Pharmacists improving osteoporosis management in long-term care using fracture risk assessments: a feasibility study

Author names and affiliations

Catherine D Laird BPharm
ORCID 0000-0002-8550-2901
Corresponding author: catherine.d.laird@student.uts.edu.au
Graduate School of Health, University of Technology Sydney, PO Box 123, Sydney, NSW, 2007, Australia.

Kylie A Williams BPharm PhD
ORCID 0000-0002-5094-243X
Graduate School of Health, University of Technology Sydney, PO Box 123, Sydney, NSW, 2007, Australia.

Helen Benson BPharm PhD
ORCID 0000-0002-6918-5045
Graduate School of Health, University of Technology Sydney, PO Box 123, Sydney, NSW, 2007, Australia.

Running title

Improving osteoporosis management in long-term care

Key words

Fractures, osteoporosis, long-term care, pharmacists

Funding sources

Catherine Laird is supported by an Australian Government Research Training Program (RTP) Scholarship. The Australian Government had no direct involvement in the study.

Helen Benson and Kylie Williams received no funding for this research.

Word count

Abstract: 289

Main text: 2185

References: 32

Tables/Figures: 1

Brief summary

Sub-optimal osteoporosis management is widespread in long-term care. This study explores the feasibility of pharmacists utilizing a fracture risk assessment tool, to improve osteoporosis management.

Acknowledgements

Nil

Abstract

Objectives

The primary outcome of this study is to test the feasibility of pharmacists completing Fracture Risk Scale (FRS) assessments using resident data routinely held by long-term care (LTC) facilities. Secondary outcomes are to ascertain the proportion of residents assessed as high fracture risk who currently receive osteoporosis medicines and explore whether under or overuse of osteoporosis medicines is occurring based on residents' fracture risk.

Design

Feasibility study

Setting and Participants

Four LTC facilities from southeast Queensland, Australia, with a total of 281 residents, participated in the study during April and May 2024.

Methods

A pharmacist reviewed individual resident files for all residents of participating facilities. Necessary data was extracted from resident files to determine their fracture risk using the Fracture Risk Scale (FRS) manual calculation tool. Residents' use of osteoporosis medicines and nutritional supplements (vitamin D and calcium) was analysed based on their calculated fracture risk.

Results

FRS assessments were completed for 275 (97.9%) residents. There were 149 (54.2%) residents assessed as having a high fracture risk, of which 43 (28.9%) were prescribed an osteoporosis medicine. Conversely, 28 (22.2%) residents with a low fracture risk received an

osteoporosis medicine. Underuse of vitamin D and calcium supplements was found for all residents, irrespective of fracture risk.

Conclusions and Implications

The feasibility of pharmacists completing FRS assessments was demonstrated. Incorporating the FRS into routine clinical practice provides a promising means to support pharmacists advising on osteoporosis prescribing decisions for LTC residents. Widespread underuse of vitamin D and calcium for all LTC residents and the underuse of osteoporosis medicines by residents with a high fracture risk were found. Future research is necessary to establish if incorporating the FRS into clinical practice can address this undertreatment and reduce fracture rates in LTC.

Introduction

Osteoporosis is a condition in which the density and quality of bone are reduced, increasing the risk of fracture.[1] Osteoporotic fractures are associated with decreased quality of life, increased care requirements, and reduced life expectancy.[1-3] Osteoporosis is highly prevalent amongst residents in long-term care (LTC), with an estimated 80% of residents affected.[2] This high prevalence, combined with the high fall rate of LTC residents, contributes to residents experiencing fractures at a rate between two and eleven times greater than community-dwelling individuals.[2] Therefore, a proactive approach to fracture prevention for LTC residents is necessary to preserve their quality of life.[3]

Medications to counter the detrimental effect of osteoporosis on bone, thereby preventing fractures, are available.[3,4] However, widespread sub-optimal use of these medications is common in LTC facilities.[5-9] This was highlighted by a European study that found substantial undertreatment with osteoporosis medicines by residents with clinical factors indicative of a high fracture risk.[5] The study also identified possible overtreatment in residents unlikely to

