Diagnosis and Management of Osteoporosis

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VINCENT E. CASIANO, MD, Evans Army Community Hospital, Fort Carson, Colorado

Osteoporosis-related fractures affect approximately one in two white women and one in five white men in their lifetime. The impact of fractures includes loss of function, significant costs, and increased mortality. The U.S. Preventive Services Task Force recommends using dual energy x-ray absorptiometry to screen all women 65 years and older, and younger women who have an increased fracture risk as determined by the World Health Organization’s FRAX Fracture Risk Assessment Tool. Although guidelines are lacking for rescreening women who have normal bone mineral density on initial screening, intervals of at least four years appear safe. The U.S. Preventive Services Task Force found insufficient evidence to recommend screening for osteoporosis in men; other organizations recommend screening all men 70 years and older. In patients with newly diagnosed osteoporosis, suggested laboratory tests to identify secondary causes include serum 25-hydroxyvitamin D, calcium, creatinine, and thyroid-stimulating hormone. First-line treatment to prevent fractures consists of fall prevention, smoking cessation, moderation of alcohol intake, and bisphosphonate therapy. Clinicians should consider discontinuing bisphosphonate therapy after five years in women without a personal history of vertebral fractures. Raloxifene, teriparatide, and denosumab are alternative effective treatments for certain subsets of patients and for those who are unable to take or whose condition does not respond to bisphosphonates. The need for follow-up bone mineral density testing in patients receiving treatment for osteoporosis is uncertain. (Am Fam Physician. 2015;92(4):261-268. Copyright © 2015 American Academy of Family Physicians.)

More than 10 million Americans have osteoporosis, which is defined by the National Osteoporosis Foundation as a chronic, progressive disease characterized by low bone mass, microarchitecture deterioration of bone tissue, bone fragility, and a consequent increase in fracture risk. Roughly 50% of white women and 20% of white men have a fracture related to osteoporosis in their lifetime; although black men and women are at lower risk of osteoporosis, those with osteoporosis have similar fracture risk. Osteoporotic fractures are associated with increased risk of disability, nursing home placement, total health care costs, and mortality (Table 1). Osteoporosis risk increases with age, and its impact will increase as the U.S. population ages. Table 2 lists risk factors for osteoporosis.

Diagnosis
Osteoporosis is diagnosed radiographically based on bone mineral density (BMD) determinations from dual energy x-ray absorptiometry (DEXA) assessment. Although quantitative calcaneal ultrasonography and peripheral DEXA can also predict fracture risk, these modalities do not correlate well enough with central DEXA to be used diagnostically. The World Health Organization (WHO) established commonly accepted definitions of osteoporosis and osteopenia (Table 3).

Screening
Published osteoporosis screening guidelines vary greatly (eTable A). The U.S. Preventive Services Task Force (USPSTF) recommends screening all women 65 years and older. DEXA of the hip and lumbar spine is the preferred assessment method. The USPSTF also advises screening women younger than 65 years whose 10-year fracture risk is greater than or equal to that of a 65-year-old white woman without additional risk factors. The FRAX WHO Fracture Risk Assessment
Tool (http://www.shef.ac.uk/FRAX/) was used by the USPSTF as a method of determining increased fracture risk for these women. Although guidelines for rescreening women with normal initial screening results are lacking, recent evidence suggests that intervals of at least four years appear safe.8,9 The USPSTF found insufficient evidence to recommend routine screening for osteoporosis in men.5 Men with a minimal trauma fracture who are older than 50 years or those with secondary causes associated with bone loss could be considered for screening. The National Osteoporosis Foundation also recommends screening all men 70 years and older, based on the assumption that this group has a similar osteoporotic fracture risk and treatment effectiveness as 65-year-old white women.1

### Evaluation for Secondary Osteoporosis

Primary osteoporosis is related to aging and loss of gonadal function. Secondary osteoporosis is caused by other health conditions (Table 4).2 Up to 30% of osteoporosis cases in postmenopausal women are estimated to be from a secondary cause.10 The estimate climbs to greater than 50% in men, premenopausal women, and perimenopausal women if vitamin D deficiency is included as a secondary cause.11-13 In addition to performing a history and physical examination, expert consensus suggests a basic laboratory evaluation for all newly diagnosed patients to determine if there are contraindications for certain osteoporosis medications and to identify the more common secondary causes. The most commonly recommended laboratory tests include serum 25-hydroxyvitamin D, calcium, creatinine, and thyroid-stimulating hormone levels.1,14

