National Osteoporosis Foundation of South Africa (NOFSA) Guideline for the Diagnosis and Management of Osteoporosis 2025.

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was central in our efforts to develop local guidelines based on South African epidemiology and for permission to use the NOGG guidelines 2024 as our main reference point[1]. A huge thanks as well to Helena Johansson and the FRAX team for their assistance and motivation in the calibration of the FRAX Tool for South Africa and the calculation of local intervention thresholds. This was made possible by the ground -breaking work of Paruk et al, and Dela et al, to provide local epidemiology.

Methods of development.

A draft guideline based on the 2010 NOFSA guideline[2] and the NOGG guideline was developed by council members and then debated and revised by the NOFSA Council during a workshop. This was then used by the principle author to draft a provisional document which was then again referred back to council for final consensus. The principle author, aided by Amanda Vincent, was simultaneously involved in developing the 2025 International Menopause Society (IMS) recommendations on osteoporosis. Appropriate references will be added when the IMS recommendations are published. Several stakeholders have been approached and feedback is pending.

Evidence and recommendations.

Systematic reviews, randomized controlled trials and meta-analyses were used as far as possible. The body of the document was referenced. Each section is then followed by recommendations. The quality of evidence and the strength of recommendations used in this 2025 guideline are based on the GRADE (Grades of Recommendation, Assessment, Development, and Evaluation)[3] and the AGREE II (Appraisal of Guidelines for Research & Evaluation II)[4] approaches.

1: Introduction to osteoporosis and fragility fractures.

The conceptual definition of osteoporosis was made by the World Health Organization (WHO) in 1994 as a “progressive systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture”[5]. Since microarchitectural deterioration could not be measured clinically, the operational description of osteoporosis was based on bone mineral density (BMD). Measurement of BMD in postmenopausal women and men older than 50 years is expressed as standard deviations change from peak bone density (T-score) or in younger persons compared to expected BMD for age (Z-score). Normal BMD is defined as BMD T-score > -1, low BMD (osteopenia) as T-score < -1.0 > -2.5 and osteoporosis as T-score

of ≤-2.5. Over the years this was adopted as a clinical definition; however, the limitations of focusing on a BMD-based definition alone have since become clear. BMD is now viewed as one, albeit very important, risk factor to be considered when assessing fracture risk.

The clinical significance of osteoporosis lies in the fractures that arise. Approximately one in two adult women and one in five men will sustain one or more fragility fractures (a low trauma fracture sustained from a fall from standing height or less) in their lifetime[6]. Although the relative risk of fracture is higher in the group of people with osteoporosis, the majority of fragility fractures occur in those diagnosed with osteopenia (absolute risk). This is not only because more people have low bone mass compared to osteoporosis but also reflects the contribution of many other factors, besides BMD, to fracture risk[7 8 9].

Common sites of fragility fracture include the vertebral bodies, hip, distal radius, proximal humerus, ribs and pelvis. Hip fracture (HF) is the most common cause of death following a fall. Loss of independence is common following HF with only 52% living in their own home after 120 days[10] and 26% will die within 12 months of their fracture[11]. Most major osteoporotic fractures are associated with reduced relative survival, part causally related and part due to associated co-morbidity[12]. Epidemiological data confirm a marked increase in hip HF incidence globally, and it is estimated that by 2050 there will be more than 6 million HFs worldwide. This rise is mainly attributed to increased ageing[13] especially in developing countries[14].
Data pertaining to HF incidence amongst South Africans are limited. A very low HF rate in Black Africans was documented by Solomon and Africa many decades ago[15]. Significantly (tenfold) higher HF rates amongst a Black African subpopulation in the eThekwini region of KwaZulu- Natal were reported in a more recent study[16]. Most recently, a multicentre multi-ethnic study supported this marked increase in HF incidence amongst Black Africans (age-adjusted hip fracture rate of 69.2 per 100,000 p.a. for women and 73.1 per 100,000 p.a. for men)[17]. These rates, however, remain amongst the lowest globally. Of note was the marked ethnic variation in hip fracture risk amongst South Africans in this study with significantly higher HF rates noted among White and Indian populations.

Recommendations: section 1.

Osteoporosis is a progressive systemic skeletal disease characterized by low bone mass and microarchitectural deterioration of bone tissue, with a consequent increase in bone fragility and susceptibility to fracture. √ [A].

Hip fracture incidence in South Africans merits this condition to be a health priority. Although the incidence is amongst the lowest in the world, the incidence is increasing significantly. ⊕⊕⊕○ [A].

There is marked ethnic variation in hip fracture risk amongst South Africans with significantly higher hip fracture rates documented in White and Indian populations. ⊕⊕⊕○ [A].

2: Fracture Risk Assessment.

2.1: Measurement of BMD.

The risk of fracture increases progressively with decreasing BMD, with an approximately two-fold increase in fracture risk for each standard deviation (SD) decrease in BMD**.** The gradient of fracture risk varies according to the site and technique used, the person's age and the fracture type. The predictive value of BMD for HF is at least as good as that of blood pressure for stroke[18]. The WHO and the International Osteoporosis Foundation (IOF) recommend that the reference technology for the measurement of BMD is dual-energy X-ray absorptiometry (DXA). NOFSA supports this view and recommends that DXA be performed and interpreted according to the principles of the International Society for Clinical Densitometry (ISCD)[19].

Osteoporosis is diagnosed on the basis of the lowest BMD T-score measured at the total hip, femoral neck or lumbar spine. However, fracture risk prediction is not improved by the use of measurements from multiple sites[20]. The spine is not always a reliable site for risk assessment or for the diagnosis of osteoporosis in older people because of the high prevalence of degenerative changes, which artifactually increase the BMD value. However, a result in an older person showing low spinal BMD is almost always valid and clinically useful. At the same DXA-measured femoral neck BMD, men and women are at approximately the same fracture risk[21]**.** Therefore, the recommended reference range, from which femoral neck and total hip T-scores are calculated for men, women and transgender individuals, is that derived from the NHANES III survey for white women aged 20-29 years. Where hip BMD measurement is not possible for technical reasons, or if the spine is differentially affected, spine BMD measurements should be used for diagnosis. if neither spine nor hip can be reliably measured or interpreted, or if a patient exceeds the weight limit for the DXA table or in primary hyperparathyroidism, a diagnosis of osteoporosis can be made based on distal forearm (1/3 radius) T-Score [22]. Serial BMD measurement can be used to monitor response to treatment. Lumbar spine BMD shows the largest treatment-related changes and is the preferred site, although if spinal degenerative changes are marked, total BMD at the hip is a better site for monitoring. Serial measurements should be performed on the same DXA machine to be able to evaluate a significant change from prior imaging and must be based on exceeding the least significant difference percentage of the DXA machine.

2.2: Assessment of Clinical Risk factors (CRFs).

The performance characteristics of a BMD assessment can be improved by the concurrent consideration of CRFs, especially those that operate independently of BMD.

Age is a major predictor of fracture. The risk is independent of bone mass and for any given BMD value, fracture risk is two- to fivefold higher in the elderly than in the young[23].

A prior fracture, particularly if sustained from low-trauma and at a site characteristic for osteoporosis, is an important CRF. Vertebral fractures should be graded according to the semi-quantitative method of Genant as mild, moderate or severe[24]. Fracture risk is approximately doubled in the presence of a prior clinical fracture and in the presence of morphometric moderate or severe vertebral fractures. The risk is even higher in the presence of multiple vertebral fractures[25]. After a fracture, the risk of subsequent fracture is highest in the immediate post fracture interval (imminent risk) with more than one-third of subsequent fractures over a ten-year time frame occurring within the first year[26].
The majority of vertebral fractures are asymptomatic and do not come to medical attention and thus remain undiagnosed. Vertebral fracture assessment (VFA), an integrated function of most modern DXA devices, is recommended as part of routine DXA imaging to effectively capture vertebral fractures at a significantly lower radiation dose compared to traditional radiographs. Where DXA-imaging is not available, conventional lateral X-rays of the lumbar and thoracic spine are indicated in postmenopausal women and men age ≥50 with multiple CRFs, a history of ≥4cm height loss, kyphosis, and in cases of acute onset of back pain.

A parental history of hip fracture is a significant risk CRF for all (but particularly hip) fractures[27].

Low body mass index (BMI) is a significant risk factor particularly for hip fracture, in both men and women[28].

Smoking is a CRF that is in part dependent on BMD[29].

Alcohol intake shows a dose-dependent relationship with fracture risk. Where alcohol intake is on average two units or less daily, no increase in risk has been identified. Intakes of 3 or more units daily are associated with a dose-dependent increase in fracture risk[30].

Chronic glucocorticoid use at any dose for a period of 3 months or longer is a major risk factor for fracture. The fracture risk associated with chronic glucocorticoid use increases in a dose-dependent manner. The fracture risk conferred by the use of glucocorticoids is not solely dependent upon bone loss and BMD-independent risks have been identified[31].

Secondary causes of osteoporosis are listed in Table 1. Bone toxic medication and some

systemic conditions predispose to fracture by predominantly decreasing BMD. By contrast, chronic glucocorticoid use, rheumatoid arthritis, Parkinson's disease and type 1 and 2 diabetes mellitus increase fracture risk independently of BMD. In patients with type 2 diabetes, a longer duration of disease and insulin use enhance the associated fracture risk. In addition to glucocorticoids, medications with an adverse impact on fracture risk mediated via BMD and BMD independent mechanisms includes thyroid hormone excess, aromatase inhibitors for the treatment of breast cancer and androgen deprivation for the treatment of prostate cancer.

Table 1 Secondary causes of osteoporosis in postmenopausal women and men including those entered into FRAX algorithm

DRUGS
Long-term glucocorticoid therapy*#
Hormone deprivation therapy for*
Breast cancer
Prostate cancer
Other (glitazones / thyroid replacement)
SYSTEMIC DISEASES
Endocrine
Primary Hyperparathyroidism
Hypogonadism (including early menopause)
Type 1 and 2 Diabetes Mellitus
Untreated, longstanding thyrotoxicosis
Iatrogenic TSH suppression in thyroid cancer
Pregnancy and lactation
Rheumatology
Rheumatoid arthritis
Other inflammatory arthritic diseases
Gastro-Intestinal
Inflammatory bowel disease
Malabsorptive disorders
Celiac disease
Haematology – Oncology
Haematological malignancies
Myeloma
Hemochromatosis
Chronic lung disease
Neurology with movement disorders
Parkinsonism
Cerebral palsy
Muscular dystrophy
Post Stroke
Other associated with muscle disuse
Infections – HIV
ORGAN FAILURE
Renal
Chronic renal failure- mineral bone disorder (CRF-MBD)
Idiopathic hypercalciuria
Liver

NUTRITIONAL / LIFESTYLE
Alcoholism
Nutritional disorders including Anorexia Nervosa
Immobilisation

**commonest secondary causes of OP and skeletal fragility*
#cause acute and significant bone loss with increased short-term fracture risk

Additional clinical risk factors for suboptimal bone health, include fall risk and nutritional deficiencies with low calcium intake, hypovitaminosis D, protein-energy malnutrition, the use of thiazolidinediones, antidepressants, antiparkinsonian drugs, antipsychotic drugs, anxiolytic drugs, benzodiazepines, sedatives, H2 receptor antagonists and proton pump inhibitors[32] [33].

