

Osteoporosis Screening Using the Fracture Risk Assessment Tool

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Abstract

Problem: In a primary care clinic in Maryland, postmenopausal women under the age of 65 were not being screened for osteoporosis as recommended by the US Prevention Screening Task Force. Preliminary data showed only 18% of eligible patients were being screened. The clinic lacked a validated screening tool for osteoporosis risk. **Purpose:** The purpose of this quality improvement project was to expand osteoporosis screening to include postmenopausal women 50 years and older seen at this primary care clinic. **Methods:** This project was initiated to screen patients using a validated Fracture Risk Assessment tool (FRAX), with results embedded in the electronic medical record (EMR) templates. FRAX questionnaires were completed by eligible patients at check-in using an online calculator by scanning a QR code, or with help from the medical assistants. The project representative gathered data over a 15-week period. FRAX scores guided treatment options and imaging as the providers determine fit. Staff buy-in was achieved through education, and morale-boosting initiatives. Reminder posters were placed around the clinic waiting areas and exam rooms. Key stakeholders included four medical assistants, two Advanced Practice Providers, and the Medical Director. **Results:** There was an overall uptake in screening practices for postmenopausal women over 50 from 18% in the previous year to 33.5% after implementation. Following the intervention, DEXA scan orders increased 7-fold compared to pre-implementation rates. **Conclusion:** Preliminary findings on the run chart show an upward trend in screening practices, demonstrating that the strategies employed in the earlier weeks were effective. As noted in the literature, screening can be a tool to open dialogue on osteoporosis prevention strategies between providers and patients.

Keywords: postmenopausal women, osteoporosis, fracture risk, FRAX

Osteoporosis Screening in Postmenopausal Women

Osteoporosis is one of the most common metabolic bone diseases, and the cost of treating fragility fractures in the United States (US) is projected to be more than \$25 billion (about \$77 per person in the US) by the year 2025 (Singer et al., 2023). Fragility fractures demean the quality of life for the patient, increase caregiver burden and the economic toll on families and the health care system. The 2020 American Association of Clinical Endocrinology (AACE) Clinical practice guidelines recommend screening for osteoporosis using the Fracture Risk Assessment tool (FRAX) (Watts et al., 2021). The Agency for Healthcare Research and Quality (2019) recommends screening and pharmacologic treatments to potentially reduce adverse events related to incidental fractures in women over 50. Practice guidelines for screening postmenopausal women over the age of 50 years fall under the Grade B best evidence level (BEL 1). The United States Preventive Services Task Force (USPSTF) also recommends osteoporosis screening for postmenopausal women over 50 (UpToDate, n.d.).

Problem

In a primary care clinic in Montgomery County, Maryland, only women over 65 years of age were screened for osteoporosis, excluding many at-risk postmenopausal women aged 50-64. The clinic serves adults 18 years of age and older, including many from long-term care and assisted living facilities, with approximately 60% of women over the age of 50. Currently, the clinic's screening rate is only 18% among eligible patients and no screening tool was available in the electronic medical record (EMR).

Purpose

The purpose of this quality improvement project was to increase screening for osteoporosis by embedding the FRAX calculator in the EMR to remind providers to assess

treatment risk scores for postmenopausal women 50 and older. A root cause analysis was conducted to implement the best evidence available (Figure 1). The standard practice was only women over the age of 65 were being screened and there was a lack in consistency in screening (Figure 2). Implementing the evidence-based intervention ensures the desired outcome where postmenopausal women over 50 were screened for FRAX scores at check-in (Figure 3).

Available Knowledge & Specific Aims

An evidence search was conducted to support this QI project utilizing PUBMED and EMBASE databases. A mesh of terms and Boolean operators comprising different key terms on osteoporosis screening guided the search. Key terms included: osteoporosis, fracture, FRAX, and postmenopausal. A total of 42 articles were initially identified as relevant to the QI project. Seven articles were selected for commonality on the tool and primary care setting as shown in the Evidence Review Table (Table 1). Evidence was rated for strength and quality using the Johns Hopkins Evidence-Based Practice for Nurses and Healthcare Professionals (Table 2). Two level I(B) Randomized control trials investigated the effect of the FRAX on increasing initiation or adherence to treatment and found statistically significant increase in treatment initiated ($p < 0.01$) (Parsons et al., 2020; Rubin et al., 2018). Three level II(B) systematic reviews of mixed studies looked at the accuracy of the FRAX in predicting fracture risk and ways it could improve uptake in screening in primary care offices and found prediction scores reliable for osteoporosis diagnosis (Adami et al., 2023; Chin et al., 2022; Gates et al., 2023). Two level III(B) cohort research studies used FRAX scores as a threshold for initiating or reinforcing pharmacologic treatment for reducing osteoporotic fracture risk and found an uptake in treatment (Fu et al., 2023; Lott et al., 2022). The evidence supports a compelling reason to implement a FRAX screening tool to identify fracture risk. Additionally, there was a consensus that screening helps

with increasing treatment of high-risk patients to reduce the costs associated with fragility fractures.

Specific Aim

This QI project aimed to implement a FRAX screening tool and workflow process to increase osteoporosis screening for postmenopausal women and identify those with one or more risk factors for osteoporosis. Identifying at risk patients will help providers offer proactive solutions in the prevention and slowing the regression of bone density due to the identified risk factors mentioned in the FRAX (Appendix A). Screening to identify risk opens the dialogue for the provider to offer guidance and empower patients to make informed decisions.

As seen in the evidence, using FRAX scores can help providers know when to initiate or reinforce pharmacologic treatment. Having a standard measure of when to treat for osteoporosis provides confidence in both the provider and the patient that they are mitigating the risk of fractures caused by osteoporosis. When the risk for osteoporosis is reduced, the cost burden of fragility fractures is also minimized.

Rationale

The Promoting Action on Research Implementation in Health Services (PARIHS) framework guided this quality improvement project using three elements: evidence, facilitation, and context (Ward et al., 2017). The evidence supporting this project included the research, clinical and patient experiences, local information gathered during the root-cause analysis. The evidence synthesized for the project showed statistical significance for using the FRAX in determining the threshold for initiating or continuing pharmacologic treatment for fragility fractures due to osteoporosis. Also, nationwide statistics show a rise in the incidence of fractures with the growing aging population (Singer et al., 2023). The facilitation component of this

project included educating and training for medical assistants to administer and document the osteoporosis screening tool and accurately document the results in the patient chart. Additionally, providers received education on using the FRAX tool and interpreting risk scores and what interventions they could use. The context element considered the clinic's culture, leadership support, and evaluation of the intervention's success. The context element was used in the project because the office culture fosters a collaborative learning environment where staff were open to change and work together as a team. Figure 4 illustrates how the three elements of context, evidence, and facilitation interconnect to facilitate the QI project.

Methods

Context

The project site was a primary care clinic serving a diverse patient population, including minority groups such as Asian, Hispanic, and Black individuals. At the time of project implementation, there was no policy written on screening protocols for osteoporosis and there was no tool to assess for fracture risk. The clinic was staffed by four medical assistants, two nurse practitioners, and one medical director.

A cultural assessment predicts the expectations, philosophies, experiences, values, and mission of the organization. Using the validated Context Assessment Index (CAI) tool, a 37-item list a formal cultural assessment of the clinic was conducted. The tool is rated on a 4-point Likert scale grading from 4-1 with strongly agree-4, Agree-3, disagree-2, and strongly disagree-1. The results for culture showed 82%, which is a strong indicator of their teamwork, and that they value individual staff and clients. Leadership showed 82.1%, which was strong for transformational leadership with an enabling, empowering approach. Lastly, the evaluation score at 81.88% was a strong rating for an effective organizational structure with open communication

within the team. The leadership and culture of the clinic supported introducing a screening tool to meet practice guidelines for reducing the risk of osteoporosis.

