Osteoporosis Overview

Osteoporosis, or porous bone, is a disease characterized by low bone mass and structural deterioration of bone tissue, leading to bone fragility and an increased risk of fractures of the hip, spine, and wrist. Men as well as women are affected by osteoporosis, a disease that can be prevented and treated.

Facts and Figures

- Osteoporosis is a major public health threat for 44 million Americans, 68 percent of whom are women.
- In the U.S. today, 10 million individuals already have osteoporosis and 34 million more have low bone mass, placing them at increased risk for this disease.
- One out of every two women and one in four men over 50 will have an osteoporosis-related fracture in their lifetime.
- More than 2 million American men suffer from osteoporosis, and millions more are at risk. Each year, 80,000 men have a hip fracture and one-third of these men die within a year.
- Osteoporosis can strike at any age.
- Osteoporosis is responsible for more than 1.5 million fractures annually, including 300,000 hip fractures, approximately 700,000 vertebral fractures, 250,000 wrist fractures, and more than 300,000 fractures at other sites.
- Based on figures from hospitals and nursing homes, the estimated national direct expenditures for osteoporosis and related fractures total $14 billion each year.

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What Is Bone?

Bone is living, growing tissue. It is made mostly of collagen, a protein that provides a soft framework, and calcium phosphate, a mineral that adds strength and hardens the framework.

This combination of collagen and calcium makes bone both flexible and strong, which in turn helps it to withstand stress. More than 99 percent of the body's calcium is contained in the bones and teeth. The remaining 1 percent is found in the blood.

Throughout your lifetime, old bone is removed (resorption) and new bone is added to the skeleton (formation). During childhood and teenage years, new bone is added faster than old bone is removed. As a result, bones become larger, heavier, and denser. Bone formation outpaces resorption until peak bone mass (maximum bone density and strength) is reached around age 30. After that time, bone resorption slowly begins to exceed bone formation.

For women, bone loss is fastest in the first few years after menopause, and it continues into the postmenopausal years. Osteoporosis – which mainly affects women but may also affect men – will develop when bone resorption occurs too quickly or when replacement occurs too slowly. Osteoporosis is more likely to develop if you did not reach optimal peak bone mass during your bone-building years.

Risk Factors

Certain risk factors are linked to the development of osteoporosis and contribute to an individual's likelihood of developing the disease. Many people with osteoporosis have several risk factors, but others who develop the disease have no known risk factors. There are some you cannot change and others you can.

Risk factors you cannot change:

- *Gender* – Your chances of developing osteoporosis are greater if you are a woman. Women have less bone tissue and lose bone faster than men because of the changes that happen with menopause.
- *Age* – The older you are, the greater your risk of osteoporosis. Your bones become thinner and weaker as you age.
- *Body size* – Small, thin-boned women are at greater risk.
- *Ethnicity* – Caucasian and Asian women are at highest risk. African American and Hispanic women have a lower but significant risk.

- *Family history* – Fracture risk may be due, in part, to heredity. People whose parents have a history of fractures also seem to have reduced bone mass and may be at risk for fractures.

Risk factors you can change:

- *Sex hormones* – Abnormal absence of menstrual periods (amenorrhea), low estrogen level (menopause), and low testosterone level in men can bring on osteoporosis.
- *Anorexia nervosa* – Characterized by an irrational fear of weight gain, this eating disorder increases your risk for osteoporosis.
- *Calcium and vitamin D intake* – A lifetime diet low in calcium and vitamin D makes you more prone to bone loss.
- *Medication use* – Long-term use of glucocorticoids and some anticonvulsants can lead to loss of bone density and fractures.
- *Lifestyle* – An inactive lifestyle or extended bed rest tends to weaken bones.
- *Cigarette smoking* – Cigarettes are bad for bones as well as the heart and lungs.
- *Alcohol intake* – Excessive consumption increases the risk of bone loss and fractures.

Prevention

To reach optimal peak bone mass and continue building new bone tissue as you age, there are several factors you should consider.

Calcium: An inadequate supply of calcium over a lifetime contributes to the development of osteoporosis. Many published studies show that low calcium intake appears to be associated with low bone mass, rapid bone loss, and high fracture rates. National nutrition surveys show that many people consume less than half the amount of calcium recommended to build and maintain healthy bones. Good sources of calcium include low-fat dairy products, such as milk, yogurt, cheese, and ice cream; dark green, leafy vegetables, such as broccoli, collard greens, bok choy, and spinach; sardines and salmon with bones; tofu; almonds; and foods fortified with calcium, such as orange juice, cereals, and breads. Depending upon how much calcium you get each day from food, you may need to take a calcium supplement.

