Overview of Osteoporosis

Osteoporosis is a bone disease that develops when bone mineral density and bone mass decreases, or when the structure and strength of bone changes. This can lead to a decrease in bone strength that can increase the risk of fractures (broken bones).

Osteoporosis is a “silent” disease because you typically do not have symptoms, and you may not even know you have the disease until you break a bone. Osteoporosis is the major cause of fractures in postmenopausal women and in older men. Fractures can occur in any bone but happen most often in bones of the hip, vertebrae in the spine, and wrist.

However, you can take steps to help prevent the disease and fractures by:

- Staying physically active by participating in weight-bearing exercises such as walking.
- Drinking alcohol in moderation.
- Quitting smoking, or not starting if you don’t smoke.
- Taking your medications, if prescribed, which can help prevent fractures in people who have osteoporosis.
- Eating a nutritious diet rich in calcium and vitamin D to help maintain good bone health.

Who Gets Osteoporosis?

Osteoporosis affects women and men of all races and ethnic groups. Osteoporosis can occur at any age, although the risk for developing the disease increases as you get older. For many women, the disease begins to develop a year or two before menopause. Other factors to consider include:

- Osteoporosis is most common in non-Hispanic white women and Asian women.
- African American and Hispanic women have a lower risk of developing osteoporosis, but they are still at significant risk.
- Among men, osteoporosis is more common in non-Hispanic whites.

Certain medications, such as some cancer medications and glucocorticoid steroids, may increase the risk of developing osteoporosis.

Because more women get osteoporosis than men, many men think they are not at risk for the disease. However, both older men and women from all backgrounds are at risk for osteoporosis.

Some children and teens develop a rare form of idiopathic juvenile osteoporosis. Doctors do not know the cause; however, most children recover without treatment.

Symptoms of Osteoporosis

Osteoporosis is called a “silent” disease” because there are typically no symptoms until a bone is broken. Symptoms of vertebral (spine) fracture include severe back pain, loss of height, or spine malformations such as a stooped or hunched posture (kyphosis).

Bones affected by osteoporosis may become so fragile that fractures occur spontaneously or as the result of:

- Minor falls, such as a fall from standing height that would not normally cause a break in a healthy bone.
- Normal stresses such as bending, lifting, or even coughing.

Causes of Osteoporosis

Osteoporosis occurs when too much bone mass is lost and changes occur in the structure of bone tissue. Certain risk factors may lead to the development of osteoporosis or can increase the likelihood that you will develop the disease.

Many people with osteoporosis have several risk factors, but others who develop osteoporosis may not have any specific risk factors. There are some risk factors that you cannot change, and others that you may be able to change. However, by understanding these factors, you may be able to prevent the disease and fractures.

Factors that may increase your risk for osteoporosis include:

- **Sex.** Your chances of developing osteoporosis are greater if you are a woman. Women have lower peak bone mass and smaller bones than men. However, men are still at risk, especially after the age of 70.
- **Age.** As you age, bone loss happens more quickly, and new bone growth is slower. Over time, your bones can weaken and your risk for osteoporosis increases.
- **Body size.** Slender, thin-boned women and men are at greater risk to develop osteoporosis because they have less bone to lose compared to larger boned women and men.
- **Race.** White and Asian women are at highest risk. African American and Mexican American women have a lower risk. White men are at higher risk than African American and Mexican American men.

- **Family history.** Researchers are finding that your risk for osteoporosis and fractures may increase if one of your parents has a history of osteoporosis or hip fracture.
- **Changes to hormones.** Low levels of certain hormones can increase your chances of developing osteoporosis. For example:
  - Low estrogen levels in women after menopause.
  - Low levels of estrogen from the abnormal absence of menstrual periods in premenopausal women due to hormone disorders or extreme levels of physical activity.
  - Low levels of testosterone in men. Men with conditions that cause low testosterone are at risk for osteoporosis. However, the gradual decrease of testosterone with aging is probably not a major reason for loss of bone.

