

# Use of Clinical Practice Guidelines and Quality Metrics to Assess Primary Care Management of Osteoporosis

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Kathlene Camp, PT, DPT<sup>1</sup> , Jessica Hartos, PhD<sup>2</sup>, and Adenike Atanda, PharmD, BCACP, CDCES, CTTS<sup>1</sup>

## Abstract

**Background:** Clinical practice guidelines and quality measures provide recommendations for physicians addressing osteoporosis management. This study explored the alignment of osteoporosis clinical practice in a primary care geriatric clinic with recommended guidelines. **Methods:** This retrospective chart review included 388 patients 65 or older from a primary care geriatric clinic diagnosed with osteopenia or osteoporosis, with or without a fragility fracture. Data included history of falls and use of DXA scans, FRAX® fracture risk assessment tool, osteoporosis medication, and fall risk mitigation plans. **Results:** For age-related primary fracture prevention, 68% of women and 87% of men had documented DXA scans, and 45% of patients diagnosed with osteoporosis and 42% determined at high risk were prescribed osteoporosis medication. For secondary fracture prevention, 72% of women aged 67 to 85 had DXA scans and 21% were prescribed osteoporosis medication. Only 10% of patients with a history of falls had documented fall risk management plans. **Conclusion:** Although showing higher rates of primary and secondary prevention outcomes than did research results from general primary care, gaps were identified for high fracture risk patients and fall risk management documentation. Medical record review may not provide sufficient data to capture factors influencing decision-making for fracture prevention.

## Keywords

osteoporosis, prevention, clinical geriatrics, quality improvement

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## Introduction

Osteoporosis has been termed a “silent disease” since its presence is often not determined until after a fracture. As such, primary care providers have a critical role in assessing bone health issues and should pay close attention when conducting wellness visits and addressing comorbidities (Singer et al., 2023). Lack of primary prevention and delayed intervention of fragility fractures have been deemed costly (Lewiecki et al., 2019), and elderly individuals suffering from fractures face lengthy hospitalizations, require long-term care, lose independence, and have an increased risk of mortality in the following year (Lewiecki et al., 2019). This economic and clinical burden is expected to escalate due to the growing aging population. The projected rise in the number of individuals diagnosed with osteopenia or osteoporosis impacts all ethnicities and genders (Wright et al., 2014), with prevalence for men likely underestimated (Rinonapoli et al., 2021).

Existing clinical practice guidelines for osteoporosis and fracture prevention provide evidence-based clinical

recommendations in conjunction with quality measures that can be used to guide and monitor health performance delivery and quality improvement initiatives. Primary prevention includes controlling bone loss and fracture prevention through early identification and intervention. Clinical practice guidelines suggest performing a dual-energy absorptiometry x-ray (DXA) bone mineral density (BMD) scan for osteoporosis in women 65 years and older (Curry et al., 2018; LeBoff et al., 2022) and in men 70 years and older (LeBoff et al., 2022). Earlier screening is warranted for those greater than 50 years old with risk factors (Camacho et al., 2020; Curry et al., 2018; LeBoff et al., 2022) or in the presence

<sup>1</sup>University of North Texas Health Science Center, Fort Worth, USA

<sup>2</sup>UTHealth Houston, TX, USA

### Corresponding Author:

Kathlene Camp, Department of Internal Medicine and Geriatrics, University of North Texas Health Science Center, 855 Montgomery Street, Suite 459, Fort Worth, TX 76107, USA.

Email: Kathlene.camp@unthsc.edu



of a fragility fracture (LeBoff et al., 2022). As a quality measure, women aged 65 to 75 are targeted for tracking screening (National committee for Quality Assurance, 2017c). Clinical practice guidelines suggest using a fracture risk assessment tool, such as FRAX<sup>®</sup>, to direct early screening or osteoporosis pharmacotherapy intervention, with a 10-year hip fracture risk  $\geq 3\%$  or overall significant osteoporosis-related fracture risk  $\geq 20\%$  suggestive of consideration for medication to prevent fractures (Camacho et al., 2020; LeBoff et al., 2022).