### Treatment

The National Osteoporosis Foundation recommends treatment of postmenopausal women and men with a personal history of hip or vertebral fracture, a T-score of −2.5 or less, or a combination of low bone mass (T-score between −1 and −2.5) and a 10-year probability of hip fracture of at least 3% or any major fracture of at least 20% as calculated by the FRAX WHO Fracture Risk Assessment Tool.1 The WHO recommendations are less specific, stating that persons with or at risk of osteoporosis should be considered for treatment.15 Randomized controlled trials of treatment have shown reduction of
Table 4. Common Causes of Secondary Osteoporosis

<table>
<thead>
<tr>
<th>Medical conditions</th>
<th>Medications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central nervous system disorders (e.g., epilepsy, multiple sclerosis, Parkinson disease, spinal cord injury, stroke)</td>
<td>Anticonvulsants (e.g., phenobarbital, phenytoin [Dilantin])</td>
</tr>
<tr>
<td>Chronic obstructive pulmonary disease</td>
<td>Chemotherapeutics</td>
</tr>
<tr>
<td>Endocrine/metabolic disorders (adrenal insufficiency, athletic amenorrhea, Cushing syndrome, hemochromatosis, homocystinuria, primary hyperparathyroidism, hyperprolactinemia, hyperthyroidism, primary or secondary hypogonadism, premature menopause, thyrotoxicosis, type 1 diabetes mellitus)</td>
<td>Cyclosporine (Sandimmune)</td>
</tr>
<tr>
<td>Gastrointestinal disorders (celiac disease, gastric bypass, inflammatory bowel disease, malabsorption, pancreatic insufficiency, primary biliary cirrhosis)</td>
<td>Depo-medroxyprogesterone (Depo-Provera)</td>
</tr>
<tr>
<td>Hematologic disorders (hemophilia, leukemia and lymphomas, monoclonal gammopathies, multiple myeloma, sickle cell disease, thalassemia)</td>
<td>Glucocorticoids</td>
</tr>
<tr>
<td>Human immunodeficiency virus infection or AIDS</td>
<td>Gonadotropin-releasing hormone agonists and antagonents</td>
</tr>
<tr>
<td>Liver disease (severe)</td>
<td>Heparin</td>
</tr>
<tr>
<td>Nutrition disorders (alcoholism, anorexia nervosa/bulimia, malnutrition, vitamin A excess, vitamin D deficiency)</td>
<td>Lithium</td>
</tr>
<tr>
<td>Renal insufficiency or renal failure</td>
<td>Methotrexate</td>
</tr>
<tr>
<td>Rheumatoid arthritis</td>
<td>Proton pump inhibitors</td>
</tr>
<tr>
<td>Systemic lupus erythematosus</td>
<td>Selective serotonin reuptake inhibitors</td>
</tr>
<tr>
<td></td>
<td>Tacrolimus (Prograf)</td>
</tr>
<tr>
<td></td>
<td>Tamoxifen</td>
</tr>
<tr>
<td></td>
<td>Thiazolidinediones (e.g., pioglitazone [Actos])</td>
</tr>
<tr>
<td></td>
<td>Thyroid hormone excess</td>
</tr>
</tbody>
</table>


Table 5. Nonpharmacologic Therapy to Reduce Fractures

<table>
<thead>
<tr>
<th>Intervention</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol moderation</td>
<td>≤ 4 drinks per day for men or ≤ 2 drinks per day for women</td>
</tr>
<tr>
<td>Decreased caffeine intake</td>
<td>≤ 2.5 cups of coffee or ≤ 5 cups of tea per day</td>
</tr>
<tr>
<td>Multicomponent exercise with strength and balance training</td>
<td>—</td>
</tr>
<tr>
<td>Multifactorial falls risk assessment</td>
<td>—</td>
</tr>
<tr>
<td>Smoking cessation</td>
<td>—</td>
</tr>
<tr>
<td>Sunlight/ultraviolet exposure</td>
<td>30 minutes per day, 5 days per week</td>
</tr>
<tr>
<td>Vitamin D supplementation</td>
<td>800 IU per day</td>
</tr>
</tbody>
</table>

