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Optimising Fracture Risk Assessment and Bone Protection Implementation in Hospitalised Older Adults: A Quality Improvement Study

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Abstract

Background

Inpatient admission offers an opportunity to identify older adults at increased fracture risk, but assessment and management may be inconsistently documented.

Objective

The study aimed to describe timely fracture-risk documentation and recorded bone-health responses across three sequential geriatric ward audit samples.

Methods

This uncontrolled, repeated cross-sectional quality improvement evaluation examined the clinical records of 90 distinct patients aged 65 years or older, with 30 patients assessed in each of three sequential audit cycles on a London geriatric ward in 2025. All had been in hospital for more than 72 hours when selected. Multidisciplinary teaching was followed by a printed Fracture Risk Assessment Tool (FRAX) reference guide. The primary measure was clinician-authored FRAX-related documentation within 72 hours of admission. Exploratory management responses were assessed through discharge among patients meeting retrospectively reconstructed National Osteoporosis Guideline Group (NOGG) intervention thresholds.

Results

Timely FRAX-related documentation was recorded in 12/30 (40.0%), 14/30 (46.7%), and 17/30 (56.7%) patients in samples 1, 2 and 3, respectively (sample 1-to-sample 3 difference, +16.7 percentage points; 95% confidence interval (CI), -8.2 to 38.8; Fisher exact p=0.301). Reconstructed intervention thresholds were met by 17, 19, and 13 patients. A recorded management-response composite was present in 7/17 (41.2%), 8/19 (42.1%), and 5/13 (38.5%) patients, respectively. A narrower treatment-or-documented-contraindication measure occurred in 3/17 (17.6%), 5/19 (26.3%), and 5/13 (38.5%).

Conclusions

Timely FRAX-related documentation was more frequent in later samples, but the uncontrolled design and uncertain individual intervention exposure prevent causal attribution. Recorded management responses showed no clear improvement and depended on the outcome definition. Future interventions should link risk recording to explicit clinical decisions and confirmed follow-up.

Categories: Geriatrics, Quality Improvement, Preventive Medicine
Keywords: bone health, clinical audit, fracture risk assessment, frax, geriatric medicine, osteoporosis, quality improvement

Introduction

Fragility fractures contribute to disability, loss of independence, and mortality among older adults [1,2]. The Fracture Risk Assessment Tool (FRAX) estimates 10-year major osteoporotic fracture (MOF) and hip-fracture probabilities, with or without bone mineral density (BMD) [3]. National Institute for Health and Care Excellence (NICE) guidance recommends considering fracture-risk assessment for women aged 65 years or older, men aged 75 years or older, and younger adults with relevant risk factors. The National Osteoporosis Guideline Group (NOGG) provides a framework for investigation and treatment [4-6].

Acute geriatric wards can identify fracture-prevention needs outside fracture liaison pathways, but competing priorities and fragmented electronic patient record (EPR) documentation may obstruct assessment [7-9]. Small quality improvement reports have evaluated teaching, electronic proformas and structured prompts [10-11]. An earlier project in a separate Whittington Hospital acute frailty service used an electronic proforma and education (Poster: Riley M, Yammine R, O'Gorman K. Improving Bone Health

Assessment and Treatment Delivery in the Acute Frailty Service at Whittington Hospital: A Quality Improvement Project. British Geriatrics Society conference; 2024). The present evaluation focused on a geriatric ward and measured early documentation separately from recorded clinical responses.

Recording a fracture-risk estimate does not establish that a management decision was made or completed. Prescribing, investigation, and referral may require different members of the multidisciplinary team. Interventions that simplify documentation may not address these subsequent steps. This distinction is important because documenting fracture risk does not necessarily lead to treatment, referral, or follow-up unless subsequent clinical decisions are made and recorded.

We assessed two low-resource ward interventions: multidisciplinary teaching on FRAX and NOGG, followed by a printed reference guide. The primary objective was to describe clinician-authored FRAX-related entries within 72 hours of admission across three sequential ward-list samples. Exploratory objectives were to describe recorded bone-health management responses and examine the influence of risk classification and outcome definition on these findings. The 72-hour window was a pragmatic process measure rather than a nationally prescribed deadline.

Materials And Methods

Study design, setting and chronology

This single-centre, uncontrolled, repeated cross-sectional quality improvement evaluation took place on an acute geriatric medicine ward at Whittington Hospital, London, using the CareFlow electronic patient record (EPR) (System C, Oxford, UK) in 2025. We reviewed three separate groups of 30 patients selected from the ward list: sample 1 on 5 August, sample 2 on 2 September, and sample 3 on 7 October 2025. Multidisciplinary teaching began on 12 August, and the printed FRAX reference guide was introduced on 9 September.