For secondary fracture prevention, guidelines suggest pharmacotherapy intervention for patients with (a) hip or vertebral fractures regardless of bone mineral density (BMD), (b) pelvis, proximal humerus or distal forearm fractures and osteopenia, and (c) a high risk of falls, injurious falls and a FRAX<sup>®</sup> fracture risk deemed at high risk (Camacho et al., 2020; LeBoff et al., 2022). A quality measure explicitly targets women 67 to 85 years of age with a fracture for incidence of DXA screening or osteoporosis medication use within the first 6 months after a fragility fracture (National committee for Quality Assurance, 2017b) due to the risk of subsequent fractures. Subsequent fracture risk for women  $\geq 65$  years of age increases yearly, with reports of 10% within the first year, 18% within 2 years, and 31% within 5 years (Balasubramanian et al., 2019). This risk is even higher with advancing age and the presence of clinical vertebral fractures (Balasubramanian et al., 2019).

Because falls are a well-established predictor of fractures, fall prevention is integral to addressing primary and secondary fracture prevention. Interventions to address common fall risk-related factors are reported to have the potential for reducing falls by up to 24% and averting \$94 million to \$442 million in fall-related costs (Stevens & Lee, 2018). As such, fall risk management should be assessed with all adults 65 and older to address balance and falls at least annually and complete mitigation plans with those who have experienced or are at risk for a fall (National Committee for Quality Assurance, 2017a).

Despite recommendations, research shows that clinical practice guidelines and quality measures associated with osteoporosis and fracture risk management are not necessarily optimized. For example, a study reviewing data from 2008 to 2014 revealed that DXA BMD screening for primary prevention might occur in less than 25% of privately insured women ages 65 and older and may be much lower for minority women (Gillespie & Morin, 2017). Even following a fracture, persistent gaps remain in primary care management of risk as research indicates that only one-third of providers utilized DXA BMD scans to investigate continued fracture risk or guide treatment decisions (Mendis et al., 2017). Fall prevention intervention has also shown to be lacking with survey research (Qin & Baccaglini, 2016) indicating that up to 70% of fallers reported never receiving education on fall prevention during primary care visits.

Previous research on osteoporosis management within primary care settings has singularly explored performance in primary (Amarnath et al., 2015) or secondary fracture prevention (Gillespie & Morin, 2017) using guidelines and quality measures, but no specific studies to date explore performance in both primary and secondary prevention utilizing guidelines and quality measures, especially within a geriatric medicine clinic. It is assumed that alignment may be higher in such clinics where the older adult and related health conditions are the care focus. The purpose of this study was to assess the degree of alignment with clinical practice guidelines and quality measures related to primary and secondary fracture prevention for women and men within a primary care geriatric clinic to measure bone quality, assess fracture risk, and implement intervention to reduce fractures.

## Methods

### Design and Sample

This retrospective chart review evaluated data over 3 years (October 2017–October 2020) to assess osteoporosis management within a primary care geriatric clinic in an academic setting providing care delivery by six geriatric-specialty-trained osteopathic physicians and nurse practitioners. Inclusion criteria included patients 65 and older diagnosed with osteopenia, osteoporosis, or fragility fracture. An information technology specialist performed the initial search queries within the electronic record system NextGen<sup>®</sup> Enterprise EHR using assigned ICD10 codes for osteoporosis, osteopenia, and/or diagnosis of fragility fractures. Afterward, trained pharmacy research students reviewed electronic chart records to verify the information and complete any missing data. IRB approval was obtained from the xx Institutional Review Board.

### Data and Analysis

Demographic data included age, gender, and race/ethnicity. Diagnostic data included osteoporosis, osteopenia, and prior fragility fracture. Practice outcomes related to clinical practice guidelines (Camacho et al., 2020; LeBoff et al., 2022) and quality measures (National committee for Quality Assurance, 2017a, 2017b, 2017c) included: (1) DXA BMD scans for women ages 65 and older, the subset of females in the targeted quality measure age range of 65 to 75 years, and men ages 70 years and older prior to a fragility fracture, (2) use of the FRAX<sup>®</sup> fracture risk assessment tool and osteoporosis medication for high-risk individuals prior to a fragility fracture, (3) DXA scans or use of osteoporosis medication for all women, the subset of females in the targeted quality measure age range of 67 to 85 years, and all men with a history of a fracture, and (4) fall risk mitigation plan in all persons and the subset of persons

