

# Stopping the silent progression of osteoporosis

The very first sign of osteoporosis can be its worst outcome—a fracture resulting from depleted bone. That's why we need to warn people about the dangers of osteoporosis and teach them about risk factors, preventive measures, and treatment. **By Adrienne Berarducci, PhD, ARNP, BC, CCD**

**OSTEOPOROSIS** and low bone mass affect about 44 million Americans. Women account for 80% of that number. And each year, more than 1.5 million Americans suffer osteoporotic fractures.

But despite the numbers and the attention osteoporosis receives in research literature and the popular media, many people remain unaware of their risk. Worse, many believe that osteoporosis has warning signs, such as pain, stiffness, and joint swelling typically associated with osteoarthritis.

As nurses, our challenge is to educate the public about the risks, warning signs, and potential complications of osteoporosis. This update on prevention and treatment is designed to help make sure you have the facts you need.

## How bone remodels

Bone is living, metabolically active tissue that undergoes remodeling throughout life. At any given time, 10% of a person's

skeletal mass is remodeling. This ongoing process takes place in response to the action of osteoclasts, or bone-resorbing cells, and osteoblasts, or bone-forming cells.

Each bone remodeling unit completes its process in about 3 months. In young, healthy people, the rate of bone resorption equals the rate of bone formation. In aging adults and those with other risk factors, the rate of resorption exceeds the rate of formation, which can result in significant loss of bone mass and decreased skeletal integrity.

## Losing bone

Bone mass increases during childhood and adolescence and peaks when we're in our early 20s. At about age 30, age-related bone loss begins throughout the skeletal system in all races and both sexes. However, bone-loss patterns differ between the sexes.

Women have less bone mass than men at all ages, and by their mid-30s, they can expect age-related bone loss at a rate of 1% a year. The rate accelerates rapidly during the first five years postmenopause, when women commonly lose 3% to 5% a year. Women in their 40s can expect a 10% loss of vertebral bone mass. Over a woman's lifetime, her cumulative bone loss can approach 40% of her peak bone mass.

A man's risk of osteoporosis and osteoporotic fractures is lower than a woman's for a few reasons. Men have

osteoporosis

CE: 1.6 contact  
hours



Rx: 0.75 contact  
hour

## LEARNING OBJECTIVES

1. State the pathophysiology of osteoporosis.
2. Identify preventive measures for osteoporosis.
3. Describe how bone mass is measured.
4. Discuss the treatment of osteoporosis.



larger bones at all ages and a greater peak bone mass in their 20s. Also, men don't have a period of accelerated bone loss, as women do during menopause.

About 50% of women over age 50 and 25% of men over age 50 suffer one or more osteoporosis-related fractures. Even though osteoporosis and osteoporotic fractures are more common in women, fracture-related complications are more devastating in men. Complications from fragility fractures include limited mobility, disfigurement, chronic pain, increased morbidity and mortality, social isolation, confinement, and depression. (See *Risk factors for osteoporosis*.)

### Preventing osteoporosis

Teach patients to prevent osteoporosis by maintaining an adequate intake of calcium and vitamin D, exercising regularly, and avoiding smoking and alcohol abuse.

### Taking calcium and vitamin D

Adequate calcium and vitamin D intake helps prevent and treat osteoporosis. Dietary sources, including fortified foods, are the best way to take in calcium, but both calcium and vitamin D are available in supplements, too. To help prevent or treat osteoporosis, men and women of any age should take 1,000 to 1,500 mg of calcium daily. (See *Calcium requirements for all*.)

Contraindications to calcium supplements include hypercalciuria. The most common complaint is constipation, which can be minimized by increasing exercise, fluid intake, and dietary fiber.

To adequately absorb and metabolize calcium, a person needs 400 to 800 IU of vitamin D a day. Taking calcium in divided doses will increase absorption. Calcium carbonate preparations require gastric acids for proper metabolism, so a person should take them with meals. Patients can take calcium citrate preparations, many of which

## Risk factors for osteoporosis

Osteoporosis progresses silently. The only sign may be a loss of height caused by microfractures and vertebral compression fractures. Because of its inconspicuous onset and progression, osteoporosis is difficult to detect—until fractures occur.