For each sample, we examined whether clinician-authored FRAX assessment was documented in the first 72 hours after initial hospital admission. Exploratory bone-health responses were identified from documentation fields reviewed through discharge. Stages were defined by sampling dates rather than verified exposure of each patient to an intervention. Individual admission and discharge dates were not retained, so we could not establish whether each patient's initial 72-hour assessment window or subsequent management documentation occurred before or after the interventions. We also could not verify whether the clinicians responsible for individual patients attended teaching or used the guide. The samples therefore represent three sequential ward-list selections, not confirmed intervention-exposure groups. There was no untreated comparator or prospective baseline trend.

A bone-health EPR proforma from an earlier Whittington acute frailty project was already available in CareFlow (Poster: Riley, 2024), although use by the participating ward was not measured. Staffing, occupancy and other contemporaneous practice changes were not recorded.

Participants and sampling

Patients were eligible if aged 65 years or older, under the participating geriatric team and hospitalised for more than 72 hours when selected from the ward list. We used 65 years as a pragmatic sampling threshold for this UK inpatient quality improvement evaluation, not as a universal definition of older age. NHS England uses age 65 years or older for routine frailty identification [12]. NICE recommends considering fracture-risk assessment in all women aged 65 years or older and all men aged 75 years or older, and in younger patients with relevant risk factors [4]. Therefore, audit eligibility did not imply that routine FRAX assessment was indicated for every patient, particularly men aged 65-74 years. The documentation period began at initial hospital admission, including for subsequent ward transfers. Day cases, admissions lasting 72 hours or less, and patients receiving end-of-life or palliative-only care were excluded. The requirement for patients to have remained hospitalised for more than 72 hours was a pragmatic audit sampling criterion, not an institutional admission policy.

The retained analytical dataset contained structured fields for demographics, admission reason, osteoporosis or prior fracture history, FRAX documentation, recorded fracture probabilities, author and note location, and bone-health management measures. A single investigator reviewed the EPR records and entered the data directly into a structured Excel spreadsheet used as the audit collection form. No independent second reviewer or systematic duplicate data abstraction was undertaken.

At each sampling date, 30 patients meeting the eligibility criteria were pragmatically selected from the ward list, producing 90 patient records across the three samples. Selection was by convenience rather than a documented consecutive-admission or random sequence. No screening log was retained, so the total number assessed for eligibility, the number excluded, and the order of patient selection cannot be reconstructed. The samples were non-overlapping, with unique hospital numbers used to ensure that no patient was included more than once. Sampling patients who had already been hospitalised for more than 72 hours preferentially included longer admissions. The sample size was determined by ward capacity and the resources available

for retrospective record review rather than a prospective sample-size calculation. The small sample sizes limited statistical precision, and all between-sample comparisons were exploratory.

Data sources and fracture-risk estimation

The de-identified analytical workbook contained 90 patient-level entries. Variables included age, sex, admission reason, a combined osteoporosis/prior-fracture indicator, timely clinician-authored FRAX documentation, profession and note location, 10-year MOF and hip-fracture probabilities, an original high-risk flag, bone-protection treatment and management-plan fields, reasons for non-initiation, vitamin D/calcium and clinic or dual-energy X-ray absorptiometry (DXA) referrals. The osteoporosis/prior-fracture field did not distinguish diagnosis from fracture history. Management fields were reviewed through discharge. The original clinical note text, timestamps, and individual FRAX calculator inputs were not retained in the de-identified analytical workbook.

United Kingdom FRAX estimates without BMD were calculated by the audit investigator at the time of data collection for all selected patients, including those without a clinician-authored FRAX entry. Calculations were based on information available in the EPR, supplemented by further review of clinical records or direct patient questioning where required. All necessary inputs were obtained before completing the calculations. These audit-generated estimates were recorded separately from clinician-authored FRAX documentation in the EPR. The individual calculator inputs and exact calculator version were not separately retained in the de-identified analytical dataset, limiting independent reproduction of the original calculations from that dataset alone. For 14 patients older than 90 years, age 90 was entered at the calculator's upper limit, producing age-capped rather than age-specific estimates [3,4].

Recorded probabilities were classified retrospectively using NOGG 2024 intervention thresholds [5,6]. The published thresholds were 16.5% for major osteoporotic fracture (MOF) and 3.5% for hip fracture at age 65, and 20.3% and 5.4%, respectively, at age 70 and above. For ages 66-69, thresholds were approximated by linear interpolation: $16.5 + 0.76 \times (\text{age} - 65)$ for MOF and $3.5 + 0.38 \times (\text{age} - 65)$ for hip fracture. Patients meeting either threshold were classified as intervention-threshold-positive, although numerical classification alone did not establish individual treatment eligibility. The original high-risk audit flag was retained descriptively because it could not be consistently reproduced from the recorded probabilities. Sensitivity analyses examined the use of the nearest published five-year age thresholds, the application of age-70 thresholds throughout the 66-69-year subgroup, and reconstructed NOGG upper assessment thresholds. These analyses assessed the robustness of retrospective risk classification rather than independently establishing clinical treatment eligibility.