Calcium needs change during one's lifetime. The body's demand for calcium is greater during childhood and adolescence, when the skeleton is growing rapidly, and during pregnancy and breastfeeding. Postmenopausal women and older men also need to consume more calcium. Also, as you age, your body becomes less

efficient at absorbing calcium and other nutrients. Older adults also are more likely to have chronic medical problems and to use medications that may impair calcium absorption.

Recommended Calcium Intakes (mg/day)
National Academy of Sciences (1997)

Ages	
Birth-6 months	210
6 months-1 year	270
1-3	500
4-8	800
9-13	1300
14-18	1300
19-30	1000
31-50	1000
51-70	1200
70 or older	1200
Pregnant or lactating	
14-18	1300
19-50	1000

Vitamin D: Vitamin D plays an important role in calcium absorption and in bone health. It is made in the skin through exposure to sunlight. While many people are able to obtain enough vitamin D naturally, studies show that vitamin D production decreases in the elderly, in people who are housebound, and for people in general during the winter. Depending on your situation, you may need to take vitamin D supplements to ensure a daily intake of between 400 to 800 IU of vitamin D. Massive doses are not recommended.

Exercise: Like muscle, bone is living tissue that responds to exercise by becoming stronger. Weight-bearing exercise is the best for your bones because it forces you to work against gravity. Examples include walking, hiking, jogging, stair climbing, weight training, tennis, and dancing.

Smoking: Smoking is bad for your bones as well as for your heart and lungs. Women who smoke have lower levels of estrogen compared to nonsmokers, and they often go through menopause earlier. Smokers also may absorb less calcium from their diets.

Alcohol: Regular consumption of 2 to 3 ounces a day of alcohol may be damaging to the skeleton, even in young women and men. Those who drink heavily are more prone to bone loss and fractures, because of both poor nutrition and increased risk of falling.

Medications that cause bone loss: The long-term use of glucocorticoids (medications prescribed for a wide range of diseases, including arthritis, asthma, Crohn's disease, lupus, and other diseases of the lungs, kidneys, and liver) can lead to a loss of bone density and fractures. Bone loss can also result from long-term treatment with certain antiseizure drugs – such as phenytoin (Dilantin[1]) and barbiturates; gonadotropin-releasing hormone (GnRH) drugs used to treat endometriosis; excessive use of aluminum-containing antacids; certain cancer treatments; and excessive thyroid hormone. It is important to discuss the use of these drugs with your physician and not to stop or change your medication dose on your own.

Preventive medications: Various medications are available for preventing and treating osteoporosis. See section entitled "Therapeutic Medications."

Symptoms

Osteoporosis is often called the "silent disease" because bone loss occurs without symptoms. People may not know that they have osteoporosis until their bones become so weak that a sudden strain, bump, or fall causes a hip to fracture or a vertebra to collapse. Collapsed vertebrae may initially be felt or seen in the form of severe back pain, loss of height, or spinal deformities such as kyphosis (severely stooped posture).

Detection

Following a comprehensive medical assessment, your doctor may recommend that you have your bone mass measured. A bone mineral density (BMD) test is the best way to determine your bone health. BMD tests can identify osteoporosis, determine your risk for fractures (broken bones), and measure your response to osteoporosis treatment. The most widely recognized bone mineral density test is called a dual-energy x-ray absorptiometry or DXA test. It is painless – a bit like

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[1] Brand names included in this publication are provided as examples only, and their inclusion does not mean that these products are endorsed by the National Institutes of Health or any other Government agency. Also, if a particular brand name is not mentioned, this does not mean or imply that the product is unsatisfactory.

having an x ray, but with much less exposure to radiation. It can measure bone density at your hip and spine. Bone density tests can:

- Detect low bone density before a fracture occurs.
- Confirm a diagnosis of osteoporosis if you already have one or more fractures.
- Predict your chances of fracturing in the future.
- Determine your rate of bone loss, and/or monitor the effects of treatment if the test is conducted at intervals of a year or more.

Treatment

A comprehensive osteoporosis treatment program includes a focus on proper nutrition, exercise, and safety issues to prevent falls that may result in fractures. In addition, your physician may prescribe a medication to slow or stop bone loss, increase bone density, and reduce fracture risk.

