Osteoporosis in South Africa: an emerging silent epidemic

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Abstract

Osteoporosis is a progressive skeletal disorder characterised by reduced bone strength and an increased risk of fragility fractures. It arises from qualitative and quantitative changes in bone – including low bone mineral density (BMD), altered macro- and microarchitecture, and impaired bone remodelling – and is now recognised as a major cause of morbidity and mortality worldwide.[1,2]

Globally, osteoporosis predominantly affects postmenopausal women, but the burden in men is increasingly acknowledged. International data suggest that 1 in 3 women and 1 in 5 men over 50 years will sustain an osteoporotic fracture, with hip and vertebral fractures driving excess disability, loss of independence and premature death. Up to 37 million fragility fractures occur annually in people older than 55 years, equating to around 70 fractures every minute.[3]

In sub-Saharan Africa (SSA), osteoporosis and osteopenia are more common than previously appreciated, with emerging evidence from South Africa and neighbouring countries highlighting high fracture rates, an ageing population, the impact of HIV, and persistent barriers to diagnosis and treatment.[1,4,5]

South African data show high one-year mortality after hip fracture, limited access to dual-energy X-ray absorptiometry (DEXA), and underdiagnosis and undertreatment of osteoporosis, particularly in the public sector.[1,4]

This review summarises the epidemiology and impact of osteoporosis in South Africa, outlines the diagnostic approach (including the role of DEXA and FRAX-based fracture risk tools), reviews key lifestyle and pharmacological management principles, and provides practical, context-specific recommendations for clinicians and pharmacists. Early identification of high-risk patients and evidence-based, resource-appropriate management remain essential to reduce the growing fracture burden in South Africa.

Keywords: osteoporosis, emerging silent epidemic, global burden

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Introduction and global burden

Osteoporosis is a skeletal disease characterised by reduced bone strength and an increased susceptibility to low-trauma fractures. Although the term is often equated with low BMD, bone fragility also reflects small bone size, unfavourable macroarchitecture (e.g. a long, thin femoral neck), disruption of trabecular microarchitecture, cortical porosity, impaired bone material properties and reduced viability of osteocytes.[2] Over time, these changes culminate in fragility fractures following minimal trauma, such as a fall from standing height.[2]

Because bone loss is asymptomatic, osteoporosis is frequently described as a "silent epidemic" and often remains undetected until a fracture occurs.[1] The consequences are substantial: fragility fractures are associated with chronic pain, functional decline, loss of independence, institutionalisation and excess mortality, particularly after hip fractures.[1,6]

Globally, osteoporosis is highly prevalent in ageing populations. Based on the WHO definition, approximately 6.3% of men and 21.2% of women over 50 years have densitometric osteoporosis, and 32 million people aged 50+ in Europe alone are estimated to have the disease. Worldwide, 1 in 3 women and 1 in 5 men above 50 years will experience an osteoporotic fracture, with up to 37 million fragility fractures annually in those older than 55 years.[3]

The impact of osteoporosis compares unfavourably with many other chronic diseases. In European data, the disability burden due to fragility fractures exceeds that of most cancers (except lung cancer) and is comparable to or greater than that associated with several major non-communicable diseases, including rheumatoid arthritis, asthma and hypertensive heart disease. When disability-adjusted life years (DALYs) associated with fragility fractures are compared with 16 other non-communicable diseases across multiple European countries, fragility fractures rank fourth, after ischaemic heart disease, dementia and lung cancer. The combined lifetime risk of hip, forearm and clinical vertebral fractures is around 40%, similar to the risk of cardiovascular disease.[3]

Despite this, patient and clinician awareness remains suboptimal. IOF survey data demonstrate denial of personal risk among postmenopausal women, limited dialogue with healthcare providers, and restricted access to diagnostic and preventive care, all of which contribute to underdiagnosis and undertreatment.[3]

Osteoporosis in Sub-Saharan Africa and South Africa

Sub-Saharan Africa: Shifting epidemiology

For decades, osteoporosis in SSA was thought to be rare. Early South African data from the 1960s contributed to the misconception that fragility fractures did not occur frequently in Black African populations.[4] More contemporary studies have

challenged this paradigm, demonstrating that osteoporosis and osteopenia are common in older adults in SSA, with fracture rates predicted to double between 2010 and 2040.[4,5]