85 experience benefit, given their clinical situation.[5] Enabling individualized prescribing
86 decisions based on the resident's health status, prognosis, care goals, and risk of experiencing
87 adverse effects is necessary to address the widespread sub-optimal management.[3,4,10,11]

88 As medication experts, pharmacists are well-positioned to take an active role in
89 individualized osteoporosis prescribing decisions.[12,13] Historically, the role of pharmacists in
90 LTC settings has been limited to dispensing medications.[13-15] However, there is increasing
91 international expansion of the pharmacist's role to include clinical activities to improve
92 medication management.[13-15] One potential activity is the completion of fracture risk
93 assessments.[12,16]

94 Completing fracture risk assessments is advocated to identify residents who should receive
95 osteoporosis medicines.[3,4,10] However, fracture risk assessment tools developed for
96 community-dwelling individuals, such as the Fracture Risk Assessment tool (FRAX) and the
97 Garvan Fracture Risk Calculator, are of limited value for guiding prescribing decisions
98 amongst LTC residents given their different risk profile.[3,10,17,18]Additionally, these tools
99 incorporate a BMD (bone mineral density) measurement, which can be challenging to obtain
100 for LTC residents.[10,17] Finally, they estimate the 5- to 10-year absolute fracture risk, which is
101 an inappropriately long time frame given the average 2.7 year life[19] expectancy of LTC
102 residents.[17-18]

103 The Fracture Risk Scale (FRS) is a fracture risk assessment tool designed for use in the LTC
104 setting.[17] It was developed and validated via a study involving 29,848 Canadian LTC
105 residents.[17] The tool uses a comprehensive set of clinical risk factors to predict 1-year fracture
106 risk without using BMD measurements.[17]

107 Pharmacists could potentially utilize the FRS assessment tool to support them in advising on
108 individualized osteoporosis prescribing decisions for LTC residents. This study seeks to

determine the feasibility of pharmacists completing FRS assessments utilising resident data routinely held by LTC facilities. Secondary outcomes are to ascertain the proportion of residents assessed as high fracture risk who currently receive osteoporosis medicines and explore if under or overuse of osteoporosis medicines is occurring, based on residents' fracture risk.

Methods

Ethics

This study was approved by the Human Research Ethics Committee (HREC) at the University of Technology Sydney (ETH24-9043). All LTC facilities provided written informed consent.

Study sample

A feasibility study was conducted in Australian LTC facilities. Sample size calculations determined that 255 individual residents would provide a representative sample of LTC residents receiving osteoporosis medicines. This sample size was based on a 95% confidence interval with a 5% margin of error, and a recently reported prevalence of osteoporosis medicine use by LTC residents of 21%.[6] Facilities were recruited to achieve the required sample size.

Data extraction and analysis

One pharmacist reviewed resident files for all residents of the participating LTC facilities in April and May 2024. Residents' sex, use of osteoporosis medicines and nutritional supplements, and necessary data to calculate the FRS score were extracted from residents' files.

Osteoporosis medicines and nutritional supplements were defined as those indicated for the treatment of osteoporosis in the Australian Medicines Handbook: alendronate, ibandronic acid, pamidronate, risedronate zoledronic acid, denosumab, raloxifene, anabolic agents romosozumab, teriparatide, calcium and vitamin D.[20]

FRS scores were calculated utilizing the Fracture Risk Scale: Manual Score Calculation tool.[21] This tool utilizes a flowchart to work through clinical risk factors and arrive at the FRS score. The clinical risk factors considered are the resident's age, body mass index (BMI), ability to walk in the corridor, transfer status, tendency to wander, cognitive function, fall history (last 30 days and last 180 days), and fracture history (last 180 days). Clinical risk factors and response options correspond to the Resident Assessment Instrument-Minimum Data Set (RAI-MDS) v2.0.[22] The pharmacist responsible for data extraction consulted with nurses and physiotherapists at the participating facilities to determine if and where necessary information could be located in resident files. The time taken to extract the necessary data to calculate the FRS score was recorded.

