Screening for Osteoporosis in the Adult U.S. Population

ACPM Position Statement on Preventive Practice

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Context: Osteoporosis is a common and costly disease that is associated with high morbidity and mortality. There is a lack of direct evidence supporting the benefits of bone mineral density (BMD) screening on osteoporosis outcomes. However, there is indirect evidence to support screening for osteoporosis given the availability of medications with good antifracture efficacy. This paper addresses the position of the American College of Preventive Medicine (ACPM) on osteoporosis screening.

Evidence acquisition: The medical literature was reviewed for studies examining the benefits and harms of osteoporosis screening. An overview is also provided of available modalities for osteoporosis screening, risk-assessment tools, cost effectiveness, benefits and harms of screening, rationale for the study, and recommendations from leading health organizations and ACPM. A review was done of English language articles published prior to September 2008 that were retrieved via search on PubMed, from references from pertinent review or landmark articles, and from websites of leading health organizations.

Evidence synthesis: There were no randomized controlled trials (RCTs) of osteoporosis screening on fracture outcomes. However, there was one observational study that demonstrated reduced fracture incidence among recipients of BMD testing. Dual energy x-ray absorptiometry is currently one of the most widely accepted and utilized methods for assessing BMD. Other potential tests for detecting osteoporosis include quantitative ultrasound, quantitative computer tomography, and biochemical markers of bone turnover. Testing via BMD is a cost-effective method for detecting osteoporosis in both men and women. Osteoporosis risk–assessment tools such as the WHO fracture-risk algorithm are useful supplements to BMD assessments as they provide estimates of absolute fracture risks. They can also be used with or without BMD testing to assist healthcare providers and patients in making decisions regarding osteoporosis treatments.

Conclusions: All adult patients aged ≥50 years should be evaluated for risk factors for osteoporosis. Screening with BMD testing for osteoporosis is recommended in women aged ≥65 years and in men aged ≥70 years. Younger postmenopausal women and men aged 50–69 years should undergo screening if they have at least one major or two minor risk factors for osteoporosis. It is also recommended that clinicians consider using an osteoporosis risk–assessment tool to evaluate absolute fracture risk to determine appropriate osteoporosis therapies.

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Introduction

The American College of Preventive Medicine (ACPM) Prevention Practice Committee coordinates the development of practice policy statements on preventive health care to provide guidance to clinicians. These position statements are brief summaries of ACPM viewpoints on important topics that have already been the focus of an evidence review, analysis, and recommendations by one or more entities outside of ACPM. For example, particular subjects for which the U.S. Preventive Services Task Force has developed recommendations are typically suitable topics for position statements (www.ahrq.gov/clinic/uspstfix.htm). The purpose of the position statements is to outline the ACPM's perspective on critical preventive medicine issues, in a timely fashion, in order to exert a positive influence on policy, practice, and research dealing with the subject of the statement. This paper addresses the ACPM position statement and rationale for osteoporosis screening, including a review of the current evidence for osteoporosis screening; an overview of available screening

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modalities, risk-assessment tools, cost effectiveness, benefits, and harms of screening; a rationale statement; and recommendations from leading health organizations and ACPM. A review was done of English language articles published prior to September 2008 that were retrieved via search on PubMed, from references from pertinent review or landmark articles, and from websites of leading health organizations.

Background

Osteoporosis is a disease characterized by reduced bone mass and increased skeletal fragility, which increases the risk for fractures. In the U.S., an estimated 4–6 million women aged >50 years (13%–18%) have osteoporosis, and another 13–17 million (37%–50%) have osteopenia (or low bone density) based on femoral bone mineral density (BMD) tests.[1] Approximately 20% of all osteoporosis cases occur in men. It is estimated that 1–2 million men aged >50 years (3%–6%) have osteoporosis, and 8–13 million (28%–47%) have osteopenia.[1] The number of women and men with osteoporosis is expected to increase to 10.5 million and 3.3 million, respectively, by 2020 (www.nof.org/advocacy/prevalence/index.htm). Osteoporosis causes 1.5 million fractures in the U.S. annually, including 300,000 and 700,000 hip and vertebral fractures, respectively.[2] The estimated cost of treating osteoporotic fractures in 2005 was $17 billion, and this cost is expected to increase by 50% by 2025 as the population ages.[3] The average mortality rate in the first year following a hip fracture is 24% (www.nof.org/osteoporosis/diseasefacts.htm). Further, many patients lose their functional independence after a hip fracture. Eighty percent of previously ambulatory hip fracture survivors require subsequent long-term care, and only 15% can walk across a room unaided 6 months after a hip fracture.