Intervention

The quality improvement project took place over a 15-week period starting in August of 2024 through early December 2024. The team consisted of seven clinical staff to include four medical assistants, two nurse practitioners, and the medical director. The project lead trained the clinical staff on recording the results of the FRAX screening tool in the EMR. The training also included identification of eligible patients at the beginning of the shift by the medical assistants and obtaining verbal consent at check in. Screening was offered to all women over the age of 50 years that came to the clinic on a given day. The medical assistants were the main champions of the project intervention, as they captured the targeted audience before they see the providers. Training was provided on how to ask questions on the questionnaire and providing clarity on what the questions asked. The providers also had access to the QR code and online link in the exam rooms if a patient was missed at check-in and time allowed for screening during the visit. The providers ordered DEXA scans either as a recommendation based on the FRAX scores or as part of routine health care maintenance to get a baseline bone scan.

Goals

The timeline for implementing the project was broken down into structure, process, and outcome goals. The structure goal was by July 15th, 2024, the FRAX score thresholds would be embedded in the electronic medical record. This task was delegated to the lead nurse practitioner, overseeing the editing of templates in the EMR. Additionally, providers were educated on appropriate initiation or reinforcing treatment modalities based on the FRAX scores. A printout of the American College of Physicians (ACP) guidelines was made available to providers to use

as a guide for pharmacologic treatment options. Barriers were polypharmacy, medication side effects, issues with adherence, and cost of medications.

The process goal was by September 1st, 2024, staff would initiate screening for osteoporosis on 100% of postmenopausal women over age 50, using the FRAX questionnaire. Medical assistants facilitated this process, as the tool is online, and calculations cannot be done on paper. Instructions for accessing the tool in different languages and for different ethnicities were posted near the medical assistants' stations. Challenges included time constraints, language barrier for many of the patients, and inadequate health literacy resulted in refusal to participate in screening. Challenges to overcome included clinician burden with the extra time needed to translate tool in another language using a language line or translator.

Additionally, providers used scores as a shared decision-making tool to approach treatment discussions with patients who had a FRAX score 3% or greater for hip fracture risk, and 20% or greater for major osteoporotic fracture (MOF) risk. Provider hesitancy to initiate treatment because of cost or side effects was a barrier. Ongoing education was provided by the project lead to encourage risk versus benefit analysis for each patient. Coverage coupons and discount programs for certain medications were explored to increase access.

The outcome goals were that by December 13th, 2024, 100% of postmenopausal women over 50 would have a FRAX score recorded in their chart as tracked by project representative each week. One challenge was the language barrier for many of the patients. Providing medical assistants with alternatives to the language line, with the use of translation applications or artificial intelligence using the office iPad increased screening rates. Another outcome goal was for 100% of postmenopausal patients screened, who had FRAX scores greater than or equal to 3% for hips and 20 % for MOF would have treatment initiated or continued by the providers.

The project lead presented educational materials to the providers from national practice guidelines on treatment modalities and their efficacy.

Measures

The structure goals were assessed by an audit of follow-up and new patient templates to ensure the existence of the FRAX score thresholds. The FRAX calculator was bookmarked on all the office computers and tablets, also a QR code was visible in the patient waiting areas and exam rooms.

Process goals were assessed by weekly Redcap survey results of the FRAX tool by race/ethnicity aiming for 100 percent capture of postmenopausal women over 50 years. The survey link was accessed via QR code at the front desk and waiting areas or administered by the MA on intake for the provider to review. The FRAX measures osteoporotic fracture risk by asking for a series of modifiable and non-modifiable risk factors for fragility fractures (Appendix). Weekly chart audits were completed and percentage of women over 50 screened for osteoporosis was recorded (Figure 5). The project lead recorded in Redcap the number of referrals for DXA scans (Figure 6).

Analysis

REDCap software was used to collect weekly project data for analysis. The data analytic plan for this QI project adhered to QI principles by using run charts and graphs to monitor trends over the 15-week quality improvement period. Data collection involved the medical assistants administering the online FRAX tool to determine osteoporosis risk. Initial and ongoing training was conducted weekly by the project lead, reinforcing project protocols as needed. Trends, shifts, or cycles were recorded by the project lead for the percentage of eligible patients screened goal. Several eligible patients were missed because of workflow issues if they needed the

medical assistant to help with completing the survey. Having a QR code available for patients to use their own device to complete the survey helped increase adherence to the screening protocol. The use of patient devices also eased time constraints for the staff. Embedding FRAX scores in follow-up and new patient templates provided medical assistants and providers with reminders to conduct screenings at check-in. Having a FRAX score available seemed to open dialogue about osteoporosis treatment and prevention as evidenced by an increase in the number of DEXA scans ordered.

Descriptive statistics for the weekly screening percentages are shown in the run chart (Figure 5). The data collection methods were free of bias because of the use of a validated tool. Integrity of data collection methods were ensured and verified by the project lead and education reinforced as needed. The screening tool came in 34 different languages allowing a more inclusion and diversity in participants. The objective was to screen all postmenopausal women over 50 years of age. This goal was met in only one week out of the 15-weeks of project implementation. However, a notable increase in screening practices was observed throughout the project implementation.

Ethical Considerations

The QI project was conducted under a Non-human Subject's Research determination from the Human Research Protections Office (HRPO) of the University of Maryland School of Medicine Institutional Review Board (IRB). To protect participants' privacy, only medical record numbers were utilized to collect data using the FRAX tool. Patient privacy notices and disclosures were displayed in the office. Screening of women at an earlier age is warranted because of the rapid loss of bone density after menopause due to hormonal changes (National Menopause Foundation, n.d.). The UPSTF does not recommend routine bone density testing for

men before the age of 65 because men, in general have higher bone mass and are at a lower risk for fractures. Patients sign health Insurance Portability and Accountability Act of 1996 (HIPAA) forms at the beginning of each year that state the patients' rights to refuse treatment if they choose. Treatment was not started before all the disclosures on risks and benefits of treatment were completed. Patients have equal say in the kind of treatments they can receive, through shared decision making. There are no conflicts of interest to disclose. The project lead obtained HIPAA and the Collaborative Institutional Training Initiative (CITI) compliance prior to implementing the quality improvement project.

Results

A total of 156 patients were identified and screened for osteoporosis risk using the FRAX tool. The process goal aimed for 100% of eligible patients to be screened for osteoporosis, however, screening rates during the project averaged 33.5% (Figure 5). Weekly screening rates for eligible candidates ranged from 10% to 100%, with a median of 33%. Initially, screenings were low due to misunderstandings by the medical assistants about screening criteria. However, reinforced training led to a significant increase in screening incidence. The run chart (Figure 5) showed an upward trend in screening as seen from week one to week 6, with a dip in the two weeks following corresponding to the absence of the lead nurse practitioner who had been championing the intervention. Also, mid-way through the intervention, the project representative began collecting weekly data earlier in the week as opposed to the end of the week. Fluctuations in screening practices were influenced by office dynamics, including staffing differences. Barriers to increased screening included reduced office presence due to the popularity of virtual visits, as the project did not go the regular check-in process with the medical assistants. Health

literacy and language barrier made other eligible patients opt out of screening, reducing the participation numbers.

Another tracked metric was the number of eligible patients for whom a DEXA scan was ordered (Figure 6). A significant increase was noted in the number of patients that had DEXA scans ordered. There was a notable seven-fold increase in DEXA scan ordered comparing pre-implementation (n=3) to post-implementation (n=21) of the QI project. Additionally, approximately 46% of eligible patients had pharmacologic treatment for osteoporosis initiated or continued.

