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Osteoporosis Prevention, Screening, and Diagnosis

Committee on Clinical Practice Guidelines–Gynecology. This Clinical Practice Guideline was developed by the ACOG Committee on Clinical Practice Guidelines–Gynecology in collaboration with David Chelmow, MD; Catherine T. Witkop, MD, MPH; and JoAnn V. Pinkerton, MD.

PURPOSE: To provide updated evidence-based recommendations for the prevention, screening, and diagnosis of postmenopausal osteoporosis.

TARGET POPULATION: Postmenopausal patients without identified risk factors for fracture, low bone mineral density, or secondary osteoporosis related to medication or a medical condition.

METHODS: This guideline was developed using an *a priori* protocol in conjunction with a writing team consisting of two specialists in obstetrics and gynecology appointed by the ACOG Committee on Clinical Practice Guidelines–Gynecology and one external subject matter expert. ACOG medical librarians completed a comprehensive literature search for primary literature within the Cochrane Library, Cochrane Collaboration Registry of Controlled Trials, EMBASE, PubMed, and MEDLINE. Studies that moved forward to the full-text screening stage were assessed by two authors from the writing team on the basis of standardized inclusion and exclusion criteria. Included studies underwent quality assessment, and a modified GRADE (Grading of Recommendations, Assessment, Development and Evaluations) evidence-to-decision framework was applied to interpret and translate the evidence into recommendation statements.

RECOMMENDATIONS: This Clinical Practice Guideline includes updated recommendations on the role of exercise, calcium, and vitamin D in osteoporosis prevention; osteoporosis screening and diagnosis; rescreening intervals; and interventions to prevent falls. Recommendations are classified by strength and evidence quality. Ungraded Good Practice Points are included to provide guidance when a formal recommendation could not be made because of inadequate or nonexistent evidence.

INTRODUCTION

Osteoporosis is a common generalized skeletal disorder characterized by low bone mineral density (BMD) and loss of bone mass, microarchitectural deterioration, and a decline in bone quality, which increase vulnerability to fracture (1). It is a silent disease until a fracture occurs. According to 2010 U.S. Census data for the total population (noninstitutionalized and institutionalized), an estimated 8.2 million women aged 50 years and older were diagnosed with osteoporosis (compared with 2 million men), and an additional 27.3 million women had low bone mass (2). Approximately 71% of osteoporotic fractures in people aged 50 years and older occur in women (3). The purpose of this Clinical Practice Guideline is to provide updated, evidence-based recommendations for the prevention, screening, and diagnosis of postmenopausal osteoporosis.

The American College of Obstetricians and Gynecologists (ACOG) recognizes and supports the gender diversity of patients who seek obstetric and gynecologic care, including people who are cisgender, transgender, gender nonbinary, or otherwise gender expansive. ACOG's goal is to use language that is inclusive of gender-diverse individuals. When describing research findings, this document uses the gender terminology reported by the investigators. Therefore, this document uses the terms "woman," "women," "patient," and "individual." ACOG advocates for inclusive, thoughtful, affirming care, including the use of language that reflects a patient's identity.

Summary of Recommendations

Prevention

ACOG recommends routine aerobic physical activity (moderate-to-high impact) and weight bearing-exercises (muscle strengthening or exercise against resistance) to maintain bone health and prevent bone loss. (**STRONG RECOMMENDATION, MODERATE-QUALITY EVIDENCE**)

Counsel patients to consume the recommended daily allowance of dietary calcium and vitamin D for bone health and general health. **(GOOD PRACTICE POINT)**

Screening and Diagnosis

ACOG recommends screening for osteoporosis in postmenopausal patients 65 years and older with BMD testing to prevent osteoporotic fractures. **(STRONG RECOMMENDATION, HIGH-QUALITY EVIDENCE**)

ACOG recommends screening for osteoporosis with BMD testing to prevent osteoporotic fractures in postmenopausal patients younger than 65 years who are at increased risk of osteoporosis, as determined by a formal clinical risk assessment tool. **(STRONG RECOMMENDATION, HIGH-QUALITY EVIDENCE**)

ACOG suggests repeat osteoporosis screening in postmenopausal patients with initial BMD test results near treatment thresholds or with significant changes in risk factors; for most patients, repeat BMD testing should be performed no sooner than 2 years after initial screening. **(CONDITIONAL RECOMMENDATION, LOW-QUALITY EVIDENCE)**

Fall Prevention

Assess risk of falls in postmenopausal patients with low BMD or osteoporosis. Fall-prevention strategies for those at increased risk include weight-bearing and muscle-strengthening exercises as well as individualized multifactorial interventions (eg, vision assessment and treatment, balance training, and environmental assessment and modification). **(GOOD PRACTICE POINT)**

STRENGTH OF RECOMMENDATION

STRONG

ACOG recommends:
Benefits clearly outweigh harms and burdens. Most patients should receive the intervention.

ACOG recommends against:
Harms and burdens clearly outweigh the benefits. Most patients should not receive the intervention.

CONDITIONAL

ACOG suggests:
The balance of benefits and risks will vary depending on patient characteristics and their values and preferences. Individualized, shared decision making is recommended to help patients decide on the best course of action for them.