2.3: Assessment of bone turnover.

Biochemical indices of skeletal turnover are not routinely used in fracture risk assessment, but may play a role in the monitoring of treatment[34].

3: Fracture Risk Assessment Tools and Intervention Thresholds (ITs).

The emphasis in fracture risk prediction has moved from a pure densitometric approach reliant on a single risk factor or characteristic for fracture, to a more integrated approach that includes a prior fracture history, DXA-BMD and the use of fracture risk assessment tools.

Postmenopausal women and men ≥ 50 years with a prior major OP fracture (clinical vertebral fracture(s) or proximal HF), have a high and even imminent risk of fracture, especially if the fracture occurred recently (within 6 months, but up to 2 years)[35]. These individuals do not require further evaluation of fracture risk to dictate the need to treat or not. Fracture risk assessment tools were developed to address the limitations of a BMD-defined threshold for the diagnosis of osteoporosis. Established densitometric diagnostic criteria and the presence of CRFs are thus combined to ensure an optimal assessment of fracture risk and to determine ITs.

NOFSA recommends the use of the internet based FRAX tool (www.shef.ac.uk/FRAX). FRAX was developed in 2008 by the then WHO Collaborating Centre for Metabolic Bone Diseases at Sheffield (UK)[36]. FRAX provides an integrated assessment of fracture risk based on genotype, phenotype, clinical risk factors that affect bone health independently of BMD (highlighted in bold in Table 2) and systemic conditions that primarily impact BMD (grouped together as secondary causes in italics in Table 2), with femoral neck BMD as an optional input. With limited resources, FRAX incorporating CRFs only, can be used to ensure that BMD measurement is targeted to those at high risk of fracture. FRAX computes the 10-year probability (percentage) of HF and/or major osteoporotic fracture (MOF) defined as clinical spine, hip, forearm or humerus fractures in men and postmenopausal women aged 40–90 years.

FRAX accounts for regional differences in fracture incidence and mortality, making country-specific models ideal. As of 2021, South Africa has its own FRAX model, calibrated for our unique ethnic specific South African population incorporating local hip fracture incidence and life expectancy. NOFSA recommends using the SA FRAX tool with ethnic specific input.

FRAX is available online free of charge for clinicians

The FRAX tool can be used as a screening and intervention tool. The FRAX algorithm without BMD performs similar to a DXA-BMD on its own to predict fracture risk. Fracture risk prediction is, however, ideal with the use of clinical risk factors and DXA-BMD, but the tool allows us to target and limit BMD to those assessed as being close to an intervention threshold to further define fracture risk and is especially useful in younger postmenopausal women and men 50-65 years of age.

Femoral neck BMD is an optional input into the FRAX algorithm to better define and re-calculate fracture risk in those who do not meet the densitometric threshold for treatment such as patients with osteopenia (T-score between -1 and -2.5 SD). The femoral neck was chosen as the reference site because it strongly predicts future fracture risk and is widely available. To ensure accurate risk assessment, clinical risk factor inputs into the algorithm must be precise, and users should understand the tool's limitations.

Enhancements to FRAX have been introduced in the FRAXPlus tool, which allows for refined risk adjustments, but at a financial cost. Alternatively, manual corrections to the calculated fracture risk can be applied (see Table 3)[37]. Importantly, at present there is no evidence base to support multiple adjustments. A single adjustment for each individual should be selected that is likely to have the greatest clinical relevance.

Table 2: FRAX model inputs

Clinical Risk Factor	Notes	Limitations / Considerations
Age	Accepts ages 40–90 years	—
Gender	Male or female	—
Weight	In kilograms	—
Height	In centimetres	—
Previous Fracture	Prior adult fragility fracture (excluding skull, face, digits)	Site, number, and recency not specified
Parental Hip Fracture	History of hip fracture in mother or father	—
Smoking (current)	Includes vaping	Dose-dependent; clinical judgment needed
Glucocorticoid Use	≥3 months of oral prednisone ≥5 mg/day (or equivalent)	Dose and duration not specified; FRAX assumes average exposure of 5mg prednisone daily; clinical judgment and adjustments to risk calculation required
Alcohol Intake	≥3 units/day: • Beer (285 ml) • Wine (120 ml) • Spirits (1 shot)	—
Rheumatoid Arthritis	Confirmed diagnosis	Osteoarthritis not included
Secondary Osteoporosis	Select “Yes” if any of the following are present:	Not all causes included; use clinical judgment
	• *Type 1 diabetes* • *Osteogenesis imperfecta (adult)* • *Untreated hyperthyroidism* • *Hypogonadism / menopause <45 years* • *Chronic malnutrition or malabsorption* • *Chronic liver disease* • *Non-dialysis renal failure* *. Human Immunodeficiency Virus and antiretroviral therapy*	
Femoral Neck	Enter BMD in g/cm² and	Optional input; improves risk

Clinical Risk Factor	Notes	Limitations / Considerations
BMD (optional)	specify scanning equipment	prediction in osteopenic patients

Table 3: Proposed manual adjustments to currently available RSA FRAX tool

Risk variable	Adjustment to FRAX
Medium and high dose exposure to oral glucocorticoids	○ Medium doses (2.5–7.5 mg daily) are the assumed minimum requirement for FRAX calculation, and the unadjusted FRAX value is used. ○ For high doses (>7.5 mg daily), MOF probabilities are upward revised by about 15% and hip fracture probabilities by 20%
Concurrent data on lumbar spine (LS) BMD	○ Increase or decrease the MOF probability by 10% of each rounded T-score difference between LS and FN
Trabecular bone score (TBS)	○ Increase MOF probability by 30% for each standard deviation (SD) decrease in TBS
Falls history	○ Increase MOF and hip fracture probability by 30% for a history of recurrent falls (≥2 falls in the last year)
Country of birth	○ Use FRAX model for country of birth since individuals retain the risk characteristics of their country of origin
Diabetes Mellitus T1 and T2	○ Enter 'yes' in the rheumatoid arthritis input to FRAX
Parkinson's disease	○ Enter 'yes' in the rheumatoid arthritis input to FRAX

Table adapted from NOGG guidelines 2024 (available at https:/www.nogg.org.uk)

NOFSA has decided to follow the National Osteoporosis Guideline Group (NOGG) recommendations regarding screening and ITs based on FRAX by making use of composite hybrid age adjusted FRAX graphs for all South Africans to dictate management.

3.1: Calculation of FRAX risk without femoral neck BMD input.

All postmenopausal women and men 50 years or older with one or more clinical risk factor for osteoporosis deserves an assessment of bone health. Those younger than 65 years of age should be offered a fracture risk assessment using the FRAX tool without BMD as initial step.

Fracture risk calculations employing the FRAX tool without BMD will provide an absolute MOF and HF risk, but only a graph displaying MOF risk will be linked to the FRAX tool to dictate further steps to be taken as shown in Fig. 1

% 10-year probability of Major Osteoporotic Fracture (MOF)

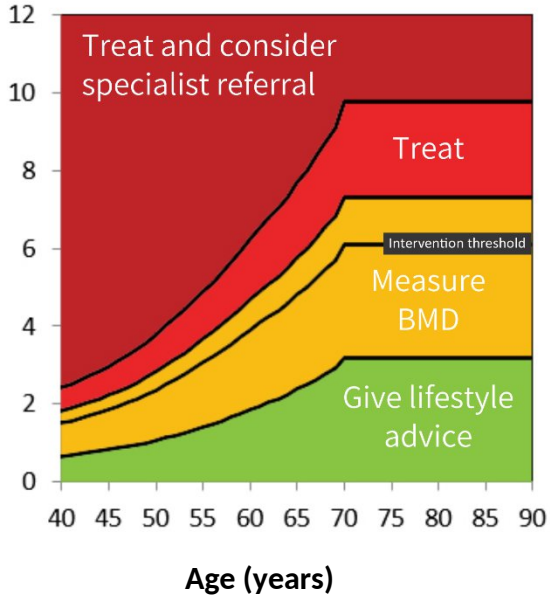

Figure 1.NOFSA assessment, interventions and risk thresholds for major osteoporotic fracture probability (MOF)in the RSA with the use of FRAX without BMD. Treatment decisions based upon risk prediction as follows:

***LOW RISK (green zone)**: give **lifestyle advice**and reassess in 5 years or less depending on the clinical context.*

***INTERMEDIATE RISK (yellow/amber zone)**: **measure BMD and recalculate fracture risk**. If BMD measurement not practical (e.g., frailty) or is unavailable, offer treatment if risk is at or above the intervention threshold shown.*

***HIGH RISK (light red zone)**: offer **treatment to reduce fracture risk**. Measure BMD to guide drug choice and provide a baseline for BMD monitoring;*

***VERY HIGH RISK (dark red zone)**: Consider referral to osteoporosis specialist for assessment and consideration of parenteral or anabolic treatment. If a delay is anticipated, start oral treatment in meantime. If not for referral, treat as for high risk.*

3.2: The need for bone mineral density measurement.

A DXA-BMD measurement, if available, is indicated as part of a fracture risk assessment in postmenopausal women and men ³ 50 years, in the following subsets of patients:

• Postmenopausal women and men aged ≥ 65 years as part of baseline assessment alongside clinical evaluation and FRAX without BMD.

• Postmenopausal women < 65 years and men aged ³50 <65 years, following FRAX without BMD if intermediate fracture risk is shown, to refine risk assessment and guide treatment decisions. In those with high or very high fracture risk based on FRAX calculation, measure BMD to establish a baseline and inform optimal therapy choice if available.

Following BMD measurement, the treatment decisions and the need for further risk assessment are based on the DXA-BMD T-score as follows:

• Normal BMD (T-score > -1): No further assessment required and no bone specific therapy

indicated. Advice on lifestyle, fall prevention, and treatment of secondary causes indicated.

• BMD in keeping with osteoporosis (T-score ≤ -2.5): Bone-specific therapy is indicated; no further fracture risk assessment needed to qualify patient for bone specific therapy.

• BMD in keeping with osteopenia (T-score between -1 and -2.5): Recalculation of FRAX with femoral neck BMD input indicated to better define fracture risk and to guide final treatment decisions.

3.3: Recalculation of FRAX with Femoral Neck BMD.

