patient identifiers. Patients who do not attend their scheduled appointment, will be called by the PI to reschedule or to ask reasons for decline, using the same question: "are there any specific reasons why you rather not attend?" De-identified answers will be recorded and kept in the same box until project evaluation.

4. Provider experience: For those providers who referred patients to the program an electronic survey (*Referring and Orthopaedic Providers*) in section j will be emailed to them by the PI to assess their experience with the process. The de-identified surveys will be kept in a folder in the locked box at the clinic by the PI until project evaluation.

5. Program intervention implementation: All patients who accept an appointment will have a clinical evaluation and recommendations by the NP/PI that follow national guidelines using the American Orthopaedic Association (AOA) 'Own the Bone' program measures outlined in section K. This registry provides national benchmarking data and

access to educational materials for patients and staff . Our current electronic health record system cannot store the data necessary to manage this. ‘Own the Bone’ is the program registry used by the other state program and the two programs in the neighboring state as well as nationally. The facility has access to this AOA program as a registered site and facility de-identified data will be provided from AOA for quality improvement. This program intervention helps the facility to meet physician quality resporting system measures (PQRS). Patient findings and NP/PI recommendations will be communicated to the patient as well as primary care and referring providers after the appointment by the PI via letter as well as a copy mailed to the patient. Patients will be given a follow-up appointment in three months or contacted via telephone for follow-up in addition to being contacted by the PI in one year to determine if they have sustained another fragility fracture to compare to the national averages of patients who access such a program and those who do not. Referral to facility services such as radiology, laboratory, physical therapy, endocrinology, or infusion clinic will be done and all visits will be billed using standard ciding by the facility coders. The NP/PI’s coder has this coding information.

6. Program evaluation/stakeholder involvement: A stakeholders’ meeting was held and suggestions incorporated. The NP/PI will hold monthly stakeholder meetings and program evaluation will be done following the program’s RE-AIM framework below in table 1.

Table 1.

RE-AIM evaluation strategy

Domain	Indicator Mechanisms
Reach: Who uses the program?	a) To identify the number of patients referred to the program, total &monthly b) To identify the number of patients accessing the program, total & monthly c) The number of referred patients and the rate of attendance (access to) to the program will be measured by a registry collecting all referred patients using a MS Excel spreadsheet and maintained by the PI in a faciltiy encrypted computer. The same spreadsheet will have the information on patient's reported barriers from those patients who chooses to not attend or does not attend their appointment.
Efficacy Did the program meet expectations from patients, and providers?	a) To evaluate patient experience measured by the CG-CAHPS. Patients who attend an appointment will be asked to complete a short 3.0 English adult version of a CG-CAPHS survey (Attachment 1) directly after their appointment to assess patient experience due to the short timeframe of the pilot project and potential for low response rate via mail. The survey will not have any patient identifier. b) To evaluate provider experience measured by *Referring and Orthopaedic Provider Survey.* After the implementation of the program, an electronic referring provider survey will be sent to each new referring provider, within a month of the patient's appointment at the program The survey will assess their perception of the program, barriers, and suggestions for improvement including the referral process. All patient referrals, visit information, and contacts will be documented in an MS Excel spreadsheet by the PI in the facility's security encrypted computer system. c) To assess subsequent fractures within a year measured by a 12 month-telephone follow up done by the PI. All data will be collected in a MS excel data sheet maintained in the facility's secure W drive. d) To evaluate compliance with the care plan at the three month follow-up appointment or telephone call and after a year measured by a 12 month-telephone follow up.
Adoption Is the program accepted and utilized?	a) To evaluate engagement of the referral providers. It will be measured by the number of new referring providers to the program monthly and the number of providers who referred more than once. b) To evaluate the engagement of the monthly multidisciplinary team who are participating in program planning as evidenced by attendance.
Implementation Is the program feasible as designed?	a) To evaluate process & workflow barriers identified with corrective action b) To evaluate what site or patient factors facilitated or inhibited access. c) To evaluate if the referral & patient contact process was appropriate. d) To identify opportunities to improve the referral processThe implementation will be evaluated by using a team of multidisciplinary stakeholders (administrators, providers and support staff), through monthly meetings reviewing the results of the surveys and the workflow experience. Stakeholders will re-evaluate design and adjust as appropriate.