- **Diet.** Beginning in childhood and into old age, a diet low in calcium and vitamin D can increase your risk for osteoporosis and fractures. Excessive dieting or poor protein intake may increase your risk for bone loss and osteoporosis.
- **Other medical conditions.** Some medical conditions that you may be able to treat or manage can increase the risk of osteoporosis, such as other endocrine and hormonal diseases, gastrointestinal diseases, rheumatoid arthritis, certain types of cancer, HIV/AIDS, and anorexia nervosa.
- **Medications.** Long-term use of certain medications may make you more likely to develop bone loss and osteoporosis, such as:
  - Glucocorticoids and adrenocorticotropic hormone, which treat various conditions, such as asthma and rheumatoid arthritis.
  - Antiepileptic medicines, which treat seizures and other neurological disorders.
  - Cancer medications, which use hormones to treat breast and prostate cancer.
  - Proton pump inhibitors, which lower stomach acid.
  - Selective serotonin reuptake inhibitors, which treat depression and anxiety.
  - Thiazolidinediones, which treat type II diabetes.

- **Lifestyle.** A healthy lifestyle can be important for keeping bones strong. Factors that contribute to bone loss include:
  - Low levels of physical activity and prolonged periods of inactivity can contribute to an increased rate of bone loss. They also leave you in poor physical condition, which can increase your risk of falling and breaking a bone.
  - Chronic heavy drinking of alcohol is a significant risk factor for osteoporosis.
  - Studies indicate that smoking is a risk factor for osteoporosis and fracture. Researchers are still studying if the impact of smoking on bone health is from tobacco use alone or if people who smoke have more risk factors for osteoporosis.

Osteoporosis Related Information

Juvenile Osteoporosis

Osteoporosis is a bone disease that develops when the bones get weaker and less dense. When a child or teen develops osteoporosis, the condition is known as juvenile osteoporosis.

Osteoporosis in Men

Osteoporosis is a bone disease that develops when bone mineral density and bone mass decreases, or when the quality or structure of bone changes. This can lead to a decrease in bone strength that can increase the risk of broken bones (fractures).

Pregnancy, Breastfeeding, and Bone Health

How do pregnancy and breastfeeding affect a woman's bones? Calcium is in high demand during both pregnancy and breastfeeding – since it is needed to support the baby's growth and development in the mother's womb and after birth.

Preventing Another Broken Bone

After you break a bone, recovery is your first priority. But you might want to find out whether this broken bone is a sign of osteoporosis.

Diagnosis of Osteoporosis

Doctors usually diagnose osteoporosis during routine screening for the disease. The U.S. Preventive Services Task Force recommends screening for:

- Women over age 65.
- Women of any age who have factors that increase the chance of developing osteoporosis.

Due to a lack of available evidence, the Task Force did not make recommendations regarding osteoporosis screening in men.

During your visit with your doctor, remember to report:

- Any previous fractures.
- Your lifestyle habits, including diet, exercise, alcohol use, and smoking history.
- Current or past medical conditions and medications that could contribute to low bone mass and increased fracture risk.
- Your family history of osteoporosis and other diseases.

- For women, your menstrual history.

The doctor may also perform a physical exam that includes checking for:

- Loss of height and weight.
- Changes in posture.
- Balance and gait (the way you walk).
- Muscle strength, such as your ability to stand from sitting without using your arms).

In addition, your doctor may order a test that measures your bone mineral density (BMD) in a specific area of your bone, usually your spine and hip. BMD testing can be used to:

- Diagnose osteoporosis.
- Detect low bone density before osteoporosis develops.
- Help predict your risk of future fractures.
- Monitor the effectiveness of ongoing treatment for osteoporosis.

The most common test for measuring bone mineral density is dual-energy x-ray absorptiometry (DXA). It is a quick, painless, and noninvasive test. DXA uses low levels of x-rays as it passes a scanner over your body while you lie on a cushioned table. The test measures the BMD of your skeleton and at various sites that are prone to fracture, such as the hip and spine. Bone density measurement by DXA at the hip and spine is generally considered the most reliable way to diagnose osteoporosis and predict fracture risk.

Some people have a peripheral DXA, which measures bone density in the wrist and heel. This type of DXA is portable and may make it easier for screening. However, the results may not help doctors predict your risk for fractures in the future or monitor the effects of your medications on the disease.

Your doctor will compare your BMD test results to the average bone density of young, healthy people and to the average bone density of other people of your age, sex, and race. If your BMD is below a certain level, you will be diagnosed with osteoporosis and your doctor may recommend both lifestyle approaches to promote bone health and medications to lower your chance of breaking a bone.