Despite the availability of screening tests, osteoporosis remains underdiagnosed and undertreated in the U.S.[4] Current evidence-based guidelines recommend osteoporosis screening in older women.[5] However, the percentage of primary care physicians in North America ordering bone densitometry as a screening test for osteoporosis in postmenopausal women is highly variable, ranging from 38% to 62%.[6] In a 2006 survey of community medical practices, more than 90% of women believed that discussion of osteoporosis and fracture prevention was important. Yet only 44% had such a discussion with their healthcare provider, and 50% of women aged >65 years had received BMD testing.[7] In addition, after Medicare reimbursement for bone density testing began in 1999, only 23% of eligible women received testing between 1999 and 2001.[8] Testing decreased with increasing age even after adjustment for race, comorbidity, fracture risk, and socioeconomic factors.

Evidence for Osteoporosis Screening

Direct evidence of the benefits of BMD screening on osteoporosis outcomes has not been determined. No randomized controlled studies of osteoporosis screening on fracture outcome exist. However, one observational study demonstrated that recipients of bone density scans had a lower fracture rate.[9] This study included men and women from the Cardiovascular Health Study aged ≥65 years who were recruited from four states in the U.S. The relative risk of hip fracture was 36% lower among participants in two states who underwent dual energy x-ray absorptiometry (DXA) testing compared with those who received usual care in the remaining two states.

There is also indirect evidence to support screening for osteoporosis by assessing BMD. Prospective studies have demonstrated that decreased BMD strongly predicts fractures,[10,11] and abundant data from RCTs show the efficacy of osteoporosis treatments in reducing fracture risk.[12] Although these studies are not conclusive, they suggest that osteoporosis screening by BMD can lower fracture risk by increasing the use of treatments for osteoporosis when indicated.

Osteoporosis Screening Modalities

At present, DXA is the most widely accepted and used method of screening for osteoporosis. It is a clinically proven method of measuring BMD, is non-invasive, takes only 10–15 minutes, and exposes patients to only a small amount of radiation (less than one tenth of the amount of a chest × ray). A *t*-score, derived from the DXA measurement, expresses an individual's BMD (in SDs) compared to the mean BMD of a "young normal" adult population of the same gender. A *t*-score of ≥ –1 is considered normal BMD; low bone mass or osteopenia is diagnosed when the *t*-score is between –1 and –2.5; and osteoporosis is diagnosed with a *t*-score of ≤ –2.5.

One disadvantage of DXA is that the machines are not portable. They also do not provide any information about bone architecture, which can influence fracture risk independent of BMD. Factors interfering with accuracy of DXA include osteoarthritis, vertebral compression fractures, osteophytes, and vascular calcification.[13]

Other potential screening tests include calcaneal quantitative ultrasound (QUS), quantitative computer tomography (QCT) radiography, and the use of biochemical (urine and serum) markers. There is increased interest in osteoporosis screening using QUS because it is portable, does not expose patients to radiation, and is relatively inexpensive. Sound waves are passed through the calcaneus, and the speed of sound and absorption patterns of various sound wavelengths are measured, which is known as broadband ultrasound attenuation. A meta-analysis of 25 studies compared the accuracy of QUS against the reference

standard of a *t*-score of ≤ –2.5 obtained by DXA, in identifying people with osteoporosis.[14] At a *t*-score threshold of –2.5, the sensitivity and specificity of QUS were 21%–45% and 88%–96%, respectively. Given the poor sensitivity of QUS for detecting osteoporosis, it has limited application in evidence-based screening programs for osteoporosis.

It is also possible to use QCT to measure BMD. A benefit of QCT is that it can analyze cortical and trabecular bone, so it is less influenced by the changes caused by degenerative disease, which can interfere with DXA accuracy. However, it is more expensive than DXA, and QCT exposes patients to a marked increase in radiation. The use of QCT as a screening tool for osteoporosis has not yet been extensively researched, and it has not yet been validated in relation to *t*-scores that predict fracture risk.