SSA is undergoing rapid demographic and epidemiological transition. The older adult population in Africa is projected to increase from 74.1 million in 2020 to 235.1 million by 2050.[1] In low- and middle-income countries (LMICs), more than 1 billion people are already older than 60 years, with life expectancy rising more rapidly in Africa than on any other continent.[4] At the same time, urbanisation, changing diets, reduced physical activity and increased non-communicable disease (NCD) prevalence are driving higher rates of osteoporosis and fragility fractures. Musculoskeletal conditions overall account for more years lived with disability than cancer and cardiovascular disease combined.[4]

Chronic infections, particularly HIV, further complicate the picture. Southern Africa is home to approximately 20.6 million people living with HIV. With successful antiretroviral therapy (ART), HIV is now a chronic disease of ageing in SSA. Long-term HIV infection is associated with immune dysregulation, chronic inflammation ("inflammaging"), premature ageing and increased fracture risk, potentially exacerbated by some ART regimens.[4] Studies suggest that older South African women living with HIV may experience greater postmenopausal bone loss than HIV-negative peers, underscoring the need to incorporate bone health into long-term HIV care.

South Africa: Local prevalence and outcomes

South African data illustrate the substantial burden of osteoporosis and fragility fractures. Hip fractures in South Africa are associated with approximately 30% one-year mortality – higher than the ~20% reported in many international cohorts – and more than half of patients never regain pre-fracture levels of independence. Between 15% and 29% require admission to frail-care facilities after a hip fracture.[1]

The country's multi-ethnic population and two-tier health system (public and private) create marked disparities in access to diagnosis and treatment. DEXA scanning, the gold standard for BMD measurement, is usually limited to tertiary centres, particularly within the public sector, leaving a large proportion of at-risk patients unassessed.[1,4]

Population-based studies have identified ethnic and sex differences:

- South African data show higher hip fracture incidence in White and Indian populations compared with Coloured and African populations.[1]
- A study by Paruk et al. reported age-adjusted hip fracture rates of 69.2 per 100 000 per year in Black South African women and 73.1 per 100 000 per year in Black South African men, dispelling earlier assumptions that fragility fractures were rare in Black Africans.[1]
- In women, vertebral fractures on DEXA may be the only sign of established osteoporosis and strongly predict future fractures. Conradie et al. found vertebral fracture rates of 9% in Black women and 5.1% in White women, suggesting a comparable vertebral fracture burden across ethnic groups.[1]

A recent Johannesburg tertiary-centre study of patients referred for DEXA scans found an overall osteoporosis prevalence of 38.8% (CI 38.6–40.8%) among 2 264 scans, with 880 patients classified as osteoporotic (96.4% female, 3.6% male) (Anavi 2025). Prevalence increased with age, and low body mass index (BMI) was strongly associated with lower T-scores and more severe osteoporosis. Thoracic vertebra T12 had the highest prevalence of vertebral fractures. Interestingly, the prevalence of osteoporosis among men in this referred population was 32.3%, substantially higher than global estimates (~11.7%), likely reflecting referral bias but nonetheless highlighting a significant male burden.[1]

In rural South Africa, cross-sectional data suggest that osteoporosis, rather than sarcopenia, is the predominant musculoskeletal disease of ageing, with high HIV prevalence compounding bone health risk.[5] Older women living with HIV appear particularly vulnerable to low BMD. Across African cohorts, urban South African women have the highest osteoporosis prevalence, comparable to US White women and higher than US Black and UK White women, while urban Zimbabwean women show a two- to four-fold lower prevalence.[4]

Overall, osteoporosis remains underdiagnosed and undertreated in South Africa.[1,4] Limited awareness among healthcare professionals and the public, constrained access to DEXA, and gaps in treatment reimbursement all contribute to missed prevention opportunities.

Risk factors and pathophysiology

Bone is a dynamic tissue that undergoes continuous remodelling. Osteoclasts resorb older bone, while osteoblasts form new bone at the same site. Osteocytes, terminally differentiated osteoblasts embedded within the mineralised matrix, sense mechanical strain and orchestrate this remodelling process.[2]

Osteoporosis develops when this delicate balance is disrupted: either bone resorption is excessive relative to need, or bone formation is inadequate to repair resorption cavities. Low peak bone mass (usually achieved by the third decade of life) increases vulnerability later in life. With advancing age, additional factors such as declining sex steroids, reduced physical activity, oxidative stress, chronic inflammation, glucocorticoid exposure and an increased tendency to fall further heighten fracture risk.[2]