Sometimes, your doctor may recommend a quantitative ultrasound (QUS) of the heel. This is a test that evaluates bone but does not measure BMD. If the QUS indicates that you have bone loss, you will still need a DXA test to diagnose bone loss and osteoporosis.

Treatment of Osteoporosis

The goals for treating osteoporosis are to slow or stop bone loss and to prevent fractures. Your health care provider may recommend:

- Proper nutrition.
- Lifestyle changes.
- Exercise.
- Fall prevention to help prevent fractures.
- Medications.

People who develop osteoporosis from another condition should work with their health care provider to identify and treat the underlying cause. For example, if you take a medication that causes bone loss, your doctor may lower the dose of that medication or switch you to another medication. If you have a disease that requires long-term glucocorticoid therapy, such as rheumatoid arthritis or chronic lung disease, you can also take certain medications approved for the prevention or treatment of osteoporosis.

Nutrition

An important part of treating osteoporosis is eating a healthy, balanced diet, which includes:

- Plenty of fruits and vegetables.
- An appropriate amount of calories for your age, height, and weight. Your health care provider or doctor can help you determine the amount of calories you need each day to maintain a healthy weight.
- Foods and liquids that include calcium, vitamin D, and protein. These help minimize bone loss and maintain overall health. However, it's important to eat a diet rich in all nutrients to help protect and maintain bone health.

Calcium and Vitamin D

Calcium and vitamin D are important nutrients for preventing osteoporosis and helping bones reach peak bone mass. If you do not take in enough calcium, the body takes it from the bones, which can lead to bone loss. This can make bones weak and thin, leading to osteoporosis.

Good sources of calcium include:

- Low-fat dairy products.
- Dark green leafy vegetables, such as bok choy, collards, and turnip greens.
- Broccoli.
- Sardines and salmon with bones.
- Calcium-fortified foods such as soymilk, tofu, orange juice, cereals, and breads.

Vitamin D is necessary for the absorption of calcium from the intestine. It is made in the skin after exposure to sunlight. Some foods naturally contain enough vitamin D, including fatty fish, fish oils, egg

yolks, and liver. Other foods that are fortified with vitamin D are a major source of the mineral, including milk and cereals.

The chart below shows how much calcium and vitamin D you need each day.

Recommended Calcium and Vitamin D Intakes

Life-stage group	Calcium mg/day	Vitamin D (IU/day)
Infants 0 to 6 months	200	400
Infants 6 to 12 months	260	400
1 to 3 years old	700	600
4 to 8 years old	1,000	600
9 to 13 years old	1,300	600
14 to 18 years old	1,300	600
19 to 30 years old	1,000	600
31 to 50 years old	1,000	600
51- to 70-year-old males	1,000	600
51- to 70-year-old females	1,200	600
>70 years old	1,200	800
14 to 18 years old, pregnant/lactating	1,300	600
19 to 50 years old, pregnant/lactating	1,000	600

Definitions: mg = milligrams; IU = International Units

Source: National Institutes of Health, Office of Dietary Supplements, November 2018

If you have trouble getting enough calcium and vitamin D in your diet, you may need to take supplements. Talk to your health care provider about the type and amount of calcium and vitamin D supplements you should take. Your doctor may check your blood levels of vitamin D and recommend a specific amount.

Lifestyle

In addition to a healthy diet, a healthy lifestyle is important for optimizing bone health. You should:

- Avoid secondhand smoke, and if you smoke, quit.
- Drink alcohol in moderation, no more than one drink a day for women and no more than two drinks a day for men.

- Visit your doctor for regular checkups and ask about any factors that may affect your bone health or increase your chance of falling, such as medications or other medical conditions.

Exercise

Exercise is an important part of an osteoporosis treatment program. Research shows that the best physical activities for bone health include strength training or resistance training. Because bone is living tissue, during childhood and adulthood, exercise can make bones stronger. However, for older adults, exercise no longer increases bone mass. Instead, regular exercise can help older adults:

- Build muscle mass and strength and improve coordination and balance. This can help lower your chance of falling.
- Improve daily function and delay loss of independence.