GOOD PRACTICE POINT

Ungraded Good Practice Points are incorporated when clinical guidance is deemed necessary in the case of inadequate or nonexistent evidence. They are based on expert opinion as well as review of the available evidence.

QUALITY OF EVIDENCE

HIGH

- Randomized controlled trials, systematic reviews, and meta-analyses without serious methodologic flaws or limitations (eg, inconsistency, imprecision, confounding variables)
- Very strong evidence from observational studies without serious methodologic flaws or limitations
- There is high confidence in the accuracy of the findings and further research is unlikely to change this.

MODERATE

- Randomized controlled trials with some limitations
- Strong evidence from observational studies without serious methodologic flaws or limitations

LOW

- Randomized controlled trials with serious flaws
- Some evidence from observational studies

VERY LOW

- Unsystematic clinical observations
- Very indirect evidence from observational studies

METHODS

ACOG Clinical Practice Guidelines provide clinical management recommendations for a condition or procedure by assessing the benefits and harms of care options through a systematic review of the evidence. This guideline was developed using an *a priori* protocol in conjunction with a writing team consisting of two

specialists in obstetrics and gynecology appointed by the ACOG Committee on Clinical Practice Guidelines–Gynecology and one external subject matter expert. A full description of the Clinical Practice Guideline methodology is published separately (4). The following description is specific to this Clinical Practice Guideline.

Literature Search

ACOG medical librarians completed a comprehensive literature search for primary literature within the Cochrane Library, Cochrane Collaboration Registry of Controlled Trials, EMBASE, PubMed, and MEDLINE. Parameters for the search included human-only studies published in English. Several U.S. Preventive Services Task Force (USPSTF) systematic reviews served as the evidence base for the clinical recommendations on osteoporosis screening, calcium and vitamin D supplementation for fracture prevention, and interventions to prevent falls (5–7). In these instances, the literature search was limited to the end date of the USPSTF search until 2018. If a USPSTF systematic review was not available, the search was restricted to studies from 2012 to 2018, based on the completion date of the previous literature search performed for ACOG Practice Bulletin 129, *Osteoporosis*. For new clinical questions, the search period was not restricted. The MeSH terms and keywords used to guide the literature search can be found in Appendix A. An updated literature search was completed in February 2020 and reviewed by two members of the writing team using the same systematic process as the original literature search. A final supplemental literature search was performed in February 2021 to ensure any newly published high-level sources were addressed in the final manuscript.

Study Selection

A title and abstract screen of all studies was completed by ACOG research staff. Studies that moved forward to the full-text screening stage were assessed by two authors from the writing team (a subject matter expert and a specialist in obstetrics and gynecology) on the basis of standardized inclusion and exclusion criteria. To be considered for inclusion, studies had to be conducted in countries ranked very high on the United Nations Human Development Index (8); be published in English; and include participants who identified as female or women, were postmenopausal, and did not have risk factors for fracture, low BMD, or secondary osteoporosis related to medication use or a medical condition. Although systematic reviews, randomized controlled trials (RCTs), and prospective cohort studies were prioritized, case-control studies were considered for topics with limited evidence, particularly for rare outcomes. A PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram of the included and excluded studies can be found in Appendix B. Included studies underwent quality assessment and had key details extracted (study design, sample size, details of interventions, outcomes) and were organized into summary evidence tables (Appendix C).

Recommendation and Manuscript Development

A modified GRADE (Grading of Recommendations, Assessment, Development and Evaluations) evidence-to-decision framework was applied to interpret and translate the evidence into draft recommendation statements, which were classified by strength and evidence quality (9, 10). Ungraded Good Practice Points were incorporated to provide clinical guidance in the case of extremely limited or nonexistent evidence. They are based on expert opinion as well as review of the available evidence (11). The recommendations and supporting evidence tables were then reviewed, revised as appropriate, and affirmed by the Committee on Clinical Practice Guidelines–Gynecology at a meeting. The guideline manuscript was then written and subsequently reviewed and approved by the Committee on Clinical Practice Guidelines and other internal review bodies before continuing to publication.

CLINICAL OVERVIEW

Epidemiology

In the United States, the prevalence of osteoporotic fracture varies by race, with the highest rates reported among White and Hispanic populations, followed by Native American, Asian, and Black populations (12) (when describing research findings, this document uses the race–ethnicity terminology reported by the investigators). In the United States, one in two women older than 50 years will experience an osteoporotic fracture (13). However, only 24% of women aged 60 and older receive osteoporosis treatment during the first year after a fracture (14).