**Table 1.** Demographics and Diagnosis of Patient Charts Reviewed (N=388).

Demographics	N (%)	Osteopenia n (%)	Osteoporosis n (%)
Women	372 (96)	106 (28)	266 (72)
Age group			
65–74	110 (30)	43 (39)	67 (61)
75–84	139 (37)	40 (29)	99 (71)
85–94	107 (29)	21 (20)	86 (80)
95+	16 (4)	3 (19)	13 (81)
Ethnicity/race			
Asian	2 (0.5)	0	2 (100)
Black or African American	22 (5.5)	10 (45)	12 (55)
Hispanic or Latino	51 (14)	11 (22)	40 (78)
White	253 (68)	74 (29)	179 (71)
Declined to Specify	44 (12)	12 (27)	32 (73)
Men	16 (4)	7 (44)	9 (56)
Age group			
65–74	2 (13)	1 (50)	1 (50)
75–84	10 (63)	5 (50)	5 (50)
85–94	3 (19)	1 (33)	2 (67)
95+	1 (6)	0	1 (100)
Ethnicity/race			
Hispanic or Latino	1 (6)	0	1 (100)
White	11 (69)	4 (36)	7 (64)
Declined to Specify	4 (25)	3 (75)	1 (25)

with an identified history of falls. All descriptive statistics were computed in Excel, version 2019.

## Results

Demographic and diagnostic data can be found in Table 1. Of the 388 patient charts reviewed, most were women ( $n=372$ , 96%). The mean age was 80.37 ( $SD=8.37$ ) with an age range from 65 to 104. Most had a diagnosis of osteoporosis ( $n=275$ , 71%) and remaining diagnosed with osteopenia ( $n=113$ , 29%). Most patients identified as White ( $n=264$ , 68%), followed by Hispanic or Latino ( $n=52$ , 13%), Black or African American ( $n=22$ , 6%), and Asian ( $n=2$ , 1%), a 12% ( $n=48$ ) who declined to specify.

Specific outcomes related to variables associated with clinical practice intervention recommendations for BMD screening and assessment, utilization of FRAX<sup>®</sup> fracture risk assessment, osteoporosis medication use and fall risk plan implementation are shown in Table 2. To address primary fracture prevention, almost two-thirds ( $n=171$ , 65%) of all females and all but one male ( $n=7$ , 88%) had a DXA BMD scan prior to a fragility fracture. FRAX<sup>®</sup> results were found for just over one-fourth ( $n=72$ , 27%) of women and one-half ( $n=4$ , 50%) of men. Of note, all but one chart indicating results were generated by a densitometry algorithm and provided in the DXA summary report. Osteoporosis medications were prescribed to just over one-third ( $n=91$ , 35%) of women and men ( $n=6$ , 38%) to address primary fracture prevention.

For secondary fracture prevention, DXA BMD scans to assess baseline and monitor intervention were documented for three-fourths ( $n=82$ , 75%) of women and seven out of eight men (88%). FRAX<sup>®</sup> risk results were available to guide decision-making for just over one-fifth ( $n=23$ , 21%) of women and five out of seven (63%) men. Osteoporosis medications were utilized in just over one-third ( $n=39$ , 35%) of women and one-half ( $n=4$ , 50%) of men to prevent subsequent fractures. For women with a prior fracture, 11% received a fall risk mitigation plan with 64% ( $n=7$ ) of those at high risk due to a history of falls.

Outcomes associated with specific clinical practice guidelines and quality measures are shown in Table 3. In alignment with the CPG for primary prevention, (Curry et al., 2018; LeBoff et al., 2022) 68% ( $n=253$ ) of women 65 years and older and 87% ( $n=13$ ) of men 70 years and older had received a DXA scan. With a targeted subset of women aged 65 to 75 (National committee for Quality Assurance, 2017c), 66% ( $n=63$ ) received a DXA scan as a quality measure to prevent osteoporotic fractures. Osteoporosis medication prescribed for individuals at a high risk for a hip or major osteoporosis-related fracture according to FRAX<sup>®</sup> results averaged 42% ( $n=32$ ). Quality measures associated with secondary fracture prevention for women 67 to 85 (National committee for Quality Assurance, 2017b) indicated 72% ( $n=21$ ) had received a DXA scan while 21% ( $n=6$ ) received osteoporosis medication to prevent a subsequent fracture. Evidence of the quality measure to address fall risk management (National Committee for Quality Assurance,