Quality improvement interventions

Two approximately 15-minute multidisciplinary teaching sessions were delivered. The first took place at handover on 12 August 2025; the date of the second was not retained. Doctors, nurses, pharmacists, physiotherapists and occupational therapists were invited. Teaching covered FRAX inputs, fracture probabilities, EPR documentation and NOGG-informed assessment and management. Attendance and intervention fidelity were not recorded.

A one-page printed FRAX reference guide was developed by the author and introduced on 9 September 2025, with copies placed in doctors' and therapy offices (Figure *1*). The guide provided instructions for locating or calculating FRAX estimates, documenting fracture probabilities in CareFlow and considering subsequent management actions. The reference guide was designed as a practical documentation aid rather than a validated standalone prescribing protocol.

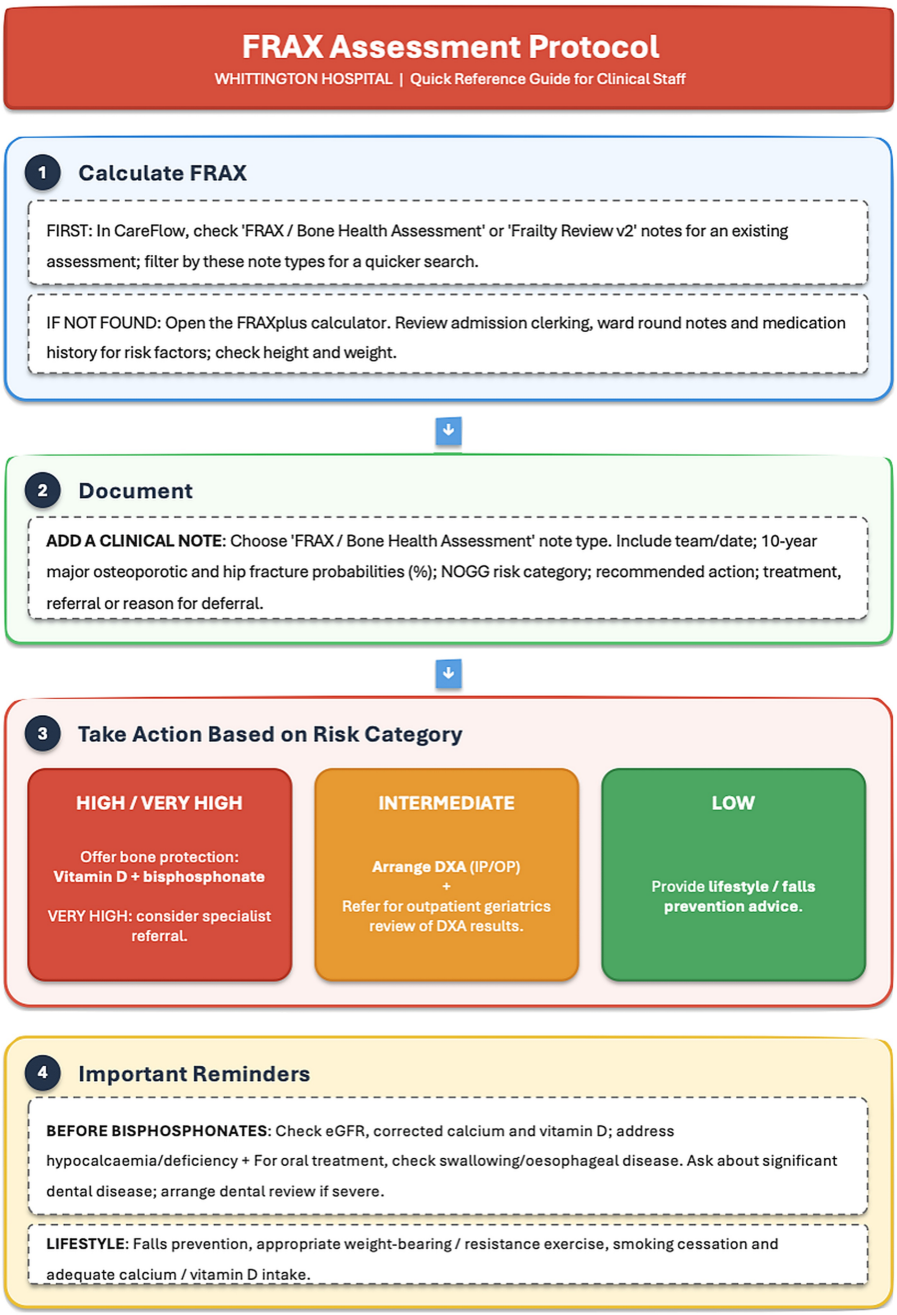


FIGURE 1: Representative historical ward FRAX reference guide (2025)

Figure 1 illustrates the printed resource introduced during the intervention. The simplified clinical prompts represent historical project guidance and should not be used as a current standalone prescribing protocol. Clinical decisions require individualised assessment and reference to current NOGG guidance and local prescribing protocols.

Original FRAX reference guide designed and created by the author for this quality improvement project at Whittington Hospital. The figure is original author-owned artwork and has not been reproduced from a previously published source.