The recalculation of fracture risk with FRAX following input of femoral neck BMD is indicated in all postmenopausal women and men ³ 50 years who have not met treatment thresholds based on a single characteristic ie:

- No prior major clinical osteoporotic fracture
- Intermediate fracture risk from FRAX without BMD
- DXA-BMD in the osteopenic range.

The updated FRAX calculation will provide an absolute MOF and HF risk, but only a graph displaying hip fracture risk will be linked to the FRAX tool to dictate further steps to be taken. If hip fracture risk exceeds the treatment threshold, bone-specific therapy should be considered to reduce future fracture risk.

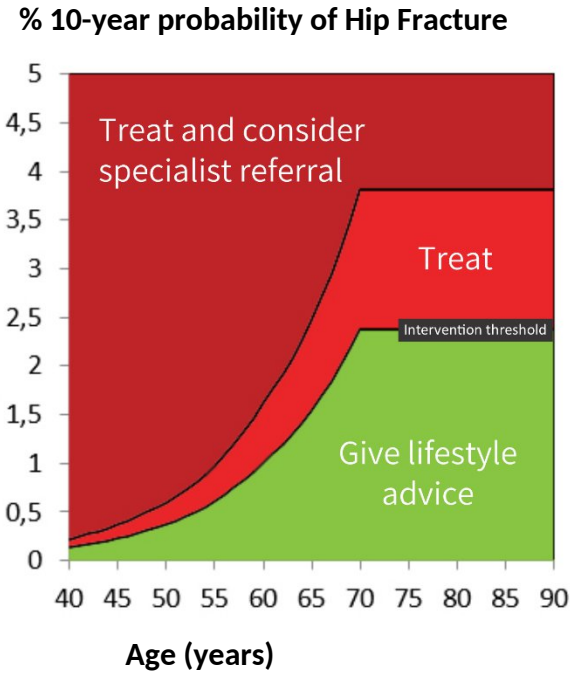

Figure 2. NOFSA assessment, intervention and risk thresholds for hip fracture probability in the RSA with the use of FRAX with BMD. Treatment decisions based upon hip fracture risk prediction as follows:

***LOW RISK (green zone)**: give **lifestyle advice**, and reassess in 5 years or less depending on the clinical context.*

HIGH RISK (light red zone): ***offer treatment to reduce fracture*** *risk if hip fracture risk prediction above IT in the high risk zone. Measure BMD to guide drug choice and provide a baseline for BMD monitoring;*

VERY HIGH RISK (dark red zone): ***consider referral to osteoporosis specialist*** *for assessment and consideration of parenteral or anabolic treatment if hip fracture risk prediction above IT in the high risk zone. If a delay is anticipated, start oral treatment in meantime. If not for referral, treat as for high risk.*

4: Integrated Strategies for screening and ITs.

Figure 3 is an algorithm of the NOFSA Guideline for screening and treatment thresholds for postmenopausal women and men > 50 years with CRFs.

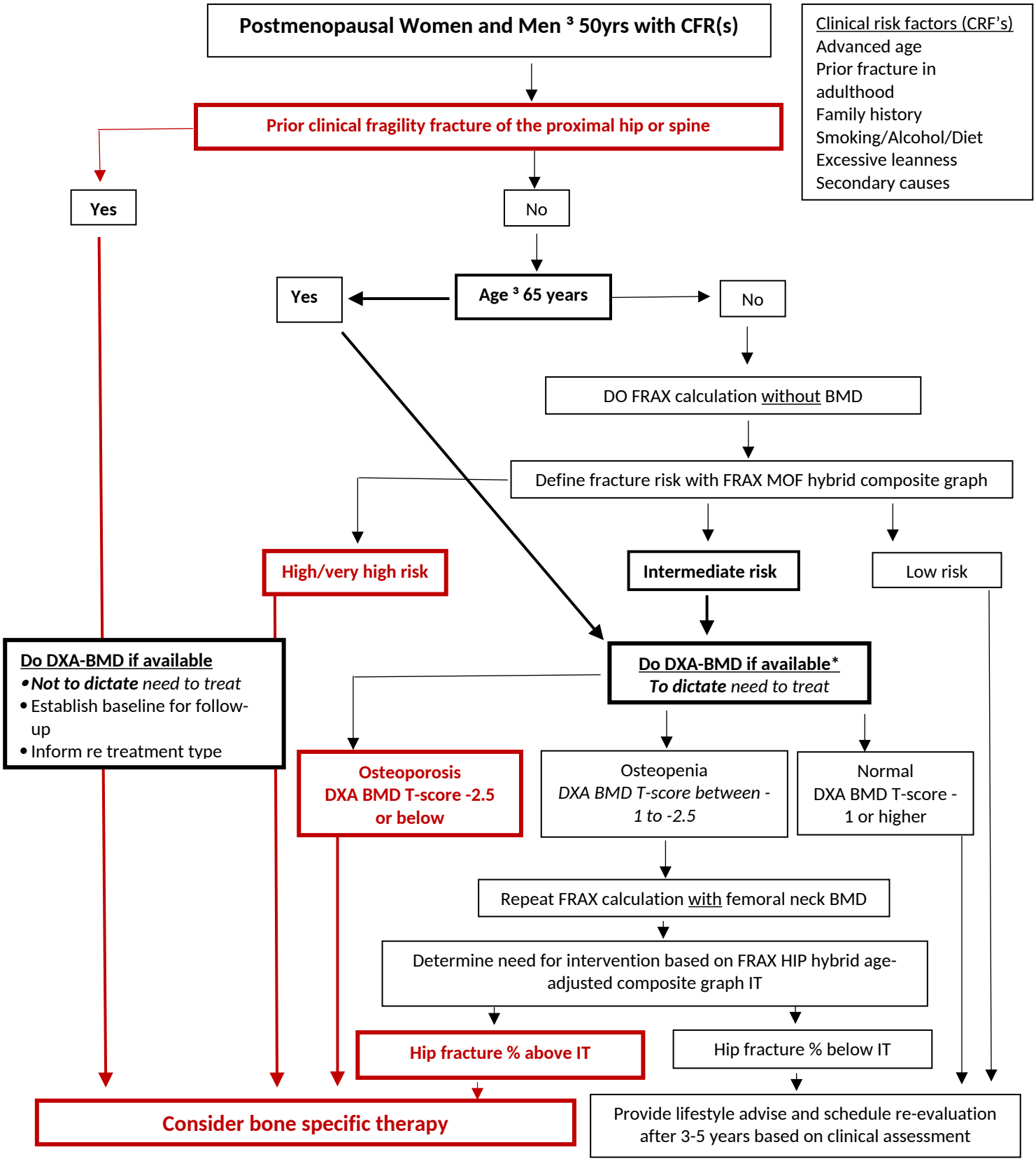

Figure 3. Fracture risk assessment and intervention thresholds in postmenopausal women and men ³ 50 years. **If DXA BMD not available/ technically not possible to consider bone specific therapy if FRAX MOF% exceeds IT; IT: Intervention threshold based on hybrid age-adjusted composite model for all South Africans; RED text and arrows: indications to consider bone specific therapy; Bold arrows: indications for DXA-BMD study*

Recommendations: sections 2-4.

Bone specific therapy should be considered in the presence of a prior fragility fracture of the proximal hip or clinical spine fracture(s), irrespective of FRAX predictions or absence of densitometric criteria for intervention per. ⨁⨁⨁⨁ [A].

The absolute 10-year fracture risk should be calculated using the South African ethnic based FRAX tool / algorithm. ⨁⨁⨁⨁ [A].

FRAX without DXA should be the initial screening instrument in all postmenopausal women < 65 years and men > 50 < 65 years with CRFs. A DXA-BMD, if available, is then indicated if the FRAX calculation of MOF% is indicative of intermediate fracture risk to inform regarding future management or in those with high or very high fracture risk to serve as baseline and to inform on treatment options. ⨁⨁⨁⨁ [A].

A FRAX MOF% calculation above the intervention threshold without DXA in postmenopausal women < 65 years and men ≥ 50 < 65 years with CRFs can be used as an indication for bone-specific therapy if a DXA-BMD measurement is unavailable. The South African MOF% hybrid age-adjusted composite intervention threshold graph (for all ethnic groups) linked to the NOFSA guidelines should be used. ⨁⨁⨁⨁ [A].

A DXA-BMD measurement if available, is indicated as part of the baseline assessment of fracture risk alongside clinical evaluation and FRAX without BMD in postmenopausal women and men > 65 years. ⨁⨁⨁⨁ [A].

Bone specific therapy should be considered if DXA-derived T-score is -2.5 or lower at the spine or hip. ⨁⨁⨁⨁ [A].

A fracture risk re-calculation employing the FRAX tool with inclusion of femoral neck BMD is indicated in postmenopausal women and men ³ 50 years with intermediate MOF% risk and /or osteopenia. Calculations will be displayed on a graph with intervention thresholds based on hip fracture risk. Bone specific therapy is indicated if the intervention threshold of hip fracture risk is exceeded. ⨁⨁⨁⨁ [A].

All the principles as stated before are integrated in the NOFSA algorithm for risk assessment and intervention thresholds for postmenopausal women and men ≥ 50 years of age. (√) [A].

5: Investigation of osteoporosis and fragility fractures.

A detailed general and dietary history, full physical examination and appropriate laboratory investigations are required in all patients prior to the initiation of treatment for fracture prevention. The diagnostic assessment should exclude diseases that mimic osteoporosis, identify the cause(s) of the osteoporosis, and include the management of any associated comorbidity. The extent of biochemical assessment is to be determined by the clinical context and the patient profile.

5.1: Routine blood tests (in all patients).

Full blood count with erythrocyte sedimentation rate or C-reactive protein.
Serum calcium, albumin, creatinine, phosphate, alkaline phosphatase and liver transaminases.
Serum 25-hydroxivitamin D.
Thyroid function tests.

5.2: Additional blood tests (individualize in select patients)

Plasma parathyroid hormone and 24 hour urinary calcium excretion (if hypercalcaemic)
Serum magnesium (if hypocalcaemic)
Serum electrophoresis, immunoglobulins, free light chain assay (if myeloma suspected)
Tissue transglutaminase antibodies (coeliac screen)
HIV tests if appropriate
Lateral radiographs of lumbar and thoracic spine if DXA LVA not available.

Recommendations: section 5

Before initiation of treatment for the prevention of fractures, the cause of osteoporosis and any associated comorbidities should be fully investigated. (√) [A]

6: Treatment of osteoporosis

6.1: Non pharmacological treatment.

All postmenopausal women and men above the age of 50 years and especially those considered for pharmacological intervention, should be educated on a bone-friendly lifestyle. This includes optimization of calcium and vitamin D status, general dietary measures, appropriate exercise, prevention of falls, cessation of tobacco smoking and excess alcohol intake and the minimisation of bone toxic medication (such a glucocorticoids, proton pump inhibitors, aromatase inhibitors).