Information from references 17 through 25.
Osteoporosis

**Bisphosphonates.** Oral bisphosphonates inhibit osteoclastic activity and are antiresorptive agents. They are considered first-line pharmacologic therapy. Randomized clinical trials demonstrate a reduction of vertebral and hip fractures with alendronate (Fosamax) and risedronate (Actonel),\(^{16,26}\). Alendronate and risedronate also decrease vertebral fractures in men\(^{30,31}\) and in patients with glucocorticoid-induced osteoporosis.\(^{32,33}\) Daily and intermittent use of ibandronate (Boniva) have demonstrated effectiveness in reducing fractures of the spine only.\(^{14}\) Weekly and monthly dosing formulations improve adherence.\(^{35}\) Oral bisphosphonates should be taken only with water and a wait of at least 30 minutes before reclining or ingesting other medication or food. This decreases upper gastrointestinal adverse effects and allows for appropriate absorption.

The intravenous bisphosphonates approved by the U.S. Food and Drug Administration for the treatment of postmenopausal osteoporosis are zoledronic acid (Reclast), 5 mg yearly (shown to decrease vertebral and hip fractures),\(^{16,26,36}\) and ibandronate, 3 mg every three months.\(^{37}\) Although these medications are expensive, they are useful for high-risk patients who are unable to tolerate or adhere to oral therapy.

The optimal length of oral bisphosphonate therapy is unknown. One study found that women who take alendronate for five years followed by five years of placebo have no increased incidence of nonvertebral or hip fractures compared with women who take alendronate for 10 years. There is, however, an increase in vertebral fractures.\(^{38}\) Osteonecrosis of the jaw and atypical femoral fractures are rare complications of bisphosphonate therapy that are associated with longer duration of use.\(^{39,40}\) Clinicians should consider discontinuing bisphosphonate therapy after five years in women without a personal history of vertebral fractures.

**Raloxifene.** Raloxifene, a selective estrogen receptor modulator, is approved for treating postmenopausal osteoporosis, and is effective at reducing vertebral fractures only.\(^{16,26}\) Raloxifene is commonly associated with increased vasomotor symptoms. It is associated with an increased risk of venous thromboembolism and a decreased risk of invasive breast cancer.\(^{16}\) The best candidates for raloxifene are postmenopausal women with osteoporosis who are unable to tolerate bisphosphonates, have no vasomotor symptoms or history of venous thromboembolism, and have a high breast cancer risk score.\(^{16,27}\) Bazedoxifene is a selective estrogen receptor modulator more recently approved for use in the United States for the prevention of osteoporosis as part of a combination therapy with conjugated estrogen (Duavee).

### Table 6. Pharmacologic Therapies for Osteoporosis

<table>
<thead>
<tr>
<th>Class/medication</th>
<th>FDA indication</th>
<th>Fracture type</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Bisphosphonates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alendronate (Fosamax)</td>
<td>Prevention</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
<tr>
<td>Alendronate/cholecalciferol (Fosamax Plus D)</td>
<td>Treatment</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
<tr>
<td>Ibandronate (Boniva)</td>
<td>Prevention and treatment</td>
<td>Vertebral only</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>Vertebral only</td>
</tr>
<tr>
<td>Risedronate (Actonel)</td>
<td>Prevention and treatment</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
<tr>
<td>Risedronate, delayed release (Atelvia)</td>
<td>Treatment</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
<tr>
<td>Risedronate with calcium</td>
<td>Prevention and treatment</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
<tr>
<td>Zoledronic acid (Reclast)</td>
<td>Prevention</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
<tr>
<td></td>
<td>Treatment</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
<tr>
<td>Raloxifene (Evista)</td>
<td>Prevention and treatment</td>
<td>Vertebral only</td>
</tr>
<tr>
<td>Teriparatide (Forteo)</td>
<td>Treatment (high risk*)</td>
<td>Vertebral, nonvertebral</td>
</tr>
<tr>
<td>Denosumab (Prolia)</td>
<td>Treatment (high risk*)</td>
<td>Hip, vertebral, nonvertebral</td>
</tr>
</tbody>
</table>