**Table 2.** Variables Associated With Risk Assessment Factors and Intervention Across Genders (N=388).

Variable	Total N (%)	BMD (DXA) n (%)	FRAX <sup>®</sup> n (%)	Osteoporosis medication n (%)	Fall risk plan n (%)
Women	372 (96)	253 (68)	95 (26)	130 (35)	23 (6)
No fracture	262 (70)	171 (65)	72 (27)	91 (35)	12 (5)
Fall History	107 (29)	77 (72)	31 (29)	35 (33)	10 (9)
Fracture	110 (30)	82 (75)	23 (21)	39 (35)	11 (10)
Fall History	52 (14)	42 (81)	12 (23)	22 (42)	7 (13)
Men	16 (4)	14 (88)	9 (56)	6 (38)	1 (6)
No Fracture	8 (50)	7 (88)	4 (50)	2 (25)	1 (13)
Fall History	5 (31)	4 (50)	2 (25)	1 (13)	0
Fracture	8 (50)	7 (88)	5 (63)	4 (50)	0
Fall History	2 (13)	2 (25)	1 (13)	1 (13)	0

Note. BMD = bone mineral density; DXA = dual-energy X-ray absorptiometry; FRAX<sup>®</sup> = fracture risk assessment tool.

**Table 3.** Outcomes Associated With Specific Clinical Practice Guidelines and Quality Measures (N=388).

CPG recommendation or quality metric	N (%)
Women 65+ years old with documented BMD scan (DXA) <sup>a</sup>	253/372 (68)
Women 65 to 75 years old who received osteoporosis screening prior to fracture <sup>b</sup>	63/95 (66)
Men 70+ years old with documented BMD scan (DXA) <sup>a</sup>	13/15 (87)
FRAX: 10-year hip fracture $\geq$ 3% on osteoporosis medication <sup>a</sup>	22/53 (42)
FRAX: 10-year major OP-related fracture $\geq$ 20% on osteoporosis medication <sup>a</sup>	10/24 (42)
Osteoporosis medication used when diagnosis of osteoporosis <sup>a</sup>	123/275 (45)
Women 67 to 85 w/ fragility fx & reported BMD scan (DXA) <sup>b</sup>	21/29 (72)
Women 67 to 85 w/ fragility fx & provided osteoporosis medication <sup>b</sup>	6/29 (21)
History of falls with documented mitigation plan <sup>b</sup>	17/166 (10)

Note. CPG = clinical practice guidelines; BMD = bone mineral density; DXA = dual-energy X-ray absorptiometry; FRAX<sup>®</sup> = fracture risk assessment tool.

<sup>a</sup>Recommended only by BHOE (formerly NOF), AACE guideline.

<sup>b</sup>NCQA quality metric.

2017a) in those with a history of falls was found for 10% (n=17) for the sample.

## Discussion

The purpose of this study was to review outcomes within a primary care geriatric clinic by assessing alignment with clinical practice guidelines and quality measures related to osteoporosis management and fracture prevention for women and men including: (1) primary fracture prevention screening, (2) fracture risk assessment tool and osteoporosis medication utilization, (3) secondary fracture prevention screening or osteoporosis medication

use, and (4) fall risk management. For primary fracture prevention, our findings indicated that 68% of women 65 years and older and 87% of men 70 years and older had a documented BMD scan. Although these rates are higher than found in other research (Gillespie & Morin, 2017), issues related to underscreening, underdiagnosis, and undertreatment of osteoporosis may delay fracture prevention. Indeed, the men in our sample only represented 4% of our population, with half of these receiving care for secondary fracture prevention. These results are concerning, especially for men, as they have higher morbidity and mortality after a fracture (Rinonapoli et al., 2021).