6.1.1: Calcium

The mineralization of bone by calcium is an essential element of bone strength but bone also acts as a reservoir of calcium to maintain serum calcium levels within narrow limits. The measurement of serum calcium does not reflect calcium status. Sufficient intake should be based on dietary history and is easily calculated by using an on-line calcium calculator[38]. The Food and Nutrition Board at the National Academies of Sciences, Engineering, and Medicine advises a dietary reference intake (DRI) of 1000–1200mg of elemental calcium for adults with an upper limit of 2000 mg per day[39]. Excessive calcium supplementation may be associated with increased risk of renal calculi and constipation. The majority of required

calcium can be obtained by dietary sources. There is no need for routine calcium supplementation and it should only cover the dietary shortfall. Calcium supplementation alone may provide a small improvement in BMD[40], however this has not been shown to reduce fractures in postmenopausal women with low BMD[41].

6.1.2: Vitamin D

Vitamin D is an essential component in the intestinal absorption of calcium. The International Osteoporosis Foundation (IOF) recommends 800-1000 IU daily[42]. Only a small portion of Vitamin D comes from diet, mainly fatty fish and supplemented foods. As the major source of vitamin D is sunlight exposure, the need for supplementation will vary based on location, time spent outdoors, skin exposure and skin tone. Measuring the blood 25-hydroxyvitamin D level may be helpful in selected cases, although there is controversy regarding the optimal Vitamin D level. NOFSA recommends that a 25-hydroxyvitamin D level <12 ng/ml be regarded as deficient, 12-19 ng/ml as insufficient and >20 ng/ml as sufficient[43]. Supplementation is generally recommended to those with Vitamin D deficiency and insufficiency, to increase levels into the sufficient range. Vitamin D supplementation has been independently shown to reduce the risk of falling in elderly institutionalised women[44]. Meta-analyses of postmenopausal women with low BMD have found a reduced risk of hip fractures with combined calcium and vitamin D[45]. Individuals on antiresorptive and anabolic osteoporosis drug therapies should be vitamin D replete. The frail and/or institutionalized elderly may benefit from supplementation of calcium and vitamin D.

6.1.3: General Dietary Measures.

There is no evidence to support the routine supplementation of any other nutrients. It is important to reach the recommended dietary allowance (RDA) for protein intake (0.8 g protein/kilogram of body weight/day) in order to avoid sarcopenia which may lead to increased risk of falling[46].

6.1.4: Exercise.

Exercise improves BMD without evidence for a reduction in fracture risk[47]. The effects of exercise on bone health may depend on the type, intensity and frequency of exercise. This complicates systematic reviews with resultant inconsistencies in results[48]. A combination of weight-bearing exercise, dynamic resistance training combined with aerobic exercise, have been shown to improve BMD at both the lumbar spine and hip and is recommended[49].

6.1.5: Falls prevention.

It is postulated that exercise can significantly reduce the risk of falls and fractures by improving muscle strength, balance and posture. However, recent large randomised controlled trials have not demonstrated an effect of multi-disciplinary interventions, targeted at falls, on fracture reduction [50] [51]. Results may be better in individuals at high risk of falling (assessment of falls risk is important). Professional care (such as an occupational therapist) is recommended to advise measures to avoid domestic falls.

Recommendations: section 6.

All postmenopausal women and men above the age of 50 years and especially those considered for pharmacological intervention, should be educated on a bone-friendly lifestyle. (√) [A].

NOFSA supports a DRI of 1000–1200mg of elemental calcium for adults with an upper limit of 2000 mg per day. Sufficient intake should be based on dietary history and is calculated by using an on-line calcium calculator. Supplemental calcium should only cover the shortfall if not able to make dietary adjustment. Routine calcium supplementation is not supported. ⊕⊕⊕⊕ [A].

NOFSA recommends 800-1000 IU of Vitamin D daily for those over 60 and 50 years respectively. As the major source of vitamin D is sunlight exposure, the need for supplementation will vary. Measuring the blood 25-hydroxyvitamin D level may be helpful in selected cases. NOFSA recommends that a 25-hydroxyvitamin D level <12 ng/ml be regarded as deficient, 12-19 ng/ml as insufficient and >20 ng/ml as sufficient. ⊕⊕⊕○ [A].

NOFSA recommends a combination of weight-bearing exercise, dynamic resistance training combined with aerobic exercise to improve BMD at both the lumbar spine and hip. ⊕⊕⊕○ [A].

6.2: Inhibitors of bone resorption

6.2.1: Menopausal Hormone Therapy (MHT) and Tibolone.

Accelerated postmenopausal bone loss in women is induced by ovarian derived estrogen deprivation. Lack of estrogen induces upregulation of the Receptor Activator of Nuclear factor Kappa B Ligand (RANKL) and a decreased expression of osteoprotegerin. This stimulates osteoclastic recruitment and function resulting in increased bone resorption, with lowering of BMD, deterioration of microarchitecture and decreased bone strength[52]. The close relationship between menopause and deleterious bone effects has been examined in depth in the Study of Women's health Across the Nation (SWAN). This is a longitudinal study of 3302 women followed from perimenopause for more than 20 years with a subset

of 2407 participants that had serial BMD estimations[53]. Bone loss occurs from 1-2 years before final menstrual period (FMP) till 3-4 years after FMP at both the lumbar spine and femur neck. Bone loss is maximal in the period one year before FMP and continues for 2 years after FMP with cumulative BMD loss averages during this time of 10.6% at lumbar spine and 9.1% at the femur neck[54]. Trabecular Bone Score (TBS), an independent indication of bone strength, declines by 1.16% annually from 1.5 years before the FMP with a loss of 6.3% over the menopausal transition. This is very important as micro-architectoral damage to the trabecular structure cannot be corrected with anti-resorptive therapy[55]. BMD at time of menopause is a highly significant predictor of the risk of future osteoporosis as significant bone loss (and loss of bone structure) will lead to earlier attainment of fracture thresholds[56].

These findings strengthen an understanding of the difference between preventing osteoporosis (bone loss) and prevention of fractures. Prevention of osteoporosis is generally applicable to the younger woman (peri and early menopause) whilst prevention of fracture is generally applicable to older woman presenting with low BMD and other risk factors for fracture. The peri and early menopause is a golden opportunity to prevent osteoporosis and bone loss with a variety of medications with menopausal hormone therapy (MHT) being the most obvious choice in the appropriate woman.

The use of MHT in general has been limited by perceived fears regarding risks, especially breast cancer, cardiovascular risk in older women and thromboembolic events. This was largely based on misinterpretation of the initial WHI results. The benefit to risk ratio has been put into perspective by long term follow-up of the WHI cohort[57 58] .

MHT decreases the incidence of all fractures, including vertebral, non-vertebral and hip fractures, even in women at low risk of fracture[59]. Meta-analysis reported 388 fewer fractures with estrogen-only therapy over 7.2 years and 230 fewer fractures with combined MHT over five years per 10,000 persons[60]. Although MHT prevents bone loss at any age after the menopause, age at the initiation of MHT is important. If initiated in the age group 50–60 years or within 10 years after menopause (the window of opportunity), the benefits of MHT are most likely to outweigh any risk[61]. This makes MHT an ideal candidate for the prevention of menopause associated bone loss. Recent opinion based on re-evaluation of the WHI data advocates that the window of opportunity should be revisited as being too restrictive and denies many deserving women the benefit of MHT especially in terms of bone health[62]. Initiation of MHT in the age group 60–70 years requires an individually calculated benefit to risk ratio as well as consideration of other available medication. There are no large RCTs assessing the prevention of fracture in osteoporotic women but there is no reason to suspect that it will not be effective.

There is no mandatory time limit for duration of MHT provided that it is consistent with treatment goals[63]. This is important as the protective effect of MHT on BMD declines after cessation of therapy at an unpredictable rate, although some degree of fracture protection may remain after cessation of MHT. A recent systematic review included two small studies which indicated that sequential therapy with alendronate or raloxifene treatment for 12 months post MHT cessation increased or maintained spine and femoral neck BMD[64].

Continuation of MHT beyond the age of 65 for the sole purpose of the prevention of fractures should be consistent with the lowest effective dose, transdermal rather than oral route and estradiol (E2) rather than conjugated equine estrogen (CEE). In women who continued MHT beyond age 65, compared to cessation at 65 or never users, many health advantages were shown, especially with estrogen monotherapy[65].

Evidence for the fracture-protective effect of MHT is limited to standard dosages of CEE and medroxyprogesterone acetate (MPA), given by the oral route. Evidence for protection against loss of BMD is available for lower than standard doses in oral and transdermal administration[66].

Tibolone, a synthetic preparation metabolized to molecules that have affinity to estrogen, progesterone and androgen receptors protected against vertebral and non-vertebral fractures in older women in a RCT and meta-analysis[67].

In women with a uterus, the stimulatory effects of CEE on the endometrium can be opposed by the selective estrogen receptor modulator (SERM) bazedoxifene. This combination, also known as tissue selective estrogen complex, has been shown to prevent the bone loss associated with menopause but the effect on fracture reduction has not been explored[68].

No significant effect of testosterone therapy on BMD in postmenopausal women was reported in a systematic review and meta-analysis of randomised controlled trial data[69].

Recommendations: section 6.2.1

MHT including Tibolone, decreases the incidence of all fractures, including vertebral, non-vertebral and hip fractures, even in women at low risk of fracture. ⨁⨁⨁⨁ [A].

If MHT is initiated in the age group 50–60 years or within 10 years after menopause (the window of opportunity), the benefits of MHT are most likely to outweigh any risk. ⨁⨁⨁⨁ [A].

There is no mandatory time limit for duration of MHT provided that it is consistent with treatment goals. (√) [A].

Continuation of MHT beyond the age of 65 for the sole purpose of the prevention of fractures should be consistent with the lowest effective dose, transdermal rather than oral route and estradiol (E2) rather than conjugated equine estrogen (CEE). (√) [A].

The protective effect of MHT on BMD declines after cessation of therapy at an unpredictable rate. ⨁⨁⨁⨁ [A].

The peri and early menopause is a golden opportunity to prevent osteoporosis and bone loss. MHT has an important role to play in this regard. ⨁⨁⨁⨁ [A].

6.2.2: Selective Estrogen Receptor Modulators (SERMs).

SERMs have an estrogen- like effect on bone (although weaker than estradiol)), but opposes estrogen receptors (ER) in the breast and uterus. Raloxifene (60mg daily orally), maintains BMD and reduces vertebral fractures in postmenopausal women with or without prevalent vertebral fracture but there is no evidence for hip fracture or non-vertebral fracture protection[70]. Raloxifene reduces the risk of estrogen receptor positive breast cancer in osteoporotic women[71]. Raloxifene is indicated in asymptomatic women at risk of vertebral fracture and breast cancer. SERMs do not alleviate vasomotor symptoms associated with menopause. SERMs increase the risk of thromboembolic events.