Strengths and Facilitators

Having the FRAX survey completed at check-in ensured that patients had a reference point to discuss their risk factors with providers. The FRAX score sparked curiosity, prompting shared decision-making between providers and patients. The QR code at check-in provided easy access for patients to take the survey independently, offering privacy and autonomy. An unintended benefit of osteoporosis screening was the promotion of physical activity for stronger bones, which may also be beneficial for patients with comorbid cardiovascular or metabolic conditions. Reinforcing staff education positively impacted screening practices. Having the project lead onsite earlier in the week served as a reminder for staff to focus on the intervention and increased screening.

Barriers and Limitations

Fluctuations in staffing affected office flow and adherence to screening practices. Screening numbers dropped when providers were out of the office or when medical assistants were unavailable to assist with check-in procedures. Barriers identified were related to health literacy and language barriers. Another limitation to achieving the screening goals was attributed to the

uptake in virtual appointments, reducing the pool of eligible patients. The process of administering the FRAX screening tool required a time investment by the medical assistants, affecting office workflow. The lack of adherence to screening practices can be attributed to workflow issues with having to carve out more time with a patient at check-in if they were unable to complete the survey on their own using the QR code.

Discussion

The project demonstrated the effectiveness of embedding FRAX scores into the EMR to remind clinicians to screen eligible patients for osteoporosis. Having FRAX scores in the EMR helped providers assess risk for developing osteoporosis and opened dialogue for shared decision making with patients. The intervention required a time investment on the staff workflow. Time constraints affected the ability to capture all eligible patients for the intervention. Many of the patients are migrants who have low health literacy and do not speak the language, creating a barrier to completing the FRAX questionnaire.

The literature review supported screening in primary care to promote healthy lifestyle changes and increased prescribing practices. The increase in ordering of DEXA scans can be correlated to providers having the conversation with the patient to decide on next steps. Having a baseline DEXA scan will help identify predisposition or progression of osteoporosis and opens dialogue for shared decision making. Though the FRAX score is not always a precursor to ordering a DEXA scan, having the FRAX score can open the conversation for the provider to share what they know through available evidence

The goal for screening was not met, but an increase in screening practices were seen. When patients know their health status, it can empower them to act towards the desired outcome for their health. FRAX scores open dialogue to remind patients the importance of exercise, diet

changes, and any necessary supplementation that they can start now without fear of medication side effects. The literature shows that having FRAX scores increases the initiation or continuation of pharmacologic treatment for osteoporosis.

Internal validity was limited by factors like small sample size. Virtual visits were one contributing factor to lower screening rates. Patients who opt for virtual visits might differ significantly to those that prefer in-person visits, which could potentially skew the results. The reduced sample size also limits the generalizability of this QI project. When staffing levels changed, the screening rates dropped, affecting the reliability of the results. Health literacy and language barriers affected patient participation and understanding of the screening process which can potentially lead to under-reporting. Temporary factors like staffing variability can show inconsistent variability in data not related to the intervention itself.

Implementation fidelity could have skewed the data in the beginning weeks when there was miscommunication on the screening criteria. Bias could also play a part in the internal validity of the data if screening practices are not consistent. Bias can be addressed by identifying inconsistencies in recruiting, to include in-person and virtual patients. Screening practices can also be more standardized using either the medical assistants to screen or having all patients utilize the QR code to take the survey independently. Reducing all these barriers to internal validity will ensure more accurate results.

Conclusion

This QI project demonstrates that having the FRAX score completed and embedded in the EMR opens dialogue for shared decision-making in fracture prevention treatment. Patients that engage in screening expand their knowledge of their risks and plants a seed for them to think about their risk, opening the possibility of shared decision making to start treatment earlier in

life. The strength of the project is that more patients were getting screened, and prevention talk was initiated with eligible patients. This work contributes to investigating ways to improve osteoporosis screening and treatment in primary care. The QI project was not long enough to measure the return on investment whether patients' fracture risk was lower or mitigated. More studies needed to track the prevalence of bone fractures due to postmenopausal changes and ways to promote screening in primary care. Current evidence shows an increase in patient adherence with anti-osteoporosis treatment, but more studies are needed to investigate the rate of fractures of patients who engaged in osteoporosis screening versus those who do not get screened.

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Table 1

Evidence Review Table

<p>Adami, G., Biffi, A., Porcu, G., Ronco, R., Alvaro, R., Bogini, R., Caputi, A. P., Cianferotti, L., Frediani, B., Gatti, D., Gonnelli, S., Iolascon, G., Lenzi, A., Leone, S., Migliaccio, S., Nicoletti, T., Paoletta, M., Pennini, A., Piccirilli, E., Tarantino, U., ... Michieli, R. (2023). A systematic review on the performance of fracture risk assessment tools: FRAX, DeFRA, FRA-HS. <i>Journal of endocrinological investigation</i>, 46(11), 2287–2297. https://doi-org.proxy-hs.researchport.umd.edu/10.1007/s40618-023-02082-8</p> <p style="text-align: right;">Level and quality: II-B</p>

Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results/Conclusions
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<p>The purpose of this research study was to compare the clinical performance of the three most used fracture risk assessment tools (DeFRA, FRAX, and HRA-HS) in order to recommend the best-performant screening tool in at-risk patients.</p>	<p>Systematic review of Randomized control trials and non-randomized trials.</p>	<p>Search strategy: Included specific keywords and/or corresponding Medical Subject Headings terms related to fragility fracture/osteoporosis AND risk assessment tools.</p> <p>Eligible studies: 43 Observational studies of individuals with osteoporosis.</p> <p>Excluded: 2565 Studies (i) not published in English, (ii) Did not report original findings (i.e., letters and case reports), (iii) did not identify patients affected by fragility fractures or osteoporosis, or (iv) did not consider the risk assessment tools of interest (FRAX, DeFRA, or FRA-HS).</p> <p>Included: 43 Observational studies of patients with osteoporosis or those who had experienced a fragility fracture. Studies using risk assessment tools DeFRA, Frax and FRA-HS</p> <p>PRISMA: 43 articles included in quantitative and qualitative studies (40 studies for FRAX tool, 1 study for FRAHS, 2 studies for DeFRA)</p> <p>Power analysis: Not applicable</p>	<p>Control: Controls varied among studies</p> <p>Intervention Protocol: Fragility fracture/osteoporosis risk assessment tools.</p>	<p>Dependent variable: Accuracy in predicting osteoporosis/fragility fracture risk</p> <p>Intervention: FRAX, DeFRA, or FRA-HS</p>	<p>Level of Measure: Sensitivity (Sn) and specificity (Sp) at different thresholds</p> <p>Outcome Data Retrieval: Researchers pulled data from all the studies</p> <p>Analysis: A total of 43 studies that assessed the performance of tools in identifying at-risk patients were included. Overall, FRAX and DeFRA appeared to perform better than FRA-HS in terms of discriminatory power. All three tools generally performed better for hip fractures than for MOF. As expected, the AUC was higher in women compared to men, mostly with the addition of BMD in the algorithm. The Sn and Sp estimates were used to realize</p>
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				<p>coupled forest plots with 95% confidence intervals (CIs) across studies (at various thresholds);</p> <p>Conclusion: the diagnostic accuracy of three (FRAX, FRA-HS, and DeFRA) fracture risk prediction tools is measured. The task force formulated recommendations on the use of any of these algorithms but did not identify a better performing tool. Although, our systematic review identified some outcomes (Sn and Sp) that were affected by very low to moderate quality evidence.</p> <p>SR Bias Risk:</p> <p>Independent authors (AB, GP, and RR) screened titles and abstracts based on the search strategy then assessed the</p>
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					full text of potentially relevant studies
<p>Chin, W. L., Chu, E. C., & Chiang, R. (2022). Screening and Diagnosing Osteoporosis Among Postmenopausal Women in Primary Care Settings in Malaysia: A Systematic Review. <i>Maedica</i>, 17(2), 492–504.</p> <p style="text-align: right;">Level and quality: II-B</p>					
Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
The purpose of this systematic review (SR) was to review evidence of the extent to which osteoporosis is	Systematic Review of cross-sectional studies	Search strategy: Several databases were searched including MEDLINE, EMBASE and CINAHL. Search terms related to diagnosis and treatment of osteoporosis, clinical practice guidelines,	Control: None Intervention: Healthy nutrition lifestyle, increased awareness of osteoporosis among	Dependent variable: Bone mass density (BMD) Measure: BMD as measured by DXA scan or quantitative	Level of Measure: Descriptive statistics by statistical package for social science (SPSS) software.