Primary prevention also should consider pharmacotherapy for patients with a diagnosis of osteoporosis confirmed by DXA (N=275, 71%) or those with low bone mass and elevated risk determined by FRAX<sup>®</sup> (N=77, 20%) (Camacho et al., 2020; LeBoff et al., 2022). The use of pharmacotherapy in individuals with diagnosed osteoporosis was only 45%. Acceptance and adherence to osteoporosis treatment recommendations suggest patient education and counseling, adherence monitoring with feedback, and dose simplification, including flexible dosing regimen, can improve treatment initiation and potentially improve adherence (Hilgsmann et al., 2019). The timing of intervention from when the problem is identified to support individuals with informed decision-making and the utilization of secondary services also has been suggested to improve rates for initiation and adherence (Paskins et al., 2022). FRAX<sup>®</sup> results were found for only 27% of patients with 74% of those showing high risk of a hip or major osteoporosis-related fracture and in receipt of osteoporosis medication. Although research indicates that the FRAX<sup>®</sup> tool may be more complicated than other methods for risk prediction available to physicians (Leslie & Morin, 2020), most of our FRAX<sup>®</sup> results were provided within DXA-generated reports. In addition, the discussion of fracture risk assessment results has led to greater acceptance and adherence to anti-osteoporosis medications (Paskins et al., 2022).



Overall, only 45% of patients with a diagnosis of osteoporosis and 42% of patients deemed at high risk of a hip or a major osteoporosis-related fracture were prescribed an osteoporosis medication. Adherence and persistence to anti-osteoporotic medications have also been shown to be low in other population-based primary prevention studies (Høiberg et al., 2019). Despite the number of available drugs to treat osteoporosis, limited acceptance in pharmaceutical treatments may result from fear of rare side effects and concern for long-term efficacy (Khosla & Hofbauer, 2017). The ability to identify and measure additional factors influencing utilization of medication intervention may be needed to better understand adoption or adherence to osteoporosis pharmacotherapy.

For secondary fracture prevention screening or osteoporosis medication use, the results indicated that 30% of patients had a prior history of fracture. For women in the targeted quality measure range of 67 to 85 years of age with fragility fractures, 72% had reported DXA scans and 21% were prescribed osteoporosis medication. Although these may not reach target measures, our referrals for BMD scans were 35% higher than noted in another study addressing secondary fracture prevention in primary care (Mendis et al., 2017). Moreover, treatment gaps have also been found internationally with general practitioners in fracture prevention, even for patients deemed at high risk for fracture (E. V. McCloskey et al., 2016; E. McCloskey et al., 2021). Again, despite the presence of a fragility fracture, factors influencing pharmacotherapy hesitancy are not adequately captured well in an algorithm-driven chart data extraction.

For fall risk management, our results identified 43% of patients as being at risk for falls based on an inquiry of recent falls or performance of a mobility screen; yet, only 10% had a documented plan of care to mitigate future fall risk. This rate is lower than reported in other research (Qin & Baccaglini, 2016). Although, our study used data extracted from templates within electronic health records and the templates may or may not be aligned with workflow practices. So, if physicians documented fall risk plans elsewhere, this would negatively impact the collection and reporting of uniform, consistent information to generate an organizational performance report.

It is widely understood that healthcare management of older adults can be complicated by multi-comorbidities and limited clinical visit time to address needs. And despite the availability of clinical practice guidelines, barriers to effective osteoporosis management have been reported as a lack of specific knowledge about who and when to investigate and treat (Mendis et al., 2017). In addition, quality measures may not capture additional pertinent factors reflective of evidence-based medicine delivery, including physician expertise and patient preferences. Future qualitative research could provide further insight into factors influencing treatment decisions to fill

gaps in understanding care alignment with clinical practice guidelines and quality performance measures.

## Conclusion

Although showing higher rates of primary and secondary prevention outcomes than results from studies focusing on general primary care, the findings from this geriatric primary care clinic identified gaps with (1) DXA BMD reports for both women and men receiving care for osteoporosis management; (2) utilization of the FRAX<sup>®</sup> risk fracture risk assessment tool, (3) osteoporosis medications or DXA scans for high fracture risk patients, and (4) identifiable fall risk mitigation plans. Medical record review may not provide consistent, uniform data for various metrics or effectively capture factors influencing decision-making or adherence to recommendations that align with clinical practice guidelines. Future research would benefit from stakeholder input to gain insight into decisions and barriers for care delivery and adherence by providers and patients.