The FRS is scored from 1 (lowest risk) to 8 (highest risk), with residents classified as having a low fracture risk if they have a FRS ≤ 3 and high risk if they have a FRS score of ≥ 4.[17] Fracture prevention recommendations based on FRS risk levels have been developed.[23] All residents should receive vitamin D supplementation and adequate calcium intake.[23] Preferably, calcium is sourced from dietary means; however, a supplement is advised if this is not possible.[23] In addition to vitamin D supplementation and adequate calcium intake, residents at high fracture risk should receive an osteoporosis medicine.[23]

Residents' use of osteoporosis medicines and nutritional supplements was compared based on their fracture risk. Statistical analysis was completed using SPSS® software,[24] including the use of the chi-square test for independence with statistical significance set at $p<0.05$.

Results

Four independent LTC facilities from southeast Queensland, Australia, participated in the study, with a total of 281 residents. The mean age of residents was 85.3 (± 7.5) years, and 162 (57.7%) were female.

Consultation with nurses and physiotherapists determined that the necessary information to complete the FRS, consistent with the descriptions of clinical risk factors provided in the RAI-MDS v2.0, was available in the resident files at all four facilities. Necessary information was found to be documented at the LTC facilities as part of their requirements under the Aged Care Quality Standards[25] and the National Aged Care Mandatory Quality Indicator Program (QI Program).[26] Age and BMI were recorded in the resident's summary of clinical information. Residents' ability to walk in the corridor and transfer status were recorded in their mobility assessment, completed by a physiotherapist. Residents' tendency to wander was obtained from their behavior chart, in which nurses document the occurrence and frequency of wandering. At all facilities, residents' cognitive function had been assessed by nurses using the Mini-Mental Status Examination (MMSE),[27] with results recorded in their files. The comparison of MMSE scores and Cognitive Performance Scale scores presented in Appendix A of the RAI-MDS v2.0[22] was used to classify residents' cognitive function. All falls and fractures were recorded by nurses in residents' incident records.

FRS scores were calculated for 275 (97.9%) residents, of which 149 (54.2%) had a high fracture risk. In the six cases where an FRS score could not be calculated, this was due to an insufficient fall history. These residents were all recent admissions; their fall history before admission was not recorded in their facility file.

At all facilities, resident files were electronic, enabling relevant information, records and assessments to be easily accessed by opening the appropriate tab and using search functions.

Once the resident's file was opened, the median time to locate and extract the necessary data to calculate the FRS score was 1m 54s (range: 1m 07s – 6m 46s). The number of data points required to calculate the FRS varied from two to five per the manual calculation score flow-chart (2 data points (n=62, 22.5%), 3 data points (n=63, 22.9%), 4 data points (n=145, 52.7%), 5 data points (n=5, 1.8%)).

Table 1 details the use of osteoporosis medicines and nutritional supplements by the 275 residents for whom a FRS was calculated. Osteoporosis medicines were prescribed to a total of 71 (25.8%) residents, of which 28 were assessed as having a low fracture risk and 43 had a high fracture risk. Vitamin D supplements were taken by 168 (61.1%) residents, and 28 (10.2%) received calcium supplements. No significant relationship was found between fracture risk and the use of osteoporosis medicines and nutritional supplements, either alone or in combination.

Discussion

This study demonstrated the feasibility of pharmacists completing FRS assessments utilising data routinely held by LTC facilities. FRS scores were calculated for 97.9% of residents, with the necessary data available in resident files within assessments and records completed by the facilities to fulfill requirements of the Aged Care Quality Standards[25] and the QI Program.[26] Further, the time taken to calculate the FRS scores suggests that it would be reasonable to incorporate this tool into established pharmacist clinical services, such as medication reviews.[14] The time taken to calculate the FRS was surprisingly quick. This was reflective of all resident files being electronic and only 2 or 3 data points being required to calculate the FRS score for 45.4% of residents.