Other potential screening tests include serum and urine tests for markers of bone formation and resorption. Markers of bone formation include bone-specific alkaline phosphatase, osteocalcin, and procollagen I carboxy and N-terminal extension peptides. Markers of bone resorption include urinary levels of pyridinolines and deoxypyridinolines, and serum and urine levels of type I collagen telopeptides. The level of these markers may identify changes in bone remodeling within a relatively short time interval (several days to months) before changes in BMD can be detected. These biochemical markers of bone turnover are often used in the research setting but have limited clinical utility. They do not predict bone mass or reliably estimate fracture risk, but they may be helpful in monitoring response to antiresorption therapies in patients with osteoporosis.[15,16] Therefore, they cannot replace BMD testing and are not useful for population-based screening.[17,18]

Overview of Osteoporosis and Fracture Risk–Assessment Tools

Table 1 provides an overview of some risk-assessment tools available to clinicians for ascertaining osteoporosis and fracture risk. An area in which osteoporosis risk–assessment tools may be useful is for selecting men at risk for osteoporotic fractures for further diagnostic evaluation with BMD testing.[19–21] Shepherd et al. [19] used data from the National Health and Nutrition Examination Survey III to develop a clinical prediction rule to identify men at risk for osteoporosis and subsequent hip fracture who might benefit from DXA to confirm the presence of latent osteoporosis. Three variables were used to derive a score: age, weight, and the presence or absence of chronic obstructive pulmonary disease (COPD). A cutoff score of ≥6 had a sensitivity of 93% and a specificity of 59% for detecting osteoporosis by DXA. The number of men aged ≥50 years who needed to be treated to prevent one hip fracture was 279 in a cohort representative of the U.S. population. The study examined only hip and not vertebral osteoporosis, and it did not include men with pre-existing or new fractures or secondary causes of osteoporosis (e.g., corticosteroid use).

The osteoporosis self-assessment screening tool (OST), based on age and weight (0.2 × [body weight in kg – age in years]), has been developed and validated in Asian and Caucasian women.[22–24] It is comparable to other developed osteoporosis risk–assessment tools such as the osteoporosis risk assessment instrument (ORAI),[26] the simple calculated osteoporosis risk estimation score (SCORE),[27] and the osteoporosis index of risk (OSIRIS)[28] in identifying osteoporosis in women. However, the advantages of the OST are that it is simpler to use and implement in the clinical setting[22,30] and has a slightly better discriminative ability compared to the ORAI and SCORE among U.S. women.[24] The sensitivity and specificity of the OST (cutoff < 2) in detecting osteoporosis of the femoral neck (*t*-score ≤ –2.5) ranged from 88% to 92% and 37% to 52%, respectively, in women aged ≥45 years.[22,30] The OST has also been validated for use in men.[20,21,25] The sensitivity and specificity of the OST (cutoff ≤ 2) in detecting osteoporosis ranged from 82% to 85% and 64% to 74%, respectively.[20,25] The performance of the OST was not adversely affected by race (white or black), age, or corticosteroid use.[25] The OST has also been validated in Asian men with excellent sensitivity and a high negative predictive value.[21] The simplicity of this screening tool and its validation in both genders and in various races account for its popularity and widespread use in selecting patients for confirmatory BMD testing.

Fracture risk–assessment tools can be helpful when BMD testing is either unavailable or inaccessible by assisting clinicians in deciding on appropriate fracture-prevention therapies. One example is a computer model that calculates the 5-year risk of hip fracture for postmenopausal women aged 50–79 years based on a clinical risk factor profile (hipcalculator.fhcrc.org). This model was developed and tested on participants from the Women's Health Initiative (WHI).[31] However, a caveat of this computer modeling program is that it has not been tested on an unhealthy population of postmenopausal women. The WHO recently announced a fracture-risk algorithm, called the FRAX tool (www.shef.ac.uk/FRAX). This tool calculates the 10-year absolute risk of hip or major osteoporotic fracture (clinical spine, wrist, hip, or shoulder fracture). It was derived from models of population-based cohorts (from Europe, North America, Asia, and Australia) that integrate clinical risk factors to estimate the 10-year risk of osteoporotic fractures. Advantages of the FRAX tool are its applicability to both men and women and that it incorporates femoral neck BMD into the algorithm to improve the predictive value of hip fracture risk. The combination of clinical risk factors and