That's why both healthcare providers and the general public need to be aware of the factors that put people at risk for osteoporosis:

- sex (women, especially postmenopausal women)
- race (more common in Whites and Asians)
- body type (thin, small-boned frames and low body weight)
- family history of hip fracture or osteoporosis
- personal history of low-trauma fracture (fracture caused by a fall from a standing height or lower)
- genetic factors, such as primary hypogonadism, growth hormone deficiency, and Turner's syndrome
- conditions, such as a past or present history of Cushing's syndrome, secondary estrogen deficiency from anorexia or bulimia, hyperthyroidism, hyperparathyroidism, chronic liver disease, and diseases of malabsorption
- bariatric surgery
- premature menopause, prolonged amenorrhea, gastric surgery, surgery or inflammatory diseases of the small intestine, and major organ transplantation
- malnutrition
- decreased intake and metabolism of calcium and vitamin D
- behavioral factors, such as smoking, excessive alcohol intake, high sodium intake, high protein diet, high phosphate intake, and sedentary lifestyle
- extended periods of immobilization
- nulliparity
- prolonged use of certain drugs, including corticosteroids, anticonvulsants, thyroid hormone replacement, and, possibly, selective serotonin reuptake inhibitors.

are available in combination with vitamin D, at any time.

### Exercising

Physical exercise has many benefits, such as improving blood pressure, cardiac function, lipid profiles, insulin sensitivity, immune function, psychological well-being, and bone mineral density. Exercise, specifically weight-bearing exercise, also reduces the risk of osteoporosis. Weight-bearing exercise, which increases mechanical stress on bones and joints, can take many forms. A person can play tennis, walk, perform low-impact aerobic exercises, climb stairs, dance, or jog—ideally for 30 minutes or more at least three times a week. Caution extremely athletic women not to exercise to the point of amenorrhea. Doing so adversely affects

bone health by inducing estrogen deficiency.

### Avoiding smoking and alcohol abuse

Lifestyle behaviors play an important role in maintaining bone health. Smoking is toxic to bones and is associated with an increased risk of osteoporosis. Alcohol abuse has also been linked to decreased bone mass and may adversely affect bone metabolism and renal excretion of calcium. Also, alcohol abuse increases the risk of falls. In modest amounts, however, alcohol doesn't appear to increase the risk of osteoporosis.

### Measuring bone mass

The most reliable measure of bone loss and fracture risk is bone mineral density (BMD) testing, which can

predict osteoporotic fractures well before they occur, when intervention may be able to prevent them. Before BMD testing, the only non-invasive testing methods were based on routine radiographs. However, these methods could predict fractures only after 25% or more of a person's bone mass had been lost.

### Dual-energy X-ray absorptiometry

Various methods are available to assess BMD, but dual-energy X-ray absorptiometry (DXA) is considered the best. DXA reliably indicates the risk of osteoporosis and the potential for fracture. This efficient measurement tool can also assess a person's response to interventions, including those intended to prevent and reverse bone loss. When used to predict fracture potential, DXA measures the hip and lumbar spine, sites of the most devastating fractures. Degenerative disc disease, degenerative arthritis, vertebral compression, spinal implants, surgical hardware, and other spinal con-



## Calcium requirements for all

These lists show the daily calcium requirements from the National Academy of Sciences.