<p>currently screened and diagnosed in primary care settings.</p>		<p>primary settings, and postmenopausal women.</p> <p>Eligible studies: 6 cross-sectional studies</p> <p>Included: Study included postmenopausal women, study conducted in Malaysia, published in the last 10 years, primary osteoporosis, and study in English. Sample size varied from 116 to 362 with a mean age between 48.8 to 65.5 years.</p> <p>Excluded: 139 Studies investigating secondary osteoporosis, studies regarding secondary or tertiary care on osteoporosis, studies not reporting primary or secondary outcome measures, previous systematic reviews, letters and editorials, previous dissertations, qualitative studies, randomized controlled trials, and meta-analysis.</p> <p>PRISMA: A two-step search strategy was used to identify all relevant published reports. 6 studies included.</p> <p>Power analysis: Not applicable in SR.</p>	<p>postmenopausal women through printed materials and responsibility of the primary care providers on delivering osteoporosis information to the public.</p> <p>Protocol: Not applicable to SR critique</p>	<p>ultrasound (QUS). One study focused on a secondary outcome to study the accessibility of primary care provider on osteoporosis and knowledge of osteoporosis among postmenopausal women.</p>	<p>Outcome Data Retrieval: Researchers pooled data from all selected articles.</p> <p>Analysis: Researchers used descriptive statistics by statistical package for social science (SPSS) software. Chee et al. and Hasnah et al. used the Pearson correlation coefficient (r) to measure the strengths of association between relevant predictors and osteoporosis. All other studies reported significant P values with $p < 0.05$. Some studies performed multivariate logistic regression to explore factors that were independent predictors of osteoporosis among post-menopausal women and reported the results as odd</p>
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					<p>ratio (OR) alongside 95% confidence interval (CI).</p> <p>Conclusion: Researchers found a fair screening status in Malaysia. A renewed effort is needed to reduce the explicit gap in practice and meet the osteoporosis guideline. Further reviews needed to best inform future practice, specifically examining the challenges of primary care providers in osteoporosis management.</p> <p>SR Bias Risk: Based on methodology described, bias risk is low.</p>
<p>Gates, M., Pillay, J., Nuspl, M., Wingert, A., Vandermeer, B., & Hartling, L. (2023). Screening for the primary prevention of fragility fractures among adults aged 40 years and older in primary care: systematic reviews of the effects and acceptability of screening and treatment, and the accuracy of risk prediction tools. <i>Systematic reviews</i>, 12(1), 51. <a href="https://doi-org.proxy-
hs.researchport.umd.edu/10.1186/s13643-023-02181-w">https://doi-org.proxy- hs.researchport.umd.edu/10.1186/s13643-023-02181-w</p>					
<p>Level and quality: II-B</p>					
Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions

<p>The purpose of this study was to review evidence on the benefits, harms, and acceptability of screening and treatment, and on the accuracy of risk prediction tools for primary prevention of fragility fractures among adults aged 40 years and older in primary care.</p>	<p>Systematic review of mixed study designs, including randomized control trials. (RCT).</p>	<p>Search strategy: A staged approach was used, starting with direct evidence from trials including all controlled trials but prioritizing evidence from RCTs of primary screening versus no screening.</p> <p>Eligible studies: A total of 12 705 records were screened.</p> <p>Included: 132 Studies published up to 2016 researching the benefits and harms of screening, predictive accuracy of screening tests, and benefits of treatment. 31 systematic reviews met criteria</p> <p>Excluded: 12 573 studies that the USPSTF judged to have serious risk of bias concerns, and those examining the comparative effectiveness of screening approaches</p> <p>PRISMA: Included following a peer-reviewed protocol based on accepted systematic review methodology. 132 studies included.</p> <p>Power analysis: Not applicable to SR</p>	<p>Control: No screening</p> <p>Intervention: Screening for osteoporosis using the FRAX and bone mass density (BMD)</p> <p>Protocol: Not applicable to SR critique</p>	<p>Dependent variable: Prediction accuracy of screening tools</p> <p>Measure: Percentage of eligible participants who were screened using FRAX and BMD</p>	<p>Level of Measure: Outcome Data Retrieval: A staged approach was used, starting with direct evidence from trials including all controlled trials but prioritizing evidence from RCTs of primary screening versus no screening.</p> <p>Analysis: Among a selected population of females aged ≥ 65 years who are willing to independently complete a mailed fracture risk questionnaire, 2-step screening with risk assessment (clinical FRAX or FRAX-like tool) and BMD probably reduces the risk of hip fractures (3 RCTs + 1 CCT; n=43,736; 6.2 fewer in 1000, 95% confidence interval [CI] 9.0 fewer to 2.8 fewer; NNS=161) and clinical fragility fractures (3 RCTs;</p>
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					<p>n=42,009; 5.9 fewer in 1000, 95% CI 10.9 fewer to 0.8 fewer; NNS=169). H</p> <p>Conclusion: Females at low risk seem to have a high willingness to be screened but there is large heterogeneity in the level of risk at which higher-risk patients would accept treatment, supporting a shared decision-making approach.</p> <p>SR Bias Risk: Low</p>
<p>Parsons, C. M., Harvey, N., Shepstone, L., Kanis, J. A., Lenaghan, E., Clarke, S., Fordham, R., Gittoes, N., Harvey, I., Holland, R., Redmond, N. M., Howe, A., Marshall, T., Peters, T. J., Torgerson, D., O'Neill, T. W., McCloskey, E., Cooper, C., & SCOOP Trial Group (2020). Systematic screening using FRAX[®] leads to increased use of, and adherence to, anti-osteoporosis medications: an analysis of the UK SCOOP trial. <i>Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA</i>, 31(1), 67–75. https://doi-org.proxy-hs.researchport.umd.edu/10.1007/s00198-019-05142-z</p>					
<p>Level and quality: I-B</p>					
Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions

<p>The purpose of this study was to predict the effectiveness of screening using the FRAX to increase adherence to anti-osteoporosis medications (AOM).</p>	<p>Research: Randomized control trial</p>	<p>Sampling Technique: Convenience.</p> <p>Participants: 12 483 Older women (age 70-85), overall mean age was 75.6</p> <p>Setting: 7 Primary care centers in the UK</p> <p>Excluded: 13 433 Women under the age of 70 or over age 85.</p> <p>Accepted: 13 029 Women aged 70-85 years</p> <p>Control: No FRAX screening for 6 250 women</p> <p>Intervention: FRAX screening of 6 233 women</p> <p>Power Analysis: No power analysis conducted.</p> <p>Group Homogeneity: Intervention/Control not homogeneous, risk categorization was only undertaken in intervention arm only</p>	<p>Control Protocol: No screening</p> <p>Intervention Protocol: Screening using the FRAX tool with or without BMD</p> <p>Treatment Fidelity: Randomization was completed using an online, web-based system, and was set up by an independent database program from the Norwich Clinical Trials Unit. Full ethics approval was obtained from the North Western–Haydock Research Ethics Committee of England in September 2007 (REC 07/H1010/70). The trial was registered on the International Standard Randomized Controlled Trial Register in June 2007 (ISRCTN55814835). All participants gave</p>	<p>Dependent Variable: Medication adherence</p> <p>DV Measure: Self-reported AOM use at 6 months based on questionnaire responses</p>	<p>Statistical Results:</p> <p>The mean (SD) age of participants was 75.6 (4.2) years, with 6233 randomized to screening and 6250 to the control group. Of those participants identified at high fracture risk in the screening group, 38.2% of those on treatment at 6 months were still treated at 60 months, whereas the corresponding figure for the control group was 21.6%. Older age was associated with poorer adherence (OR per year increase in age 0.96 [95% CI 0.93, 0.99], $p = 0.01$), whereas history of parental hip fracture was associated with greater rate adherence (OR 1.67 [95% CI 1.23, 2.26], $p < 0.01$).</p> <p>Conclusions: Systematic fracture</p>
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			written, informed consent.		risk screening using FRAX® leads to greater use of AOM and greater adherence, in women at high fracture risk, compared with usual care.
<p>Rubin, K. H., Rothmann, M. J., Holmberg, T., Høiberg, M., Möller, S., Barkmann, R., Glüer, C. C., Hermann, A. P., Bech, M., Gram, J., & Brixen, K. (2018). Effectiveness of a two-step population-based osteoporosis screening program using FRAX: the randomized Risk-stratified Osteoporosis Strategy Evaluation (ROSE) study. <i>Osteoporosis international : a journal established as result of cooperation between the European Foundation for Osteoporosis and the National Osteoporosis Foundation of the USA</i>, 29(3), 567–578. https://doi-org.proxy-hs.researchport.umd.edu/10.1007/s00198-017-4326-3</p> <p style="text-align: right;">Level and quality: I-B</p>					
Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
The purpose of this study was to investigate the effectiveness of a two-step population-based osteoporosis screening program using the Fracture Risk Assessment Tool (FRAX) derived	Research: Randomized Controlled Trial	<p>Sampling Technique: Purposive sampling.</p> <p>Participants: Women aged 65-80 years (n= 34 229)</p> <p>Setting: Southern Denmark residence obtained through several Danish Health Registries.</p> <p>Excluded: Men and women below the age of 65 years and over the age of 85 years.</p> <p>Accepted: 34 229 Women aged</p>	<p>Control Protocol: Individuals with FRAX \geq 15% were not offered DXA scan</p> <p>Intervention Protocol: 10-year risk of osteoporotic fracture was calculated based on questionnaire response. Those with</p>	<p>Dependent Variable: Major osteoporotic fractures (MOFs)</p> <p>DV Measure: DV measured through a screening tool. FRAX \geq 15% with or without a DXA scan.</p>	<p>Statistical Results: The per-protocol analyses showed a risk reduction in the group that underwent DXA scanning compared to women in the control group with a FRAX \geq 15%, regarding major osteoporotic</p>

<p>from a self-administered questionnaire to select women for DXA scan.</p>		<p>65-80 years</p> <p>Control: Individuals with a FRAX\geq 15%, no DXA scan offered. (n= 17 157)</p> <p>Intervention: Individuals with a FRAX\geq 15% were offered a DXA scan. (n= 17 072)</p> <p>Power Analysis: Initial sample size calculation was performed assuming that 80 % of the population would return the questionnaire, that 76 % of these would have a 10-year probability of major osteoporotic fractures above 15 %, that 80 % of these would accept invitation for DXA scan, and that 50 % of the women invited for DXA scan would have osteoporosis. It is expected that the number of incident clinical fractures will be 1,400 in the control group and 1,260 in the screening group within 3–5 years yielding 80 % power to demonstrate effectiveness.</p> <p>Group Homogeneity: Analysis showed screening and control groups had similar sociodemographic baseline characteristics</p>	<p>a FRAX\geq 15% were offered a DXA scan</p> <p>Treatment Fidelity: The ROSE study was performed according to the declaration of Helsinki II and approved by the Regional Scientific Ethical Committee for Southern Denmark (jr.nr S-20090127) and the Danish Data Protection Agency (jf.nr. 2008-58-0035). The study was registered in ClinicalTrials.gov (NCT01388244). Women invited for DXA received oral and written information before signing informed consent.</p>		<p>fractures, hip fractures, and all fractures. The risk reduction was most pronounced for hip fractures (adjusted SHR 0.741, p = 0.007).</p> <p>Conclusions: Compared to an office-based case-finding strategy, the two-step systematic screening strategy had no overall effect on fracture incidence. The two-step strategy seemed, however, to be beneficial in the group of women who were identified by FRAX as moderate- or high-risk patients and complied with DXA.</p>
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<p>Fu, S.-H., Lai, C.-Y., Wang, C.-Y., Hung, C.-C., Ye, J.-D., Yen, H.-K., Wu, C.-H., Ku, L.-J. E., Yu, T., Yang, R.-S., Hsiao, F.-Y., & Li, C.-Y. (2023). Screening of Fracture Risk and Osteoporosis Among Older Long-term Care Residents: A Prospective Study. <i>Journal of Nutrition, Health & Aging</i>, 27(12), 1255–1261. https://doi-org.proxy-hs.researchport.umd.edu/10.1007/s12603-023-2045-3</p> <p style="text-align: right;">Level and quality: III-B</p>					
Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions
<p>The purpose of this study was to assess the effectiveness of screening older long-term care residents (LTCRs) for fracture risk and osteoporosis.</p>	<p>Research: Prospective cohort study</p>	<p>Sampling Technique: Purposive sampling.</p> <p>Participants: 785 LTCRs screened, 338 men (mean age 75.6) and 447 women (mean age 81.2).</p> <p>Setting: LTCRs in Taiwan.</p> <p>Excluded: Residents who were at terminal stage of life or comatose.</p> <p>Accepted: Men and women from LTCR who are not at terminal stage of life or comatose</p> <p>Control: No referral for osteoporosis work-up.</p> <p>Intervention: Referral for osteoporosis work-up.</p> <p>Power Analysis: 80% Beta, 0.1 Alpha, and moderate effect size.</p>	<p>Control Protocol: Patients with low FRAX risk scores</p> <p>Intervention Protocol: Patients with moderate-high risk scores on the FRAX</p> <p>Treatment Fidelity: Consent was sort from patients and caregivers before entered in study.</p>	<p>Dependent variable: Bone mass density and FRAX score</p> <p>DV Measure: High risk-Major osteoporotic fracture risk\geq20% or Hip fracture risk \geq3%. Moderate risk- MOF \geq10%or Hip fracture risk \geq1.5%. Low risk- MOF<10% or Hip fracture risk<1.5%.</p>	<p>Statistical Results: The Chi-square test or Fisher exact test was applied to evaluate the differences in the distribution of these categorical variables among different groups. All statistical analyses were conducted using SAS software, Version 9.4 (SAS Institute, Cary, NC, USA), with an a-significance level of 0.05.</p> <p>Conclusion: study demonstrates that FRAX is associated with high fracture incidence,</p>

					high fall occurrence, and elevated mortality. Therefore, further research is warranted when utilizing FRAX-based fracture risk assessment for selecting appropriate osteoporosis treatment in patients . More comprehensive information on screening and treatment effectiveness and costs is needed to identify the most appropriate candidates for AOM treatment and assess the cost-effectiveness of interventions.
<p>Lott, A., Pflug, E. M., Parola, R., Egol, K. A., & Konda, S. R. (2022). Predicting the Subsequent Contralateral Hip Fracture: Is FRAX the Answer? <i>Journal of Orthopedic Trauma</i>, 36(12), 599–603. https://doi-org.proxy-hs.researchport.umd.edu/10.1097/BOT.0000000000002441</p> <p style="text-align: right;">Level and quality: III-B</p>					
Purpose or Hypothesis	Type of Evidence and Research Design	Sample (population, size, setting)	Intervention Procedures	Primary Outcome/Measures	Results Conclusions