Although exercise is beneficial for people with osteoporosis, it should not put any sudden or excessive strain on your bones. If you have osteoporosis, you should avoid high-impact exercise. To help prevent injury and fractures, a physical therapist or rehabilitation medicine specialist can:

- Recommend specific exercises to strengthen and support your back.
- Teach you safe ways of moving and carrying out daily activities.
- Recommend an exercise program that is tailored to your circumstances.

Exercise specialists, such as exercise physiologists, may also help you develop a safe and effective exercise program.

Medications

Your doctor may prescribe medications for osteoporosis. The U.S. Food and Drug Administration (FDA) has approved the following medications for the prevention or treatment of osteoporosis:

Your health care provider will discuss the best option for you, taking into consideration your age, sex, general health, and the amount of bone you have lost. No matter which medications you take for osteoporosis, it is still important that you get the recommended amounts of calcium and vitamin D. Also, exercising and maintaining other aspects of a healthy lifestyle are important.

Medications can cause side effects. If you have questions about your medications, talk to your doctor or pharmacist.

- **Bisphosphonates.** Several bisphosphonates are approved to help preserve bone density and strength and to treat osteoporosis. This type of drug works by slowing down bone loss, which can lower the chance of fractures.

- **Calcitonin.** This medication is made from a hormone from the thyroid gland and is approved for the treatment of osteoporosis in postmenopausal women who cannot take or tolerate other medications for osteoporosis.
- **Estrogen agonist/antagonist.** An estrogen agonist/antagonist, also known as a selective estrogen receptor modulator (SERM), and tissue-selective estrogen complex (TSEC), are both approved to treat and prevent osteoporosis in postmenopausal women. They are not estrogen, but they have estrogen-like effects on some tissues and estrogen-blocking effects on other tissues. This action helps improve bone density, lowering the risk for some fractures.
- **Estrogen and hormone therapy.** Estrogen and combined estrogen and progestin (hormone therapy) are approved to prevent osteoporosis and fractures in postmenopausal women. Because of potential side effects, researchers recommend that women use hormone therapy at the lowest dose, and for the shortest time, and if other medications are not helping. It is important to carefully consider the risks and benefits of estrogen and hormone therapy for the treatment of osteoporosis.
- **Parathyroid hormone (PTH) analog and parathyroid hormone related-protein (PTHrP) analog.** PTH is a form of human parathyroid hormone that increases bone mass and is approved for postmenopausal women and men with osteoporosis who are at high risk for fracture. PTHrP is a medication that is also a form of parathyroid hormone. It is an injection and is usually prescribed for postmenopausal women who have severe osteoporosis and a history of multiple fractures.
- **RANK ligand (RANKL) inhibitor.** This is an inhibitor that helps slow down bone loss and is approved to treat osteoporosis in:
  - Postmenopausal women or men with osteoporosis who are at high risk for fracture.
  - Men who have bone loss and are being treated for prostate cancer with medications that cause bone loss.
  - Women who have bone loss and are being treated for breast cancer with medications that cause bone loss.
  - Men and women who do not respond to other types of osteoporosis treatment.
- **Sclerostin inhibitor.** This is a medication that treats severe osteoporosis by blocking the effect of a protein, and helps the body increase new bone formation as well as slows down bone loss.

Who Treats Osteoporosis?

Health care providers who treat osteoporosis include:

- Endocrinologists, who treat problems related to the glands and hormones.
- Geriatricians, who specialize in caring for all aspects of health in older people.
- Gynecologists, who specialize in diagnosing and treating conditions of the reproductive system of women.

- Nurse educators, who specialize in helping people understand their overall condition and set up their treatment plans.
- Occupational therapists, who teach ways to protect joints, minimize pain, perform activities of daily living, and conserve energy.
- Orthopaedists, who specialize in the treatment of and surgery for bone and joint diseases or injuries.
- Physiatrists (doctors specializing in physical medicine and rehabilitation).
- Physical therapists, who help to improve joint function.
- Primary care providers, such as a family physician or internal medicine specialist.
- Rheumatologists, who specialize in arthritis and other diseases of the bones, joints, and muscles.

Living With Osteoporosis

In addition to the treatments your doctor recommends, the following tips can help you manage and live with osteoporosis, prevent fractures, and prevent falls.