FDA = U.S. Food and Drug Administration; IV = intravenous; NNT = number needed to treat.  
*—History of osteoporotic fracture, multiple fracture risk factors, or intolerant to other therapy.  
Information from references 16, and 26 through 29.
<table>
<thead>
<tr>
<th>Class/medication</th>
<th>FDA indication</th>
<th>Fracture type</th>
<th>Typical dosage and monthly cost</th>
<th>Adverse effects and contraindications</th>
<th>NNT (to prevent one fracture)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bisphosphonates</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alendronate</td>
<td>Prevention</td>
<td>Hip, vertebral, nonvertebral</td>
<td>5 mg per day or 35 mg per week, oral $53 10 mg per day or 70 mg per week, oral $107</td>
<td>Small risk of atypical femoral shaft fractures; osteonecrosis of the jaw</td>
<td>Hip: 91 (2 to 5 years)</td>
</tr>
<tr>
<td></td>
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<td>70 mg plus 2,800 IU or 5,600 IU per week, oral $140</td>
<td>Mild upper gastrointestinal events, esophageal ulcerations, perforations, bleeding events, muscular and joint pains Contraindications: abnormalities of the esophagus; inability to stand or sit upright for at least 30 minutes; hypersensitivity to any product component; increased risk of aspiration or dysphagia</td>
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<td></td>
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<td>150 mg monthly or 2.5 mg per day, oral $153</td>
<td>Same as alendronate</td>
<td>Spine: 20 (3 years)</td>
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<tr>
<td></td>
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<td>3 mg every 3 months, IV $159 (one dose = $477)</td>
<td>Same as alendronate</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>5 mg per day or 35 mg per week or 75 mg in two consecutive days per month or 150 mg per month, oral $199</td>
<td>Same as alendronate</td>
<td>Hip: 77 (3 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>35 mg per week, oral $168</td>
<td>Same as alendronate</td>
<td>—</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>35 mg per week (day 1) plus 1,250 mg calcium per day (days 2 to 7 each week), oral $216</td>
<td>Same as alendronate</td>
<td>—</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>5 mg every 2 years, IV $45 (one dose = $1,083) 5 mg per year, IV $90 (one dose = $1,083)</td>
<td>Muscular and joint pains Contraindications: hypocalcemia creatinine clearance &lt; 35 mL per minute per 1.73 m² (0.58 mL per second per m²) and acute renal impairment; hypersensitivity to zoledronic acid or any components of this product</td>
<td>Hip: 91 (3 years) Spine: 30 (2 years; from 1 study of men)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60 mg per day, oral $198</td>
<td>Pulmonary embolism, thromboembolic events Contraindications: venous thromboembolism; pregnancy, women who may become pregnant, and breastfeeding mothers</td>
<td>Spine: 29 (3 years)</td>
</tr>
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<td></td>
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<td></td>
<td>20 mcg per day for up to 2 years, subcutaneous $1,545</td>
<td>Arthralgia, pain, nausea, transient orthostatic hypotension, hypercalcemia, hyperuricemia Contraindications: hypersensitivity to teriparatide or to any of its components; reactions have included angioedema and anaphylaxis</td>
<td>Spine: 11 (1.5 years)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>60 mg every 6 months, subcutaneous $146 (one dose = $881)</td>
<td>Muscular and joint pains; small risk of osteonecrosis of the jaw (especially older women with poor dental hygiene or cancer) Contraindications: hypocalcemia; pregnancy</td>
<td>Spine: 21 (3 years)</td>
</tr>
</tbody>
</table>

Notes: Consider drug discontinuation after 5 years in low-risk patients. Information from references 16, and 26 through 29.
Osteoporosis. Teriparatide is approved for treatment of postmenopausal osteoporosis. It has been shown to decrease the occurrence of vertebral compression fractures only.\textsuperscript{16, 26} Although calcitonin has modest analgesic properties in the setting of acute and chronic vertebral compression fracture, it is not considered first-line treatment for osteoporosis because more effective medications are available.\textsuperscript{16, 41} There have also been reports of increased cancer rates associated with use of calcitonin.\textsuperscript{42}

Teriparatide. Teriparatide is a recombinant human parathyroid hormone with bone anabolic activity. In a dosage of 20 mcg per day given subcutaneously for up to two years, teriparatide decreases vertebral and nonvertebral fractures.\textsuperscript{16, 26} Teriparatide is approved for the treatment of postmenopausal women with severe bone loss, men with osteoporosis who have high risk of fracture, and individuals whose condition has not improved with bisphosphonate therapy. One study suggests that it is advisable to follow teriparatide therapy with bisphosphonate therapy to maintain BMD gains.\textsuperscript{43}