Having established the feasibility of pharmacists completing FRS assessments, further research is necessary to determine if using the FRS can reduce fracture rates in LTC. This

will require validation that FRS scores reliably predict fracture rates for Australian aged-care residents. Determining how to best incorporate the FRS into clinical practice to support prescribing decisions is also necessary. Noting that the resident's fracture risk alone should not determine prescribing decisions; rather, fracture risk should be considered alongside the resident's overall clinical status and care goals. One option for incorporating the FRS into clinical practice is to embed it into electronic clinical assessment and decision support tools. This has occurred in Canada, where the FRS has been embedded in the RAI-MDS 2.0 and Long-Term Care Facilities Assessment System (LTCF).[28] The effectiveness of using the FRS in this manner, supported by an education program for LTC healthcare staff, for decreasing hip fractures is being investigated.[29]

Analysis of osteoporosis medicine and nutritional supplement use identified key focus areas for pharmacists when advising on prescribing decisions. These are the underuse of osteoporosis medicines by residents with high fracture risk, potential deprescribing of osteoporosis medicines for residents with low fracture risk, and widespread underuse of vitamin D and calcium.

Consensus recommendations for osteoporosis management in LTC residents advise osteoporosis medicines should be prescribed to those with a high fracture risk.[3,23] In this study, only 28.9% of these residents were prescribed an osteoporosis medicine, while 22.2% of residents with a low fracture risk received one. These findings are consistent with previous studies that have found both under and overuse of osteoporosis medicines in the LTC population.[5,7,8] It is likely that the use of osteoporosis medicines by residents with low fracture risk reflects residents who have experienced a decline in functional status, resulting in a reduction in their fracture risk. Therefore, pharmacists could employ the FRS to identify residents who would benefit from treatment commencement and also identify potential deprescribing opportunities.

Underuse of the nutritional supplements, vitamin D and calcium, was deemed to be widespread amongst all residents, irrespective of fracture risk. Vitamin D supplements are advocated for all LTC residents, given the high prevalence of deficiency in this population which is linked to an increased rate of falls and fractures.[3,23] Despite this, only 61.1% of residents in this study were prescribed a vitamin D supplement, consistent with the use of vitamin D reported in other studies involving LTC residents.[5,6,30,31] Clinical guidelines and consensus recommendations advocate calcium supplementation for residents with inadequate dietary intake.[3,4,10,23] In this study, only 10.2% of residents received a calcium supplement, comparable with the low rates reported in other studies.[5,6] As residents' dietary intake was not assessed, it is not possible to comment on the extent to which this represents undertreatment. However, given reports that malnourishment is widespread in LTC facilities,[32] the use of calcium supplements would be expected to be significantly higher than that observed. Accordingly, there is a need to ensure all residents receive vitamin D and calcium supplements when indicated.

Limitations

Some limitations must be acknowledged. A single pharmacist completed data extraction and FRS assessments. Multiple pharmacists completing FRS at a wider range of facilities would enhance the confidence and generalisability of the study results. It is possible that resident files were incomplete, resulting in incorrect calculation of FRS scores; however, auditing of LTC facilities' compliance with the Quality Standards[25] and the QI Program[26] reduces this risk. Furthermore, osteoporosis medicine use was obtained from LTC facility medication charts. Intermittently administered osteoporosis medicines, such as denosumab and zoledronic acid, may be omitted from these charts.[6,12] Use of a secondary record to confirm prescribed medications could increase confidence in the results.