### Children and adolescents

ages 1–3 years ..... 500 mg  
 ages 4–8 years ..... 800 mg  
 ages 9–18 years ..... 1,300 mg

### Adult men and women

ages 19–49 years ..... 1,000 mg  
 ages 50 years and older .... 1,200 mg

### Pregnant and lactating women

ages 18 years and younger  
 ..... 1,300 mg  
 ages 19 years and older  
 ..... 1,000 mg

## Who needs a BMD measurement?

People in any of the following categories should have bone mineral density (BMD) testing:

- women age 65 and older
- postmenopausal women younger than age 65 with risk factors
- women discontinuing estrogen replacement therapy
- men and women with radiographic findings suggesting osteoporosis
- men and women starting or receiving prolonged therapy with drugs that can cause low bone mass or bone loss
- men and women with one or more low-impact fractures
- men and women with a disease or disorder associated with low bone mass or bone loss
- men and women being considered for treatment or receiving treatment for osteopenia or osteoporosis
- men and women who have lost more than 1.5 inches or 4 cm of their peak height
- men and women in whom evidence of bone loss would lead to treatment.

ditions can cause false DXA measurements. (See *Who needs a BMD measurement?*)

Two critical outcome measures—the T-score and the Z-score—are used to evaluate DXA results. Both are statistically compared in standard deviations (SD) from a normal distribution or along a bell curve. The T-score, which compares a person's BMD to the mean score of a healthy young adult, is used to diagnose and monitor primary osteoporosis and bone loss. The relative risk of a fracture increases 1.5- to 3-fold for every decrease in BMD of 1 SD from the mean value of a healthy young adult. The Z-score, which compares a person's BMD to the mean score of an age-, gender-, and race-matched control, is used to indicate secondary osteoporosis. If the Z-score is significantly lower than the matched control, consider possible secondary causes of osteoporosis.

The World Health Organization has established BMD-based criteria as a diagnostic framework for preventive and therapeutic decisions for those who have not sustained fragility fractures:

- *normal*: BMD value within 1 SD of young-adult mean (T-

score at or above -1)

- *osteopenia*: BMD value between -1 SD and -2.5 SD below young-adult mean (T-score between -1 and -2.5)
- *osteoporosis*: BMD value at least -2.5 SD below young-adult mean (T-score at or below -2.5).

Persons who have sustained one or more low-impact fractures are considered to have osteoporosis regardless of their BMD score.

The optimal interval between DXA tests is controversial and should be based on a careful evaluation of osteoporosis risk. When used to assess the effectiveness of therapy for osteopenia or osteoporosis, a DXA should be performed every 12 to 18 months.

### Heel quantitative ultrasound

Another method of assessing BMD and fracture risk, heel quantitative ultrasound (QUS) uses sonography to determine BMD of the calcaneus, the densest trabecular bone in the skeleton. QUS is relatively inexpensive and doesn't expose patients to ionizing radiation. Plus, the machine is portable. The results of large-scale prospective studies indicate that QUS effectively predicts fracture risk.

## Drugs for osteoporosis at a glance

### Drug therapy

Two types of drugs are prescribed for osteoporosis—anti-resorptive and anabolic agents. (See *Drugs for osteoporosis at a glance*.) The anti-resorptives include:

- estrogen
- calcitonin (Miacalcin)
- selective estrogen receptor modulators such as raloxifene (Evista)
- bisphosphonates, including risedronate (Actonel), alendronate (Fosamax), and ibandronate (Boniva).

These drugs reduce bone turnover and loss and stabilize the bone micro-architecture. Anti-resorptives work by inhibiting osteoclasts, which stimulates osteoblasts to synthesize new bone in the lacunae or resorption spaces, increasing BMD and reducing the risk of fractures.

The only anabolic agent approved by the Food and Drug Administration (FDA) is teriparatide (Forteo), which stimulates new bone formation on trabecular, endocortical, and periosteal bone surfaces by stimulating osteoblastic activity over osteoclastic activity. Teriparatide is typically reserved for patients who continue to experience fractures or bone loss despite preventive measures and anti-resorptive drug therapy.

Before starting any regimen, consider the risks and benefits, contraindications, and cost as well as patient adherence and lifestyle. All regimens should include adequate calcium and vitamin D intake, weight-bearing exercise, changes in unhealthy behaviors, and measures to prevent falls.

### Risks and cautions

Before the Women's Health Initiative study in 2002, estrogen was considered the first-line treatment for osteoporosis because it's the best preserver of bone mass in women. But recent data suggest that prolonged use may increase the risk of breast cancer and throm-

boembolic disorders. Today, estrogen isn't considered a primary treatment for osteoporosis.