Recommendations: section 6.2.2

Raloxifene is indicated in asymptomatic women at risk of vertebral fracture and breast cancer. It does not alleviate vasomotor symptoms associated with menopause and increases the risk of thromboembolic events. ⨁⨁⨁⨁ [A].

6.2.3: Bisphosphonates.

Bisphosphonates (BPs) are the most commonly prescribed therapy for the treatment of postmenopausal osteoporosis. BPs act by inhibiting farnesyl pyrophosphate synthase in the mevalonate pathway, thus inhibiting osteoclast function and survival. BPs bind to the bone surface at different strengths and remain in bone for lengthy periods dependant on the strength of the binding. Zoledronate (5mg yearly as intravenous infusion) binds to bone the strongest, followed by oral alendronate (70mg weekly), oral risedronate (35mg weekly), and oral ibandronate (150mg monthly). Because of the extended action in bone, BPs are ideal to follow after other anti-resorptive or anabolic drugs as cessation of these drugs is followed by rapid bone loss.

BPs are potent inhibitors of bone resorption with proven efficacy in the prevention of vertebral (50-70%), non-vertebral (20-30%) and hip fractures (40-50%), in women and men with osteoporosis (secondary prevention), in large RCTs and meta-analyses[72].

Alendronate is registered in South Africa for the prevention of vertebral and hip fracture. A recent Cochrane review reported that alendronate is associated with a clinically important reduction in vertebral but not hip or wrist fractures as primary prevention, although a reduction in vertebral, hip and wrist fracture is observed for secondary prevention[73]. Risedronate is registered in South Africa for the prevention of vertebral and hip fracture in women and men as secondary prevention. An updated Cochrane review of risedronate concluded no significant benefit for primary fracture prevention of osteoporotic fracture, but risedronate (5mg daily) significantly reduced non-vertebral and hip fractures with unclear effect on vertebral fracture in secondary prevention[74].

Ibandronate reduces the risk of vertebral fracture in primary analysis (secondary prevention) and has been shown to reduce the risk of hip fracture only in women at high risk of hip fracture[75]. However, large post hoc analysis compared to other BPs, showed non-inferiority in the reduction of hip fractures[76].

Zoledronate is effective in reducing vertebral and non- vertebral fracture risk for both primary and secondary prevention in women and men[77]. When given shortly after hip fracture, men and women given zoledronate 5mg annually had fewer clinical fractures and lower mortality after 3 years[78].

In postmenopausal women with osteopenia, meta-analyses indicate that BP therapy reduces the risk of fragility and vertebral fracture for primary prevention[79]. A 2023 meta-analysis (12 RCTs; n=1722) of perimenopausal or early postmenopausal women without osteoporosis reported improved lumbar spine, femoral neck and hip BMD with oral or IV bisphosphonates versus placebo, although fracture outcomes were lacking[80]. A recent RCT where zoledronate 5 mg IV was administered at baseline and after 5 years showed efficacy in preventing bone loss and morphometric vertebral fracture in early postmenopausal women of average BMD, after 10 years[81].

The frequency and type of adverse event varies with the type of bisphosphonate[82]. Common side-effects of oral BPs include upper gastrointestinal symptoms, bowel disturbance, headaches, musculoskeletal pain and hypocalcaemia. Zoledronate infusion may cause an acute phase flu-like reaction which can be reduced by co-administration of paracetamol or corticosteroids. As BPs are solely excreted by the kidneys, glomerular filtration rate should be calculated to be >35ml/min prior to initiation of treatment and caution advised for recipients at risk of kidney failure. Pre- treatment hypocalcaemia should be investigated and treated. The infusion of zoledronate should be given over a minimum of 20 minutes for renal protection.

BP therapy may be associated with rare but serious adverse events. Osteonecrosis of the jaw (ONJ) is a rare condition characterised by nonhealing of exposed bone in patients receiving bisphosphonate or denosumab therapy for osteoporosis. The estimated incidence in those receiving bisphosphonates is 10-100/100,000 person-years of exposure in clinical trials. The absolute risk is 0,05% after 5 years and 0.18% after 10 years. The risk is less with denosumab. Risk factors for ONJ include poor oral hygiene, dental disease, dental interventions, smoking, cancer, chemotherapy and/or glucocorticoid therapy. The incidence of ONJ is substantially greater with the higher doses of bisphosphonates or denosumab that are sometimes used to treat patients with skeletal metastases. Appropriate dental care in patients on anti-retroviral therapy should not be delayed as untreated dental sepsis is also a risk of ONJ.

A recent International taskforce found that current evidence does not suggest an association between antiresorptive therapy in patients with osteoporosis and dental implant failure. Implants may be safely placed in the presence of concomitant use of bisphosphonates or denosumab in patients with osteoporosis with no evidence of an increased risk of implant failure/compromise[83]. They found no evidence that cessation of bisphosphonate or denosumab therapy improves implant survival or reduces the development of medication-

related ONJ. Cessation of denosumab is not advised as it has been associated with rebound bone loss and an increased risk of multiple vertebral fractures. Patients on antiresorptive therapy should receive routine comprehensive oral examination and maintain good dental hygiene.
Individualized management is advised balancing the risks and benefits of continuing pharmacotherapy in patients with osteoporosis undergoing dental implant placement.
It is advised though before initiating BP or denosumab therapy, to first complete any planned dental procedures and to stress the importance of sound oral hygiene.

Atypical femoral fractures (AFF), mainly of the subtrochanteric and diaphyseal regions of the femoral shaft, have been reported rarely in patients taking bisphosphonates or denosumab for osteoporosis. AFFs are often bilateral, associated with prodromal pain and tend to heal poorly. Prodromal pain can be felt in the thigh, groin or hip for days, weeks or months before fracture. A recent large prospective cohort study of women using bisphosphonates for fracture protection found that the risk of AFF was related to duration of therapy but discontinuation of bisphosphonates was associated with a rapid decrease in risk. The risk of AFF was extremely small. After 3 years of treatment 149 typical hip fractures were prevented at the cost of 2 AFFs[84]. Discontinuation of bisphosphonate or denosumab therapy is advised in patients who develop an atypical fracture, weight-bearing activity should be restricted, adequate calcium and vitamin D should be ensured, and alternative treatment options considered where appropriate. Surgical treatment with intramedullary nailing is often recommended. Teriparatide therapy is an option to be considered[85].

The optimal duration of bisphosphonate therapy thus becomes relevant as osteoporosis is a life-long disease. Management should ensure that the benefit of fracture risk reduction at all times exceeds the small risk of AFFs and ONJ. Defining the optimal duration of treatment takes into account the persistent action of BPs after cessation, the fact that BMD increase plateaus after 3-5 years and the small risk of AFF and ONJ. Typical recommendations are a drug free period after 3 years of annual IV therapy and after 5 years of oral therapy. Exceptions are women at high risk of fracture, notably when older than 70, those with a previous fracture or those who fracture while on treatment without change in treatment. In these patients treatment should persist for 6 years(IV) or 10 years(oral). Restarting treatment should be based on FRAX values determined after 18 months for risedronate and ibandronate, 2 years for alendronate, and 3 years for zoledronate (NOGG 2024). After 10 years of BP treatment, patient management should be considered on an individual basis.

Recommendations: section 6.2.3

BPs are potent inhibitors of bone resorption with proven efficacy in the secondary prevention of vertebral (50-70%), non-vertebral (20-30%) and hip fractures (40-50%) in large RCTs and meta-analyses. ⨁⨁⨁⨁ [A].

BPs bind to the bone surface at different strengths and remain in bone for lengthy periods dependant on the strength of the binding. Zoledronate(5mg yearly as intravenous infusion) binds to bone the strongest, followed by oral alendronate (70mg weekly), oral risedronate (35mg weekly), and oral ibandronate (150mg monthly). ⊕⊕⊕⊕ [A].

Because of the extended action in bone, BPs are ideal to follow after other anti-resorptive or anabolic drugs as cessation of these drugs is followed by rapid bone loss. (√) [A].

BPs may blunt the effect and BMD response of anti-resorptive and anabolic treatment that follows BP therapy. ⊕⊕⊕⊕ [A].

As BPs are solely excreted by the kidneys, glomerular filtration rate should be calculated to be >35ml/min prior to initiation of treatment and caution advised for recipients at risk of kidney failure. Pre- treatment hypocalcaemia should be investigated and treated. ⊕⊕⊕⊕ [A].

Common side-effects of oral BPs include upper gastrointestinal symptoms, bowel disturbance, headaches, musculoskeletal pain and hypocalcaemia. Zoledronate infusion may cause an acute phase flu-like reaction which can be reduced by co-administration of paracetamol or corticosteroids. ⊕⊕⊕⊕ [A].

Osteonecrosis of the jaw (ONJ) is a rare condition characterised by nonhealing of exposed bone in patients receiving bisphosphonate or denosumab therapy for osteoporosis. The estimated incidence in those receiving bisphosphonates is 10-100/100,000 person-years of exposure in clinical trials. ⊕⊕⊕⊕ [A].

A recent International taskforce found no evidence to suggest an association between antiresorptive therapy in patients with osteoporosis and dental implant failure. They found no evidence that cessation of bisphosphonate or denosumab therapy improves implant survival or reduces the development of medication-related osteonecrosis of the jaw. ⊕⊕⊕○ [A].

It is advised that before initiating BP or denosumab therapy, to first complete any planned dental procedures and to stress the importance of sound oral hygiene. (√) [A].

The risk of atypical femur fracture (AFF) is related to duration of therapy but is extreme small. After 3 years of treatment 149 typical hip fractures were prevented at the cost of 2 AFFs. ⊕⊕⊕⊕ [A].

Defining the optimal duration of BP treatment must take into account the persistent action of BPs after cessation, the fact that BMD increase plateaus after 3-5 years and the small risk of AFF and ONJ. ⨁⨁⨁⨁ [A].

A drug free period can be considered after 3 years of annual IV therapy and after 5 years of oral therapy. Exceptions are women at high risk of fracture, notably when older than 70, those with a previous fracture or those that fracture while on treatment without change in treatment. In these patients treatment should persist for 6 years(IV) or 10 years(oral). Restarting treatment should be based on FRAX values determined after 18 months for risedronate and ibandronate, 2 years for alendronate, and 3 years for zoledronate. ⨁⨁⨁◯ [A].

6.2.4: Denosumab

Denosumab, developed as targeted therapy, is a monoclonal antibody against RANKL, the regulator of osteoclast development and activity. By blocking RANKL, denosumab inhibits osteoclast formation and function. Denosumab is given as a subcutaneous injection of 60 mg once every 6 months.

Denosumab has been shown to reduce the incidence of vertebral, non-vertebral and hip fractures in postmenopausal women with osteoporosis[86]. Safety and efficacy have been shown in 10 years of follow-up[87].