FRAX: Fracture Risk Assessment Tool; NOGG: National Osteoporosis Guideline Group; DXA: dual-energy X-ray absorptiometry; eGFR: estimated glomerular filtration rate; IP: inpatient; OP: outpatient

Measures and coding rules

The primary process measure was the number of patients with an EPR-documented FRAX assessment within 72 hours of initial admission, divided by 30 selected patients per sample. Although the indicator recorded the presence of a documented assessment, the retained data did not allow independent verification of

complete numerical fracture probabilities, NOGG classification, or a management decision. Original note text and timestamps were not retained. Age, sex, and both FRAX probabilities were populated for all 90 records.

Among patients meeting reconstructed intervention thresholds, the exploratory management-response composite was retrospectively defined from the available documentation fields and counted any of the following: a bone-protection treatment plan (excluding zoledronate explicitly given for hypercalcaemia); a positive clinic/dual-energy X-ray absorptiometry referral; or a documented contraindication accompanied by an alternative documented management plan. The narrower measure included only treatment or contraindication-with-plan, excluding referral alone. Patients were counted once even if components overlapped. An unexplained consultant decision, a recorded "below-threshold" reason, an entry of "not discussed," or a plan without a qualifying reason was insufficient. Contraindications were not independently adjudicated. Renal impairment, for example, can restrict individual osteoporosis treatments without contraindicating every option. These measures describe documentation, not validated guideline-concordant care.

A bone-protection treatment plan could indicate ongoing rather than newly initiated therapy. A management-plan flag did not establish clinical adequacy; referral did not verify completion. Recorded clinical responses were assessed through discharge over variable lengths of stay. Vitamin D/calcium was described separately because supplementation alone is not osteoporosis-specific pharmacological treatment. Balancing measures and subsequent fractures were not collected.

Statistical analysis

Counts and percentages were summarised by sample, with median and interquartile range (IQR) for age. Exact Clopper-Pearson 95% confidence intervals (CIs) were calculated for proportions; sample 1-to-sample 3 differences used unadjusted Newcombe 95% CIs. Two-sided Fisher exact tests were exploratory and not used to infer treatment effects. The analysis assumed independent patients but could not account for ward-level practice, convenience sampling, or temporal confounding. No prospective power calculation, multiplicity adjustment, or multivariable causal model was undertaken.

Sensitivity analyses excluded patients older than 90 years and, separately, used reconstructed NOGG upper assessment thresholds. We described differences between original high-risk flags and numerical classification, and co-occurrence of early FRAX entries and recorded responses. The timing of documentation relative to clinical decisions was unavailable, so co-occurrence was descriptive. The reported confidence intervals reflect statistical uncertainty under the stated assumptions but do not account for potential selection bias from convenience sampling, ward-level dependence, or temporal confounding. Reporting was informed by Standards for Quality Improvement Reporting Excellence (SQUIRE) 2.0 [13], with the participant-selection summary also drawing on applicable Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting recommendations [14].

Governance and ethics

This project was undertaken as a local clinical audit and quality improvement activity at Whittington Health NHS Trust rather than as research. The project team classified it as clinical audit/service evaluation under local arrangements, for which NHS Research Ethics Committee review and individual research consent were not required. Only de-identified patient-level data were retained for analysis, and findings are reported in aggregate.

Results

Patient characteristics and risk classification

The workbook contained 30 patients per sample, with 90 unique patients overall (Figure *2*). The numbers screened and excluded at each sample were not retained. Median ages were 83.0, 84.5, and 79.5 years, respectively. Fourteen patients were older than 90 years (three, seven, and four by sample). Sample 3 was younger and had fewer patients meeting reconstructed intervention thresholds (Table *1*), limiting direct comparisons of management responses.

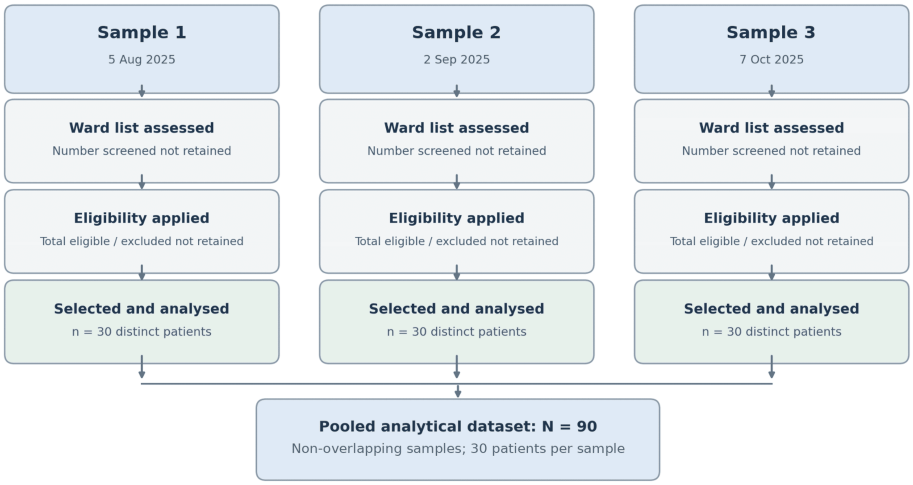


FIGURE 2: Patient selection flow across the three sequential ward-list audit samples: Whittington Hospital Acute Geriatric Ward, 2025

Eligibility: age ≥65 years; participating geriatric team; hospitalised >72 hours at selection.