Commonly used in intranasal form, calcitonin (Miacalcin) is considered safe, though some patients develop rhinitis and, rarely, epistaxis. Calcitonin exerts an analgesic effect in people with osteoporotic fractures, particularly vertebral fractures, though the precise analgesic mechanism isn't known.

Raloxifene (Evista), approved to prevent and treat osteoporosis in postmenopausal women, may increase the risk of deep vein thrombosis and worsen menopausal vasomotor symptoms.

Indications and contraindications vary among the bisphosphonates, so check the package insert for the prescribed drug. Adverse effects include difficulty swallowing, esophageal inflammation, and gastric ulcers. The FDA has received a few reports of osteonecrosis of the jaw (particularly after I.V. bisphosphonate treatment for bone-related malignancy) and visual disturbances. Patients should report these effects immediately. Bone pain may mis-

takenly be attributed to the underlying disease process.

Patients must take risedronate (Actonel) and alendronate (Fosamax) in the morning on an empty stomach with 8 ounces of water at least 30 minutes before eating or drinking. For the next 30 minutes, they should stand or sit upright. Patients should take ibandronate (Boniva) on the same date each month on an empty stomach with 8 ounces of water at least 60 minutes before eating or drinking. For the next 60 minutes, they should stand or sit upright. Tell patients to take these drugs only with water, not other liquids. You should know that a promising new once-a-year injectable bisphosphonate is now in clinical trials.

Teriparatide (Forteo) is well tolerated, although some people experience leg cramps, nausea, and dizziness. In laboratory rats, teriparatide has been associated with osteosarcoma. Thus, it's contraindicated for patients at risk for developing osteosarcoma—that is, patients with Paget's disease of bone, prior radiation therapy of the

Drug	Route	Frequency	Significant vertebral fracture reduction	Significant hip fracture reduction
<b>Anti-resorptives</b>				
<b>Estrogen</b>	Oral Transdermal	Daily Weekly	Yes	Yes
<b>Calcitonin</b>	Intranasal Subcutaneous	Daily 3-5 Times a week	Yes	No
<b>Raloxifene</b>	Oral	Daily	Yes	No
<b>Risedronate</b>	Oral	Weekly	Yes	Yes
<b>Alendronate</b>	Oral	Weekly	Yes	Yes
<b>Ibandronate</b>	Oral	Monthly	Yes	No
<b>Anabolics</b>				
<b>Teriparatide</b>	Subcutaneous	Daily	Yes	Yes

skeleton, bone metastases, hypercalcemia, or a history of skeletal malignancy. The safety and efficacy of teriparatide beyond 2 years of treatment haven't been demonstrated.

## Preventing falls

Prevention is the best medicine for falls, which cause nearly 90% of all fractures among the elderly. Consider risk factors such as disorders and drugs that affect the patient's balance and the ability to walk. Recommend discontinuing, or at least lowering the dose of, drugs that can cause bone loss. The same goes for anxiolytics, antipsychotics, opioids, sedatives, muscle relaxants, antihistamines, diuretics, hypoglycemics, and drugs that can cause hypotension. If appropriate, encourage regular exercise to enhance strength, coordination, and balance.

Evaluate patients with osteoporosis for visual deficits, especially difficulty with depth perception, which is a risk factor for falls. Tell these patients to avoid walking in stocking feet and wearing shoes with open toes, open heels, or raised heels. Encourage them to wear flat, closed-heel, and closed-toe shoes with nonslip soles.

Explain that environmental factors, such as exposed wires, mobile furniture, uneven walking surfaces, poor lighting, and slippery floors and rugs must be eliminated or corrected. As appropriate, arrange for a home evaluation to check for durable medical equipment needs, including shower or bath bars, raised toilet seats, handrails, and bedrails. Encourage those with gait and balance disorders and those with a history of falls to wear hip protectors.