Nutrition: The foods we eat contain a variety of vitamins, minerals, and other important nutrients that help keep our bodies healthy. All of these nutrients are needed in balanced proportion. In particular, calcium and vitamin D are needed for strong bones, and for your heart, muscles, and nerves to function properly. (See **Prevention** section for recommended amounts of calcium.)

Exercise: Exercise is an important component of an osteoporosis prevention and treatment program. Exercise not only improves your bone health, but it increases muscle strength, coordination, and balance, and leads to better overall health. While exercise is good for someone with osteoporosis, it should not put any sudden or excessive strain on your bones. As extra insurance against fractures, your doctor can recommend specific exercises to strengthen and support your back.

Therapeutic Medications: Currently, alendronate, raloxifene, risedronate, and ibandronate are approved by the U. S. Food and Drug Administration (FDA) for preventing and treating postmenopausal osteoporosis. Teriparatide is approved for treating the disease in postmenopausal women and men at high risk for fracture. Estrogen/hormone therapy (ET/HT) is approved for preventing postmenopausal osteoporosis, and calcitonin is approved for treatment.

- *Bisphosphonates* – Alendronate (Fosamax), risedronate (Actonel), and ibandronate (Boniva), are medications from the class of drugs called bisphosphonates. Like estrogen and raloxifene, these bisphosphonates are approved for both prevention and treatment of postmenopausal osteoporosis. Another bisphosphonate, zoledronic acid (Reclast), is approved for the treatment of postmenopausal osteoporosis. Alendronate is also approved to treat bone loss that results from glucocorticoid medications like prednisone or

cortisone and is approved for treating osteoporosis in men. Risedronate is approved to prevent and treat glucocorticoid-induced osteoporosis and to treat osteoporosis in men.

Alendronate, risedronate, and zoledronic acid have been shown to increase bone mass and reduce the incidence of spine, hip, and other fractures. Ibandronate has been shown to reduce the incidence of spine fractures.

Alendronate is available in daily and weekly doses. Risedronate is available in daily, weekly, and twice monthly doses. Ibandronate is available in a monthly dose and as an intravenous injection administered once every three months. Zoledronic acid is available as an intravenous injection administered once yearly.

Oral bisphosphonates should be taken on an empty stomach and with a full glass of water first thing in the morning. It is important to remain in an upright position and refrain from eating or drinking for at least 30 minutes after taking a bisphosphonate.

Side effects for oral bisphosphonates include gastrointestinal problems such as difficulty swallowing, inflammation of the esophagus, and gastric ulcer.

Side effects for intravenous bisphosphonates include flu-like symptoms, fever, pain in muscles or joints, and headache. These side effects can occur shortly after receiving an infusion and generally stop within two to three days.

There have also been rare reports of osteonecrosis of the jaw and of visual disturbances in people taking oral and intravenous bisphosphonates.

Some bisphosphonates are marketed with calcium and vitamin D supplements. These nutrients are important for everyone, and people should include adequate amounts of them in their diets.

- *Raloxifene* – Raloxifene (Evista) is approved for the prevention and treatment of postmenopausal osteoporosis. It is from a class of drugs called estrogen agonists/antagonists, commonly referred to as selective estrogen receptor modulators (SERMs). Raloxifene appears to prevent bone loss in the spine, hip, and total body. It has beneficial effects on bone mass and bone turnover and can reduce the risk of vertebral fractures. While side effects are not common with raloxifene, those reported include hot flashes and blood clots in the veins, the latter of which is also associated with estrogen therapy. Additional research studies on raloxifene will continue for several more years.

- *Calcitonin* – Calcitonin (Miacalcin, Fortical) is a naturally occurring hormone involved in calcium regulation and bone metabolism. In women who are at least 5 years past menopause, calcitonin slows bone loss, increases spinal bone density, and may relieve the pain associated with bone fractures. Calcitonin reduces the risk of spinal fractures and may reduce hip fracture risk as well. Studies on fracture reduction are ongoing. Calcitonin is currently available as an injection or nasal spray. While it does not affect other organs or systems in the body, injectable calcitonin may cause an allergic reaction and unpleasant side effects including flushing of the face and hands, frequent urination, nausea, and skin rash. The only side effect reported with nasal calcitonin is nasal irritation.