Table 1. Overview of risk-assessment tools

Risk-assessment tool	Population studied	Risk factors	BMD measurement required?	Scoring method/ predictive outcome	Sensitivity and specificity for osteoporosis
Osteoporosis risk estimation score for men[19]	U.S. men	Age, weight, COPD	No	Risk score of ≥6 predictive of hip osteoporosis	Sensitivity of 93% and specificity of 59%
OST[20–24,25]	U.S. women and men	Age, weight	No	0.2 × (body weight in kg [–] age in years); cutoff score ≤2 predictive of osteoporosis	Sensitivity of 88%–92% in women and 82%–85% in men; specificity of 37%–52% in women and 64%–74% in men
ORAI[26]	Canadian women	Age, weight, HRT	No	Score of ≥9 predictive of osteoporosis	Sensitivity of 94.4% and specificity of 41.4%
SCORE[27]	U.S. women	Age, weight, race, personal history of fracture, rheumatoid arthritis, HRT	No	Score of ≥6 predictive of osteoporosis	Sensitivity of 93.6% and specificity of 43.3%
OSIRIS[28]	European postmenopausal women	Age, body weight, HRT, personal history of fracture	No	Score of <1 predictive of osteoporosis	Sensitivity of 78.5% and specificity of 51.4%
WHI hip fracture risk calculator (www.hipcalculator.fhcrc.org)	U.S. postmenopausal women aged 50–79 years	Age, BMI, health status, race, physical activity, smoking, personal history of fracture, parental history of hip fracture, glucocorticoid therapy, diabetes treatment	No	Predicts the 5-year absolute risk of hip fracture	—
WHO FRAX (www.shef.ac.uk/FRAX)	Men and women from Europe, North America, Asia, Australia	Age, gender, BMI, smoking, alcohol intake, glucocorticoid therapy, secondary osteoporosis, parental and personal history of a fracture, femoral neck	Optional	FRAX algorithms provide the 10-year risk of hip and major osteoporotic fracture (clinical spine, forearm, hip, or shoulder)	—
Osteoporosis Society of Canada and Canadian Association of Radiologists Working Group[29]	Adults aged >50 years (data derived from European population)	Age, gender, personal history of fracture, glucocorticoid therapy	Yes	10-year absolute risk of fracture stratified into low (<10%), moderate (10%–20%), and high (>20%)	—

BMD, bone mineral density; BMI, body mass index; COPD, chronic obstructive pulmonary disease; DXA, dual x-ray absorptiometry; FRAX, fracture risk–assessment tool; HRT, hormone replacement therapy; ORAI, osteoporosis risk–assessment instrument; OSIRIS, osteoporosis index of risk; OST, osteoporosis self-assessment screening tool; SCORE, simple calculated osteoporosis risk estimation score; WHI, Women's Health Initiative; WHO, World Health Organization

BMD measurements has been shown to improve sensitivity without sacrificing specificity in predicting fractures. For example, for those aged 50 years, the gradient of hip fracture risk per SD change in risk score was 2.05, 3.68, and 4.23 with the use clinical risk factors, BMD, and the combination of the two, respectively.[32]

The Osteoporosis Society of Canada and the Canadian Association of Radiologists have also proposed estimating an individual's 10-year absolute fracture risk by incorporating both BMD measurements and clinical variables (such as age, gender, fragility fracture history, and glucocorticoid use) to help clinicians determine the need for medical therapy.[29] The lowest *t*-score at any centrally determined DXA site (lumbar spine, total hip, femoral neck, or trochanter) is interpreted together with the individual's age and gender to categorize the 10-year absolute fracture risk (combined risk of hip, spine, forearm, and proximal humerus fractures) into low, moderate, or high. The presence of either fragility fractures after age 40 or systemic glucocorticoid therapy for more than 3 months elevates the fracture risk to the next level. However, one limitation of this approach is that fracture risk was derived from femoral neck data in a European population using reference data on women only to derive risks for both men and women. This tool also does not incorporate other potentially useful clinical risk factors that might further influence fracture risk.