Maintenance Is the program financially sustainable?	a) To identify billing process with standard coding and barriers b) To identify what practice change can be sustained after the funded timeframe and is there a plan for growth and collaboration c) To develop a projected financially sustainable budget to follow funded time d) To calculate the return of investment (ROI)

7. Program findings dissemination: The program will be announced by the NP/PI as outlined above with background importance information. After stakeholder approval, the NP/PI will disseminate a report of project findings and recommendations to the facility administration and the Orthopedic service. The NP/PI will attend Orthopaedic staff meetings for program evaluation and present project at local, regional and national meetings as appropriate.

H. Potential risks**:** There is no more than minimal risk involved in participating in this initial program by patients or providers. Data collection to complete the evaluation process will be de-identified. Patients participating in the fragility fracture program will receive evidenced based care, and their participation in the proposed program will not pose a greater risk than daily life, including routine physical and psychological examinations or tests. Patients and providers participating in the surveys will not be identified, and their information will not be disseminated.

I. Potential benefits: There is no financial benefit or incentives to the participants. The information acquired will be used to re-design the implementation of a new program to improve the access and quality of care. The implementation of this program will provide a service currently not available, a place to refer patients,

and a mechanism for patients to receive continuity of quality bone health care. This program will provide data for quality improvement for the facility.

J. Data collection and analysis: All data collected for this program will not have identifiers or personal health information (PHI). All surveys and questions will not have patient or provider identifiers. The analysis will be done with aggregated data. Written surveys will be kept in a locked box at the PI's clinic until after evaluation and in the facility's secure encrypted computer system via excel spread sheet/w-drive.

1.Demographics*:* age, gender, race/ethnicity, height, weight. Patients over 89 years old will be identified as >89. No PHI will be stored in the national registry.

2.Referring and Orthopaedic Provider Survey:

a. Did you refer any patients over age 50 with wrist fractures to the fragility fracture liaison service pilot program? (Yes or No)

b. If no, what was the reason(s)?

c. If yes, did you find the referral process easy to use? (Yes or No)

Why or why not?

d.If yes, do you think that the program was beneficial? (Yes or No)

Why or why not?

e.What suggestions do you have to improve the program including referring?

K. Quality measures***:*** De-identified patient data is entered into the 'Own the Bone' registry for compliance with addressing the following measures: nutrition and lifestyle counseling, physical activity, pharmacotherapy, diagnostic testing, and communication with patients, primary care and referring providers. The data will be

entered by the PI at the patient's clinic visit and then subsequently for three month follow-up visits or telephone calls as well for the annual follow-up via telephone as discussed previously. The data can be tracked as a method for care coordination including follow-up, PQRS, and quality improvement. ' Own the Bone' is a nationally-accepted web-based registry that utilizes de-identified patient data to track patient follow-up and provider/facility measures for use in national benchmarking.

The program will rely on quantitative and qualitative data from several sources in order to answer the questions listed above. All data will be compiled and analyzed using MS Excel on a facility secure computer and reported as descriptive variables using percentages for dichotomous variables and mean for continuous variables.

This program will begin to address a current research-practice gap in care, barriers, and provide evidence of performance improvement. The outcomes that we would be measuring are the number of eligible patients referred as well as the percent of those patients who access the service. The PI will also obtain qualitative data about provider beliefs about the experience through the short email survey as outlined previously. The NP/PI will obtain qualitative data concerning patient barriers through the telephone contact and visits. Data will be gathered and evaluated for the patient experience of the program and PI using the standard CG-CAPHS surveys from patients who agree to complete the survey after their visit. PQRS can be captured by enrolling de-identified patients in the national 'Own the Bone' registry and reports from them.

Appendix F: Permission to Use 'Own the Bone' Measures

From: [redacted]
Sent: Tuesday, July 04, 2017 11:53 AM
To: [redacted]
Subject: permission to use measures table and new patient and follow-up patient visit forms from Own the Bone

Hi [redacted],

I had asked you this before but wanted to make sure that I had permission to use the table of measures and patient visit forms in my [redacted] University DNP project paper as a student. The table would be put in the body of the paper and the patient visit forms would be appendices. The paper is read by the University committee faculty members and then published on ProQuest for anyone to read. Thank-you in advance for your assistance.