- *Teriparatide* – Teriparatide (Forteo) is an injectable form of human parathyroid hormone. It is approved for postmenopausal women and men with osteoporosis who are at high risk for having a fracture. Unlike the other drugs used in osteoporosis, teriparatide acts by stimulating new bone formation in both the spine and the hip. It also reduces the risk of vertebral and nonvertebral fractures in postmenopausal women. In men, teriparatide reduces the risk of vertebral fractures. However, it is not known whether teriparatide reduces the risk of nonvertebral fractures. Side effects include nausea, dizziness and leg cramps. Teriparatide is approved for use for up to 24 months.

- *Estrogen/Hormone Therapy* – Estrogen/hormone therapy (ET/HT) has been shown to reduce bone loss, increase bone density in both the spine and hip, and reduce the risk of spine and hip fractures in postmenopausal women. ET/HT is approved for preventing postmenopausal osteoporosis and is most commonly administered in the form of a pill or skin patch. When estrogen – also known as estrogen therapy or ET – is taken alone, it can increase a woman's risk of developing cancer of the uterine lining (endometrial cancer). To eliminate this risk, physicians prescribe the hormone progestin – also known as hormone therapy or HT – in combination with estrogen for those women who have not had a hysterectomy. Side effects of ET/HT include vaginal bleeding, breast tenderness, mood disturbances, blood clots in the veins, and gallbladder disease.

  The Women's Health Initiative, a large Government-funded research study, recently demonstrated that the drug Prempro (estrogen combined with progestin), which is used in hormone therapy, is associated with a modest increase in the risk of breast cancer, stroke, and heart attack. The WHI also demonstrated that in patients who had a hysterectomy**,** estrogen therapy alone was associated with an increase in the risk of stroke, but not of breast cancer or cardiovascular disease. A large study from the National Cancer Institute indicated that long-term use of estrogen therapy may be associated with an increased risk of ovarian cancer.

Estrogen therapy is approved for treatment of menopausal symptoms but should be prescribed for the shortest period of time possible. When used solely for the prevention of postmenopausal osteoporosis, any ET/HT regimen should only be considered for women at significant risk of osteoporosis, and nonestrogen medications should be carefully considered first.

Fall Prevention

Preventing falls is a special concern for men and women with osteoporosis. Falls can increase the likelihood of fracturing a bone in the hip, wrist, spine, or other part of the skeleton. In addition to the environmental factors listed below, falls can also be caused by impaired vision and/or balance, chronic diseases that affect mental or physical functioning, and certain medications, such as sedatives and antidepressants. It is important that individuals with osteoporosis be aware of any physical changes that affect their balance or gait, and that they discuss these changes with their health care provider. Here are some tips to help eliminate the environmental factors that lead to falls.

Outdoors:

- Use a cane or walker for added stability.
- Wear rubber-soled shoes for traction.
- Walk on grass when sidewalks are slippery.
- In winter, carry salt or kitty litter to sprinkle on slippery sidewalks.
- Be careful on highly polished floors that become slick and dangerous when wet.
- Use plastic or carpet runners when possible.

Indoors:

- Keep rooms free of clutter, especially on floors.
- Keep floor surfaces smooth but not slippery.
- Wear supportive, low-heeled shoes even at home.
- Avoid walking in socks, stockings, or slippers.
- Be sure carpets and area rugs have skid-proof backing or are tacked to the floor.
- Be sure stairwells are well lit and that stairs have handrails on both sides.
- Install grab bars on bathroom walls near tub, shower, and toilet.
- Use a rubber bath mat in shower or tub.
- Keep a flashlight with fresh batteries beside your bed.
- If using a step stool for hard-to-reach areas, use a sturdy one with a handrail and wide steps.
- Add ceiling fixtures to rooms lit by lamps.
- Consider purchasing a cordless phone so that you don’t have to rush to answer the phone when it rings, or so that you can call for help if you do fall.

The National Resource Center acknowledges the assistance of the National Osteoporosis Foundation in the preparation of this publication.

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For Your Information

This publication contains information about medications used to treat the health condition discussed here. When this fact sheet was printed, we included the most up-to-date (accurate) information available. Occasionally, new information on medication is released.

For updates and for any questions about any medications you are taking, please contact the U.S. Food and Drug Administration at 1-888-INFO-FDA (1-888-463-6332, a toll-free call) or visit their Web site at www.fda.gov.

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