Exclusion criteria: day cases, admissions ≤72 hours, palliative-only/end-of-life care; counts were not retained.

The three samples contained 30 distinct patients each. Numbers screened, total eligible, and excluded or not selected were not recorded; no exclusion counts were imputed. The dates indicate selection dates, not dates of admission or verified individual exposure to either intervention.

Characteristic	Sample 1 (n=30)	Sample 2 (n=30)	Sample 3 (n=30)
Age, median (IQR), years	83.0 (76.25-88.5)	84.5 (80.25-86.75)	79.5 (76.0-82.75)
Female, n (%)	16 (53.3)	14 (46.7)	13 (43.3)
Admission recorded as fall, n (%)	11 (36.7)	13 (43.3)	13 (43.3)
Known osteoporosis and/or prior fracture, n (%)	7 (23.3)	9 (30.0)	9 (30.0)
Age >90 years, n (%)	3 (10.0)	7 (23.3)	4 (13.3)
High-risk, n (%)	4 (13.3)	3 (10.0)	8 (26.7)
Reconstructed intervention-threshold-positive, n (%)	17 (56.7)	19 (63.3)	13 (43.3)

TABLE 1: Characteristics of the three selected Whittington Hospital audit cohorts

Osteoporosis/prior fracture was one combined source field. Samples were non-random ward-list selections; reconstructed risk classification does not establish treatment eligibility.

Reconstructed NOGG intervention thresholds were met by 17/30 (56.7%), 19/30 (63.3%), and 13/30 (43.3%) patients. The original high-risk flag disagreed with this numerical classification in 40/90 cases: 37 were numerically positive but originally flagged negative, and three showed the reverse pattern. Among 49 numerical threshold-positive records, 32 met the hip-fracture criterion alone. This discrepancy cannot be equated with inappropriate clinical care.

Among the 49 threshold-positive records, 13 (26.5%) had below-threshold recorded as the reason for not starting bone protection; 12 met the hip-fracture criterion alone. Different contemporaneous and retrospective interpretations may explain these findings.

Clinical FRAX-related documentation within 72 hours

Timely clinician-authored FRAX-related documentation occurred in 12/30 (40.0%, exact 95% CI 22.7-59.4%), 14/30 (46.7%, 95% CI 28.3-65.7%), and 17/30 (56.7%, 95% CI 37.4-74.5%) patients (Table *2*; Figure *3A*). The

sample 1-to-sample 3 difference was +16.7 percentage points (Newcombe 95% CI -8.2 to 38.8; Fisher exact p=0.301). The confidence interval was wide and included no improvement.

Sample	Documented within 72 h, n/N (%)	Exact 95% CI (%)
Sample 1	12/30 (40.0)	22.7-59.4
Sample 2	14/30 (46.7)	28.3-65.7
Sample 3	17/30 (56.7)	37.4-74.5

TABLE 2: Timely clinician-authored FRAX-related documentation by audit sample

Sample 1-to-3 difference: +16.7 percentage points (Newcombe 95% CI -8.2 to 38.8; Fisher exact p=0.301). Denominators were 30 patients per sample.

FRAX: Fracture Risk Assessment Tool

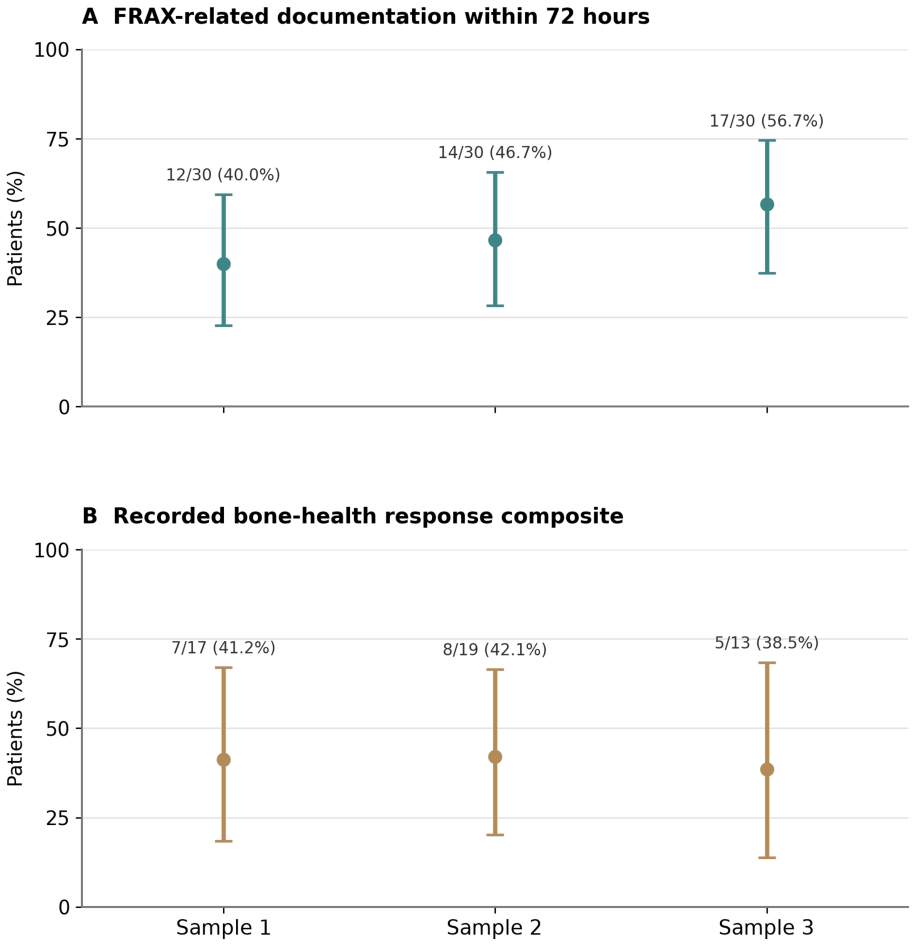


FIGURE 3: Early fracture-risk documentation and recorded bone-health responses

Panel A shows clinician-authored FRAX-related documentation within 72 hours of admission across three audit samples (12/30, 14/30, and 17/30 patients). Panel B shows the recorded bone-health response composite among patients meeting retrospectively reconstructed NOGG intervention thresholds (7/17, 8/19, and 5/13 patients). Points represent proportions, and error bars indicate exact binomial 95% confidence intervals. The samples were separate ward-list cohorts, not a continuous time series.

FRAX: Fracture Risk Assessment Tool; NOGG: National Osteoporosis Guideline Group.

Among positive timely documentation flags, a doctor was the recorded author in five, eight, and 10 cases, respectively. Author profession did not establish teaching attendance or guide use.

Recorded bone-health management and its components

Recorded management-response analyses involved only retrospectively threshold-positive patients: 17, 19, and 13 per sample. The broad composite occurred in 7/17 (41.2%, exact 95% CI 18.4-67.1%), 8/19 (42.1%, 95% CI 20.3-66.5%) and 5/13 (38.5%, 95% CI 13.9-68.4%) patients (Table *3*; Figure *3B*). The sample 1-to-sample 3 difference was -2.7 percentage points (Newcombe 95% CI -33.6 to 29.8; Fisher exact p=1.000). No clear improvement was observed.

Outcome	Sample 1 (n=17)	Sample 2 (n=19)	Sample 3 (n=13)
Composite recorded response, n/N (%)	7/17 (41.2)	8/19 (42.1)	5/13 (38.5)
Positive bone-protection treatment field (not verified new), n/N (%)	3/17 (17.6)	2/19 (10.5)	4/13 (30.8)
Recorded contraindication reason with plan flag, n/N (%)	0/17 (0.0)	3/19 (15.8)	1/13 (7.7)
Referral recorded, n/N (%)	7/17 (41.2)	5/19 (26.3)	3/13 (23.1)
Treatment flag or recorded contraindication, n/N (%)	3/17 (17.6)	5/19 (26.3)	5/13 (38.5)
Referral-only contribution to composite, n	4	3	0

TABLE 3: Exploratory recorded bone-health responses among records meeting reconstructed NOGG intervention thresholds

Components overlap and patients are counted once in the composite. Referral indicates a positive source field, not completed follow-up; treatment fields do not confirm new prescribing. Two-sided Fisher exact p=1.000 for the broad composite and p=0.242 for the narrower measure.

NOGG: National Osteoporosis Guideline Group

The narrower treatment-or-documented-contraindication measure was positive in 3/17 (17.6%), 5/19 (26.3%), and 5/13 (38.5%) patients, respectively (sample 1-to-sample 3 difference, +20.8 percentage points; Newcombe 95% CI -10.4 to 49.2; Fisher exact p=0.242). Referral alone accounted for four, three and zero of the broad composite responses. The descriptive pattern therefore depended on the outcome definition. Neither measure verified initiation of therapy or completed referrals.

Across all patients, the treatment flag occurred in 5/30 (16.7%), 4/30 (13.3%), and 6/30 (20.0%) cases. Clinic/DXA referral fields were positive in 11/30 (36.7%), 7/30 (23.3%), and 6/30 (20.0%), and vitamin D/calcium in 18/30 (60.0%), 20/30 (66.7%), and 21/30 (70.0%). These fields did not confirm new prescriptions or completed investigations.