Conclusions and Implications

This study demonstrated that it is feasible for pharmacists to determine residents' fracture risk using the FRS and data held in resident files. Incorporating the FRS into clinical practice provides a promising means to support pharmacists when advising on individualized osteoporosis prescribing decisions and should be the subject of future research. Aspects of osteoporosis management that should receive focussed attention are increasing the use of osteoporosis medicines by residents with high fracture risk and addressing the widespread underuse of vitamin D and calcium supplements.

Conflicts of interest

The authors have no conflicts of interest to declare.

References

1. NIH Consensus Development Panel on Osteoporosis Prevention, Diagnosis, and Therapy. Osteoporosis prevention, diagnosis, and therapy. JAMA 2001;285:785–95.
2. Australian Institute of Musculoskeletal Science. Osteoporosis in Residential Aged Care. https://osteoporosisrac.aimss.org.au/tools-resources/ . Accessed on January 3, 2024.
3. Duque G, Iuliano S, Close JCT, et al. Prevention of Osteoporotic Fractures in Residential Aged Care: Updated Consensus Recommendations. J Am Med Dir Assoc 2022;23(5):756-63.
4. The Royal Australian College of General Practitioners. RACGP aged care clinical guide (Silver Book). 5th Ed. East Melbourne, Victoria: RACGP, 2019.
5. Makan AM, Hout G, Onder H, et al. Pharmacological management of osteoporosis in nursing home residents: the Shelter study. Maturitas 2021;143:184-9.
6. Laird C, Williams KA, Benson H. Osteoporosis management in Australian aged care facilities: a mixed method study. Arch Osteoporosis 2024. 19(1):37.

7. Lind KE, Jorgensen ML, Gray LC, et al. Anti-osteoporosis medication use in a high fracture-risk population: Contemporary trends in Australian residential aged care facilities. Health Serv Insights 2019;12:1-11.
8. Niznik JD, Li X, Gilliam MA, et al. Are Nursing Home Residents with Dementia Appropriately Treated for Fracture Prevention? J Am Med Dir Assoc 2021;22(1):28-35.e23.
9. Kalisch Ellet LM, Kassie GM, Caughey GE et al. Medication-related hospital admissions in aged care residents. Australas J Ageing 2021;40(4):e323-31.
10. Niznik JD, Gilliam MA, Colón-Emeric C, et al. Controversies in Osteoporosis Treatment of Nursing Home Residents. J Am Med Dir Assoc 2022;23(12):1928-34.
11. Sloane PD, Brandt NJ, Cherubini A, et al. Medications in Post-Acute and Long-Term Care: Challenges and Controversies. J Am Med Dir Assoc 2021;22(1):1-5.
12. Laird C, Williams KA, Benson H. Perceptions and practices of aged care pharmacists regarding osteoporosis management: a qualitative study. Int J Clin Pharm 2023; 45(4):913-21.
13. Pharmaceutical Society of Australia. Submission to the Royal Commission into Aged Care Quality and Safety. https://my.psa.org.au/servlet/fileField?entityId=ka10o0000005aO0AAI&field=PDF_File_Member_Content__Body__s. Accessed on September 24, 2024.
14. Haider I, Naunton M, Davey R, et al. How do pharmacists practice in aged care? A narrative review of models from Australia, England, and the United States of America. Int J Environ Res Public Health 2021;18:12773.
15. Royal Pharmaceutical Society. The right medicine: improving care in care homes.https://www.rpharms.com/Portals/0/RPS%20document%20library/Open%20acces

s/Publications/The%20Right%20Medicine%20-%20Care%20Home%20Report.pdf?ver=2016-10-19-134849-913 . Accessed on September 24, 2024.