<p>The purpose of this study was to determine the ability of the fracture Risk Assessment Tool (FRAX) to identify the probability of contralateral hip fractures within 2 years of index fracture and identify independent risk factors for a subsequent hip fracture.</p>	<p>Research: Retrospective cohort studies</p>	<p>Sampling Technique: Purposive sampling</p> <p>Setting: Urban, academic medical center</p> <p>Excluded: Those patients who died during the admission for their first hip fracture were treated for a fracture related to a metastatic tumor or were discharged to hospice. (n=22)</p> <p>Accepted: Patients were included if they had sustained a hip fracture (femoral neck, intertrochanteric, and subtrochanteric) and were treated operatively during their index admission. (n=832)</p> <p>Control: No fracture within 2 years, (n=801) .</p> <p>Intervention: Contralateral hip fracture within 2 years, (n=31).</p> <p>Power analysis: 80% Beta, 0.1 Alpha, and moderate effect size.</p> <p>Group Homogeneity: Intervention and control groups had similar sociodemographic baseline characteristics</p>	<p>Control Protocol: Patients who did not receive medical therapeutics for osteoporosis</p> <p>Intervention protocol: Patients who received therapeutics for osteoporosis</p> <p>Treatment Fidelity: Not disclosed.</p>	<p>Dependent variable: Fracture risk score ability to predict risk of contralateral hip fracture within 2 years.</p> <p>DV Measure: As screened by FRAX > 80% were high risk, and age 80 years or older and decreasing BMI further increases the risk.</p>	<p>Statistical Results: patients who sustained a subsequent contralateral hip fracture were more likely to be older at the time of their first fracture (86.7 vs. 80.5 years, $P = 0.001$) and more likely to have a subsequent fracture if they were at least age 80 years (OR = 7.6, $P = 0.009$).</p> <p>Conclusion: This study demonstrates the strong ability of the FRAX score to triage patients at risk of subsequent contralateral hip fracture within 2 years. Patients with a FRAX score greater than 18% are considered high risk and have a 7% risk of sustaining a contralateral hip fracture in the short-term period. This risk increases to 12.5% if patients are</p>
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					age older than 80 years and have a BMI that decreases after their index hip fracture.
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Table 2

Synthesis Table

JHNEBP Model Level	Total Number of Sources	Author and Quality Rating of each study	Synthesis of Findings
Level I Experimental study · Randomized Controlled Trial (RCT) · Systematic review of RCTs with or without meta-analysis	2 RCTs	Rubin et al (B) Parsons et al (B)	Both studies investigated the use of the FRAX tool for effect on increasing initiation or adherence to treatment for secondary prevention of fragility fractures. Rubin et al. (2018) found significant results in patients with moderate-to-high fracture risk.
Level II Quasi-experimental studies · Systematic review of a combination of RCTs and quasi-experimental studies, or quasi-experimental studies only, with or without meta-analysis	3 systematic reviews of mixed studies	Gates et al (B) Chin et al (B) Adami et al (B)	Adami et al., 2023 investigated the effectiveness of using the FRAX to predict fracture risk. Chin et al., (2022) and Gates et al., (2023) looked at willingness to be screened and enhancing future recommendations for uptake in screening in primary care offices.
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 of qualitative studies with or without meta-synthesis	2 Research cohort studies	Lott et al., (2022) (B) Fu et al., (2023) (B)	Lott et al., (2022) used the FRAX scores to triage patients at risk of subsequent contralateral hip fracture within 2 years. Fu et al., (2023) used the FRAX scores of Long-term Care Residents to guide initiation of pharmacological treatments to reduce fracture risk. Both studies valued the guidance from the FRAX scores to establish a threshold for recommending treatment.
Level IV Opinion of respected authorities and/or reports of nationally recognized expert committees/consensus panels based on scientific evidence			
Level V Evidence obtained from literature reviews, quality improvement, program evaluation, financial evaluation, or case reports ·			

Opinion of nationally recognized expert(s) based on experiential evidence			
<p>Overall Quality Rating w/rational and Recommendation: Overall quality rating is B-Good and consistent evidence-practice change recommended based on reasonably consistent results; sufficient sample size for the study design; some control; definitive conclusions; reasonably consistent recommendations to initiate pharmacologic treatment based FRAX scores. Fairly comprehensive literature review that includes some reference to scientific evidence.</p>			
<p>Recommendations Based on Evidence Synthesis</p> <ul style="list-style-type: none"> • Strong, compelling evidence, consistent results: solid indication for a practice change. • Good and consistent evidence – practice change • Good but conflicting evidence: questionable indication for practice change; consider risk/benefit analysis • Little or no evidence: no indication for practice change 			