General risk factors

Common clinical risk factors include:[1,6,7]

General risk factors	Chronic Disease	Medication
• **Age and sex**: risk increases with age; postmenopausal women are most affected, but men are also at substantial risk. • **Low BMI and underweight**: consistently associated with low BMD and higher fracture risk. • **Early menopause** (e.g. < 45 years) or hypogonadism. • **Family or personal history of fragility fracture**, particularly hip or vertebral fracture. • **Lifestyle factors**: smoking, physical inactivity, excessive alcohol intake, poor dietary calcium and vitamin D intake. • **Nutritional factors**: chronic undernutrition, low calcium and vitamin D, and broader micronutrient deficiencies.	• Endocrine disorders (hyperthyroidism, Cushing's disease, poorly controlled diabetes). • Chronic inflammatory and autoimmune conditions (rheumatoid arthritis, inflammatory bowel disease, chronic lung disease). • Chronic hepatic or renal disease. • Neurological disorders (e.g. multiple sclerosis) and conditions that increase fall risk. • Malabsorption syndromes and severe vitamin D deficiency.	• **Oral glucocorticoids**. • Certain **anticonvulsants**. • Some **thyroid preparations** (when causing overtreatment). • **Cancer therapies**, including chemotherapy and gonadal hormone suppression. • Potent **immunosuppressive agents**.

In SSA, HIV infection, ART exposure, high adiposity, recurrent infections and malnutrition contribute to chronic low-grade inflammation ("inflammaging"), which is linked to impaired musculoskeletal health. Rapid urbanisation alters physical activity and dietary patterns, often reducing dietary diversity and undermining calcium and vitamin D intake.[4]

Diagnostic Approach

Bone mineral density assessment

Dual-energy X-ray absorptiometry (DEXA/DXA) remains the gold standard for BMD measurement and densitometric diagnosis of osteoporosis.[1] BMD values are expressed as T- and Z-scores:[1]

- **T-score**: number of standard deviations (SD) a patient's BMD deviates from the young adult reference mean. The WHO defines osteoporosis as a T-score ≤ –2.5. T-scores are used in postmenopausal women and men aged ≥50 years.
- **Z-score**: number of SD a patient's BMD deviates from the age- and sex-matched mean. Z-scores are preferred in premenopausal women and men younger than 50 years.

Reference data are derived from the National Health and Nutrition Examination Survey (NHANES) for Caucasian women aged 20–29, using femoral neck BMD as the WHO-recommended site.[8]

Importantly, many fragility fractures occur in individuals without densitometric osteoporosis; that is, BMD alone does not fully capture fracture risk. Clinical risk assessment is therefore essential to complement DEXA.[2]

South African studies highlight a high prevalence of osteoporosis among patients referred for DEXA, especially older adults and postmenopausal women, and demonstrate a strong link between low BMI and more severe disease.[1]

Fracture risk estimation: FRAX and South African models

In settings where DEXA access is limited, fracture risk calculators play a particularly important role. The FRAX® tool integrates clinical risk factors (age, sex, BMI, prior fracture, parental hip fracture, glucocorticoid use, smoking, alcohol and rheumatoid arthritis) with or without BMD to estimate 10-year fracture probabilities.

FRAX models have now been calibrated for South African populations, allowing more accurate estimation of major osteoporotic and hip fracture risk. These locally adapted FRAX tools can be used to:[9]

- Identify high-risk patients when DEXA is not available.
- Prioritise referrals for DEXA in resource-constrained settings.
- Guide treatment decisions, particularly in patients with osteopenia

Given the silent nature of osteoporosis and low access to densitometry, FRAX and similar tools offer a pragmatic strategy to broaden fracture risk assessment beyond tertiary centres.

Barriers to diagnosis in SSA and South Africa

Multiple system-level obstacles limit early diagnosis:[1,4]

- Low awareness among clinicians and patients.
- Limited specialist services (e.g. rheumatology, endocrinology, geriatrics). South Africa has approximately one geriatrician per 275 000 older adults, and some SSA countries have none.
- Restricted DEXA availability, especially outside urban tertiary hospitals.
- Long travel distances, costs, and weak service integration in rural and peri-urban areas.

In such contexts, wider use of clinical risk tools, opportunistic case-finding (e.g. in HIV clinics or chronic disease programmes), and simple fracture-risk algorithms are essential to identify patients who may benefit from investigation and treatment.