Denosumab. Denosumab is a human monoclonal antibody that inhibits the formation and activity of osteoclasts by blocking receptor activator of nuclear factor kappa B ligand. In a dose of 60 mg given subcutaneously every six months for three years, it significantly increased BMD in postmenopausal women compared with weekly dosing of alendronate.\textsuperscript{44} Denosumab has been shown to decrease hip, vertebral, and nonvertebral fractures compared with low doses of calcium and vitamin D. It appears to be a reasonable alternative for persons whose condition does not improve with bisphosphonates. Renal insufficiency is a listed caution, but denosumab appears to be safe for patients with chronic kidney disease stages 1 to 3.\textsuperscript{45}

Calcitonin nasal spray is an antiresorptive agent approved for the treatment of postmenopausal osteoporosis. It has been shown to decrease the occurrence of acute and chronic vertebral compression fractures only.\textsuperscript{16, 26} Although calcitonin has modest analgesic properties in the setting of acute and chronic vertebral compression fracture, it is not considered first-line treatment for osteoporosis because more effective medications are available.\textsuperscript{16, 41} There have also been reports of increased cancer rates associated with use of calcitonin.\textsuperscript{42}

Hormone Therapy. The Women’s Health Initiative study confirmed that estrogen, with or without progesterone, slightly reduced the risk of hip and vertebral fractures; however, this benefit did not outweigh the increased risk of stroke, venous thromboembolism, coronary heart disease, and breast cancer, even for women at high risk of fracture.\textsuperscript{46} Lower doses of conjugated equine estrogens and estradiol have been shown to improve BMD, but a reduced risk of fracture has not been demonstrated and the safety is unknown.\textsuperscript{47}

Combination Therapy. There has been no demonstrated effectiveness of combination therapy in reducing fractures. Although research continues, there is currently a limited role for combination therapy beyond clinical trials.

**BEST PRACTICES IN PREVENTIVE MEDICINE: RECOMMENDATIONS FROM THE CHOOSING WISELY CAMPAIGN**

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Sponsoring organization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do not use dual energy x-ray absorptiometry (DEXA) to screen for osteoporosis in women younger than 65 years or in men younger than 70 years with no risk factors.*</td>
<td>American Academy of Family Physicians</td>
</tr>
<tr>
<td>Do not routinely repeat dual energy x-ray absorptiometry (DEXA) scans more often than once every two years.</td>
<td>American College of Rheumatology</td>
</tr>
</tbody>
</table>

*—Risk factors include, but are not limited to, fractures after 50 years of age, prolonged exposure to corticosteroids, diet deficient in calcium or vitamin D, cigarette smoking, alcoholism, and thin/small build.

Source: For more information on the Choosing Wisely Campaign, see http://www.choosingwisely.org. For supporting citations and to search Choosing Wisely recommendations relevant to primary care, see http://www.aafp.org/afp/recommendations/search.htm.
Osteoporosis

FOLLOW-UP

After initiation of treatment, the need for follow-up bone density testing is uncertain. A decrease in BMD could suggest treatment nonadherence, inadequate calcium or vitamin D intake, an unidentified secondary cause of osteoporosis, or treatment failure.18 However, a single-institution study found that although follow-up DEXA scanning for patients with osteoporosis was performed often, this rarely led to changes in treatment, even in patients found to have decreased BMD.19

Data Sources: We reviewed all cited references from the original 2009 review article, then performed a PubMed search using the following key words: osteoporosis, osteopenia, screening, diagnosis, treatment, prevention, secondary, and vitamin D. The search included meta-analyses, randomized controlled trials, clinical trials, and reviews. Additional searches included Essential Evidence Plus, the U.S. Preventive Services Task Force, the Institute for Clinical Systems Improvement, the National Guideline Clearinghouse, the Cochrane Database of Systematic Reviews, and the National Osteoporosis Foundation website. Search dates: April and July 2014, and May 2015.

The opinions or assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the Department of Defense, the U.S. Army Medical Corps, or the U.S. Army at large.

