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Osteoporosis management and fall-related complications in older adults: a retrospective study from the UMMC falls clinic

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Abstract

Background Osteoporosis, defined by a bone mineral density (BMD) of less than -2.5 SD, significantly increases fracture risk, especially among older adults. Falls in individuals with osteoporosis often result in severe complications, including fractures, reduced mobility, and diminished quality of life. This study explores fall-related complications and evaluates osteoporosis management at the University Malaya Medical Centre (UMMC) Falls Clinic.

Methods A retrospective cross-sectional study involving 563 patients was conducted from January 2020 to December 2022. Demographic data, fall characteristics, comorbidities, and treatment patterns were analyzed. Statistical analyses included chi-square tests and t-tests.

Results Of the 563 patients, 25.9% were diagnosed with osteoporosis, with 74.7% being female. Indoor falls were more common in the osteoporotic group (66%) compared to the non-osteoporotic group (46.6%). Fractures occurred in 63.4% of osteoporotic patients compared to 12% in the non-osteoporotic group. Calcium and vitamin D were commonly prescribed, but bisphosphonate usage remained low.

Conclusion Osteoporotic patients at a falls clinic are predominantly female and experience markedly higher fracture rates. Enhancing evidence-based pharmacotherapy uptake, systematic physiotherapy referral, and provider/patient education are needed. This study is limited by its retrospective design and single-center setting, which may limit the generalizability of the findings. Additionally, the patient population attending the Falls Clinic may represent a more motivated group, which could introduce selection bias.

Keywords Osteoporosis, Falls, Older adults, Management, Fractures

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Introduction

Falls among older adults represent a leading cause of morbidity, disability, and mortality worldwide. Approximately 28–35% of individuals aged 65 years and above experience at least one fall annually, often resulting in functional impairment, reduced independence, and diminished quality of life [1, 2]. Osteoporosis, characterised by low bone mineral density (BMD) and impaired bone strength, substantially increases the risk of fractures following falls, particularly of the hip, spine, and wrist, leading to long-term disability and increased healthcare expenditure [3, 4].

Despite the availability of effective pharmacological therapies such as bisphosphonates, denosumab, and teriparatide, osteoporosis remains underdiagnosed and undertreated globally [5, 6]. Early intervention is critical, as timely treatment can reduce fracture risk by up to 50%. However, treatment uptake remains suboptimal, especially among older adults who face barriers including poor awareness, concerns about side effects, and limited provider emphasis on guideline-based management [7].

In Malaysia, osteoporosis is an emerging public health concern. Population studies report that nearly one in four postmenopausal women have osteoporosis, with prevalence projected to rise as the population ages [8]. Hip fractures are associated with significant morbidity, mortality, and economic costs, with estimates suggesting a doubling of cases by 2050 without effective prevention strategies [9, 10]. Despite the existence of national Clinical Practice Guidelines (CPG), gaps remain in screening, diagnosis, and adherence to evidence-based management pathways [11].

Falls prevention is integral to osteoporosis management. The 2022 Malaysian CPG recommends routine fall-risk assessments and integration of exercise and physiotherapy into care for older adults [11]. Nevertheless, referral rates to physiotherapy remain low, and multidisciplinary fall-prevention strategies are inconsistently applied [12]. Dedicated services such as the Falls Clinic offer opportunities to combine fall risk evaluation with pharmacological treatment and rehabilitation, addressing both fracture prevention and functional outcomes. This study therefore aims to examine fall-related complications among patients with osteoporosis at the UMMC Falls Clinic and to identify treatment gaps and system-level opportunities for improvement.

Methods

This single-center, retrospective cross-sectional study was conducted at the University Malaya Medical Centre (UMMC) Falls Clinic, with data collected from January 2020 to December 2022. A total of 563 patients were included in the analysis. Patients were categorized into two groups based on their diagnosis: osteoporotic and

non-osteoporotic. Osteoporosis was defined by clinical diagnosis, supported by bone mineral density (BMD) measurements, with a BMD of less than -2.5 standard deviations (SD) as per the World Health Organization (WHO) criteria.

Inclusion and exclusion criteria

- Inclusion criteria: Patients aged 65 years and above who attended the Falls Clinic for evaluation and who had undergone BMD testing were included. Both newly diagnosed and previously diagnosed osteoporotic patients were considered.
- Exclusion criteria: Patients with incomplete medical records or those who had been diagnosed with other significant bone diseases (e.g., Paget's disease) were excluded from the study.

Data collection

Data were extracted from electronic medical records and included:

- Demographic information (age, gender).
- Fall characteristics (fall location, frequency, type of injuries).
- Comorbidities (hypertension, diabetes mellitus, dyslipidemia).
- Fracture occurrence (spine, hip, wrist).
- Treatment modalities for osteoporosis (calcium supplementation, vitamin D supplementation, bisphosphonates, denosumab, teriparatide, and romosozumab).

The treatment rates reported in this study reflect the treatments patients were already receiving at the time of their visit to the clinic. In cases where treatment was not initiated prior to the visit, appropriate pharmacologic therapies were prescribed during the clinic visit.

Statistical analysis

Descriptive statistics were used to summarize demographic characteristics and fall-related outcomes. Chi-square tests were used to compare categorical variables, and t-tests were used to compare continuous variables between the osteoporotic and non-osteoporotic groups. P-values < 0.05 were considered statistically significant. Data analysis was conducted using SPSS version 25 (IBM Corp, Armonk, NY, USA).