Cost Effectiveness of DXA Screening

Studies suggest that BMD screening of older women and men is cost effective.[33–35] Markov modeling showed that universal bone densitometry combined with alendronate therapy for those diagnosed with osteoporosis was highly cost effective for women aged ≥65 years.[33] The costs per quality-adjusted life year (QALY) gained for women aged 65 years and 75 years were $43,000 and $5600, respectively. The screen-and-treat strategy was cost saving for women aged 85 years and 95 years. Universal densitometry screening of men aged ≥80 years, or men aged ≥65 years with a prior fracture, followed by bisphosphonate treatment was also cost effective.[35] The costs per QALY gained were <$50,000 for men aged ≥65 years with a prior clinical fracture and for men aged ≥80 years without a prior fracture. Assuming oral bisphosphonate costs of <$500 per year, the screen-and-treat strategy demonstrated cost effectiveness for men aged as young as 70 years without a prior clinical fracture.

The National Osteoporosis Foundation (NOF), in their recently updated economic analysis, employed a fracture incidence–based model to identify the absolute 10-year hip fracture risk for which osteoporosis treatment became cost effective. A Markov-cohort model of annual U.S. aggregate incidence of clinical fractures examined costs in 2005 U.S. dollars and QALYs. Assumptions in this cost-effectiveness analysis included aggregated treatment costs of $600/year (drug and nondrug) for 5 years, with 35% fracture reduction by age, gender, and race/ethnicity groups. The absolute 10-year hip fracture probability at which treatment cost $60,000 per QALY gained was comparable across racial and ethnic groups, ranging from 2.5% in women aged 50 years to 4.7% in women aged 75 years. For men, the intervention thresholds for hip fracture were slightly higher, ranging from 2.4% to 4.7%.[34]

There is some uncertainty regarding the appropriate frequency of BMD screening, because of insufficient data, although an interval of 2 years is generally accepted. Biennial BMD screening is covered by Medicare for individuals at risk for osteoporosis, including women aged ≥50 years, individuals with a family or personal history of broken bones, and individuals who are small boned, have low body weight, smoke or drink a lot, are white or Asian, or have a low-calcium diet (www.medicare.gov).

Benefits and Harms of Osteoporosis Screening and Treatment

Given the limited evidence of the direct benefits resulting from BMD screening, potential benefits of screening may be inferred from abundant studies demonstrating the antifracture efficacy of available osteoporosis treatments (Table 2). A recent systematic review[12] concluded that there is good evidence supporting the use of the following therapies in preventing vertebral and nonvertebral fracture: bisphosphonates (alendronate, ibandronate, risedronate, and zoledronic acid); estrogen; calcium; and vitamin D.[12] In addition, there was good evidence supporting the use of alendronate, risedronate, zoledronic acid, estrogen, calcium, and vitamin D in preventing hip fractures. There was also good evidence of vertebral fracture–reduction efficacy with raloxifene and teriparatide. Although most osteoporosis treatment trials were conducted in women, there are studies that demonstrate antifracture efficacy in men as well. Risedronate, calcitonin, and teriparatide have been shown to decrease the risk of hip, vertebral, and total fractures, respectively.[36]

Potential harms associated with osteoporosis screening and treatment have been previously identified.[12,37] These include anxiety from perceived vulnerability to fracture when osteoporosis is identified.[38] False-negative results can occur from bone density screening, leading to missed opportunities for treatment.[39,40] Studies are lacking on the harms related to radiation exposure from repeated DXA scans and harms pertaining to osteoporosis screening in men. Harms associated with osteoporosis screening may also occur from the adverse effects related to treatment of osteopenia or osteoporosis. The harms of treatment depend on the type of therapy chosen. High rates of adverse reactions have been re-

Table 2. Summary of evidence about drugs and fracture risk[36]