Denosumab differs from BPs in not being excreted via the kidneys and the fact that the improvement in BMD does not plateau after 3-5 years but increases during every year of treatment. Unlike BPs, denosumab cessation leads to rapid reductions in BMD and elevations in bone turnover to levels above those seen before treatment initiation as well as an increased incidence of multiple vertebral fracture[88]. Long-term treatment with denosumab can be considered for patients at high fracture risk in view of favorable efficacy and safety profile.

In case of denosumab discontinuation, alternative antiresorptive treatment should be initiated 6 months after the final denosumab injection. Zoledronate is the preferred option. Bone markers of turnover should be reviewed 6 months after the first dose of zoledronate. If these remain elevated a second dose of zoledronate should be administered. If bone markers are unavailable, a second dose of zoledronate should be given at 6 months as routine. A careful assessment of indications to start denosumab treatment is advised, especially for younger patients.

Hypocalcemia, a side-effect of denosumab treatment should be excluded prior to treatment, especially when renal impairment is present. Other side-effects include cellulitis, eczema and rarely ONJ and AFF.

Recommendations: section 6.2.4

Denosumab, a monoclonal antibody that inhibits RANKL, blocks osteoclast formation and prevents vertebral, non-vertebral and hip fractures in postmenopausal women with osteoporosis. ⨁⨁⨁⨁ [A].

Denosumab differs from BPs in not being excreted via the kidneys and the fact that the improvement in BMD does not plateau after 3-5 years but increases during every year of treatment. ⨁⨁⨁⨁ [A].

Unlike BPs, denosumab cessation leads to rapid reductions in BMD and elevations in bone turnover to levels above those seen before treatment initiation and an increased rate of multiple vertebral fracture. In case of denosumab discontinuation, alternative antiresorptive treatment should be initiated 6 months after the final denosumab injection. ⨁⨁⨁⨁ [A].

Hypocalcemia should be excluded and corrected prior to treatment. ⨁⨁⨁⨁ [A].

In spite of a very small risk of ONJ and AFF, Long-term treatment with denosumab can be considered for patients at high fracture risk in view of favorable efficacy and safety profile. ⨁⨁⨁○ [A].

6.3: Anabolic therapy

6.3.1: Teriparatide.

Teriparatide (recombinant human parathyroid hormone [PTH] 1-34), when administered intermittently as a daily subcutaneous injection of 20 ug, stimulates bone formation (anabolic effect) by activation of the osteoblast. The anabolic effect is most marked in trabecular bone. Maximum duration of treatment is limited to 24 months. Cessation of teriparatide leads to a rapid loss of BMD and should be followed by an anti-resorptive. Teriparatide has been shown to reduce vertebral and non-vertebral fractures in postmenopausal women with osteoporosis in a RCT[89] and meta-analyses[90], with greater fracture risk reduction versus risedronate or ibandronate[91]. Evidence for the reduction of hip fracture risk is based on systematic review and meta-analysis[92]. Prior treatment with a bisphosphonate may blunt the effect on BMD of subsequent teriparatide. The reduction in fracture risk does not however appear to be reduced. PTH levels and serum calcium levels need to be normal prior to initiation of teriparatide. Side effects include headache, nausea, dizziness, postural hypotension and leg pain. Slight and transient elevations of serum calcium may occur following teriparatide injection. A recent systematic review concluded that there was no significant evidence of an increased risk of osteosarcoma with teriparatide[93]. A synthetic teriparatide generic has been registered in South Africa.

Recommendations: section 6.3.1.

Teriparatide is presently the only anabolic drug available in SA. It acts by direct stimulation of the osteoblast and reduces vertebral and non-vertebral fractures in postmenopausal women with osteoporosis with greater fracture risk reduction versus risedronate or ibandronate. ⨁⨁⨁⨁ [A].

Maximum duration of treatment is limited to 24 months. Cessation of teriparatide leads to a rapid loss of BMD and should be followed by an anti-resorptive. ⨁⨁⨁⨁ [A].

PTH levels and serum calcium levels need to be normal prior to initiation of teriparatide. (√) [A].

It is recommended to start with teriparatide treatment for 2 years in patients at very high risk for fracture, followed by an anti-resorptive agent. ⨁⨁⨁⨁ [A].

6.3.2: Romosozumab.

Romosozumab is an anabolic agent that is presently not registered in South Africa, but is available under section 21 application. It is a humanised monoclonal antibody that binds to and inhibits sclerostin. It was developed as targeted therapy with a dual action of stimulating bone formation and inhibiting bone resorption. The dosing of romosozumab is a subcutaneous injection of 210 mg once monthly for a maximum duration of 12 months. It must then be followed by anti-resorptive therapy.

Fracture preventative efficacy was proven In a comparator-controlled study (ARCH) [94]. Postmenopausal women with severe osteoporosis received romosozumab 210mg once monthly for 12 months followed by oral alendronate 70mg once weekly for 12 months and compared to alendronate 70mg once weekly for 24 months. New vertebral, non- vertebral, clinical and hip fractures were all significantly lower in women treated with romosozumab followed by alendronate compared to treatment with alendronate alone. Meta-analyses confirm these findings reporting with a decreased incidence of vertebral and non-vertebral fractures with romosozumab versus control at 24 months[95].

A significantly higher incidence of cardiovascular events was reported in the romosozumab group compared to the alendronate group. A history of myocardial infarction or stroke is thus considered a contraindication to romosozumab initiation. Post registration network meta-analyses did not report an increased risk of cardiovascular death or major events with romosozumab, although the certainty of evidence was low[96]. Prior to initiation of treatment, hypocalcaemia should be corrected and patients should be adequately supplemented with calcium and vitamin D.

Recommendations: section 6.3.2.

Romosozumab is only available in South Africa, under section 21 application. It is a humanised monoclonal antibody that binds to and inhibits sclerostin with a dual action of stimulating bone formation and inhibiting bone resorption. The dosing of romosozumab is a subcutaneous injection of 210 mg once monthly for a maximum duration of 12 months. It must then be followed by anti-resorptive therapy. ⨁⨁⨁⨁ [A].

7.1: Comparative efficacy of bone -specific drugs.

Comparative efficacy of bone-specific drugs is limited by a lack of head-to-head studies. A recent systemic review and network meta-analysis found evidence that all the drugs as discussed (MHT not included in study) are effective in the prevention of clinical and vertebral fractures but that bone anabolic treatments were more effective than bisphosphonates[97]. A different network meta-analysis included MHT and found MHT and tibolone to significantly reduce hip fractures, non-vertebral fractures and vertebral fractures. Teriparatide, denosumab and romosozumab were associated with the highest relative risk reductions[98].

7.2: The initial drug of choice and sequencing of drugs.

Although NOFSA advises that the initial drug of choice be guided by fracture risk (see 7.2.1) individualization based on fracture risk, age, type of fracture prevention targeted, prior treatment, affordability, likelihood of adherence to therapy and co-morbidities, must also be considered. Osteoporosis is a life-long disease and cannot be cured. The first consultation should involve planning of treatment over an extended period of time. The duration of therapy and the sequence of drugs and drug free periods are drug specific. Anabolic and anti-resorptive therapy should not be combined. In sequential therapy, anabolic therapy should preferably be given before antiresorptive drugs. This is shown by the findings of a 2024 network meta-analysis of sequential osteoporosis therapies (n=14 trials; seven different interventions; 15,586 postmenopausal women), which indicated that, compared to only anti-resorptive therapy, sequential anti-resorptive to anabolic or anabolic to anti-resorptive therapy were more effective in reducing vertebral fracture incidence. Anabolic to anti-resorptive therapy was most effective in reducing non-vertebral and total fractures[99].

7.2.1: Choice of drug according to risk of fracture.

NOFSA advises to estimate the risk of fracture as explained in section 2-4. The absolute 10-year fracture risk should be calculated using the South African ethnic based FRAX tool / algorithm. The South African MOF% and HF hybrid age-adjusted composite intervention threshold graphs (for all ethnic groups) linked to the NOFSA guidelines should then be used to estimate risk as low, high or very high.

In **low risk** individuals, consider lifestyle changes and optimize calcium and Vit D status, with repeat estimation after 5 years.

In **high risk** individuals, consider anti-resorptive drugs such as a BP, denosumab, menopausal hormone therapy or raloxifene, as appropriate. Offer intravenous zoledronate as first line therapy following hip fracture.

In **very high risk** individuals, consider anabolic drug treatments as first-line therapy. This recommendation is supported by a recent meta-analysis (n=4) that reported a 40% decreased risk of new vertebral fractures with anabolic agents compared to oral bisphosphonate therapy in women with osteoporosis at high or very high risk of fracture. This meta-analysis included the VERO study, in which postmenopausal women with severe osteoporosis received teriparatide or risedronate . After 24 months, teriparatide-treated women had a significantly reduced risk of vertebral and any clinical fracture with a non-significant trend in reduction of non-vertebral fractures compared to risedronate. It also includes the ARCH study, in which postmenopausal women with severe osteoporosis who first received 12 months of romosozumab, followed by 12 months of alendronate had superior protection compared to the alendronate treated group after 24 months. It should also be considered that prior BP therapy blunts the BMD response of subsequent anabolic therapy.

Recommendations: section 7.2.1.

Comparative efficacy of bone-specific drugs is limited by a lack of head-to-head studies. (√) [A].

NOFSA advises that the need for and type of medication to be used, be guided by the calculated ITs and risk of fracture based on the South African ethnic based FRAX tool / algorithm. The South African MOF% and HF hybrid age-adjusted composite intervention threshold graphs (for all ethnic groups) linked to the NOFSA guidelines should then be used to estimate risk as low, high or very high. (√) [A].

In **low risk** individuals, consider lifestyle changes and optimize calcium and Vit D status, with repeat estimation after 5 years. (√) [A].

In **high risk** individuals, consider anti-resorptive drugs such as a BPs, denosumab, menopausal hormone therapy or raloxifene, as appropriate. Offer intravenous zoledronate as first line therapy following hip fracture. (√) [A].

In **very high risk** individuals, consider anabolic drug treatments as first-line therapy. (√) [A].

Osteoporosis is a life-long disease and cannot be cured. The first consultation should involve planning of treatment over an extended period of time. The duration of therapy and the sequence of drugs and drug free periods are drug specific. ⊕⊕⊕⊕ [A].

7.2.2: Special Categories.

7.2.2.1: Glucocorticoid-induced osteoporosis.

Glucocorticoids (GCs) can have a deleterious effect on bone by inhibiting bone formation, stimulating bone resorption, impairing calcium absorption and reducing insulin-like growth factor 1. It is a very common cause of secondary osteoporosis and clinically very important as the deleterious effects on bone can start within months of starting therapy. The severity of effect correlates with dose (prednisolone ≥7.5mg daily) or duration (≥ 3months).