16. Laird C, Benson H, Williams KA. Pharmacist interventions in osteoporosis management: a systematic review. Osteoporos Int 2023;34(2):239-54.
17. Ioannidis G, Jantzi M, Bucek J, et al. Development and validation of the Fracture Risk Scale (FRS) that predicts fracture over a 1-year time period in institutionalised frail older people living in Canada: an electronic record-linked longitudinal cohort study. BMJ Open 2017;7(9):e016477.
18. Berry SD, Zullo AR, Lee Y, et al. Fracture Risk Assessment in Long-term Care (FRAiL): Development and Validation of a Prediction Model. J Gerontol A Biol Sci Med Sci 2018;73(6):763-9.
19. Australian Institute of Health and Welfare. GEN fact sheet 2018-2019: People leaving aged care. https://www.gen-agedcaredata.gov.au/getmedia/4ea25f16-2b62-436d-bab8-29a987b30d89/People-leaving-aged-care-fact-sheet-2018%E2%80%9319.pdf . Accessed on September 24, 2024.
20. Australian Medicines Handbook (online). Adelaide: Australian Medicines Handbook Pty Ltd, 2024, July.
21. GERAS Centre. Fracture Risk Scale: Manual Score Calculation. https://www.gerascentre.ca/wp-content/uploads/Fracture-Risk-Scale-Manual-Calculation-Tool-7Dec21.pdf . Accessed November 23, 2023.
22. Morris JN, Hawes C, Mor V, Phillips C, Fries BE, Nonemaker S, et al. Resident Assessment Instrument (RAI) RAI-MDS 2.0 User's Manual, Canadian Version, Washington DC: interRAI, 2010.

23. McArthur C, Hillier L, Ioannidis G, et al. Developing a Fracture Risk Clinical Assessment Protocol for Long-Term Care: A Modified Delphi Consensus Process. J Am Med Dir Assoc 2021;22(8):1726-1734.e8.
24. IBM Corp. Released 2022. IBM SPSS Statistics for Windows, Version 29.0. Armonk, NY: IBM Corp.
25. Aged Care Quality and Safety Commission, Australian Government. Quality Standards. https://www.agedcarequality.gov.au/providers/quality-standards . Accessed on October 22, 2024.
26. Department of Health and Aged Care, Australian Government. National Aged Care Mandatory Quality Indicator Program (QI Program). https://www.health.gov.au/our-work/qi-program#:~:text=The%20QI%20Program%20collects%20information%20from%20residential%20aged,services%20for%20older%20people%20living%20in%20residential%20care. . Accessed on October 22, 2024.
27. Folstein M, Folstein SE, McHugh, P.R. “Mini-Mental State” a Practical Method for Grading the Cognitive State of Patients for the Clinician. J Psychiatr Res 1975;12(3): 189-98.
28. GERAS Centre. Fracture Risk Scale (FRS). https://www.gerascentre.ca/our-guidelines/fracture-risk-scale-frs/ . Accessed on January 7, 2025.
29. GERAS Centre. PREVENT- Person-centred Routine Fracture Prevention in LTC. https://www.gerascentre.ca/our-research/prevent/ . Accessed on January 7, 2025.
30. Walker P, Miller Amberber A, Kurrle S, et al. Prevalence of vitamin D supplement use in Australian residential aged care facilities in November 2014. BMC Res Notes 2017; 10(1):385.

348 31. Robbins RN, Serra M, Ranjit N, et al. Efficacy of various prescribed vitamin D
349 supplementation regimens on 25-hydroxyvitamin D serum levels in long-term care.
350 Public Health Nutr 2022;25(1), 82-9.
351 32. O'Shea MC, Bauer J, Barrett C, et al. Malnutrition Prevalence in Australian Residential
352 Aged Care Facilities: A Cross-Sectional Study. Healthcare 2024;12(13):1296.

353

354 Table 1 Osteoporosis medicine and nutritional supplement use according to fracture risk

Medication	**Low Fracture Risk (n=126)**	**High Fracture Risk (n=149)**	**Overall (n=275)**
No treatment	43	47	90
Osteoporosis medicine alone	3	12	15
Osteoporosis medicine with vitamin D	17	20	37
Osteoporosis medicine with vitamin D and calcium	8	11	19
Vitamin D alone	51	54	105
Calcium alone	0	1	1
Vitamin D with calcium	4	4	8

355