Health inequities have been identified at each step in osteoporosis care, including screening, dual energy X-ray absorptiometry (DXA) testing after fracture, treatment initiation, and outcomes after fracture. Studies of DXA screening rates among postmenopausal women show that Black women are less likely to be screened for osteoporosis compared with women in other racial and ethnic groups (15–19). Black women (relative risk [RR] 0.66; 95% CI 0.50–0.88) and Hispanic women (RR 0.58; 95% CI 0.39–0.87) are less likely than White women to undergo DXA testing after hip fracture (17). In a study of 1,000 women 60 years and older who received care at a primary care practice, African American women received fewer prescriptions for osteoporosis treatment after diagnosis than Caucasian women (79.6% vs 89.2%, $P<.05$) (19). In a secondary analysis of data from the Reasons

for Geographic and Racial Differences in Stroke (REGARDS) study, women with osteoporosis who self-identified as African American were less likely to receive therapy than women who identified as Caucasian (20). In a *post hoc* analysis of data from the Women's Health Initiative study, Black women with osteoporosis were significantly less likely to receive treatment compared with White women (odds ratio 0.55; 95% CI 0.41–0.72), whereas treatment rates among White women and Hispanic women were similar (21). In a study of outcomes after major fragility fracture, Black women had higher rates of 1-year mortality (19.6% vs 15.4%; $P<.001$); destitution (2.4% vs 2.0%; $P=.006$); and a composite outcome combining death, debility, and destitution (24.6% vs 20.2%; $P<.001$) compared with their White counterparts (22).

Although these studies did not investigate the underlying causes of the observed patient-level differences in osteoporosis screening, treatment, and outcomes, racial inequities in health care reflect racism and discrimination at the structural, institutional, and individual levels (23–27). System-level structures, policies, and practices that promote inequity, such as varying geographic availability of health care institutions, lack of health care delivery in one's language or at one's health literacy level, and high health care costs and insurance premiums, all play a critical role in reducing access to care and in decreasing the quality of care provided (23, 25). Individual practitioner-level factors, including implicit biases, also contribute to health inequities (23, 25). For example, in the case of osteoporosis, several studies showed that racial disparities in screening and treatment rates persisted even after accounting for insurance status and socioeconomic factors, suggesting that health practitioner bias may have influenced clinical decision making (17–19). It also is important to consider the social factors that affect health care access and health outcomes (24). In one study, among patients who received referral for DXA testing, African American women were less likely to complete screening than Caucasian women (20.8% vs 27.0%, $P<.05$) (19), which may reflect patient mistrust of the health care system because of historic and ongoing systemic racism, or may be related to social determinants of health (eg, limited access to transportation), or a complex interplay of these factors (23, 24). Additional research that is explicitly focused on racial inequities along the entire spectrum of osteoporosis care is needed to help identify strategies and interventions to ensure quality care for all patients.

Bone Physiology

Although changes in bone mass and microarchitecture are well characterized, other aspects of bone quality are not as well understood. Bone mass is usually stable in healthy premenopausal individuals. As estrogen levels decline around menopause, bone resorption by osteoclasts increases and exceeds the ability to form new bone by osteoblasts. This leads to bone loss and loss of microarchitecture of both trabecular and cortical bone, which increases the risk of fracture. Bone mass may begin to decrease before menopause, with an accelerated phase of bone loss during the menopausal transition (28). Age also affects bone quality, such that a woman aged 80 years has a much higher risk of fracture compared with a woman aged 50 years with the same BMD (29).

Risk Factors

There are a variety of genetic and lifestyle factors, medications, and medical conditions that contribute to the development of osteoporosis (Box 1) (30–33). Low BMD and a history of fragility fracture are significant predictors of future fractures (34). Postmenopausal women who experience an osteoporotic vertebral fracture are at significantly increased risk of a subsequent vertebral fracture within the next year, and this risk remains elevated over time if the fracture is untreated (35).

Bone Mineral Density Measurement and Classification

Dual energy X-ray absorptiometry, which measures BMD, is the preferred test for identifying bone loss and assessing risk of fracture. Hip and lumbar spine measurements by DXA provide the most accurate and precise measurements of BMD. Results from a DXA test are reported as a T-score or a Z-score. The World Health Organization defines osteoporosis as a BMD T-score of less than or equal to −2.5 standard deviations. (Table 1) (36).

The T-score is the basis for diagnosing osteoporosis in the postmenopausal population. It is calculated by comparing an individual's BMD measurements at the hip or spine with the peak mean BMD in a healthy, young-adult reference population and is expressed as the number of standard deviations from the mean BMD. The International Society for Clinical Densitometry recommends using "a uniform Caucasian (non-race adjusted) female normative database for women of all ethnic groups" and data from the Third National Health and Nutrition Examination Survey (NHANES III) for this reference standard (37, 38). Some research suggests that T-scores may have different predictive value in different racial and ethnic groups. In a study that pooled deidentified data from the Women's Health Initiative, the World Health Organization T-score classification underestimated the risk of major osteoporotic fracture in all racial and ethnic groups, with the degree of underestimation varying between groups, and the largest underestimation occurring in African American women (39). The authors of another study that used a Chinese American reference standard to recalculate the T-scores of 4,039 postmenopausal Chinese American women found that a large percentage of women who had been diagnosed with osteoporosis using NHANES III reference standards were reclassified as having osteopenia (40). The source of these variations is not clearly understood, and more research is

Box 1. Common Risk Factors for Osteoporosis

- Increasing age
- Parental history of hip or spine fracture
- BMI less than 20 kg/m^2 or body weight less than 127 lb
- Smoking
- Excessive alcohol use (ie, more than three drinks per day)
- Conditions, diseases, and medications associated with secondary osteoporosis:*
  - AIDS and HIV, anorexia nervosa, diabetes mellitus (type 1 and type 2), diminished ovarian reserve, gastric bypass, hyperparathyroidism, hypocalcemia, premature menopause (induced, surgical, or spontaneous), primary ovarian insufficiency, renal impairment, rheumatoid arthritis, Turner's syndrome, vitamin D deficiency
  - Antiepileptic drugs (eg, phenytoin, carbamazepine, primidone, and phenobarbital), antiretroviral drugs, aromatase inhibitors, chemotherapy, DMPA, glucocorticoids, gonadotropin-releasing hormone agonists, gonadotropin-releasing hormone antagonists), heparin

Abbreviations: AIDS, acquired immunodeficiency syndrome; BMI, body mass index; DMPA, depot medroxyprogesterone acetate; HIV, human immunodeficiency virus.

*This is not intended to be an all-inclusive list of causes of secondary osteoporosis.

Data from Curry SJ, Krist AH, Owens DK, Barry MJ, Caughey AB, et al. Screening for osteoporosis to prevent fractures: US Preventive Services Task Force recommendation statement. US Preventive Services Task Force. JAMA 2018;319:2521–31. doi: 10.1001/jama.2018.7498; Camacho PM, Petak SM, Binkley N, Diab DL, Eldeiry LS, Farooki A, et al. American Association of Clinical Endocrinologists/American College of Endocrinology clinical practice guidelines for the diagnosis and treatment of postmenopausal osteoporosis-2020 update. Endocr Pract 2020;26:1–46. doi: 10.4158/GL-2020-0524SUPPL; *and* Cosman F, de Beur SJ, LeBoff MS, Lewiecki EM, Tanner B, Randall S, et al. Clinician's guide to prevention and treatment of osteoporosis. National Osteoporosis Foundation [published erratum appears in Osteoporos Int 2015;26:2045–7]. Osteoporos Int 2014;25:2359-81. doi: 10.1007/s00198-014-2794-2.

needed in this area to explore the observed differences and to clarify the implications for clinical practice.

A Z-score is expressed as the number of standard deviations between an individual's BMD and the mean BMD of a reference population of the same sex, age, and ethnicity (37). It is useful for identifying premenopausal individuals who may be at risk of secondary osteoporosis (ie, osteoporosis caused by a medical condition or a medication) for whom further evaluation might be needed. For premenopausal individuals, a Z-score of −2.0 or lower is considered "below the expected range for age" (37). As with T-scores, further research is needed to explore and address nonbiologic contributors to Z-score differences based on race and ethnicity.

CLINICAL RECOMMENDATIONS AND EVIDENCE SUMMARY

Prevention Strategies

Physical Activity

ACOG recommends routine aerobic physical activity (moderate-to-high impact) and weight-bearing exercises (muscle strengthening or exercise against resistance) to maintain bone health and prevent bone loss. (STRONG RECOMMENDATION, MODERATE-QUALITY EVIDENCE)

Table 1. World Health Organization Bone Densitometry Criteria for Diagnosing Osteoporosis

Category	T-Score*
Normal	−1.0 or greater
Low bone mass (osteopenia)	Between −1.0 and −2.5
Osteoporosis	−2.5 or less

*T-score is the number of standard deviation units above or below the mean average bone mineral density value for a healthy young adult.

Data from World Health Organization. Assessment of fracture risk and its application to screening for postmenopausal osteoporosis: report of a WHO study group. WHO Technical Report Series 843. WHO; 1994. Accessed May 18, 2021. https://apps.who.int/iris/bitstream/handle/10665/39142/WHO_TRS_843_eng.pdf

Physical activity provides a number of benefits throughout the lifespan, and the Centers for Disease Control and Prevention recommends that all adults engage in at least 150 to 300 minutes per week of moderate-intensity activity or 75 minutes to 150 minutes per week of vigorous-intensity aerobic physical activity (or a combination of both) (41). Physical activity early in life stimulates bone remodeling, which leads to increased bone density and contributes to higher peak bone mass. Although the ideal physical activity for strengthening bone has not been established, resistance and high-impact or weight-bearing exercises (eg, free weights or resistance bands, jogging, stepping, and jumping rope) appear to show the most benefit (42, 43). One meta-analysis of studies conducted in premenopausal women found that jumping exercises significantly increased BMD in the femoral neck and trochanter (42). A subsequent review of 12 systematic reviews of studies that included populations ranging from girls to postmenopausal women showed that combined impact exercise protocols, such as high-impact exercise with resistance training, appeared to preserve or improve BMD or both throughout the lifespan (43). Some studies also have found that in addition to improving balance and helping to prevent falls, tai chi training in postmenopausal women may have a beneficial effect on BMD and bone turnover markers, which is thought to be related to its weight-shifting movements (44, 45).

Because menopause can be a time of significant reduction in bone density, it is critical that perimenopausal and postmenopausal patients are intentional in their approach to exercise. In a systematic review of 43 RCTs with 4,320 postmenopausal women aged 45–70 years, the authors reported a small, but statistically significant increase in femoral neck BMD associated with the use of non–weight-bearing, high-force exercises such as progressive resistance strength training and a slight increase in spinal BMD with the use of combination exercise programs (46). These results are consistent with findings from more recent, higher-quality meta-analyses that examined the effect of different types of exercise and found that combined resistance training programs (ie, resistance and high-impact or weight-bearing exercise) among postmenopausal women increased femoral neck and lumbar spine BMD when compared with resistance alone (47) and preserved BMD at the lumbar spine, femoral neck, total hip, and total body when compared with baseline values (48). A systematic review of 15 studies in postmenopausal and older women (aged 65 years or older) demonstrated mixed results with multicomponent training (49). Because the interventions were heterogeneous and included various combinations of exercises (ie, low-impact and high-impact aerobic, resistance, strength training, and weight-bearing), it was unclear which type of multicomponent training program was the most effective; however, many of the included studies demonstrated an overall positive effect on bone mass (49). The amount of exercise performed also may influence the effects on BMD. In an RCT of 379 postmenopausal women, those who participated in a 300-minute weekly regimen of high-intensity aerobic exercise compared with 150 minutes weekly had a statistically significant higher BMD at the end of 12 months, with the effects remaining at 12-month follow-up (50).

Studies have attempted to determine the best types of exercise to improve bone health in older postmenopausal women. The LIFTMOR RCT found that high-intensity resistance and impact training in postmenopausal women older than 58 years with osteopenia was associated with improvement in lumbar spine and femoral neck BMD without an increased risk of fracture, which is one of the concerns about high-intensity exercise in older women (51, 52). Older postmenopausal women who cannot do 150 minutes per week of moderate-intensity activity or bone-strengthening exercises (eg, because of mobility issues or chronic diseases) should be as physically active as their conditions allow. There is some evidence that walking programs alone may improve BMD of the hip (53). In addition, because of the minimal risk and other beneficial general health effects of physical activity, sedentary women can be encouraged to perform brisk walking in a safe environment as a means of improving bone health.

Whole-body vibration training, which uses a machine with a vibrating platform, also has been suggested as a possible way to improve muscle strength, balance, motility, and BMD in older women. Several high-quality systematic reviews (54–56) and a more recent RCT (57) showed a positive effect of whole-body vibration for postmenopausal women. However, the adequate level of vibratory stimulation to reduce BMD decline is not clear, and further study is needed before a recommendation can be made about this intervention.

In a small RCT of postmenopausal women with osteopenia who were taking calcium and vitamin D supplementation, those who participated in a 6-month regimen of three-times-weekly high-impact exercise had a significant increase in BMD at the spine and femoral neck compared with those who participated in strength training or no exercise (58). In a more recent small RCT of postmenopausal women who took calcium and vitamin D supplements, twice-weekly combined high-impact and high-resistance training was associated with greater improvement in BMD at the femoral neck compared with fast walking three to five times per week; however, T-score differences at the lumbar spine were not statistically significant (59).

Vitamin D and Calcium

Counsel patients to consume the recommended daily allowance of dietary calcium and vitamin D for bone health and general health. (GOOD PRACTICE POINT)

The USPSTF has issued guidelines on the use of vitamin D and calcium supplementation for fracture prevention in community-dwelling adults (ie, not living in a nursing home or institution) who do not have vitamin D deficiency, osteoporosis, or a history of fracture (60). For community-dwelling, postmenopausal women, the USPSTF recommends against supplementation with 400 international units or less of vitamin D and 1,000 mg or less of calcium to prevent fractures because adequate evidence indicates that supplementation has no effect on fracture incidence (6, 60). The USPSTF found that there is insufficient evidence on whether supplementation with higher doses of vitamin D and calcium, alone or combined, prevents fracture in community-dwelling postmenopausal individuals (ie, a USPSTF "I statement") (60). For premenopausal individuals, the USPSTF has concluded that the evidence is insufficient to recommend for or against supplementation with calcium and vitamin D, alone or combined, for primary prevention of osteoporotic fracture (ie, an "I statement").

The USPSTF recommendations are based on a systematic review of 11 RCTs that included a total of 51,419 community-dwelling adults without vitamin D deficiency, osteoporosis, or prior fracture (6). There was no difference in hip fracture risk with vitamin D supplementation alone (three RCTs, 5,496 participants; absolute risk difference [ARD], −0.01%; 95% CI −0.80% to 0.78%). Supplementation with vitamin D and calcium together had no effect on the risk of total fractures (one RCT, 36,282 participants; ARD −0.35%; 95% CI −1.02% to 0.31%) or hip fracture (two RCTs, 36,727 participants; ARD not reported). Supplementation with vitamin D and calcium was associated with an increased risk of kidney stones (three RCTs, 39,213 participants; ARD, 0.33%; 95% CI 0.06%–0.60%). Only two trials studied calcium supplementation alone, and neither reported a significant difference in fractures at any site.

Although calcium and vitamin D supplementation do not appear to be effective for prevention of osteoporotic fractures in average-risk individuals, a diet that includes the Institute of Medicine (now known as the National Academy of Medicine) recommended daily allowance (RDA) of calcium and vitamin D is important for bone health and general health. The RDA for calcium is 1,000 mg per day from ages 19 to 50 years and 1,200 mg per day in older women (61). For vitamin D, the RDA is 600 international units per day to age 70 years and 800 international units thereafter (61). The RDA of vitamin D is believed to maintain an adequate serum level of 25-hydroxyvitamin D (20 ng/mL) in 97.5% of the population (61). Although severe and prolonged vitamin D deficiency can cause bone mineralization diseases such as osteomalacia in adults, the USPSTF has concluded that the current evidence is insufficient to assess the balance of benefits and harms of screening for vitamin D deficiency in asymptomatic adults (62). Similarly, the Endocrine Society advises that there is insufficient evidence to recommend screening individuals who are not at risk of vitamin D deficiency (63).