NOTE: This review updates a previous article on this topic by Sweet, Jeremiah, and Galazka.29

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REFERENCES


Osteoporosis


eTable A. Osteoporosis Screening Recommendations

<table>
<thead>
<tr>
<th>Organization</th>
<th>Recommendation</th>
</tr>
</thead>
</table>
| American Association of Clinical Endocrinologists (2010) | All women 65 years or older  
All postmenopausal women:  
- With a history of fracture(s) without major trauma after 40 to 45 years of age  
- With osteopenia identified radiographically  
- Starting or taking long-term systemic glucocorticoid therapy (≥ 3 months)  
- Patients at increased risk of secondary osteoporosis (e.g., rheumatoid arthritis)  
Other perimenopausal or postmenopausal women with risk factors for osteoporosis if willing to consider pharmacologic interventions:  
- Current smoker  
- Early menopause  
- Family history of osteoporotic fracture  
- Excessive consumption of alcohol (> 2 drinks per day for women)  
- Low body weight (< 58 kg [128 lb] or body mass index < 20 kg per m²)  
- Any history of long-term systemic glucocorticoid therapy (≥ 3 months) |
| American College of Obstetricians and Gynecologists (2012) | Bone density screening no more than once every two years beginning at 65 years of age, unless new health risks develop  
Selective screening in women younger than 65 years if they are postmenopausal and have other osteoporosis risk factors or fracture  
In the absence of new risk factors, DEXA monitoring of therapy should not be repeated after BMD is determined to be stable or improved |
| National Osteoporosis Foundation (2014)* | BMD testing should be performed:  
In women 65 years and older and in men 70 years and older  
In postmenopausal women and men 50 to 69 years of age; recommended based on risk factor profile  
With vertebral imaging in those who have had a fracture to determine degree of disease severity  
At DEXA facilities using accepted quality assurance measures  
Vertebral imaging should be performed:  
In women 65 years and older and in men 70 years and older to diagnose vertebral fractures if T-score is ≤ –1.5  
In women 70 years and older and in men 80 years and older to diagnose vertebral fractures, regardless of T-score  
In postmenopausal women and men 50 years and older with a low-trauma fracture  
In postmenopausal women and men 50 to 69 years of age to diagnose vertebral fractures if there is height loss ≥ 4 cm (1.5 in), or recent or ongoing long-term glucocorticoid therapy  
To check for causes of secondary osteoporosis  
Monitoring should include:  
BMD testing one to two years after initiating therapy to reduce fracture risk and every two years thereafter  
More frequent testing in certain clinical situations  
Longer interval between repeat BMD tests for patients without major risk factors and who have an initial T-score in the normal or upper low–bone mass range |

BMD = bone mineral density; DEXA = dual energy x-ray absorptiometry.
### eTable A. Osteoporosis Screening Recommendations (continued)

<table>
<thead>
<tr>
<th>Organization</th>
<th>Recommendation</th>
</tr>
</thead>
</table>
| Osteoporosis Canada<sup>a4</sup> (2010)<sup>*</sup> | Younger adults (age < 50 years):  
Fragility fracture  
Risk factors: glucocorticoid use (> 3 months cumulative therapy in past year), high-risk medication use, hypogonadism or premature menopause (age < 45 years), malabsorption syndrome, hyperparathyroidism, other associated disorders  
Older adults (age > 50 years):  
Fragility fracture  
High alcohol intake  
Low body weight (< 60 kg [132 lb]) or weight loss (> 10% of weight at 25 years of age)  
Parental hip fracture  
Rheumatoid arthritis  
Smoking  
Vertebral fracture or osteopenia on radiography  
Men and women 65 years and older  
Repeat BMD testing in one to three years and reassess risk in moderate- and high-risk groups |
| United Kingdom National Osteoporosis Guideline Group<sup>a5</sup> (2009) | Population screening not recommended  
Case finding for BMD assessment is based on risk factor assessment and comparison of risk to age- and sex-specific fracture probabilities |
| U.S. Preventive Services Task Force<sup>a6</sup> (2011) | Screen for osteoporosis in women 65 years and older, and in younger women whose fracture risk is equal to or greater than that of a 65-year-old white woman who has no additional risk factors  
Current evidence is insufficient to assess the balance of benefits and harms of screening for osteoporosis in men |

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BMD = bone mineral density; DEXA = dual energy x-ray absorptiometry.

*—Supported in part by pharmaceutical companies that produce medications for osteoporosis.

Information from:


