

Hip Fractures in Older Adults in 2019

Sarah D. Berry, MD, MPH; Douglas P. Kiel, MD, MPH; Cathleen Colón-Emeric, MD

The incidence of osteoporotic fracture increases exponentially throughout life, as does the risk of the devastating consequences of these fractures, including functional decline, institutionalization, mortality, and destitution.¹



Related article [page 2233](#)

Adults in their eighth and ninth decades of life are less likely to be screened and treated for osteoporosis than younger individuals. Guidelines for pharmacologic treatment suggest using 10-year fracture risk estimations, but they do not address decision making for patients with life expectancies less than 10 years. Further, existing fracture risk calculators do not include many comorbidities or frailty characteristics common in older adults that influence risk-benefit assessment when considering pharmacologic treatment as a preventive measure for osteoporosis.

An approach to fracture prevention in older community-dwelling adults is reviewed, including an estimation of fracture risk and life expectancy, shared decision making for pharmacologic interventions, and important nonpharmacologic prevention strategies.

Estimating Fracture Risk

Many tools exist to estimate fracture risk.² Bone mineral density (BMD), assessed by dual-energy x-ray absorptiometry and clinically used because T-scores are a strong predictor of future fracture, is included in some of these models. The FRAX tool (University of Sheffield) is the most validated and commonly used fracture prediction model. Individuals with a 10-year estimated risk of major osteoporotic fracture between 10% and 20% are at moderate fracture risk, whereas individuals with an estimated risk of at least 20% have a high risk for fracture.²

Despite the many strengths of the FRAX tool in estimating fracture risk, it omits important fracture risk factors in older adults, including falls, cognitive impairment, urinary incontinence, neurological conditions, and medications. When estimating fracture risk and considering pharmacologic treatment, additional geriatric assessments that are not included in most fracture prediction tools should be considered, such as tests of cognition, vision, gait and balance, and polypharmacy. Currently, there is no evidence to guide how these assessments should be factored into the risk calculation. In the absence of evidence, a practical suggestion is that if a patient is near the threshold for pharmacologic treatment and has abnormal findings from these assessments, a clinician should consider the patient to have a higher risk for fracture than derived from the commonly used risk calculators and consider pharmacologic treatment.

In the United States, pharmacologic therapy is recommended^{2,3} in individuals with (1) hip or vertebral fracture, (2) BMD T-scores less than or equal to -2.5 , or (3) BMD T-scores between -1.0 and -2.5 and a 10-year probability of hip fracture of at least 3% or 10-year probability of major osteoporotic fracture of at least 20%. For example, using the FRAX model, an 80-year-old woman with a body mass index of 26, a BMD T-score of -2.0 , and no additional risk factors for fracture has an estimated 10-year risk of hip fracture of 4.7% and of major osteoporotic fracture of 16%. Although the hip fracture risk is over the 3% threshold for starting pharmacologic treatment, many patients and

clinicians may elect to monitor a patient without treatment given the relatively low major osteoporotic fracture risk. However, if this patient also had mild dementia and a recent fall, her fracture risk would be substantially higher than estimated by the FRAX, and this knowledge might lower the threshold to pursue pharmacologic treatment.

Estimating Life Expectancy

Although the current osteoporosis treatment guidelines do not explicitly address life expectancy, it is an important consideration when choosing preventive treatment. There is substantial heterogeneity in life expectancy among older adults. Median life expectancy for an 80-year-old woman is approximately 10 years; however, for women in the "healthiest" quartile, life expectancy is more than 14 years, whereas for women in the "sickest" quartile, life expectancy is less than 5 years.⁴ Clinicians tend to overestimate survival, and so it is recommended to instead use standardized tools, such as life tables or ePrognosis (University of California, San Francisco), to estimate remaining life expectancy. Clinicians should be aware that FRAX estimates for median life expectancy.

It may take more than 10 years before the benefits of cancer screening are observed. In contrast, the benefits of oral osteoporosis medications may occur at 6 to 12 months, and the benefits for effective fall prevention interventions might be immediate. As age increases, the number needed to treat to prevent 1 hip fracture declines until after the age of 80 years.⁵ Despite a shorter life expectancy, a woman aged 90 years still has a substantially higher lifetime fracture risk and lower number needed to treat to prevent 1 hip fracture than a woman aged 70 years. Therefore, in contrast to cancer and other screening and prevention services, for which the benefits of screening cease beyond some age threshold, the effectiveness of fracture prevention increases with advancing age.