Screening and Diagnosis

Evaluation for osteoporosis involves clinical examination (medical history, physical examination, height measurement), risk assessment with a formal risk assessment tool, and BMD testing (as indicated by age or risk assessment tool results). Diagnostic criteria are presented in Box 2.

Box 2. Diagnostic Criteria for Postmenopausal Osteoporosis

Any one of the following criteria is consistent with a diagnosis of postmenopausal osteoporosis:

- T-score −2.5 or lower by DXA of the femoral neck, total hip, lumbar spine, or distal 1/3 radius*
- History of fragility fracture, including asymptomatic vertebral fracture
- T-score between −1.0 and −2.5 and increased risk of fracture, as determined by a formal clinical risk assessment tool†

*Hip (femoral neck) and lumbar spine measurements by DXA provide the most accurate and precise measurements of BMD. When one or both these sites cannot be evaluated (eg, in the case of bilateral hip replacements, lumbar spine surgery, or both), BMD measurement at the forearm (distal one third of the radius) can be used for diagnosis.

†For example, using the U.S. Fracture Risk Assessment Tool (FRAX) tool, this would be a 10-year hip fracture probability of 3% or greater or a 10-year major osteoporotic fracture probability of 20% or greater.

Data from Camacho PM, Petak SM, Binkley N, Diab DL, Eldeiry LS, Farooki A, et al. American Association of Clinical Endocrinologists/American College of Endocrinology clinical practice guidelines for the diagnosis and treatment of postmenopausal osteoporosis-2020 update. Endocr Pract 2020;26:1–46. doi: 10.4158/GL-2020-0524SUPPL; Cosman F, de Beur SJ, LeBoff MS, Lewiecki EM, Tanner B, Randall S, et al. Clinician's guide to prevention and treatment of osteoporosis. National Osteoporosis Foundation [published erratum appears in Osteoporos Int 2015;26:2045–7]. Osteoporos Int 2014;25:2359–81. doi: 10.1007/s00198-014-2794-2; *and* Eastell R, Rosen CJ, Black DM, Cheung AM, Murad MH, Shoback D. Pharmacological management of osteoporosis in postmenopausal women: an Endocrine Society Clinical Practice Guideline. J Clin Endocrinol Metab 2019;104:1595–622. doi: 10.1210/jc.2019-00221

Clinical Evaluation

Clinical evaluation for osteoporosis includes medical history, physical examination, and measurement of changes in height. Medical history should assess for significant risk factors and conditions, diseases, and medications associated with secondary osteoporosis (Box 1). An unexplained fragility fracture is diagnostic of osteoporosis even with normal or absent BMD test results (Box 2) (32).

Height loss can be an indicator of an asymptomatic vertebral fracture (30). In an analysis of a cohort of postmenopausal women who underwent serial height measurements, a change of greater than 0.8 inches (2 cm) during 1–3 years appeared to be the optimal threshold for evaluation for vertebral fracture (64). The National Osteoporosis Foundation recommends that patients who have lost 1.5 inches (4 cm) or more from their peak height at age 20 years or 0.8 inches (2 cm) or more from a previously documented measurement should undergo vertebral imaging (30). Vertebral compression fractures can be diagnosed on X-ray or by vertebral fracture assessment at the time of DXA, when available. Assessment can be performed using either lateral thoracic and spine X-ray or lateral vertebral fracture assessment, which is available on most DXA machines.

Height loss also may indicate an increased risk of nonvertebral fracture (65). In a cohort study of 3,124 postmenopausal women aged 65 years and older, height loss of greater than 2 inches (5 cm) was associated with a significantly increased risk of hip fracture (hazard ratio [HR], 1.50; 95% CI 1.06–2.12] and nonspine fracture (HR, 1.48; 95% CI 1.20–1.83), even after adjustment for BMD and vertebral fracture incidence (65).

Risk Assessment Tools

The USPSTF review of some of the most common validated osteoporosis risk assessment tools (Osteoporosis Risk Assessment Instrument, Osteoporosis Index of Risk, the Osteoporosis Self-Assessment Tool, the Simple Calculated Osteoporosis Risk Estimation, and the Fracture Risk Assessment Tool [FRAX]) showed that they performed comparably and had moderate predictive ability for osteoporosis, with individual or pooled area under the curve (AUC) values ranging from 0.58 to 0.82 (5, 31). (An AUC of 0.5 indicates no discrimination; 0.7 or greater, acceptable discrimination; and 1.0, perfect discrimination.)

FRAX, one of the most widely used tools, is a computer-based algorithm that can be applied with or without a femoral neck BMD score to estimate the 10-year risk of hip fracture and the 10-year probability of a major osteoporotic fracture (clinical spine, forearm, hip, or shoulder fracture) in adults 40 years and older. FRAX can be used to help assess the need for BMD testing in postmenopausal patients younger than 65 years with potential risk factors or to determine the need to initiate pharmacotherapy in a patient with a T-score between −1.0 and −2.5.