Figure 1

Root Cause Analysis

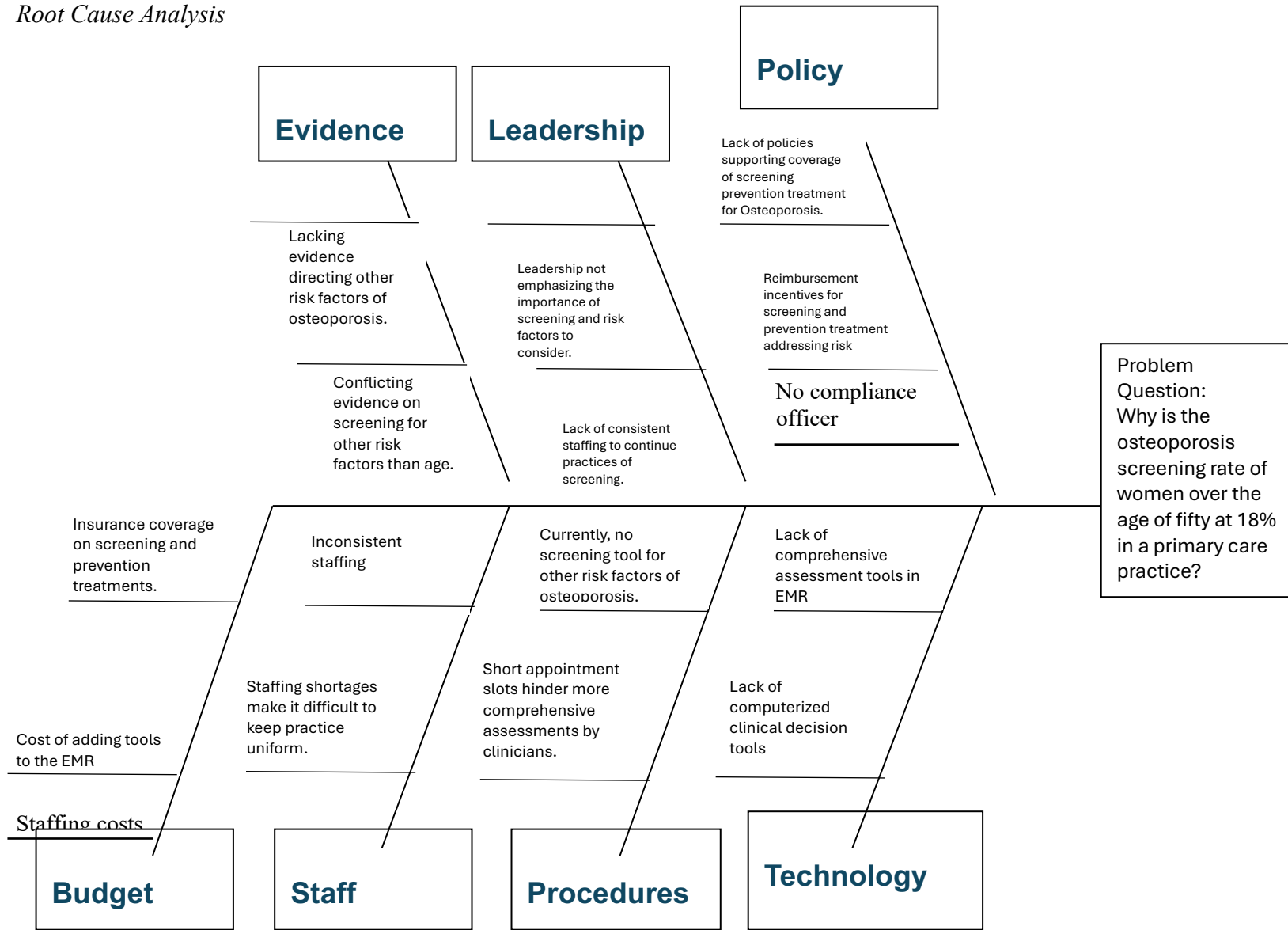


Figure 2

Current Screening Process

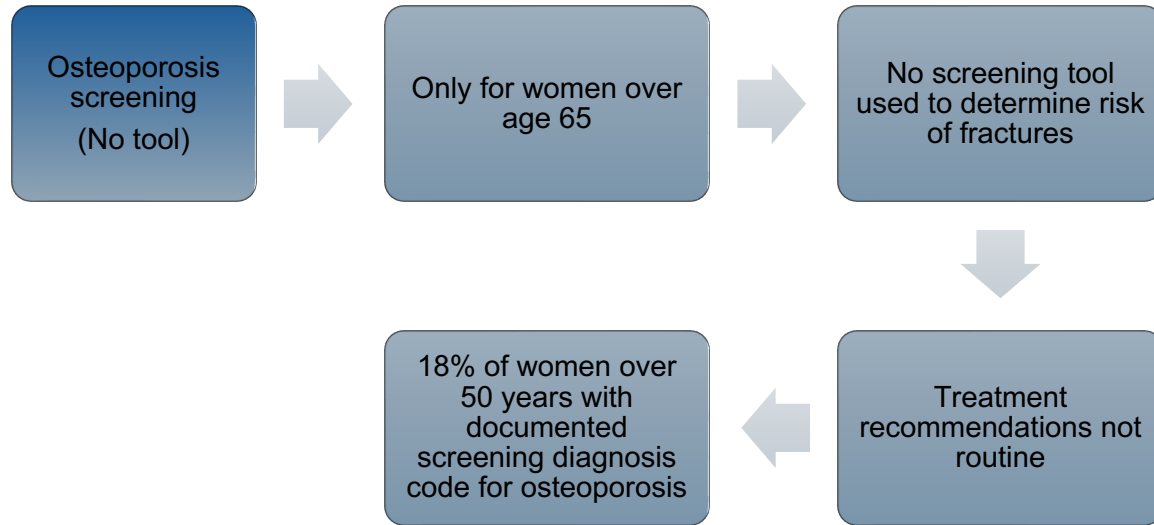


Figure 3

Desired Screening Process

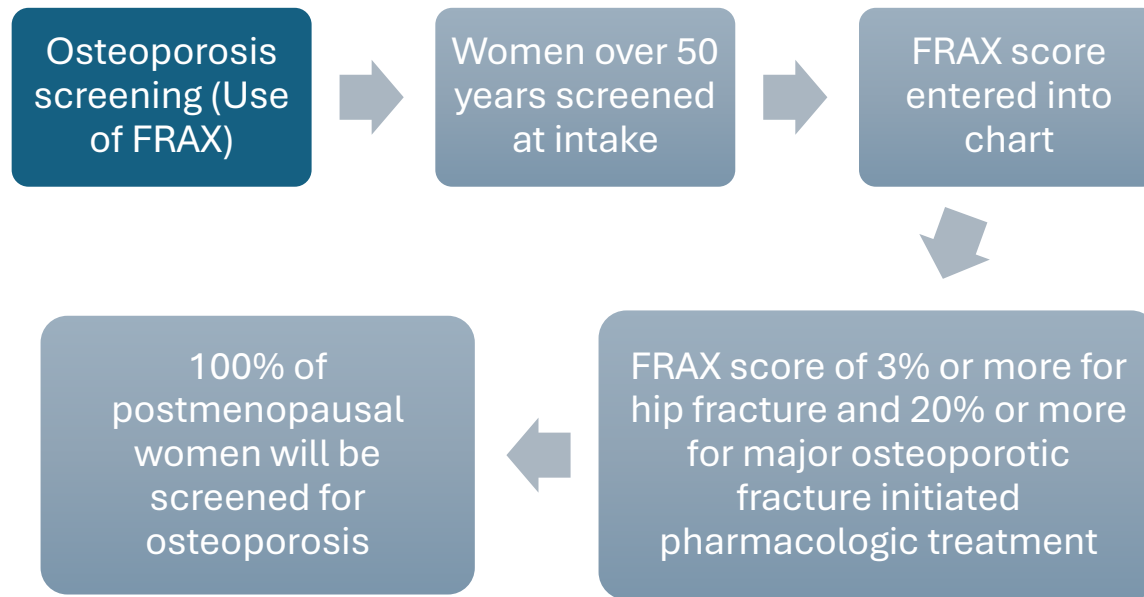


Figure 4

The PARIHS Framework

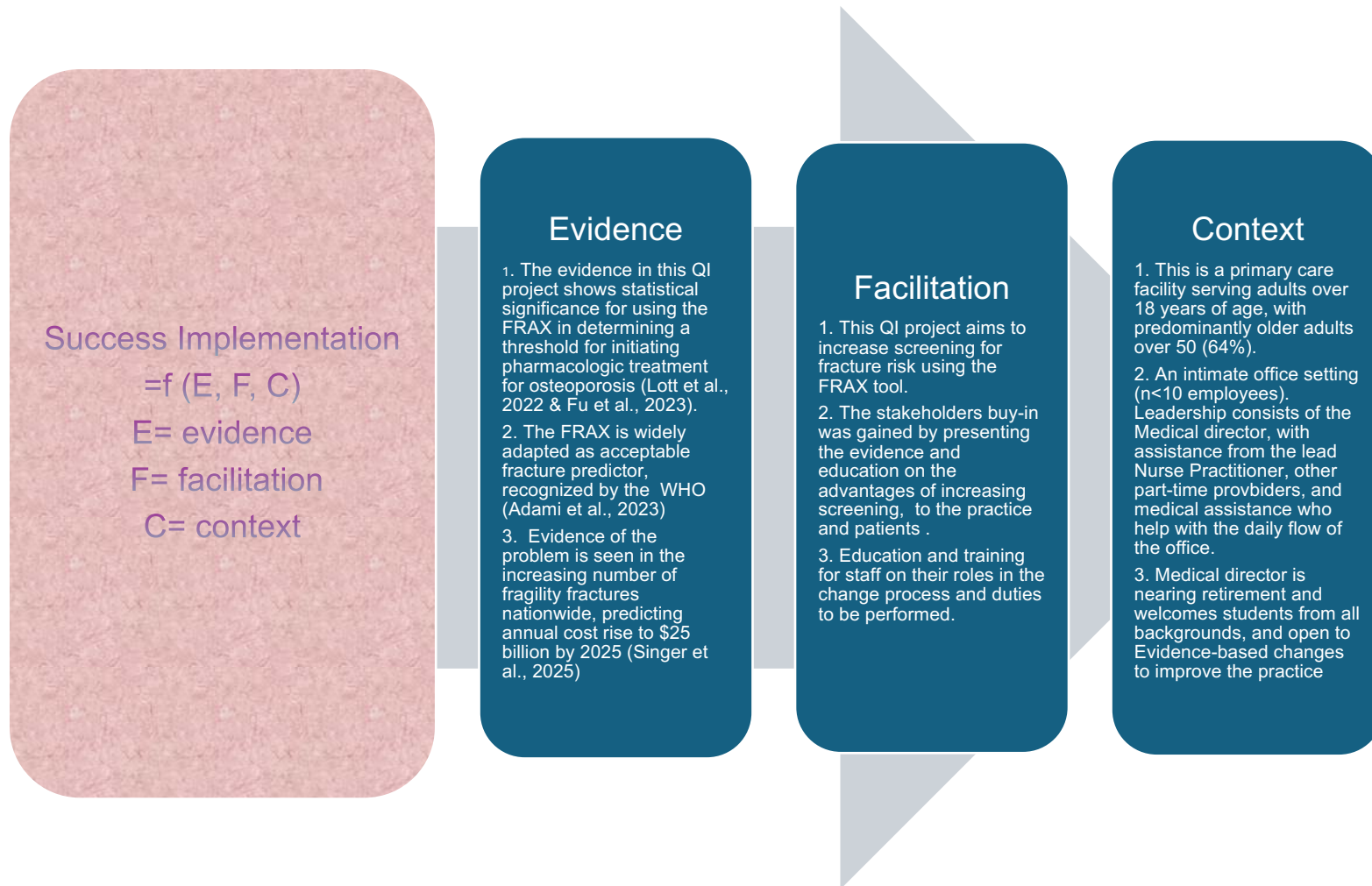
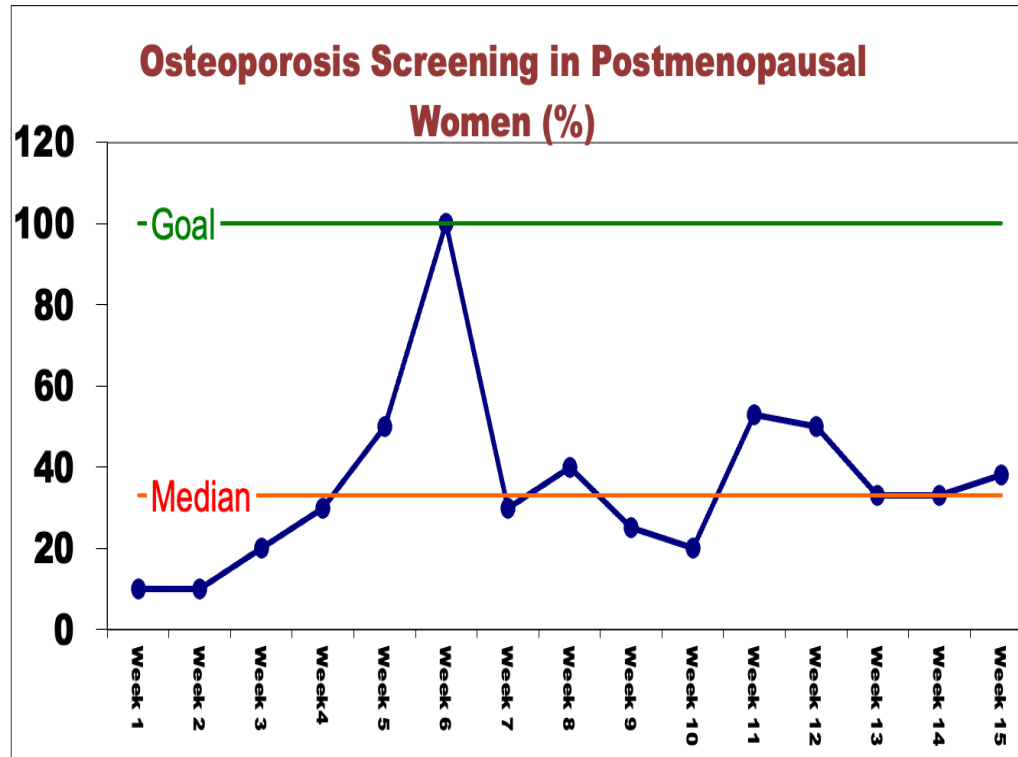


Figure 5

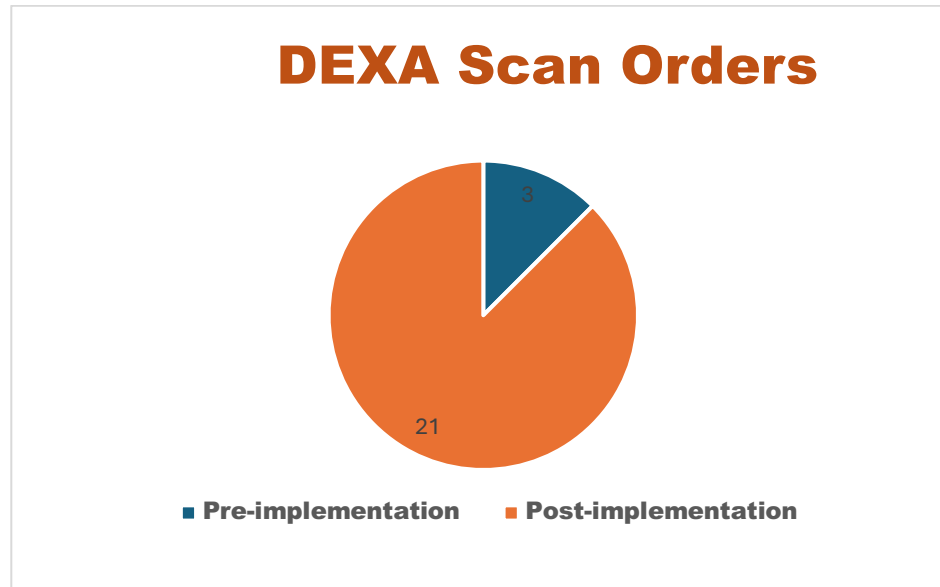
Run Chart



Footnote: n=156

Figure 6

Pre-implementation and Post-implementation DEXA Orders



Appendix

FRAX

4/1/24, 5:14 PM

frax.shef.ac.uk/FRAX/tool.aspx?country=7

Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: US (Asian) Name/ID:

Questionnaire:

1. Age (between 40 and 90 years) or Date of Birth
 Age: Date of Birth: Y: M: D:

2. Sex Male Female

3. Weight (kg)

4. Height (cm)

5. Previous Fracture No Yes

6. Parent Fractured Hip No Yes

7. Current Smoking No Yes

8. Glucocorticoids No Yes

9. Rheumatoid arthritis No Yes

10. Secondary osteoporosis No Yes

11. Alcohol 3 or more units/day No Yes

12. Femoral neck BMD (g/cm²)
 Select BMD

For USA use only

Consider FDA-approved medical therapies in postmenopausal women and men aged 50 years and older, based on the following:

- A hip or vertebral (clinical or morphometric) fracture
- T-score ≤ -2.5 at the femoral neck or spine after appropriate evaluation to exclude secondary causes
- Low bone mass (T-score between -1.0 and -2.5 at the femoral neck or spine) and a 10-year probability of a hip fracture $\geq 3\%$ or a 10-year probability of a major osteoporosis-related fracture $\geq 20\%$ based on the US-adapted WHO algorithm
- Clinicians judgment and/or patient preferences may indicate treatment for people with 10-year fracture probabilities above or below these levels

Risk factors

For the clinical risk factors a yes or no response is asked for. If the field is left blank, then a "no" response is assumed. See also notes on risk factors.

The risk factors used are the following:

Age	The model accepts ages between 40 and 90 years. If ages below or above are entered, the programme will compute probabilities at 40 and 90 year, respectively.
Sex	Male or female. Enter as appropriate.
Weight	This should be entered in kg.
Height	This should be entered in cm.
Previous fracture	A previous fracture denotes more accurately a previous fracture in adult life occurring spontaneously, or a fracture arising from trauma which, in a healthy individual, would not have resulted in a fracture. Enter yes or no (see also notes on risk factors).
Parent fractured hip	This enquires for a history of hip fracture in the patient's mother or father. Enter yes or no.
Current smoking	Enter yes or no depending on whether the patient currently smokes tobacco (see also notes on risk factors).