It is recommended that all postmenopausal women and men at start of GC therapy be evaluated by FRAX (with BMD if available) and to follow the intervention threshold for therapy. Medium doses (2.5–7.5 mg daily) are the assumed minimum requirement for FRAX calculation, and the unadjusted FRAX value is used. For high doses (>7.5 mg daily), MOF probabilities are upward revised by about 15% and hip fracture probabilities by 20%. The FRAXplus tool can also be used for a revised estimate.

Oral bisphosphonates (alendronate or risedronate) or intravenous zoledronate are the most cost-effective first-line drug options for bone protection. Denosumab is an alternative option. Teriparatide can be a first-line drug option in those at very high fracture risk. A bone-friendly lifestyle and optimisation of calcium and Vitamin D status is essential.

DXA should be repeated one year after initiation of GC therapy. The need for continued bone-specific therapy should be reassessed at completion of GC therapy by FRAX. Bone protective therapy may be appropriate in some premenopausal women and younger men.

Recommendations: section7.2.2.1.

Glucocorticoids (GCs) can have a deleterious effect on bone that can start within months of starting therapy. The severity of effect correlates with dose (prednisolone ≥7.5mg daily) or duration (≥ 3months). ⊕⊕⊕⊕ [A].

It is recommended that all postmenopausal women and men at start of GC therapy (≥7.5 mg daily), be evaluated by FRAX (with BMD if available). The intervention threshold for therapy should be adjusted upwards 15% (MOF) and 20% (HF). (√) [A].

The need for continued bone-specific therapy should be reassessed at completion of GC therapy by FRAX. (√) [A].

7.2.2.2 Aromatase inhibitor-associated bone loss (AIBL).

About 80% of breast cancers are estrogen receptor positive (ER+). Adjuvant endocrine therapy in ER+ breast cancer, is standard of care to prevent recurrence and improve survival outcomes [100]. Aromatase inhibitors (AIs) prevent aromatization of endogenous androgens into estrogen and have largely replaced tamoxifen (SERM) as the treatment of choice due to their superior effect on preventing cancer recurrence. Endocrine therapy is usually recommended for 5-10 years. Estrogen lowering results in an accelerated rate of bone loss that exceeds bone formation. AI therapy in menopause can increase the risk of bone loss by 2–4 times compared to the usual postmenopausal decrease in BMD, with a high risk of fragility fractures, especially vertebral fractures. The FRAX® tool was developed for use in the general population and was not specifically designed for use in patients with breast cancer undergoing AI treatment and may not adequately reflect fracture risk, even when inputting AI exposure as secondary osteoporosis. NOFSA endorses a recent updated International Consensus Position Statement. It is suggested that fracture risk should be assessed by DXA at start of AI therapy. Treatment to prevent bone loss and fractures is recommended in those with a T-score of less than -2, or less than -1.5 with 1 additional risk factor, or in those with 2 or more risk factors[101].

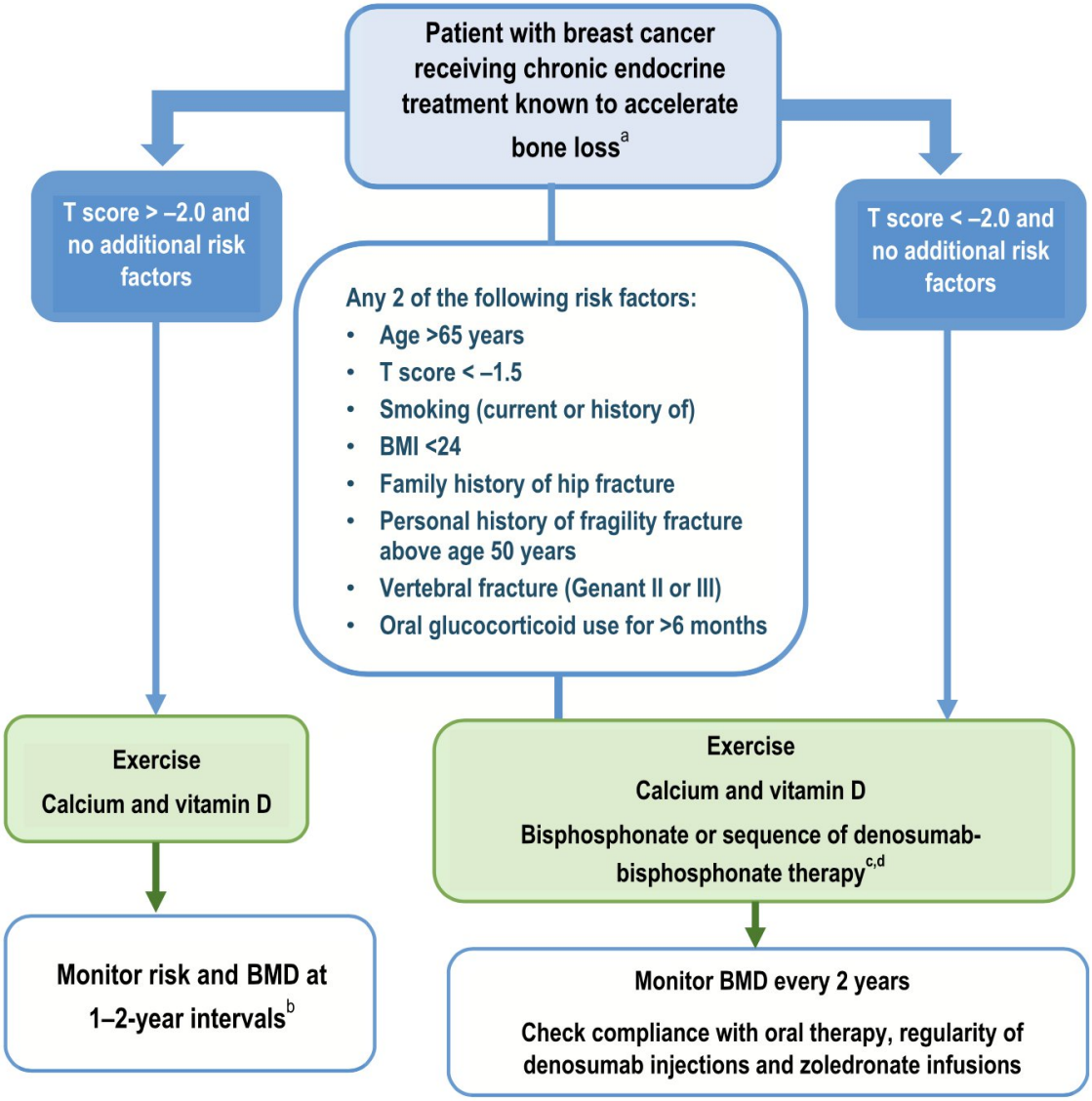

Fig 4 Recommended algorithm for managing bone health in women receiving aromatase inhibitor therapy for breast cancer. (Hadji et al, 2025).

[a] Includes AIs and ovarian suppression therapy/oophorectomy.

[b] If patients experience an annual decrease in BMD of ≥ 10 % at any site (or ≥ 4–5 % in patients who were osteopenic at baseline) using the same DXA absorptiometry machine, secondary causes of bone loss such as vitamin D deficiency should be evaluated and antiresorptive therapy initiated. Use the lowest T-score from spine or hip.

[c] Either denosumab (60 mg every 6 months) or yearly intravenous zoledronate (5mg) or six-monthly intravenous zoledronate (4 mg) as first-line treatment (for the duration of endocrine treatment/together typically for up to 5 years). Discontinuation of denosumab should be followed up by an appropriate antiresorptive.

[d] Weekly oral alendronate (70 mg) or risedronate (35 mg) or monthly oral ibandronate (150 mg) for the duration of endocrine treatment/typically for up to 5 years.

Denosumab and zoledronate both lead to significant gains in BMD at the spine and hip in postmenopausal women with breast cancer receiving AI and have been shown to reduce fracture risk[102]. Adjuvant bisphosphonates, especially intravenous zoledronate, have been shown to significantly reduce bone recurrence and breast cancer mortality in postmenopausal women[103].

Recommendations: section 7.2.2.2.

AI therapy in menopause can increase the risk of bone loss by 2–4 times compared to the usual postmenopausal decrease in BMD, with a high risk of fragility fractures, especially vertebral fractures. ⨁⨁⨁⨁ [A].

The FRAX® tool may not adequately reflect fracture risk in AI users, even when inputting AI exposure as secondary osteoporosis. Fracture risk should be assessed by DXA at start of AI therapy (with TBS if available). Treatment to prevent bone loss and fractures is recommended in those with a T-score < -2, or < -1.5 with 1 additional risk factor, or in those with 2 or more risk factors. (√) [A].

Either denosumab or intravenous zoledronate is regarded as first-line treatment (for the duration of endocrine treatment/together typically for up to 5 years). Discontinuation of denosumab should be followed up by an appropriate antiresorptive agent. (√) [A].

7.2.2.3: Androgen-deprivation therapy

Androgen deprivation therapy (ADT), is used primarily in the treatment of older men with prostate cancer and is frequently associated with hypogonadism, a known cause of bone-loss. Osteoporosis caused by ADT is associated with rapid loss of BMD within 6–12 months of initiation of ADT. There is a significant increase in fracture risk in men with prostate cancer in the 5 years following the initiation of ADT when compared to those not receiving ADT[104].

Bisphosphonates and denosumab are effective drug treatments for preventing BMD loss in men with prostate cancer taking ADT, although effects on fracture risk have not been demonstrated[105].

All men starting androgen deprivation therapy (ADT) should have their fracture risk assessed using FRAX with BMD, considering ADT use as a secondary cause of osteoporosis. Treatment should be considered using FRAX IT or if T score < -2.0, with other RFs for fracture.

Recommendations: section 7.2.2.3.

ADT may be associated with rapid bone-loss within 6-12 months after initiation with increased risk of fracture. ⨁⨁⨁⨁ [A].

Fracture risk assessment should be done prior to initiation of ADT with DXA and FRAX.

(√) [A].

Treatment should be considered using FRAX IT or if T score < -2.0, with other RFs for fracture. Bisphosphonates and denosumab are effective drug treatments for preventing BMD loss in men with prostate cancer taking ADT, although effects on fracture risk have not been demonstrated. (√) [A].

8: Management of symptomatic osteoporotic vertebral fractures

Vertebral fractures are the most common type of osteoporotic fracture and are increasing in incidence[106]. These fractures can cause both acute and chronic pain, spinal deformity, height loss, functional impairment, and can reduce mobility and health related quality of life[107].

There is limited direct evidence to guide pain management and rehabilitation[108]. Analgesia for acute pain is important to allow restoration of function and mobility but must be used as safely as possible [109 110.] Pain should be regularly reviewed, and analgesia titrated up or down according to pain intensity and side effects, with use of the weakest effective agent for the shortest possible time. NSAIDs and opioids are often prescribed for pain relief despite the limited evidence of their efficacy and associated risk of adverse drug events especially in the elderly population[111 112]. There is no evidence to support the use of drugs within the antidepressant and anticonvulsant drug classes, as well as muscle relaxants[113].