Ethical considerations

Ethics approval was obtained from the UMMC Research Ethics Committee (UMMC REF. No. 3407/2023). Informed consent was waived for the retrospective nature of the study, and all patient data were anonymized.

Table 1 Demographic and clinical characteristics

Characteristic	Osteoporotic (n = 146)	Non-Osteoporotic (n = 417)	p-value
Mean Age (years)	78.6 ± 6.0	72.4 ± 5.8	< 0.001
Female (%)	74.7	49.6	< 0.001
Indoor Falls (%)	66.0	46.6	< 0.001
Fracture (%)	63.4	12.0	< 0.001
Hypertension (%)	55.9	59.5	0.447
Diabetes Mellitus (%)	28.8	36.9	0.075
Dyslipidemia (%)	39.3	29.7	0.034

Table 2 Osteoporosis management and treatments

Treatment Type	Osteoporotic (%)
Calcium Supplementation	76.7
Vitamin D Supplementation	69.2
Bisphosphonates	50.0
Denosumab	17.8
Teriparatide	4.1
Romosozumab	0.7

to maintain confidentiality in accordance with ethical standards.

Results

Of 563 patients, 146 (25.9%) had osteoporosis; 74.7% were female. Indoor falls were more frequent in the osteoporotic group (66.0% vs. 46.6%, $p < 0.001$). Fractures occurred in 63.4% of osteoporotic patients vs. 12.0% of non-osteoporotic patients ($p < 0.001$) Table 1.

Treatment patterns: bisphosphonates 50.0%, denosumab 17.8%, teriparatide 4.1%. Calcium/vitamin D were widely prescribed. (See Table 2).

Discussion

Our study highlights a significant treatment gap in managing osteoporosis among older adults prone to falls. Female patients were more affected, consistent with global findings [13, 14]. Despite the availability of effective therapies such as bisphosphonates, denosumab, and teriparatide, underutilisation of anti-resorptive agents remains evident. Patient-related barriers include fear of side effects and poor adherence, while systemic challenges include medication cost and limited access. A lack of consistent provider training on national guidelines also contributes to suboptimal prescribing [7, 11]. While calcium and vitamin D supplementation is common, pharmacological treatments to reduce fracture risk are insufficiently prescribed, particularly in patients with advanced osteoporosis.

Rehabilitation gaps were also apparent. Limited physiotherapy referral reflects both the absence of structured referral pathways and the competing priorities of providers in busy clinics. Patient reluctance, cost, and resource constraints further reduce uptake. Strength and balance

training are strongly recommended in both Malaysian and international guidelines as core strategies for fall and fracture prevention [11, 12].

Proposed solutions include

- Embedding structured physiotherapy referral pathways into clinic workflows.
- Increasing provider education on the role of rehabilitation in fracture prevention.
- Expanding physiotherapy availability and patient education on its benefits.
- Implementing electronic prompts or care bundles that integrate pharmacological treatment with fall-prevention referrals.

Bridging the knowledge–action gap

Despite the availability of evidence-based osteoporosis guidelines, gaps remain between knowledge and implementation. Providers may be aware of recommendations but fail to act consistently due to time constraints, competing priorities, or lack of support systems [15].

Solutions include:

1. Healthcare provider education and decision support: Continuous professional development and electronic decision aids can improve adherence to guidelines.
2. Patient-centred strategies: Addressing concerns, providing clear information on benefits/risks, and offering follow-up support can improve treatment uptake.
3. Multidisciplinary care teams: Integrating geriatricians, physiotherapists, nutritionists, and pharmacists provides holistic care addressing both pharmacological management and fall prevention [11, 12].

The Falls Clinic plays an essential role in addressing the treatment gap by providing osteoporosis diagnosis and initiating pharmacologic treatment. The clinic also integrates fall prevention strategies, including physical therapy referrals, to improve overall patient outcomes.

This study has several limitations. The retrospective design and single-center nature of the study may limit the generalizability of the findings. Additionally, the patients who attended the Falls Clinic may represent a more motivated group, potentially introducing selection bias. These factors should be taken into account when interpreting the results.

Conclusion

There is a clear need to address the treatment gaps in osteoporosis management, particularly in older adults at risk for falls. Overcoming systemic barriers, improving patient compliance, and enhancing healthcare provider education are crucial steps toward improving osteoporosis treatment uptake. Similarly, integrating structured referral systems for physiotherapy and strengthening fall prevention programs are necessary to reduce the risk of fractures and improve patient outcomes. By implementing evidence-based strategies to bridge the knowledge-action gap, both healthcare providers and patients can work together to achieve better outcomes in osteoporosis management.

Authors' contributions

Izzati Saedon and Lok Jia Qi wrote the main manuscript text and both prepared figures. All authors reviewed the manuscript.

Funding

This study received no external funding.

Data availability

The datasets generated and/or analysed during the current study are not publicly available due to institutional data protection policies but are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the University Malaya Medical Centre (UMMC) Research Ethics Committee (Ref. No. 3407/2023). Informed consent for participation was obtained from all participants or their legal representatives as part of the Falls Clinic registry process. Patient confidentiality was maintained throughout the study.

Consent for publication

Not applicable. This manuscript does not contain any individual person's identifiable data, images, or clinical details.

Competing interests

The authors declare no competing interests.

Received: 8 April 2025 / Accepted: 4 November 2025

Published online: 22 November 2025

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