Preventing fractures is important when you have osteoporosis because fractures can cause other medical problems and take away your independence. Exercise can help prevent fractures that occur as a result of falling and improve bone strength, when your health care provider tailors a program to your individual need. If you have osteoporosis or bone loss, it is important to talk to your doctor or physical therapist before beginning any exercise program.

In addition, preventing falls helps prevent fractures. Falls increase your likelihood of fracturing a bone in the hip, wrist, spine, or other part of the skeleton. Taking steps to prevent falls both inside and outside of the house can help prevent fractures.

Some factors that may contribute to falls include:

- Loss of muscle mass.
- Illnesses that impair your mental or physical functioning, such as low blood pressure or dementia.
- Use of four or more prescription medications.
- Poor vision.
- Poor balance.
- Certain diseases that affect how you walk.
- Alcohol use.
- Side effects of some medications, such as:
    - Sedatives or tranquilizers.
    - Sleeping pills.

- Antidepressants.
- Anticonvulsants.
- Muscle relaxants.
- Heart medicines.
- Blood pressure pills.
- Diuretics.

If you have osteoporosis, it is important to be aware of any physical changes you may experience that affect your balance or gait and to discuss these changes with your doctor or other health care provider. It is also important to have regular checkups and tell your doctor if you have had problems with falling.

Falls can also be caused by factors around you that create unsafe conditions. Here are some tips to help prevent falls outdoors and when you are away from home:

- Use a cane or walker for added stability.
- Wear shoes that provide support and have thin nonslip soles. Avoid wearing slippers and athletic shoes with deep treads.
- Walk on grass when sidewalks are slippery; in winter, put salt or kitty litter on icy sidewalks.
- Stop at curbs and check their height before stepping up or down.

Some ways to help prevent falls indoors are:

- Keep rooms free of clutter, especially on floors. Avoid running electrical cords across walking areas.
- Use plastic or carpet runners on slippery floors.
- Wear shoes, even when indoors, that provide support and have thin nonslip soles. Avoid wearing slippers and athletic shoes with deep treads.
- If you have a pet, be mindful of where they are to avoid tripping over them.
- Do not walk in socks, stockings, or slippers.
- Be careful on highly polished floors that are slick and dangerous, especially when wet, and walk on plastic or carpet runners when possible.
- Be sure carpets and area rugs have skid-proof backing or are tacked to the floor. Use double-stick tape to keep rugs from slipping.
- Be sure stairs are well lit and have rails on both sides.
- Install grab bars on bathroom walls near the tub, shower, and toilet.
- Use a rubber bathmat or slip-proof seat in the shower or tub.
- Improve lighting in your home. Use nightlights or keep a flashlight next to your bed in case you need to get up at night. Install ceiling fixtures or lamps that can be turned on by a switch near the room’s entrance.

- Use a sturdy stepstool with a handrail and wide steps.
- Add more lights in rooms.
- Keep a cordless phone or cell phone with you so that you don’t have to rush to the phone when it rings. In addition, if you fall, you can call for help.
- Consider having a personal emergency-response system; you can use it to call for help if you fall.

Other tips that can help you manage your osteoporosis include:

- Talking with other people who have osteoporosis.
- Reaching out to family and friends for support.
- Learning about the disorder and treatments to help you make decisions about your care.

Research Progress Related to Osteoporosis

The NIAMS leads the federal research effort on osteoporosis. Scientists at universities, medical centers, and other research institutions across the United States who are funded by the NIAMS and other National Institutes of Health (NIH) entities are pursuing a wide range of basic and clinical studies on osteoporosis.

These include studies on:

- Bone composition, structure, and function to help understand bone loss.
- New treatments for osteoporosis.
- The influence of genetics on the development of osteoporosis.
- The impact of environmental risk factors.
- Prevention of osteoporosis.

Some key areas of osteoporosis research supported by the NIAMS and its partners at the NIH are described below.

Genetic Studies

Researchers continue to define genetic differences that underlie variation in bone formation, maintenance, and turnover. Applying the findings of genome-wide association studies to identify new molecular pathways related to bone health and disease may lead to new ways to prevent bone loss and fractures.

Bone Cell Biology

Scientists are studying the cells that control bone remodeling to learn more about the underlying causes of osteoporosis and to identify possible new therapeutic targets. Over the past several years, researchers have made considerable progress in understanding connections between bone