[redacted]
From: [redacted]
Sent: Wednesday, July 5, 2017 9:11 AM
To: [redacted]
Cc: [redacted]
Subject: RE: permission to use measures table and new patient and follow-up patient visit forms from Own the Bone

Hi [redacted],

Thank you for resending!

I know we can give you permission to use the list of measures.

As far as the patient visit forms go, to confirm, are you referencing the enrollment and follow-up form from the registry? If so, we may allow them to be viewed by the University as part of your paper, but they cannot be published for the public to view. The reason for this is because they are our program's proprietary information and are considered a benefit of the program and only accessible to enrolled institutions.

I'm in the office if you have follow-up questions or want to discuss.

Warm regards,
[redacted]

Appendix G: CG-CAHPS Survey (Used With Permission)

CAHPS Clinician & Group Adult Survey 3.0

Your Provider

1. Our records show that you got care from the provider named below in the last 6 months.

Name of provider label goes here

Is that right?

[1] ☐ Yes
[2] ☐ No → **If No, go to #23 on page 4**

The questions in this survey will refer to the provider named in Question 1 as "this provider." Please think of that person as you answer the survey.

2. Is this the provider you usually see if you need a check-up, want advice about a health problem, or get sick or hurt?

[1] ☐ Yes
[2] ☐ No

3. How long have you been going to this provider?

[1] ☐ Less than 6 months
[2] ☐ At least 6 months but less than 1 year
[3] ☐ At least 1 year but less than 3 years
[4] ☐ At least 3 years but less than 5 years
[5] ☐ 5 years or more

Your Care From This Provider in the Last 6 Months

These questions ask about **your own** health care. Do **not** include care you got when you stayed overnight in a hospital. Do **not** include the times you went for dental care visits.

4. In the last 6 months, how many times did you visit this provider to get care for yourself?

☐ None → **If None, go to #23 on page 4**
☐ 1 time
☐ 2
☐ 3
☐ 4
☐ 5 to 9
☐ 10 or more times

5. In the last 6 months, did you contact this provider's office to get an appointment for an illness, injury, or condition that **needed care right away**?

[1] ☐ Yes
[2] ☐ No → **If No, go to #7**

6. In the last 6 months, when you contacted this provider's office to get an appointment for **care you needed right away**, how often did you get an appointment as soon as you needed?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

Agency for Healthcare Research and Quality. (2017). Clinician & Group Survey, Adult 3.0 (Adult CG-CAHPS 3.0). Illustration. *CAHPS Clinician & Group Survey*. Retrieved August 5, 2017 from http://www.ahrq.gov/cahps/surveys-guidance/cg.

7. In the last 6 months, did you make any appointments for a **check-up or routine care** with this provider?

[1] ☐ Yes
[2] ☐ No → **If No, go to #9**

8. In the last 6 months, when you made an appointment for a **check-up or routine care** with this provider, how often did you get an appointment as soon as you needed?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

9. In the last 6 months, did you contact this provider's office with a medical question during regular office hours?

[1] ☐ Yes
[2] ☐ No → **If No, go to #11**

10. In the last 6 months, when you contacted this provider's office during regular office hours, how often did you get an answer to your medical question that same day?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

11. In the last 6 months, how often did this provider explain things in a way that was easy to understand?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