Economic models suggest that it might be cost effective to treat older women for fracture reduction who have life expectancies of as little as 2 years.⁴ If life expectancy is less than 1 year, pharmacologic osteoporosis treatment should not be provided.

Selecting an Appropriate Medication

Oral bisphosphonates are often considered first-line therapy for individuals with osteoporosis, and the number of older adults (mean age, 85 years) needed to treat to prevent 1 hip fracture is approximately 200.⁶ Although oral bisphosphonates are the most cost-effective therapy, other considerations in choosing therapy for older and more frail patients include pill burden and comorbidities. Patients already prescribed multiple oral medications for other conditions may prefer annual or biannual formulations. Intravenous (eg, zoledronic acid) or subcutaneous (eg, denosumab) formulations may be preferable for individuals with dysphagia or poor adherence to medication. Stage 4 to 5 chronic kidney disease is common with aging, and denosumab is a preferred agent for these patients. Zoledronic acid is available at a typical cost of less than \$200 per annual infusion, whereas denosumab costs around \$2000 annually. Limited data from post hoc analyses of randomized clinical trials and observational studies suggest

Figure. Managing Medications in Older Adults at Risk for Fracture

MEDICATION REVIEW									
Older patient at high risk for hip and other fractures <ul style="list-style-type: none"> • Prior hip or vertebral fracture • T-score ≤ -2.5 at any site • High FRAX 10-year fracture risk ($\geq 3\%$ for hip or $\geq 20\%$ for major fracture) • Borderline FRAX score with prior fall or additional risk factors 									
Deprescribe fall-related medications <ul style="list-style-type: none"> Consider discontinuing or tapering to lowest effective dose Benzodiazepines Antipsychotics Antidepressants Anticholinergics Opiates Sedative-hypnotics Antihypertensives if blood pressure is below target or the patient has orthostatic hypertension Hypoglycemics if hemoglobin A_{1c} < 7.5 	Prescribe bone-protective medications <ul style="list-style-type: none"> • Ensure vitamin D sufficiency and dietary or supplemental calcium intake ≥ 1200 mg daily • Determine life expectancy ≥ 2 y <p>Standard first-line therapy Oral bisphosphonates</p> <p>Alternate first-line therapies</p> <table border="1"> <thead> <tr> <th>Condition</th> <th>Medication</th> </tr> </thead> <tbody> <tr> <td>Chronic kidney disease stage 4-5^a</td> <td>Denosumab</td> </tr> <tr> <td>Severe osteoporosis</td> <td>Romosozumab or abaloparatide</td> </tr> <tr> <td>Dysphagia</td> <td>Intravenous bisphosphonates or denosumab</td> </tr> </tbody> </table>	Condition	Medication	Chronic kidney disease stage 4-5 ^a	Denosumab	Severe osteoporosis	Romosozumab or abaloparatide	Dysphagia	Intravenous bisphosphonates or denosumab
Condition	Medication								
Chronic kidney disease stage 4-5 ^a	Denosumab								
Severe osteoporosis	Romosozumab or abaloparatide								
Dysphagia	Intravenous bisphosphonates or denosumab								
^a Stage IV chronic kidney disease: creatinine clearance 15-29 mL/min; stage V chronic kidney disease: creatinine clearance < 15 mL/min or receiving dialysis.									

osteoporosis drugs are safe and effective in older patients.^{2,6} Monitoring patients during bisphosphonate treatment with repeat dual-energy x-ray absorptiometry is not necessary.⁷

Shared Decision Making

Preventing fractures is a priority for many older adults; in a survey of 194 women (mean age, 83 years), 80% reported that they would prefer death rather than a hip fracture leading to institutionalization.⁸ Older adults are also concerned with polypharmacy and rare but serious adverse events associated with osteoporosis treatment.³ It is important for clinicians to help patients navigate the potential risks and benefits of treatment and involve family or caregivers when the

patient has or is suspected to have cognitive impairment. Decision aids for osteoporosis treatment exist, such as the Mayo Clinic Shared Decision Making National Resource Center, and may facilitate treatment decisions. Shared decision making with clear descriptions of benefits and risks may have the added benefit of encouraging treatment adherence, because osteoporosis medications are often discontinued within months.

Essential Fall Prevention Strategies

Regardless of the decision to treat individuals pharmacologically, all older patients should receive fall risk assessment and prevention counseling. Fall prevention starts with asking patients about falls. Patients with a fall or fear of falling should undergo gait and balance assessment.⁹ If gait is abnormal, a comprehensive assessment of fall risk factors should include testing for visual impairment, orthostatic hypotension, improper footwear, and medication review. Patients with impaired gait or balance should be referred to physical therapy for supervised exercises,^{9,10} and all patients should be encouraged to exercise regularly. Medication use is among the most common and modifiable risk factors for falls in older adults. Evidence from clinical trials supports deprescribing (ie, discontinuing or reducing the dose of) psychoactive and, probably, cardiometabolic drugs as an effective strategy to prevent falls.¹⁰ Clinicians may be conflicted with the choice between wanting to reduce polypharmacy and starting osteoporosis medications to reduce fracture risk. Nonetheless, this dual approach (ie, stopping medications that cause falls and starting a medication for osteoporosis) is appropriate in older adults with many comorbidities who prioritize fracture prevention. The Figure describes this recommended approach to managing medications in older adults at risk for falls and fracture.

Conclusions

Preventing fractures in older community-dwelling adults requires careful consideration of an individual's estimated fracture risk, life expectancy, and health priorities. Clinicians must consider pharmacologic and nonpharmacologic interventions to reduce fracture burden in this vulnerable population.

ARTICLE INFORMATION

Author Affiliations: Hinda and Arthur Marcus Institute for Aging Research, Hebrew SeniorLife, Boston, Massachusetts (Berry, Kiel); Department of Medicine, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts (Berry, Kiel); Duke University School of Medicine, Durham, North Carolina (Colón-Emeric).

Corresponding Author: Sarah D. Berry, MD, MPH, Hinda and Arthur Marcus Institute for Aging Research, Hebrew SeniorLife, 1200 Centre St, Boston, MA 02131 (sarahberry@hsl.harvard.edu).

Published Online: May 10, 2019.
doi:10.1001/jama.2019.5453

Conflict of Interest Disclosures: Dr Berry reported grants from Amgen as the co-investigator on a project investigating bone mineral density change in adults undergoing osteoporosis treatment and receiving royalties from Wolters-Kluwer for a chapter on falls. Dr Kiel reported personal fees from Wolters-Kluwer for an UpToDate chapter and an editor stipend from Springer for a book on osteoporosis. Dr Colón-Emeric reported receiving

grants from Policy Analysis to analyze risk factors for short-term fracture risk and the National Dairy Council as a co-investigator on a project examining dairy and bone measures.

REFERENCES

1. Tajeu GS, Delzell E, Smith W, et al. Death, debility, and destitution following hip fracture. *J Gerontol A Biol Sci Med Sci.* 2014;69(3):346-353.
2. Viswanathan M, Reddy S, Berkman N, et al. Screening to prevent osteoporotic fractures: updated evidence report and systematic review for the US Preventive Services Task Force. *JAMA.* 2018; 319(24):2532-2551. doi:10.1001/jama.2018.6537
3. Drugs for postmenopausal osteoporosis. *Med Lett Drugs Ther.* 2017;59(1536):203-210.
4. Pham AN, Datta SK, Weber TJ, Walter LC, Colón-Emeric CS. Cost-effectiveness of oral bisphosphonates for osteoporosis at different ages and levels of life expectancy. *J Am Geriatr Soc.* 2011; 59(9):1642-1649.
5. Wells GA, Cranney A, Peterson J, et al. Alendronate for the primary and secondary

prevention of osteoporotic fractures in postmenopausal women. *Cochrane Database Syst Rev.* 2008;(1):CD001155.

6. Zullo AR, Zhang T, Lee Y, et al. Effect of bisphosphonates on fracture outcomes among frail older adults. *J Am Geriatr Soc.* 2019;67(4):768-776
7. Burns RB, Rosen H, Berry S, Smetana GW. How would you manage this patient with osteoporosis? Grand Rounds discussion from Beth Israel Deaconess Medical Center. *Ann Intern Med.* 2018; 168(11):801-808. doi:10.7326/M18-0950
8. Salkeld G, Cameron ID, Cumming RG, et al. Quality of life related to fear of falling and hip fracture in older women. *BMJ.* 2000;320(7231): 341-346.
9. Stevens JA. The STEADI tool kit: a fall prevention resource for health care providers. *IHS Prim Care Provid.* 2013;39(9):162-166.
10. Hopewell S, Adedire O, Copey BJ, et al. Multifactorial and multiple component interventions for preventing falls in older people living in the community. *Cochrane Database Syst Rev.* 2018;7:CD012221.