Age-restricted and exploratory co-occurrence analyses

After excluding patients older than 90 years, the broad composite occurred in 6/14 (42.9%), 7/13 (53.8%) and 4/11 (36.4%) threshold-positive records; the narrower measure occurred in 3/14 (21.4%), 5/13 (38.5%) and 4/11 (36.4%). Using reconstructed NOGG upper assessment thresholds, 13, 17, and 11 patients were classified as threshold-positive across the three samples. The corresponding composite recorded-response proportions were 6/13 (46.2%), 8/17 (47.1%), and 5/11 (45.5%). The narrower treatment-or-documented-contraindication measure occurred in 2/13 (15.4%), 5/17 (29.4%), and 5/11 (45.5%) patients, respectively. These sensitivity analyses did not establish a clear improvement.

Eleven patients were aged 66-69 years (three, three, and five in samples 1, 2, and 3, respectively). Applying the nearest published five-year age thresholds did not change intervention-threshold classification in any of these patients. Applying the age-70 thresholds throughout this subgroup as a conservative sensitivity analysis reclassified one patient in sample 2, reducing the number meeting reconstructed intervention thresholds from 19 to 18. The recorded management-response composite for sample 2 consequently changed from 8/19 (42.1%) to 8/18 (44.4%). Neither sensitivity analysis materially changed the descriptive interpretation.

Among 49 threshold-positive patients, the recorded-response composite co-occurred with timely FRAX-related documentation in 18/28 (64.3%), compared with 2/21 (9.5%) without timely documentation (Table *4*). Timing of the recorded actions was not retained, and the association could reflect differences in documentation rather than clinical effects.

Timely FRAX-related entry	Composite response Yes	Composite response No	Total
Yes	18	10	28
No	2	19	21
Total	20	29	49

TABLE 4: Exploratory co-occurrence of timely FRAX-related documentation and recorded-response composite among intervention-threshold-positive patients (pooled samples)

Pooled descriptive cross-tabulation only. The temporal relationship between documentation and clinical responses was not established.

FRAX: Fracture Risk Assessment Tool; NOGG: National Osteoporosis Guideline Group

Discussion

In this single-ward evaluation, the proportion with a clinician-authored FRAX-related entry within 72 hours increased numerically from 40.0% in sample 1 to 56.7% in sample 3. The estimate was imprecise, and the sampling design does not permit causal attribution to either intervention. The broad composite of recorded bone-health responses did not show a parallel improvement. Even in the final sample, 13 of 30 patients had no flagged timely FRAX-related entry.

Recording FRAX does not necessarily lead to treatment. The teaching and reference materials were intended to address knowledge and documentation barriers, but they did not assign prescribing responsibility or establish a system to verify referrals. The primary documentation flag did not require complete probabilities, NOGG interpretation or a management decision.

Downstream action may also depend on patient suitability, medication history and arrangements for investigation or follow-up. These processes were not targeted by the interventions. The different documentation and management patterns are consistent with such barriers but do not establish their cause.

The outcome definition affected the interpretation. The broad composite included referral alone and remained similar across samples. The narrower measure increased numerically, but had wide confidence intervals and included continuing treatment or recorded contraindication rather than verified new therapy. The components represent different clinical actions and should not be treated as equivalent outcomes.

Timely FRAX documentation and recorded management responses frequently co-occurred, but this pooled, exploratory association is hypothesis-generating only. The timing of recorded management responses was unavailable, and differences in patient characteristics or documentation practices could explain the association. It therefore cannot establish that early FRAX documentation led to subsequent clinical management.

Original high-risk flags frequently differed from retrospective numerical classification, particularly when only the hip-fracture threshold was met. These findings suggest a need to record both FRAX probabilities and their interpretation, but they cannot establish inappropriate decisions. Although the clinical information required for FRAX calculation was obtained during data collection, individual calculator inputs and the full supporting clinical context were not retained in the de-identified analytical dataset. Estimates were calculated without BMD, and age-capping in patients older than 90 years introduced additional uncertainty [4].

Previous quality improvement studies have reported improvements in fracture-risk assessment following educational and documentation-based interventions. In a separate acute frailty service at Whittington Hospital, Riley et al. (Poster: Riley, 2024) reported an increase in FRAX calculation from 35% to 61% following the introduction of an electronic bone-health proforma and staff education. Referrals for bone-protective treatment also increased from 63% to 90%, although this change was not statistically significant. Similarly, Bridgewater et al. [10] reported an increase in FRAX scoring among patients admitted with falls from 22% to 47% after implementing a standardised geriatric assessment document. In a later-life psychiatry ward, Senior et al. [11] reported an increase in FRAX assessment among patients without pre-existing osteoporosis from 50% to 88% following structured ward-round documentation and educational posters. Despite improved assessment, none of the four high-risk patients in their final audit was started on bisphosphonate therapy.