Agent	Effect on risk and level of evidence: Vertebral fracture	Nonvertebral fracture	Hip fracture	Adverse effects	FDA approval
Bisphosphonates					
Alendronate	↓; strong evidence	↓; strong evidence	↓; strong evidence	Mild upper GI events, esophageal ulcerations, perforations, and bleeding events	Prevention or treatment
Etidronate	↓; strong evidence	↔; fair evidence	↔; strong evidence	Mild upper GI events, esophageal ulcerations, perforations, and bleeding events	Not FDA-approved for prevention or treatment
Ibandronate	↓; strong evidence	↔; strong evidence	Not studied	Esophageal ulcerations, perforations, and bleeding events	Prevention or treatment
Pamidronate	↔; weak evidence	↔; weak evidence	↔; weak evidence	Mild upper GI events, esophageal ulcerations, perforations, and bleeding events	Not FDA-approved for prevention or treatment
Risedronate	↓; strong evidence	↓; strong evidence	↓; strong evidence	Esophageal ulcerations, perforations, and bleeding events	Prevention or treatment
Zoledronic acid	↓; strong evidence	↓; strong evidence	↓; strong evidence	Muscular and joint pain	Prevention
Calcitonin	↓; fair evidence	↔; strong evidence	Not studied	No clinically significant adverse effects	Treatment
Estrogen	↓; strong evidence	↓; strong evidence	↓; strong evidence	Thromboembolic events; cerebrovascular accident, stroke, and breast cancer (when combined with progestin); gynecologic problems (endometrial bleeding); breast abnormalities (pain, tenderness, and fibrocytosis)	Prevention
Teriparatide	↓; strong evidence	↓; fair evidence	↔; weak evidence	No clinically significant adverse effects	Treatment
SERMs					
Raloxifene	↓; strong evidence	↔; strong evidence	↔; strong evidence	Pulmonary embolism, thromboembolic events	Prevention or treatment
Tamoxifen	↔; strong evidence	Not studied	↔; strong evidence	Pulmonary embolism	Not FDA-approved for prevention or treatment
Testosterone	Not studied	Not studied	Not studied	No clinically significant adverse effects	Not FDA-approved for prevention or treatment
Calcium and vitamin D	Modest effect[a]; strong evidence	Modest effect[a]; strong evidence	Modest effect[a]; strong evidence	No clinically significant adverse effects	Over the counter

↓ = decreased; ↔ = no effect

[a]Pooled estimate across fracture sites

FDA, U.S. Food and Drug Administration; GI, gastrointestinal; SERM, selective estrogen receptor modulator

ported with bisphosphonate use. Twenty-one percent of alendronate and 25% of risedronate users experience adverse effects, which led to discontinuation of the medications in at least two thirds of those who experienced adverse effects.[41] The majority of adverse effects are related to gastrointestinal problems. Alendronate treatment was associated with higher rates of mild gastrointestinal adverse effects in head-to-head comparison with nonbisphosphonate therapies.[12] However, pooled clinical trial data[12] showed that apart from etidronate, other bisphosphonates (including alendronate, risedronate, ibandronate, and zoledronate) were not significantly associated with increased rates of serious gastrointestinal adverse effects (esophageal ulcerations, perforations, or bleeding episodes) when compared with placebo.

Bisphosphonates have also been associated with adverse musculoskeletal side effects. Postmarketing reports describe severe disabling and incapacitating musculoskeletal pain that may occur up to 4 years after the treatment initiation with alendronate or risedronate.[42] Although osteonecrosis of the jaw (ONJ) was not reported in bisphosphonate trials, there have been case reports of ONJ, the majority of which have occurred in cancer patients receiving intravenous bisphosphonates.[43] Most of these cases were found to have occurred after a dental surgical procedure. However, the risk of ONJ associated with oral bisphosphonate treatment of osteoporosis is relatively low and has been estimated to be between 1 in 10,000 and <1 in 100,000 patient-treatment years, compared with 1 to 10 per 100 patients receiving intravenous bisphosphonates for cancer.[44] The optimal duration of bisphosphonate therapy is unknown. However, studies[45,46] involving postmenopausal women indicate that continued treatment with alendronate for 10 years maintained BMD at the hip and lumbar spine compared to stopping treatment after 5 years without undue risk. In addition, long-term treatment may be associated with fewer clinical vertebral fractures.[45]

Raloxifene, a selective estrogen receptor modulator used in postmenopausal osteoporosis, is associated with an elevated risk of venous thromboembolism and a modestly increased risk of mild cardiac events.[12]

Rationale Statement

Osteoporosis is an important public health issue with estimated annual direct costs of $17 billion ($US2005), which are anticipated to increase. It is a common and costly disease that is associated with high morbidity and mortality. The DXA is a safe screening test that provides practitioners with accurate information about BMD with minimal radiation exposure for patients. Given this knowledge, patients found to have osteoporosis can be started on treatment and counseled regarding the importance of lifestyle changes to reduce their risk of osteoporotic fracture. Screening for osteoporosis in patients at risk is beneficial because osteoporosis is easily detectable and highly treatable.