## Our crucial role

Osteoporosis can bring devastating physical, emotional, and financial consequences. To avoid them, we need to identify those at risk and promote prevention and early intervention. We also must increase

public awareness of osteoporosis. As the largest group of healthcare providers in the United States, nurses can lead the public effort to prevent this disease.

One more thing: We need to take care of our own bone health. In our female-dominated profession, the average age of the 2.9 million practicing nurses in the U.S. is 46.8 years. And that puts us at high risk for bone loss and osteoporosis in the near future. ★

## Selected references

Berarducci A. *Osteoporosis: Clinical Issues, Detection, and Treatment Strategies. A Continuing Education Self-Study Program for Nurses and Nurse Practitioners*. 3rd ed. Glendale, AZ: American Academy of Nurse Practitioners Foundation; 2002.

Bone health and osteoporosis: a report of the Surgeon General. October 14, 2004. <http://www.surgeongeneral.gov/library/bonehealth>. Accessed March 12, 2008.

*Clinician's Guide to Prevention and Treatment of Osteoporosis*. Washington, DC: National Osteoporosis Foundation; 2008.

Cosman F. The prevention and treatment of osteoporosis: a review. *Journal CME*. May

2005. [www.medscape.com/viewprogram/4011](http://www.medscape.com/viewprogram/4011). Accessed March 12, 2008.

Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. *Lancet*. 2002;359:1761-1767.

"Fit to a T" Program for patients and community. US Bone and Joint Decade. 2004. [www.usbjd.org/projects/Fit2aT\\_op.cfm?CFID=1576904&CFTOKEN=77878264](http://www.usbjd.org/projects/Fit2aT_op.cfm?CFID=1576904&CFTOKEN=77878264). Accessed March 12, 2008.

International Osteoporosis Foundation. [www.iofbonehealth.org](http://www.iofbonehealth.org). Accessed March 12, 2008.

FDA updates health claim for calcium and osteoporosis. U.S. Food and Drug Administration. [www.fda.gov/bbs/topics/NEWS/2007/NEW01543.html](http://www.fda.gov/bbs/topics/NEWS/2007/NEW01543.html). Accessed March 12, 2008.

International Society for Clinical Densitometry. Official positions. <http://iscd.org/Visitors/positions/OfficialPositionsText.cfm>. Accessed March 12, 2008.

National Osteoporosis Foundation. [www.nof.org](http://www.nof.org). Accessed March 12, 2008.

For a complete list of selected references, visit [www.AmericanNurseToday.com/journal](http://www.AmericanNurseToday.com/journal).

**Adrienne Berarducci is an Associate Professor at the University of South Florida in Tampa. The planners and author of this CNE activity have disclosed no relevant financial relationships with any commercial companies pertaining to this activity.**

## CE POST-TEST — Stopping the silent progression of osteoporosis

### Instructions

To take the post-test for this article and earn contact hour credit, please go to [www.AmericanNurseToday.com](http://www.AmericanNurseToday.com). Simply use your Visa or MasterCard to pay the processing fee. (Online: ANA members \$15; nonmembers \$20.) Once you've successfully passed the post-test and completed the evaluation form, you'll be able to print out your certificate *immediately*.

If you are unable to take the post-test online, complete the print form and mail it to the address at the bottom of the next page. (Mail-in test fee: ANA members \$20; nonmembers \$25.)

### Provider accreditation

The American Nurses Association Center for Continuing Education and Professional Development is accredited as a provider of continuing nursing education by the American Nurses Credentialing Center's Commission on Accreditation.

ANA is approved by the California Board of Registered Nursing, Provider Number 6178.

Contact hours: 1.6      Rx contact hours: 0.75

Expiration: 12/31/12      Post-test passing score is 75%.

ANA Center for Continuing Education and Professional Development's accredited provider status refers only to CNE activities and does not imply that there is real or implied endorsement of any product, service, or company referred to in this activity nor of any company subsidizing costs related to the activity. This CNE activity does not include any unannounced information about off-label use of a product for a purpose other than that for which it was approved by the Food and Drug Administration (FDA).