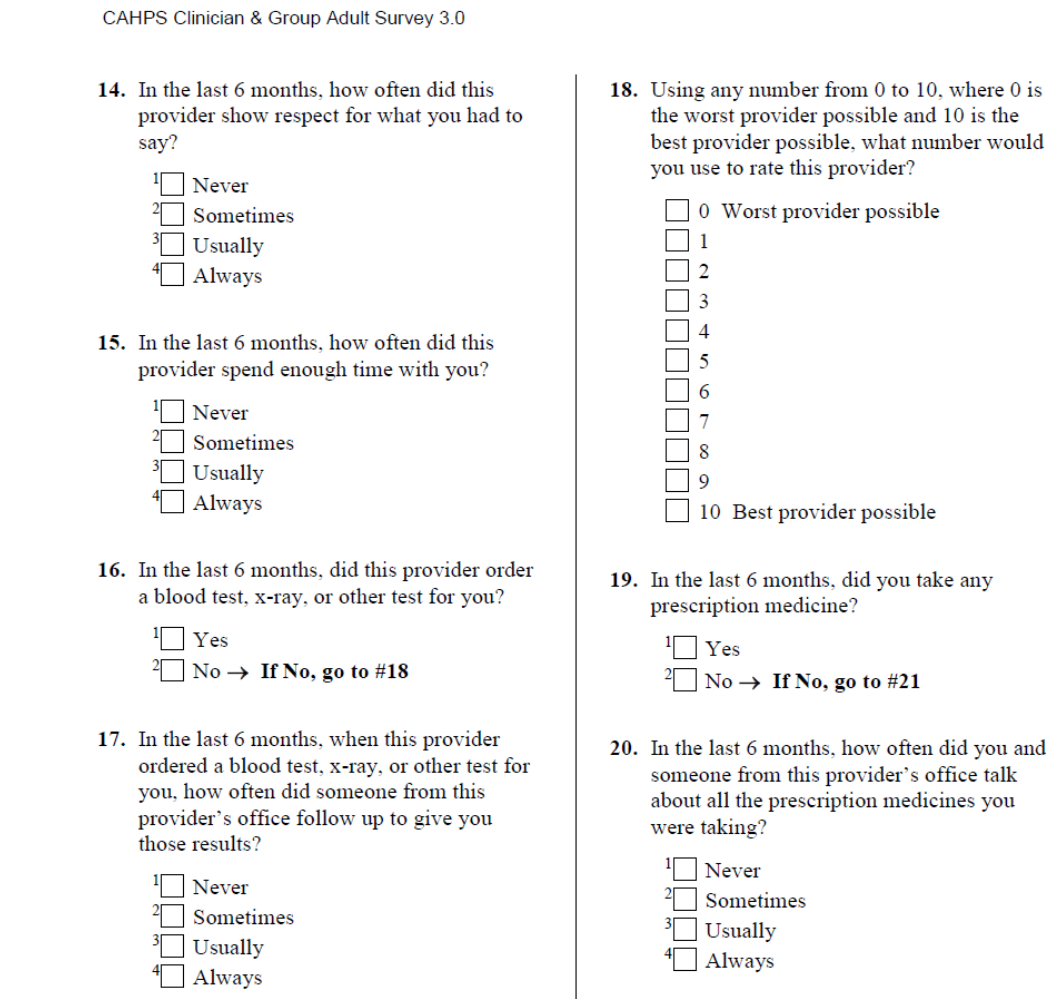
12. In the last 6 months, how often did this provider listen carefully to you?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

13. In the last 6 months, how often did this provider seem to know the important information about your medical history?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

Agency for Healthcare Research and Quality. (2017). Clinician & Group Survey, Adult 3.0 (Adult CG-CAHPS 3.0). Illustration. *CAHPS Clinician & Group Survey*. Retrieved August 5, 2017 from http://www.ahrq.gov/cahps/surveys-guidance/cg.



CAHPS Clinician & Group Adult Survey 3.0

14. In the last 6 months, how often did this provider show respect for what you had to say?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

15. In the last 6 months, how often did this provider spend enough time with you?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

16. In the last 6 months, did this provider order a blood test, x-ray, or other test for you?

[1] ☐ Yes
[2] ☐ No → **If No, go to #18**

17. In the last 6 months, when this provider ordered a blood test, x-ray, or other test for you, how often did someone from this provider's office follow up to give you those results?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

18. Using any number from 0 to 10, where 0 is the worst provider possible and 10 is the best provider possible, what number would you use to rate this provider?

☐ 0 Worst provider possible
☐ 1
☐ 2
☐ 3
☐ 4
☐ 5
☐ 6
☐ 7
☐ 8
☐ 9
☐ 10 Best provider possible

19. In the last 6 months, did you take any prescription medicine?

[1] ☐ Yes
[2] ☐ No → **If No, go to #21**

20. In the last 6 months, how often did you and someone from this provider's office talk about all the prescription medicines you were taking?

[1] ☐ Never
[2] ☐ Sometimes
[3] ☐ Usually
[4] ☐ Always

Agency for Healthcare Research and Quality. (2017). Clinician & Group Survey, Adult 3.0 (Adult CG-CAHPS 3.0). Illustration. *CAHPS Clinician & Group Survey*. Retrieved August 5, 2017 from http://www.ahrq.gov/cahps/surveys-guidance/cg.