Management of Osteoporosis

Effective osteoporosis management rests on three pillars:[10,11,12,13]

1. **Lifestyle and non-pharmacological measures.**
2. **Optimising calcium and vitamin D.**
3. **Appropriate pharmacological therapy guided by fracture risk.**

International guidelines broadly align on these principles, with local adaptation required for the South African context.[10,11,12,13]

Lifestyle and non-pharmacological strategies

All patients at risk of osteoporosis or fragility fracture should receive counselling on lifestyle measures[10,11,12,13]

- **Physical activity:** Regular weight-bearing and muscle-strengthening exercise tailored to individual ability (e.g. walking, stair climbing, resistance training). Balance and strength programmes reduce falls and associated fractures.
- **Smoking cessation:** Smoking is associated with lower BMD and approximately 55% higher hip fracture risk than in non-smokers.
- **Alcohol moderation:** Advise limiting intake to ≤2 units/day.
- **Falls prevention:**
  - Correct reversible visual impairment.
  - Review medications that increase fall risk (sedatives, antihypertensives, hypoglycaemics).
  - Encourage safe footwear and home hazard assessment (loose rugs, poor lighting).
- **Nutrition:** Ensure adequate protein, calcium and vitamin D intake; promote a balanced diet with fruits, vegetables and whole foods.

These interventions are safe, cost-effective, and particularly important in LMICs where access to medications and DEXA is constrained.

Calcium and vitamin D

Most guidelines recommend a **total daily elemental calcium intake of around 1 000–1 200 mg** and **vitamin D 800–1 000 IU** in adults at risk of osteoporosis or on anti-osteoporotic treatment. Dietary sources are preferred; supplements are used where intake is inadequate or where deficiency is documented.

Before initiating pharmacotherapy, it is good practice to:

- Check serum calcium, creatinine and 25-hydroxyvitamin D.
- Correct vitamin D deficiency (with re-testing after ± 8 weeks).
- Ensure adequate ongoing calcium and vitamin D intake to support treatment response and reduce hypocalcaemia risk, particularly with agents such as denosumab.

Pharmacological therapy

Indications for pharmacotherapy typically include:[10,11,12,13]

- Established osteoporosis (T-score ≤ –2.5 at hip, lumbar spine or 33% radius).
- Prior hip or vertebral fragility fracture (or certain non-vertebral fractures in the presence of low BMD).
- Osteopenia (T-score between –1.0 and –2.5) with a FRAX 10-year risk above the country-specific treatment threshold (e.g. ≥ 3% for hip fracture or ≥ 20% for major osteoporotic fracture in US data).

First-line antiresorptive therapy

For most postmenopausal women and men aged ≥ 50 years at high fracture risk, guidelines recommend oral bisphosphonates as initial therapy:[10,11,12,13]

- **Alendronate** or **risedronate** (weekly or monthly oral dosing).
- **Zoledronic acid** as an intravenous option, especially after hip fracture or where oral therapy is not suitable.

These agents reduce vertebral and non-vertebral fractures and have extensive long-term safety data.

Other antiresorptive options

- **Denosumab** – a RANKL inhibitor given 6-monthly subcutaneously; useful for patients unable to take bisphosphonates or with severe osteoporosis. Treatment discontinuation without follow-on bisphosphonate is associated with rebound vertebral fractures, so long-term planning is essential.
- **Selective oestrogen receptor modulators (SERMs)** such as raloxifene – particularly for spine-predominant osteoporosis in younger postmenopausal women with low risk of venous thromboembolism.
- **Hormone replacement therapy (HRT)** – effective in reducing postmenopausal bone loss and fractures, but now generally reserved for women ≤60 years with menopausal symptoms and low baseline risk for breast cancer and thromboembolism.

Anabolic or uncoupling therapies[10,11,12,13]

In very high-risk patients – for example, those with multiple vertebral fractures, very low T-scores (≤ –3.0) or rapid bone loss – anabolic or dual-action agents may be considered

These agents are typically given for a fixed duration (e.g. 12–24 months) and should be followed by antiresorptive therapy to maintain gains in BMD.