Recommendations of Other Groups

Recommendations for osteoporosis screening from major professional and healthcare organizations are summarized in Table 3. The U.S. Preventive Services Task

Table 3. Recommendations for osteoporosis screening from major professional and healthcare organizations

U.S. Preventive Services Task Force[5]	• Women aged ≥65 years • Women age ≥60 years who are at increased risk of osteoporotic fractures (e.g., low body weight and absence of estrogen replacement therapy)
American Association of Clinical Endocrinologists[47]	• All women aged ≥65 years • All adult women who have a history of fracture not caused by severe trauma • Younger postemenopausal women with clinical risk factors for fracture including body weight <127 pounds or a family history of hip or spine fracture
American College of Obstetricians and Gynecologists[48]	• All postmenopausal women aged ≥65 years • Postmenopausal women aged <65 years who have one or more risk factors for osteoporosis • All postmenopausal women who have a history of fracture • In the absence of new risk factors, screening should not occur more frequently than every 2 years
Osteoporosis Society of Canada[49]	• Postmenopausal women • Men aged >50 years with at least one major or two minor risk factors
International Society for Clinical Densitometry (www.iscd.org)	• Women aged ≥65 years • Postmenopausal women aged <65 years with risk factors for fracture • Women during the menopausal transition with clinical risk factors for fracture, such as low body weight, prior fracture, or high-risk medication use • Men aged ≥70 years • Men aged <70 years with clinical risk factors for fracture • Adults with a fragility fracture • Adults with a disease or condition associated with low bone mass or bone loss • Adults taking medications associated with low bone mass or bone loss • Anyone being considered for pharmacologic therapy • Anyone being treated, to monitor treatment effect • Anyone not receiving therapy in whom evidence of bone loss would lead to treatment • Women discontinuing estrogen should be considered for bone density testing according to the indications listed above
National Osteoporosis Foundation (www.nof.org)	• Women aged ≥65 years and men aged ≥70 years, regardless of clinical risk factors • Younger postmenopausal women and men aged 50–70 years based on their clinical risk factor profile • Women in the menopausal transition if there is a specific risk factor associated with increased fracture risk such as low body weight, prior low-trauma fracture, or high-risk medication • Adults who have a fracture after age 50 • Adults with a condition (e.g., rheumatoid arthritis) or taking a medication (e.g., glucocorticoids, ≥5 mg/day for ≥3 months) associated with low bone mass or bone loss • Anyone being considered for pharmacologic therapy for osteoporosis • Anyone being treated for osteoporosis, to monitor treatment effect • Anyone not receiving therapy in whom evidence of bone loss would lead to treatment • Consider postmenopausal women discontinuing estrogen for bone density testing
American College of Physicians[50]	• Clinicians should periodically assess risk factors for osteoporosis in older men • DXA scans should be obtained in men at increased risk for osteoporosis who are candidates for drug therapy

Force (USPSTF) makes no recommendation for or against routine screening in postmenopausal women aged <60 years or in women aged 60–64 years who do not have an increased risk of osteoporotic fractures. The USPSTF recognizes that screening women eligible for osteoporosis treatment and at lower risk of osteoporosis can identify additional treatment opportunities. However, because the number of fractures prevented would be small, USPSTF found the balance of benefits and harms of screening and treatment to be too close to make a recommendation.