Our study similarly demonstrated a numerical increase in fracture-risk documentation, from 40.0% to 56.7%, but the increase was smaller than those reported in these previous projects. Direct numerical comparisons

are limited by differences in study populations, intervention components, assessment windows, and outcome definitions. The previous studies principally reported FRAX calculation, whereas our primary outcome was a source-coded documentation flag within 72 hours that did not establish assessment completeness. Furthermore, an electronic bone-health proforma was already available in our clinical setting, and individual exposure to the interventions could not be verified. Unlike the increased treatment referrals reported by Riley et al. (Poster: Riley, 2024), our broad composite of recorded management responses showed no clear improvement. These findings highlight the distinction between improving fracture-risk documentation and ensuring subsequent clinical action. Future interventions may benefit from integrating risk assessment with explicit prescribing responsibilities, investigation pathways and confirmation of follow-up, consistent with established fracture liaison service principles [8,9,15,16].

Strengths and limitations

Strengths include a relevant inpatient setting, practical low-resource interventions and 90 unique patient records. Reporting separate treatment, contraindication, and referral components avoids reliance on one composite outcome. Sensitivity analyses explored age-capped FRAX estimates and alternative numerical thresholds.

This was a single-ward, uncontrolled evaluation with convenience samples of longer-stay inpatients. Screening totals, eligibility and exclusion counts, a baseline trend, individual intervention exposure, and contemporaneous staffing changes were unavailable. Samples differed in age and reconstructed fracture risk; discharge-based management documentation could span intervention periods. The separate effects of the two resources cannot be estimated.

The de-identified analytical workbook did not retain the underlying clinical note text or timestamps, limiting independent verification of the primary documentation indicator from the retained dataset alone. Individual FRAX calculator inputs were not retained in the de-identified analytical dataset, and estimates were calculated without BMD. Details of prior therapy and the original high-risk classification algorithm could not be independently verified retrospectively; numerical thresholds were reconstructed for analysis.

Recorded treatment might reflect existing therapy. Contraindication, management-plan, and referral fields did not verify clinical appropriateness, medication administration or follow-up completion. No workload, adherence, fracture, mortality, or quality-of-life outcomes were measured, and sustainability was not assessed. These findings describe documentation rather than patient benefit. The broad composite combined clinically distinct actions, and neither a recorded management response nor meeting a numerical NOGG intervention threshold established that the management provided was appropriate for an individual patient.

Implications for future improvement

Future work should combine FRAX probabilities, current treatment, relevant risk factors and NOGG interpretation with an explicit decision to treat, investigate, refer or defer. Each action should have an accountable clinician and documented completion. Prospective evaluation should retain screening logs, patient-level dates, staff exposure, balancing measures, and follow-up, while avoiding uncritical interpretation of age-capped estimates in patients older than 90 years.

The teaching and reference-guide approach could be adapted to other hospitals, although the sampling criteria, documentation processes, and implementation would need to reflect local admission pathways and electronic record systems.

Conclusions

Clinician-authored FRAX documentation within 72 hours was more frequent in sample 3 than sample 1 (17/30 versus 12/30 patients), but the difference was imprecisely estimated. The uncontrolled study design and uncertain individual intervention exposure prevent attribution of this change to the teaching or reference guide. Recorded bone-health management responses showed no clear corresponding improvement, and the descriptive pattern depended on whether referral alone was counted. These findings reflect documented assessments and recorded management responses rather than verified new prescribing, completed referrals, or patient benefit. Future quality improvement should connect fracture-risk assessment to explicit clinical decisions and confirm completion of planned actions.

Additional Information

Author Contributions

All authors have reviewed the final version to be published and agreed to be accountable for all aspects of the work.

Concept and design: Annelore Figari

Acquisition, analysis, or interpretation of data: Annelore Figari

Drafting of the manuscript: Annelore Figari

Critical review of the manuscript for important intellectual content: Annelore Figari

Disclosures

Human subjects: Informed consent for treatment and open access publication was obtained or waived by all participants in this study. **Animal subjects:** All authors have confirmed that this study did not involve animal subjects or tissue. **AI use statement:** The authors used OpenAI ChatGPT (GPT-6, October 2026) as follows: language polishing, structure or formatting in Introduction, Materials and Methods, Results, Discussion, Conclusions, and overall manuscript formatting. AI-generated suggestions were reviewed and edited by the author for consistency with the original manuscript, study methodology, and findings. AI was used to support manuscript preparation and presentation, rather than to generate patient data or independently validate statistical results. The author retains responsibility for the scientific interpretation, methodological decisions, and final conclusions, as well as verification of numerical results, factual statements, and references against the original study materials and cited publications. The authors confirm that they have reviewed and verified all AI-assisted content and take full responsibility for the work. **Conflicts of interest:** In compliance with the ICMJE uniform disclosure form, all authors declare the following: **Payment/services info:** All authors have declared that no financial support was received from any organization for the submitted work. **Financial relationships:** All authors have declared that they have no financial relationships at present or within the previous three years with any organizations that might have an interest in the submitted work. **Other relationships:** All authors have declared that there are no other relationships or activities that could appear to have influenced the submitted work.

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