Clerks and Receptionists at This Provider's Office

21. In the last 6 months, how often were clerks and receptionists at this provider's office as helpful as you thought they should be?

1 ☐ Never
2 ☐ Sometimes
3 ☐ Usually
4 ☐ Always

22. In the last 6 months, how often did clerks and receptionists at this provider's office treat you with courtesy and respect?

1 ☐ Never
2 ☐ Sometimes
3 ☐ Usually
4 ☐ Always

About You

23. In general, how would you rate your overall health?

1 ☐ Excellent
2 ☐ Very good
3 ☐ Good
4 ☐ Fair
5 ☐ Poor

24. In general, how would you rate your overall **mental or emotional** health?

1 ☐ Excellent
2 ☐ Very good
3 ☐ Good
4 ☐ Fair
5 ☐ Poor

25. What is your age?

1 ☐ 18 to 24
2 ☐ 25 to 34
3 ☐ 35 to 44
4 ☐ 45 to 54
5 ☐ 55 to 64
6 ☐ 65 to 74
7 ☐ 75 or older

26. Are you male or female?

1 ☐ Male
2 ☐ Female

Agency for Healthcare Research and Quality. (2017). Clinician & Group Survey, Adult 3.0 (Adult CG-CAHPS 3.0). Illustration. *CAHPS Clinician & Group Survey*. Retrieved August 5, 2017 from http://www.ahrq.gov/cahps/surveys-guidance/cg.

CAHPS Clinician & Group Adult Survey 3.0

27. What is the highest grade or level of school that you have completed?

- [1] ☐ 8th grade or less
- [2] ☐ Some high school, but did not graduate
- [3] ☐ High school graduate or GED
- [4] ☐ Some college or 2-year degree
- [5] ☐ 4-year college graduate
- [6] ☐ More than 4-year college degree

28. Are you of Hispanic or Latino origin or descent?

- [1] ☐ Yes, Hispanic or Latino
- [2] ☐ No, not Hispanic or Latino

29. What is your race? Mark one or more.

- [1] ☐ White
- [2] ☐ Black or African American
- [3] ☐ Asian
- [4] ☐ Native Hawaiian or Other Pacific Islander
- [5] ☐ American Indian or Alaska Native
- [6] ☐ Other

30. Did someone help you complete this survey?

- [1] ☐ Yes
- [2] ☐ No → **Thank you. Please return the completed survey in the postage-paid envelope.**

31. How did that person help you? Mark one or more.

- [1] ☐ Read the questions to me
- [2] ☐ Wrote down the answers I gave
- [3] ☐ Answered the questions for me
- [4] ☐ Translated the questions into my language
- [5] ☐ Helped in some other way

Thank you.

Please return the completed survey in the postage-paid envelope.

Agency for Healthcare Research and Quality. (2017). Clinician & Group Survey, Adult 3.0 (Adult CG-CAHPS 3.0). Illustration. *CAHPS Clinician & Group Survey*. Retrieved August 5, 2017 from http://www.ahrq.gov/cahps/surveys-guidance/cg.

pendix H: Permission to Show CG-CAPHS survey

[redacted]

August 1, 2017

[DNP student
University]

Dear

Thank you for the additional information you provided me in your email of July 19th. This letter is formal permission from the Agency for Healthcare Research and Quality (AHRQ). to reprint the CAHPS® Clinician & Group Adult Survey, Version 3.0 (https://www.ahrq.gov/cahps/surveys-guidance/cg/index.html) as an appendix to your capstone paper for the Doctor of Nursing Practice degree at University.

Please give an appropriate reference citation, such as:

> "Clinician & Group Survey, Adult Version 3.0 (Adult CG-CAHPS 3.0)." *In:* CAHPS® Clinician & Group Survey. Content last reviewed June 2017. Agency for Healthcare Research and Quality, Rockville, MD. http://www.ahrq.gov/cahps/surveys-guidance/cg/index.html

Remember that CAHPS® is a registered trademark of AHRQ, and to include the registration mark as indicated by your program's style guide.

Sincerely,

[redacted]