## Declaration of Conflicting Interests

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## IRB approval

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## ORCID iD

Kathlene Camp  <https://orcid.org/0009-0005-3267-5736>

## References

- Amarnath, A. L. D., Franks, P., Robbins, J. A., Xing, G., & Fenton, J. J. (2015). Underuse and overuse of osteoporosis screening in a regional health system: A Retrospective cohort study. *Journal of General Internal Medicine*, *30*(12), 1733–1740. <https://doi.org/10.1007/s11606-015-3349-8>
- Balasubramanian, A., Zhang, J., Chen, L., Wenkert, D., Daigle, S. G., Grauer, A., & Curtis, J. R. (2019). Risk of subsequent fracture after prior fracture among older women. *Osteoporosis International*, *30*(1), 79–92. <https://doi.org/10.1007/s00198-018-4732-1>
- Camacho, P. M., Petak, S. M., Binkley, N., Diab, D. L., Eldeiry, L. S., Farooki, A., Harris, S. T., Hurley, D. L.,

- Kelly, J., Lewiecki, E. M., Pessah-Pollack, R., McClung, M., Wimalawansa, S. J., & Watts, N. B. (2020). American association of clinical endocrinologists/american college of endocrinology clinical practice guidelines for the diagnosis and treatment of postmenopausal osteoporosis—2020 Update Executive Summary. *Endocrine Practice*, 26(5), 564–570. <https://doi.org/10.4158/gl-2020-0524>
- Curry, S. J., Krist, A. H., Owens, D. K., Barry, M. J., Caughey, A. B., Davidson, K. W., Doubeni, C. A., Epling, Jw, Jr, Kemper, AR, Kubik, M, Landefeld, CS, Mangione, CM, Phipps, MG, Pignone, M, Silverstein, M, Simon, MA, Tseng, CW, & Wong, JB. (2018). Screening for osteoporosis to prevent fractures: US Preventive services task force recommendation statement. *Journal of the American Medical Association*, 319(24), 2521–2531. <https://doi.org/10.1001/jama.2018.7498>
- Gillespie, C. W., & Morin, P. E. (2017). Trends and disparities in osteoporosis screening among women in the United States, 2008–2014. *The American Journal of Medicine*, 130(3), 306–316. <https://doi.org/10.1016/j.amjmed.2016.10.018>
- Hilgsmann, M., Cornelissen, D., Vrijens, B., Abrahamsen, B., Al-Daghri, N., Biver, E., Brandi, M. L., Bruyère, O., Burret, N., Cooper, C., Cortet, B., Dennison, E., Diez-Perez, A., Gasparik, A., Grosso, A., Hadji, P., Halbout, P., Kanis, J. A., Kaufman, J. M., . . . Reginster, J. Y. (2019). Determinants, consequences and potential solutions to poor adherence to anti-osteoporosis treatment: Results of an expert group meeting organized by the European Society for Clinical and economic aspects of osteoporosis, osteoarthritis and Musculoskeletal Diseases (ESCEO) and the International Osteoporosis Foundation (IOF). *Osteoporosis International*, 30(11), 2155–2165. <https://doi.org/10.1007/s00198-019-05104-5>
- Høiberg, M. P., Rubin, K. H., Holmberg, T., Rothmann, M. J., Möller, S., Gram, J., Bech, M., Brixen, K., & Hermann, A. P. (2019). Use of antiosteoporotic medication in the Danish ROSE population-based screening study. *Osteoporosis International*, 30(6), 1223–1233. <https://doi.org/10.1007/s00198-019-04934-7>
- Khosla, S., & Hofbauer, L. C. (2017). Osteoporosis treatment: recent developments and ongoing challenges. *The Lancet Diabetes & Endocrinology*, 5(11), 898–907. [https://doi.org/10.1016/S2213-8587\(17\)30188-2](https://doi.org/10.1016/S2213-8587(17)30188-2)
- LeBoff, M. S., Greenspan, S. L., Insogna, K. L., Lewiecki, E. M., Saag, K. G., Singer, A. J., & Siris, E. S. (2022). The clinician's guide to prevention and treatment of osteoporosis. *Osteoporosis International*, 33(10), 2049–2102. <https://doi.org/10.1007/s00198-021-05900-y>