South African and SSA treatment barriers

In SSA, and particularly in the South African public sector, treatment access is severely limited:[4]

- Few anti-osteoporotic medicines are available on national formularies. Bisphosphonates, are not routinely stocked in many public hospitals.
- The WHO Essential Medicines List does not include standard osteoporosis treatments (e.g. oral bisphosphonates or HRT for fracture prevention), contributing to their omission from national lists. By contrast, intravenous zoledronate appears on the list for cancer-related skeletal events, but not for fragility

fracture prevention

- Private medical schemes may reimburse treatment only in severe osteopenia/osteoporosis with fractures; osteoporosis is often not considered a primary benefit, discouraging proactive screening.

Addressing these inequities, by including basic osteoporosis therapies on essential medicine lists, integrating bone health into chronic disease and HIV programmes, and improving access to rehabilitation and physiotherapy – is critical for South Africa and SSA.[4]

Monitoring and follow-up

Monitoring aims to assess response, reinforce adherence and reconsider therapy when necessary:[2,12]

- **DEXA scanning:** Repeat hip and spine DEXA roughly 1–2 years after initiating therapy. If BMD is stable or improved, intervals can be extended (e.g. every 2–5 years, depending on risk). Progressive loss beyond the least significant change or a new fracture on therapy should trigger reassessment and possible treatment modification.
- **Biochemical monitoring:** Periodic checks of serum calcium, renal function and 25-hydroxyvitamin D are advised, especially in patients on bisphosphonates, denosumab or with comorbid renal disease.
- **Adherence and persistence:** Non-adherence is common with oral bisphosphonates due to stringent dosing instructions and gastrointestinal adverse effects. Pharmacists are well placed to identify poor adherence, manage adverse effects and counsel on correct administration.
- **Treatment review:**
  - Consider "drug holidays" after 3–5 years of bisphosphonate therapy in low-to-moderate risk patients (Endocrine Society).

    In very high-risk patients or those with incident fractures on treatment, assess for secondary causes, optimise adherence and consider switching to anabolic agents or more potent antiresorptives.
- **Interdisciplinary care:** Coordination between primary care, endocrinology/rheumatology, orthopaedics, HIV clinics, physiotherapy and pharmacy is important to optimise fracture prevention and rehabilitation.

Practical Considerations for Clinicians and Pharmacists

In the South African context, clinicians and pharmacists can play a pivotal role in case-finding, education and safe, cost-effective treatment. Key practical steps include:[1,4,5,9]

1. Identifying high-risk patients:

- Adults ≥ 65 years (women) and ≥ 70 years (men), especially with additional risk factors (NOFSA screening recommendations.
- Patients with prior fragility fractures or family history of hip fracture.
- Long-term oral glucocorticoid users, those on anticonvulsants or other high-risk medicines.
- Persons living with HIV, particularly postmenopausal women or older men

2. Using simple risk tools:

- FRAX (with or without BMD) to quantify fracture risk in primary care
- Locally adapted osteoporosis risk questionnaires in settings without access to FRAX or DEXA.

3. Counselling on lifestyle and supplements:

- Reinforce weight-bearing exercise, smoking cessation, alcohol moderation and falls prevention.
- Discuss achievable dietary sources of calcium and vitamin D, and safe supplement use where needed.

4. Optimising medication use:

- Educate patients on correct bisphosphonate administration (e.g. taking tablets on an empty stomach with water, remaining upright for at least 30 minutes).
- Review medication lists for agents that compromise bone health or increase fall risk, and discuss alternatives with prescribers where appropriate.

5. Pharmacoeconomic stewardship:

- Advocate for cost-effective first-line therapies (e.g. generic alendronate) in formularies.
- Highlight the long-term cost savings associated with fracture prevention compared to acute fracture care and institutionalisation.

Future Directions and Research Needs

Key gaps relevant to South Africa and SSA include:[1,4]

- **Epidemiological data:** Few robust, nationally representative osteoporosis prevalence and fracture incidence studies exist for South Africa. More local data are needed to inform FRAX thresholds, resource allocation and policy.
- **Access to diagnostics:** Expanding DEXA availability in the public sector is unlikely in the short term; research into validated low-cost screening tools and portable technologies is needed. **Integration into chronic disease models:** Incorporating osteoporosis assessment into existing HIV, diabetes, hypertension and geriatric programmes may be a pragmatic way to identify high-risk patients.
- **Health economics and adherence:** Local cost-utility analyses comparing treatment strategies, and real-world adherence and persistence studies, would support rational formulary decisions and guideline adaptation.

Reprioritisation towards care of ageing populations and equitable access to bone-health services is urgently required in SSA.