There is low evidence that exercise in the acute setting benefits pain and reduces falls[114 115]. However moderate evidence demonstrates that exercise may have quality of life benefits with reduced psychosocial symptoms, fear of falling and improved physical functioning. There is clear evidence for the long term benefits of reduced falls rates with either physiotherapist or biokineticist supervised training, addressing balance, coordination and gait patterns.There is very low evidence demonstrating benefit with the use of either soft or rigid external orthoses for pain and/or core muscle strength in patients with painful vertebral fractures. There is no evidence to support improved fracture healing or long-term outcome with the use of bracing. The current evidence does not support the routine use of percutaneous vertebroplasty or balloon kyphoplasty for the treatment of painful osteoporotic vertebral fractures, as these procedures do not show consistent patient benefit[116 117].

Patients with a recent vertebral fracture have high and even imminent risk of further fragility fracture and should receive bone-specific pharmacotherapy without the need for further

fracture risk quantification [118] [119]. Ensure that prompt secondary fracture prevention is started following a fracture, with follow-up through fracture liaison services if available. If a vertebral fracture is associated with impending or existing neurological deficits, referral to spinal surgical services is indicated.

Recommendations: section 8.

Vertebral fractures are the most common type of osteoporotic fracture. They can cause acute and chronic pain, spinal deformity, functional impairment, reduced mobility and impaired quality of life. ⨁⨁⨁⨁ [A].

There is little evidence that NSAIDs and opioids offer significant pain relief. (√)

There is no evidence to support the use of drugs within the antidepressant and anticonvulsant drug classes, or muscle relaxants. (√)

There is low evidence that exercise in the acute setting benefits pain and reduces falls, but there may be long-term benefit. (√)

There is no evidence to support improved fracture healing or long-term outcome with the use of bracing. (√)

The current evidence does not support the routine use of percutaneous vertebroplasty or balloon kyphoplasty for the treatment of painful osteoporotic vertebral fractures, as these procedures do not show consistent patient benefit. ⨁⨁◯◯ [B]

9: Human Immunodeficiency Virus (HIV) and Bone Health.

Sub-Saharan Africa, particularly South Africa, carries the highest global burden of HIV[120]. With the introduction of universal treatment with highly effective antiretroviral therapy (ART), people living with HIV (PLHIV) are living longer. This increased longevity, combined with HIV itself, increases the risk of bone-related complications[121]. PLHIV are at a significantly higher risk for bone loss and fragility fractures compared to the general population, even when traditional osteoporosis risk factors are accounted for[122]. In a large meta-analysis, the overall prevalence of fractures in PLHIV was 21% and that of osteopenia and osteoporosis was 43% and 14% respectively[123]. However, there was significant heterogeneity between studies. The risk of developing osteoporosis in PLHIV was estimated to be approximately 25% higher than in HIV negative individuals. Fractures rates were higher in men, individuals aged 50 years and over and those with an ART duration > 10 years. Fractures also tended to occur about ten years earlier than the general population.

The pathogenesis of HIV-associated bone loss is multifactorial and includes direct and indirect mechanisms. Directly, HIV-related chronic inflammation increases RANKL and reduces OPG

resulting in increased bone resorption[124]. In addition, mitochondrial dysfunction damages bone cells. Indirect mechanisms include an earlier menopause (4-5 years) in women LHIV as well as the bone-toxic effects of ART medications, particularly tenofovir disoproxil fumarate (TDF)[125]. Other traditional risk factors such as smoking, excessive alcohol use, vitamin D deficiency, low body weight, and hormonal imbalances, may also be present in PLHIV. Coinfections like hepatitis C can further exacerbate bone loss, and muscle loss related to HIV can increase the risk of falls and subsequent fractures.

International guidelines, including those from the Infectious Diseases Society of America (IDSA), the European AIDS Clinical Society (EACS), and the British HIV Association (BHIVA), recommend routine screening and management of bone health in PLHIV[126]. The guidelines currently advocate that all postmenopausal women and men aged 50 years and over living with HIV should be screened for osteoporosis. Risk assessments should focus on individuals with known fragility fractures, low body weight, smoking or alcohol use, family history of osteoporosis, and ART regimens that negatively affect bone health. While screening tools like the FRAX are well established and commonly used to estimate fracture risk in persons aged 40 years and over, evidence suggests that the FRAX tool may significantly underestimate fracture risk in PLHIV, even when adjusted for HIV as a secondary cause and for trabecular bone score (TBS), especially in persons aged 50 years and under. Therefore, the FRAX tool is not recommended as a primary tool for screening and treatment decisions in high-risk individuals[127]. Dual-energy X-ray absorptiometry (DXA) is recommended for high-risk patients, including postmenopausal women, men over 50 years old, those with intermediate FRAX scores, who have high fall risk, or younger PLHIV with significant risk factors e.g. high fall risk or those on prolonged corticosteroid therapy[128].

Lifestyle modification is a key component of prevention, and includes weight-bearing exercises, smoking cessation, moderation of alcohol intake, and adequate calcium and vitamin D intake.

For PLHIV at high risk of bone disease, ART regimens should be reviewed and a switch from TDF to newer agents such as Tenofovir Alafenamide (TAF), which has a more favorable bone safety profile, considered if indicated.

Treatment for osteoporosis should be initiated in PLHIV with a DXA T-score of -2.5 or lower, a history of fragility fracture, or if they have a very high or high FRAX score for major osteoporotic or hip fracture. Treatment decisions should be individualized and made collaboratively between HIV specialists, primary care providers, and osteoporosis experts and usually will follow as per the treatment guideline. Bisphosphonates, unless contraindicated (oral or intravenous) are often the first-line treatment, while denosumab should be considered in those with renal dysfunction or bisphosphonate intolerance. Bone forming agents should be considered in very high-risk patients. Treatment duration is similar to that of the general population followed by reassessment for all patients.

Education and counseling are vital to empower both primary care clinicians and PLHIV to understand the risks, adopt preventive strategies, and adhere to treatment plans aimed at preserving bone health and preventing fractures. Bone health screening and management should be integrated into HIV programs.

Recommendations: section 9.

Sub-Saharan Africa, particularly South Africa, carries the highest global burden of HIV. ⨁⨁⨁⨁ [A].

PLHIV are at a significantly higher risk for bone loss and fragility fractures compared to the general population. ⨁⨁⨁⨁ [A].

NOFSA recommends routine screening and management of bone health in PLHIV. (√) [A].

The FRAX tool may underestimates the risk of fracture in PLHIV. Treatment for osteoporosis should be initiated with a DXA T-score of -2.5 or lower, a history of fragility fracture, or a very high or high FRAX score for major osteoporotic or hip fracture. (√) [A].

For PLHIV at high risk of bone disease, ART regimens should be reviewed and a switch from TDF to newer agents such as Tenofovir Alafenamide (TAF), which has a more favorable bone safety profile, should be considered. (√) [A].

10: Fracture Liaison Service models of care.

Collaboration between primary care clinicians, secondary care physicians, orthopaedic surgeons, radiologists, and pharmacists and between the medical and non-medical disciplines concerned, should underpin secondary fracture prevention programmes. Fracture Liaison Service (FLS) programmes reduce re-fracture rates and improve survival and should be available to all patients sustaining a fragility fracture [129] [130] [131].

FLS should provide fully coordinated, intensive models of care for secondary fracture prevention. FLS models which provide identification, assessment and treatment initiation, or a treatment recommendation to primary care, are more clinically effective and cost-effective in improving patient outcomes than approaches that provide identification and/or patient alerts, and/or patient education only**.** The required approach is a FLS in which identification, assessment and osteoporosis treatment are all conducted within an integrated health care network, overseen by a coordinator and utilizing a dedicated database measuring performance[132]**.**

FLS which initiate pharmacological treatment, rather than making a treatment recommendation for primary care initiation, have higher rates of treatment initiation[133]**.** FLS should also initiate appropriate non-pharmacological interventions and communicate ongoing care effectively with primary care practitioners[134]. FLS should provide a programme

with an integrated approach for falls and fracture prevention[135]. As risk of re-fracture is highest immediately after a fragility fracture, secondary fracture prevention assessment and intervention should be initiated as soon as possible, and no later than 16 weeks post fracture.
FLSs need to employ a range of case finding strategies, to identify both inpatients and outpatients with fragility fractures, and people with vertebral fractures who are often undiagnosed. Reasons for non-identification of vertebral fractures include the absence of a fall as a trigger for investigation, absence of symptoms, or attribution of symptoms to other causes. Furthermore, in patients who do have spinal imaging, use of ambiguous non-standardised terminology in imaging reports, and failure to routinely evaluate the vertebrae captured in imaging of other body systems can both contribute to non-identification of vertebral fractures. It is recommend that radiology services should establish local processes to ensure that the spine is routinely evaluated for the presence of vertebral fracture in all available imaging and that reports identifying vertebral fractures should be standardised, using the words 'vertebral fracture', are actionable, and indicate future management[136].
Primary care plays an important role in case finding for osteoporotic fractures, particularly vertebral fractures as acute onset back pain, especially thoracic pain, is a common presenting complaint. Targeted use of spinal imaging can help increase case identification, appropriate symptom management, and prompt secondary fracture prevention.
Patients identified by any clinical service, to be in need of further intervention, should be offered an explanation of osteoporosis, the causes, consequences and how it can be managed with pharmacological and non-pharmacological interventions. When discussing pharmacological treatment, explanation should be offered for why drug treatment is recommended, the aims and benefits, common and/or severe side effects, the practicalities of taking the medicine and for how long it should be taken[137]. The use of decision aids in osteoporosis to support communication of medicine risk-benefit has been shown to improve shared decision making, reduce decisional conflict and improve accuracy of patient perceived fracture risk[138]. Information should be tailored to the needs of the patient to make it accessible and understandable, including provision of written information[139].

To promote treatment adherence, healthcare professionals should elicit and address any beliefs and concerns associated with reduced adherence and establish realistic treatment expectations with the patient. No one type of intervention has been demonstrated to enhance medicines adherence in osteoporosis care, but multi-component models with active patient engagement have the most positive effects[140 141]. FLS models with a greater number of patient interactions have demonstrated greater clinical effectiveness. Follow-up within 16 and 52 weeks post fracture is recommended to review use of medications that increase the risk of falls and/or fracture, to ensure co-prescription of calcium and vitamin D with bone protective interventions where indicated and to review adverse effects and monitor adherence to therapy.

Recommendations: section 10

NOFSA supports the concept of FLS at all secondary and tertiary institutions involved in the care of osteoporosis and related fractures. (√)

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