The American Association of Clinical Endocrinologists (AACE) recommends screening all adult women who have a history of low-trauma fracture and younger postmenopausal women with clinical risk factors for fracture.[47] The American College of Obstetricians and Gynecologists (ACOG) recommendations are similar to the AACE, but they propose that in the absence of new risk factors, screening should not occur more frequently than every 2 years.[48]

The guidelines from the Osteoporosis Society of Canada state that postmenopausal women and men aged >50 years with at least one major or two minor risk factors (Table 4) should undergo screening.[49] The 2007 International Society for Clinical Densitometry and 2008 NOF make recommendations on osteoporosis screening in women that are generally similar to the recommendations from USPSTF, and to those of AACE with respect to BMD testing, but they also make recommendations for BMD testing in men (www.iscd.org; www.nof.org). The NOF also proposes the calculation of the 10-year absolute risk of hip or major osteoporotic fracture (clinical spine, wrist, hip, or shoulder fracture) based on the FRAX tool (www.shef.ac.uk/FRAX). Osteoporosis treatment is recommended in postmenopausal women and men aged >50 years with DXA-confirmed osteoporosis at the femoral neck, hip, and spine. Treatment is also recommended if osteopenia is present at the above sites and the 10-year risk for hip fracture is 3% or more, or the 10-year risk for major osteoporotic fractures is 20% or more. For example, a 70-year-old female smoker who has a BMI of 22 kg/m^2 and a *t*-score of –2.0 at the femoral neck has a 10-year hip fracture risk of 4%, making her a suitable candidate for osteoporosis therapy. BMD testing is generally recommended every 2 years by the NOF. The American College of Physicians (ACP) recently published their guidelines for osteoporosis screening in men.[50,51] Although a specific age at which to initiate DXA screening in men was not specified because of a lack of data, ACP recognized that men aged >70 years were at increased risk of osteoporosis.

Table 4. Risk factors for osteoporosis[49]

Major risk factors	Minor risk factors
Vertebral compression fracture	Rheumatoid arthritis
Fragility fracture after age 40	Past history of hyperthyroidism
Family history of osteoporotic fracture	Chronic anticonvulsant therapy
Systemic glucocorticoid therapy lasting >3 months	Low dietary calcium intake
Malabsorption syndrome	Smoking
Primary hyperparathyroidism	Excessive alcohol intake
Propensity to fall	Excessive caffeine intake
Osteopenia apparent on x-ray film	Weight <57 kg
Hypogonadism	Weight loss >10% of weight at age 25
Early menopause (before age 45)	Chronic heparin therapy

Recommendations of the American College of Preventive Medicine

The ACPM agrees with the USPSTF recommendation to screen all women aged ≥65 years. Older men also have an increased risk of osteoporosis. We therefore endorse the recommendations by NOF to screen men aged ≥70 years. Even though men experience the equivalent risk of a major osteoporotic fracture at age 75 years as a woman aged 65 years (assuming no prior fracture and normal BMI),[52] screening men as young as 70 years has been shown to be cost effective.[35] Screening for osteoporosis should be performed with BMD testing by DXA if available, and not more frequently than every 2 years. All adult patients aged ≥50 years should be evaluated for risk factors for osteoporosis. Younger postmenopausal women and men aged 50–69 years should undergo screening if they have at least one major or two minor risk factors for osteoporosis (Table 4). Secondary causes of osteoporosis should be considered, with appropriate diagnostic workup, especially in men and younger postmenopausal women with osteoporosis.

Osteoporosis risk–assessment tools such as the WHI Hip Fracture Risk Calculator (www.hipcalculator.fhcrc.org) and the FRAX tool (www.shef.ac.uk/FRAX) are useful supplements to BMD assessments because they provide estimates of absolute fracture risk based on population cohort studies. They can also be used, if BMD testing is not readily available or not feasible, to assist healthcare providers and patients make treatment decisions to reduce the risk of fracture.

We recommend that clinicians consider using an osteoporosis risk–assessment tool that estimates absolute fracture risk. Use of a 10-year absolute fracture risk–based score has generally been well received by physicians in practice and may even be preferred over *t*-score reporting alone.[53] Fracture risk information can be presented in a more informative manner, making it easier to understand for both physicians and patients. This type of presentation may also improve recognition for appropriate pharmacologic intervention and medica-

tion adherence. In addition, using the combination of clinical risk factors and BMD measurements can improve sensitivity and specificity over using either alone.[32]

The APCM recognizes that osteoporosis screening is only one arm of a multifaceted approach toward secondary and tertiary prevention of osteoporotic fractures. All patients should be provided with recommendations to ensure an adequate intake of calcium (1200 mg daily for adults aged ≥50 years); vitamin D (800–1000 IU for adults aged ≥50 years); and regular weight-bearing physical activity. In addition, smoking and excessive alcohol consumption should be strongly discouraged.

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