Conclusion

Osteoporosis is a major, yet often invisible, contributor to morbidity and mortality in South Africa. As the population ages and the burden of NCDs and HIV-related comorbidities

grows, fragility fractures will place increasing strain on already stretched health systems. Evidence from SSA and South Africa shows that osteoporosis and osteopenia are common, hip and vertebral fractures carry substantial mortality and disability, and large segments of the population lack access to diagnostic and therapeutic services.[1,4,5]

Early identification of high-risk individuals, systematic fracture-risk assessment (including use of South African FRAX models), lifestyle optimisation, adequate calcium and vitamin D intake, and appropriate pharmacological therapy are essential to reduce fracture burden. Clinicians and pharmacists in both public and private sectors play a crucial role in case-finding, patient education, adherence support and advocacy for equitable access to basic osteoporosis care.

In conclusion, those living in SSA do not yet have equitable access to diagnostic and treatment options for osteoporosis, despite the high prevalence of low bone mass and fragility fractures. Awareness is increasing, but sustained effort is required to co-develop context-appropriate diagnostic pathways and treatment strategies with communities and stakeholders. Reprioritising bone health within broader healthy-ageing agendas, and ensuring affordable access to essential diagnostics and medicines, must become a key goal for policy-makers and healthcare providers in South Africa and the region.

References

1. Anavi K, Daya R, Bayat Z. The prevalence of osteoporosis in patients referred for DEXA scans at a tertiary academic center in Johannesburg, South Africa. Wits Journal of Clinical Medicine. 2025;7(1):1-8. https://doi.org/10.18772/26180197.2025.v7n1a1.
2. Manolagas SC, Rosen CJ, Rubinow K. Osteoporosis. UpToDate. 2025Available at: https://www.uptodate.com.
3. International Osteoporosis Foundation (IOF). Osteoporosis Foundation. 2025Available at: https://www.osteoporosis.foundation/
4. Ward KA, Pearse CM, Madanhire T, et al. Disparities in the prevalence of osteoporosis and osteopenia in men and women living in Sub-Saharan Africa, the UK, and the USA. Current Osteoporosis Reports. 2023;21:360-71. https://doi.org/10.1007/s11914-023-00801-x.
5. Gregson CL, Madanhire T, Rehman A, et al. Osteoporosis, rather than sarcopenia, is the predominant musculoskeletal disease in a rural South African community where HIV prevalence is high: A cross-sectional study. J Bone Miner Res. 2022;37(2):244-55. https://doi.org/10.1002/jbmr.4464.
6. Osteoporosis South Africa. 2025. Available at: https://www.osteoporosis.co.za.
7. Dela SS, Paruk F, Brown SL, et al. Ethnic and gender-specific incidence rates for hip fractures in South Africa: A multi-centre study. Bone. 2020;133:115253. https://doi.org/10.1016/j.bone.2020.115253.
8. Centers for Disease Control and Prevention (CDC). National Health and Nutrition Examination Survey (NHANES). 2025. Available at: https://www.cdc.gov/nchs/nhanes/index.html.
9. Johansson H, Dela SS, Cassim B, et al. FRAX-based fracture probabilities in South Africa. Archives of Osteoporosis. 2021;16(51). https://doi.org/10.1007/s11657-021-00905-w.
10. National Osteoporosis Guideline Group (NOGG). Full clinical guideline. 2025Available at: https://www.nogg.org.uk/full-guideline.
11. National Osteoporosis Foundation (NOF). Clinical guidelines. 2025. Available at: https://www.bonesource.org/clinical-guidelines.
12. Camacho PM, Petak, Binkley N; on behalf of the American Association of Clinical Endocrinology (AACE). Americal Association of Clinical Endocrinologists/American College of Endocrinology Clinical Practice Guidelines for the diagnosis and treatment of postmenopausal osteoporosis – 2020 Update. Endocrine Practice. 2020;26(S1). Available from: https://pro.aace.com/sites/default/files/2020-05/Vol%2026%20Supplement%201%20(May%202020)%20GL-2019-0524_0.pdf.
13. Qaseem A, Hicks LA, Etxeandia-Ikobaltzeta I, Shamliyan T, Cooney TG. Pharmacologic treatment of primary osteoporosis or low bone mass to prevent fractures in adults: A living clinical guideline from the American College of Physicians. Annals of Internal Medicine. 2023;176(2). https://doi.org/10.7326/M22-1034.