Risk calculations are based on multiple clinical risk factors, including sex, age, height, weight, previous fracture, parental history of hip fracture, use of steroids, smoking and alcohol intake, rheumatoid arthritis, and other secondary causes of bone loss (66, 67). FRAX is based on country-specific epidemiologic data, and the U.S. FRAX tool has separate calculators for Caucasian, Black, Asian, and Hispanic racial and ethnic groups (66). FRAX's accuracy in identifying major osteoporosis fracture risk without input of femoral neck BMD T-score was similar to the other common risk assessment tools evaluated, with a pooled AUC of 0.66 (95% CI 0.63–0.69). When including the hip BMD T-score, FRAX's pooled AUC for predicting future major osteoporotic fracture in women was 0.70 (95% CI 0.68–0.71) (5).

The FRAX tool has several important limitations. The degree of each potential risk factor alters overall fracture risk, but FRAX scoring does not allow input of specific amounts, dosage, or duration for alcohol intake, corticosteroid use, or smoking or for the number of prior fractures. Spine BMD is not incorporated into the model, nor is a history of recent falls, both of which increase the risk of osteoporotic fracture. The fracture risk score may be underestimated in individuals with these risk factors (68). FRAX has separate calculators to adjust for differences in T-score–related fracture risk that have been observed between racial and ethnic groups, but the basis for these differences is poorly understood. The role of systemic racism and social determinants of health as contributing factors merits further study to address racial and ethnic inequities in bone health.

Bone Mineral Density Testing

ACOG recommends screening for osteoporosis in postmenopausal patients 65 years and older with BMD testing to prevent osteoporotic fractures.
(STRONG RECOMMENDATION, HIGH-QUALITY EVIDENCE)

In addition to ACOG, several other major osteoporosis guideline groups recommend screening for osteoporosis with DXA in all postmenopausal women who are 65 years and older (30, 31, 69, 70). Hip (femoral neck) and lumbar spine measurements by DXA provide the most accurate and precise measurements of BMD. When one or both of these sites cannot be evaluated (eg in the case of bilateral hip replacements, lumbar spine surgery, or both), BMD measurement at the forearm (distal one third of the radius) can be used for diagnosis (30, 32). In a postmenopausal patient, a BMD T-score of −2.5 or less establishes a diagnosis of osteoporosis (Table 1) (36). A T-score between −1.0 and −2.5 indicates low bone density (or osteopenia) (36). For patients with T-scores between −1.0 and −2.5, the use of a risk assessment tool such as FRAX can help determine the need for pharmacologic therapy.

ACOG recommends screening for osteoporosis with BMD testing to prevent osteoporotic fractures in postmenopausal patients younger than 65 years who are at increased risk of osteoporosis, as determined by a formal clinical risk assessment tool. **(STRONG RECOMMENDATION, HIGH-QUALITY EVIDENCE)**

Screening for osteoporosis with DXA also is recommended in postmenopausal women younger than 65 years who are at elevated risk (30, 31, 69, 70). Formal, validated risk assessment tools should be used to estimate fracture risk in patients younger than 65 years to determine whether DXA testing would be useful. The USPSTF suggests assessing risk factors (Box 1) and applying a clinical assessment tool like FRAX to patients with at least one risk factor (31). The USPSTF recommends BMD testing for postmenopausal women younger than 65 years who have a 10-year FRAX calculated risk of major osteoporotic fracture of greater than 8.4%, which is equal to the risk of a 65-year-old White woman without major risk factors for osteoporosis (31).

Screening Intervals

Most major osteoporosis screening guidelines do not provide guidance on the role or timing of retesting in patients with normal bone density and low fracture risk. The North American Menopause Society notes that for individuals who are not receiving osteoporosis treatment, repeat screening before 2–5 years from initial testing is not necessary (69). The USPSTF screening guidelines also do not include a recommendation regarding the need for repeat testing or appropriate screening intervals, but note that limited good-quality evidence shows no benefit to repeating BMD testing earlier than 4–8 years after an initial normal BMD test result (5, 31). The USPSTF evidence review included modeling studies that suggested that the optimal screening interval varies primarily based on BMD and age (71, 72). One modeling study used data from 4,957 women 67 years or older who were monitored for up to 15 years to estimate the time for 10% of women to develop osteoporosis before having a hip or clinical vertebral fracture: approximately 15 years for those with initial normal bone density (T-score −1.00 or higher) or mild osteopenia (T-score −1.01 to −1.49), 5 years for initial moderate osteopenia (T score −1.50 to −1.99), and 1 year for initial advanced osteopenia (T-score −2.00 to −2.49) (71). In another modeling study, 4,068 postmenopausal women in the Women's Health Initiative BMD cohort were monitored for up to 11.2 years (72). The authors estimated that the time for 1% of women without baseline osteoporosis to have a hip or clinical vertebral fracture was 12.8 years for women aged 50–54 years and 7.6 years for women aged 60–64 years. A more recent analysis of data from 9,304 participants in the Women's Health Initiative Bone Density Substudy who were monitored for a mean of 12.4 years showed that repeat BMD testing 3 years after a baseline BMD test was not associated with improved prediction of subsequent hip or major osteoporotic fracture beyond the baseline BMD test alone, leading the authors to conclude that 3-year repeat BMD testing should not routinely be performed (73).