- Leslie, W. D., & Morin, S. N. (2020). New Developments in fracture risk assessment for current osteoporosis reports. *Current Osteoporosis Reports*, 18(3), 115–129. <https://doi.org/10.1007/s11914-020-00590-7>
- Lewiecki, E. M., Ortendahl, J. D., Vanderpuye-Orgle, J., Grauer, A., Arellano, J., Lemay, J., Harmon, A. L., Broder, M. S., & Singer, A. J. (2019). Healthcare policy changes in osteoporosis can improve outcomes and reduce costs in the United States. *JBMR Plus*, 3(9), e10192. <https://doi.org/10.1002/jbmr.4.10192>
- McCloskey, E., Rathi, J., Heijmans, S., Blagden, M., Cortet, B., Czerwinski, E., Hadji, P., Payer, J., Palmer, K., Stad, R., O'Kelly, J., & Papapoulos, S. (2021). The osteoporosis treatment gap in patients at risk of fracture in European primary care: A multi-country cross-sectional observational study. *Osteoporosis International*, 32(2), 251–259. <https://doi.org/10.1007/s00198-020-05557-z>
- McCloskey, E. V., Harvey, N. C., Johansson, H., & Kanis, J. A. (2016). FRAX updates 2016. *Current Opinion in Rheumatology*, 28(4), 433–441. <https://doi.org/10.1097/BOR.0000000000000304>
- Mendis, A. S., Ganda, K., & Seibel, M. J. (2017). Barriers to secondary fracture prevention in primary care. *Osteoporosis International*, 28(10), 2913–2919. <https://doi.org/10.1007/s00198-017-4131-z>
- National Committee for Quality Assurance. (2017a). *Fall Risk Management (FRM)*. Retrieved January 5, 2018 from <https://www.ncqa.org/hedis/measures/fall-risk-management/>
- National Committee for Quality Assurance. (2017b). *Osteoporosis management in women who had a fracture (OMW)*. Retrieved January 5, 2018 from <https://www.ncqa.org/hedis/measures/osteoporosis-management-in-women-who-had-a-fracture/>
- National Committee for Quality Assurance. (2017c). *Osteoporosis Screening in Older Women (OSW)*. Retrieved January 5, 2018 from <https://www.ncqa.org/wp-content/uploads/2022/07/HEDIS-MY-2023-Measure-Description.pdf>
- Paskins, Z., Babatunde, O., Sturrock, A., Toh, L. S., Horne, R., & Maidment, I. (2022). Supporting patients to get the best from their osteoporosis treatment: A rapid realist review of what works, for whom, and in what circumstance. *Osteoporosis International*, 33(11), 2245–2257. <https://doi.org/10.1007/s00198-022-06453-4>
- Qin, Z., & Baccaglini, L. (2016). Distribution, determinants, and prevention of falls among the elderly in the 2011–2012 California Health Interview Survey. *Public Health Reports*, 131(2), 331–339. <https://doi.org/10.1177/003335491613100217>
- Rinonapoli, G., Ruggiero, C., Meccariello, L., Bisaccia, M., Ceccarini, P., & Caraffa, A. (2021). Osteoporosis in men: A review of an underestimated bone condition. *International Journal of Molecular Sciences*, 22(4), 2105. <https://doi.org/10.3390/ijms22042105>
- Singer, A. J., Sharma, A., Deignan, C., & Borgermans, L. (2023). Closing the gap in osteoporosis management: The critical role of primary care in bone health. *Current Medical Research and Opinion*, 39(3), 387–398. <https://doi.org/10.1080/03007995.2022.2141483>
- Stevens, J. A., & Lee, R. (2018). The potential to reduce falls and avert costs by clinically managing fall risk. *American Journal of Preventive Medicine*, 55(3), 290–297. <https://doi.org/10.1016/j.amepre.2018.04.035>
- Wright, N. C., Looker, A. C., Saag, K. G., Curtis, J. R., Delzell, E. S., Randall, S., & Dawson-Hughes, B. (2014). The recent prevalence of osteoporosis and low bone mass in the United States based on bone mineral density at the femoral neck or lumbar spine. *Journal of Bone and Mineral Research*, 29(11), 2520–2526. <https://doi.org/10.1002/jbmr.2269>