ACOG suggests repeat osteoporosis screening in postmenopausal patients with initial BMD test results near treatment thresholds or with significant changes in risk factors; for most patients, repeat BMD testing should be performed no sooner than 2 years after initial screening. **(CONDITIONAL RECOMMENDATION, LOW-QUALITY EVIDENCE)**

Evidence suggests that the individuals who are most likely to benefit from a shorter interval between BMD screenings include those with a low baseline BMD or a BMD near treatment thresholds and those with medical conditions or who use medications that place them at risk of accelerated bone loss (71). For follow-up of patients with risks for fracture or low BMD, the American College of Radiology recommends a 2-year monitoring interval based on the expected rate of change of bone mineralization. In patients at risk of substantial short-term decreases in demineralization, such as those receiving glucocorticoid therapy, 1-year follow up is recommended (74). Serial bone density measurements should be performed at the lumbar spine, total hip, or femoral neck. Because of differences between types of DXA machines and the need for consistent calibration, patients ideally should have follow-up measurements on the same DXA device as their prior measurement (32, 37, 74).

Lifestyle and Environmental Modifications to Prevent Falls

Assess risk of falls in postmenopausal patients with low BMD or osteoporosis. Fall-prevention strategies for those at increased risk include weight-bearing and muscle-strengthening exercises as well as individualized multifactorial interventions (eg, vision assessment and treatment, balance training, and environmental assessment and modification). **(GOOD PRACTICE POINT)**

Postmenopausal patients with osteoporosis or low BMD are at increased risk of fractures, which often occur in older adults as a result of trips, slips, or falls. Based on indirect evidence from fall-prevention studies among older community-dwelling adults, strategies that identify and address important risk factors for falls are likely also beneficial for individuals at increased risk of fall-related osteoporotic fracture. Important risk factors for falls include older age; history of falls; impairments in mobility, gait, and balance; environmental factors (eg, loose throw rugs, low-level lighting); medical conditions (eg, anxiety, depression, vitamin D deficiency, kyphosis, orthostatic hypotension, poor vision, history of stroke); and

medications that cause sedation (30, 32, 75). Referral to or consultation with a specialist in fall prevention, such as a physical therapist or occupational therapist, can be considered to provide further risk assessment and targeted interventions for patients at increased risk of falls.

The USPSTF recommends exercise interventions for community-dwelling adults 65 years or older who are at increased risk of falls (75). The systematic review that informed the USPSTF guidelines found that a variety of exercise interventions were associated with a statistically significant reduction in fall incidence (RR 0.89; 95% CI 0.81–0.97) and injurious falls (incidence rate ratio 0.81; 95% CI 0.73–0.90) among community-dwelling adults 65 years or older (7). Although it was unclear which specific types of exercises were the most beneficial, the most common exercises studied included those that targeted gait, balance, and functional training (17 trials); flexibility (eight trials); and endurance training (five trials) (7).

The USPSTF systematic review found that multifactorial interventions were associated with a small but statistically significant reduction in the incidence of falls (incidence rate ratio 0.79; 95% CI 0.68–0.91) among community-dwelling adults 65 years and older, but did not decrease the incidence of fall-related morbidity or mortality (7). Multifactorial interventions that were evaluated included assessment for modifiable risk factors for falls followed by initiation of targeted interventions, such as group or individual exercise, cognitive–behavioral therapy, nutritional therapy, education, medication management, urinary incontinence management, environmental changes, physical or occupational therapy, and other services or referrals tailored to address other identified risk factors (75).

Expert guidelines on osteoporosis management recommend multifactorial interventions for fall prevention, including risk assessment, exercise, vision assessment, balance training, and environmental assessment and modification (30, 32, 76). For individuals at increased risk of falls, the National Osteoporosis Foundation recommends consideration of multifactorial interventions, including tai chi and other exercises programs, home safety assessment and appropriate modification, removal of psychotropic medications, and correction of visual impairment (30). The American Association of Clinical Endocrinologists recommends similar multifactorial fall-prevention strategies, particularly exercises for balance and increased trunk muscle strength, such as walking, jogging, tai chi, stair climbing, weight training, and other activities with resistance (32). European guidelines on osteoporosis management also recommend fall risk assessment, regular weight-bearing exercise that is tailored to the individual, and interventions to address modifiable risk factors for those at increased risk (76).

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APPENDICES

Supplemental Digital Content

A. Literature search strategy: http://links.lww.com/AOG/C371
B. PRISMA diagram: http://links.lww.com/AOG/C372
C. Evidence tables: http://links.lww.com/AOG/C373

CONFLICT OF INTEREST STATEMENT

All ACOG committee members and authors have submitted a conflict of interest disclosure statement related to this published product. Any potential conflicts have been considered and managed in accordance with ACOG's Conflict of Interest Disclosure Policy. The ACOG policies can be found on acog.org. For products jointly developed with other organizations, conflict of interest disclosures by representatives of the other organizations are addressed by those organizations. The American College of Obstetricians and Gynecologists has neither solicited nor accepted any commercial involvement in the development of the content of this published product.

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